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(54) Electrical connector having a conductor holding block.

(57) An electrical connector **(10)** provides for the termination of discrete insulated conductors **(18)** of a multi-conductor cable. The connector includes an insulative connector housing **(20)** supporting plural electrical contacts **(44)** having insulation displacing contact portions. A conductor holding block **(80)** is movably supported by the housing with respect to the insulation displacing contact portions. The conductor holding block includes contact slots **(82)** for receipt of the insulation displacing contact portions. The conductor holding block further includes passages **(84)** in communication with the contact slots for receipt of the conductors. The conductor holding block is movable between a conductor receiving position and a conductor termination position. The conductor holding block is continuously supported by the connector housing so as to define a conductor support position to temporarily support the conductors against the insulation displacing contact portions without effecting conductor termination.

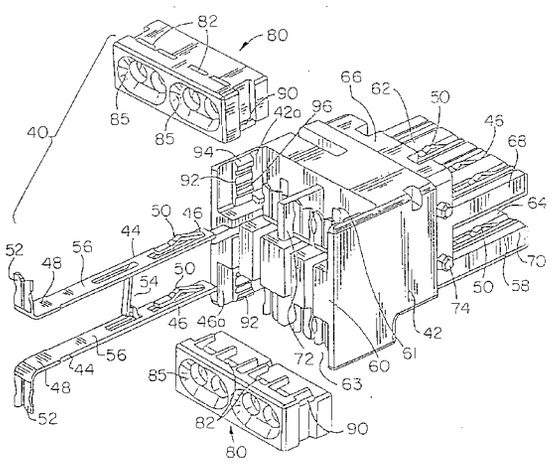


FIG. 3

EP 0 653 804 A1

FIELD OF THE INVENTION:

The present invention relates generally to improvements in electrical data connectors. More particularly the present invention relates to a shielded compact data connector which permits reliable termination of a multi-conductor electrical cable.

BACKGROUND OF THE INVENTION:

In the field of data/communications technology, information in the form of electrical signals is being transmitted at ever increasing speeds. Along with the desire to transmit information at faster data rates, the industry has also seen the need to reduce the size of hardware employed so as to increase portability and ease of use. In order to keep pace with these improvements, the interconnection technology, which includes electrical cables and electrical connectors designed to connect such hardware, has also undergone significant changes. Electrical connectors and cables are now available which are much smaller in size and capable of transmitting data at higher rates.

Continued improvement in connection technology is not without problems. When decreasing the size of electrical connectors while requiring the connectors to transmit data at higher rates, cross-talk between adjacent conductive components of the connector becomes a factor which must be addressed. Additionally, as these components are normally used in close proximity to other electronic components, the individual connector components must be shielded from electro-magnetic interferences and radio-frequency interferences. These interferences can adversely affect the performance levels of the connectors especially at higher data rates.

An additional demand on connector technology is that the connector components must be "user friendly". That is, the components must be easy to assemble as well as easy to connect and disconnect. Further, the portability of many electronic components requires that these connections and disconnections be repeated many times. A connector must be able to withstand the rigors of repeated interconnection without degradation of mechanical or electrical performance. In addition, as these connectors are manufactured to be field installable, the connector must permit simple and reliable termination of a multi-conductor electrical cable by the installer.

It can be appreciated that merely "downsizing" a connector will be insufficient to meet the current requirements of the industry. Smaller connectors must be designed to meet increased signal transmission requirements, and provide for internal and external shielding as well as long term reliable mechanical performance.

SUMMARY OF THE INVENTION:

It is an object of the present invention to provide an electrical connector for terminating discrete conductors of a multi-conductor cable.

It is a further object of the present invention to provide a conductor holding block for supporting conductors in position for subsequent termination with contacts of an electrical connector.

It is a still further object of the present invention to provide a conductor holding block which retentively supports conductors of a multi-conductor cable against insulation displacing contacts of a connector prior to termination therewith.

In the efficient attainment of these and other objects, the present invention provides an electrical connector for terminating individually insulated conductors of a multi-conductor cable. The connector includes an insulative housing which supports plural electrical contacts therein. The contacts include aligned insulation displacing contact portions. A conductor holding block is movably supported by the housing for movement with respect to the insulation displacing contact portions. The conductor holding block includes individual contact slots for receipt of the insulation displacing contact portions upon movement of the holding block with respect to said housing. The conductor holding block further includes conductor receiving passages in communication with the contact slots for receipt of the individually insulated conductors of the cable and for retentive support of the conductors adjacent the insulation displacing contact portions prior to termination therewith.

As more particularly described by way of the preferred embodiment herein, the conductor holding block and the housing further include cooperative securement elements which provide for the movable securement of the holding block with respect to the housing. The securement elements permit continuous securement of the holding block between a conductor receiving position and a conductor termination position including a temporary conductor support positions therebetween which supports the conductor against the insulation displacing contact portions prior to termination therewith.

BRIEF DESCRIPTION OF THE DRAWINGS:

Figure 1 shows an exploded perspective view of the compact data connector of the present invention and a shielded multi-conductor electrical cable positioned for termination therewith.

Figure 2 is a perspective showing of the internal shield of the connector of Figure 1.

Figure 3 is an exploded perspective view of a subassembly of the connector of Figure 1.

Figures 4 and 5 show in front plan and perspective views respectively, a conductor holding block

used in the connector sub-assembly of Figure 3.

Figure 6 is a perspective view a strain relief device used to secure the multi-conductor cable to the connector shown in Figure 1.

Figure 7 is a perspective showing of a ground clip employed in the connector shown in Figure 1.

Figure 8 is a perspective view the connector of Figure 1 including a latch for attachment to a mating connector.

Figure 9 shows the connector of Figure 8 in connected position with the mating connector.

Figure 10 is an exploded perspective view of a further embodiment of the sub-assembly of Figure 1.

Figure 11 is an enlarged perspective view of a portion of the conductor holding block of Figure 10.

Figure 12 is a schematic representation of the interengagement of the conductor holding block and connector housing of Figure 10.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT:

Referring to Figure 1 a compact electrical data connector 10 is shown. Connector 10 may be employed to terminate electrical cable 12 having an insulative outer jacket 14, an inner conductive cable shield 16 and a plurality of individually insulated electrical conductors 18 extending therethrough. In order to prepare cable 12 for termination in connector 10, jacket 14 is cut away exposing a portion of cable shield 16 and a length of conductors 18 suitable for termination.

In the present illustrated embodiment cable 12 is an eight conductor cable. However, it may be appreciated that the invention may be employed with cables having greater or fewer conductors. Also, cable shield 16 is shown to be a metallic foil shield, however cables having other types of conductive shields, such as metallic braiding, may also be employed in accordance with the present invention. Connector 10 includes an outer connector housing 20 formed in two parts, a housing base 22 and a housing cover 24. Housing cover 24 includes a plurality of depending deflectable locking arms 26 which engage protrusions 28 on base 22 to provide for snap fit engagement of cover 24 on base 22. Other similar snap fitting elements may also be employed to secure cover 24 to base 22. Housing 20 may be formed of a suitably electrically insulative plastic such as polyester. In order to provide external electrical shielding which shields the connector 10 from external interferences such as radio-frequency interferences and electromagnetic interferences, both base 22 and cover 24 may be internally and externally electrolessly plated with a metallic plating such as nickel/copper. The process of metallically plating a plastic member may be accomplished in a manner which is conventional in the art.

Housing 20 is generally an elongate rectangular member having a connection end 30 and an opposed cable receiving end 32. Housing 20 shown in Figure 1 is a plug type electrical connector where connection end 30 is insertable into a jack type electrical connector for mating engagement therewith (Fig. 8). While a plug connector 10 is shown, the concepts of the present invention may also be employed in a jack connector configuration.

Cable receiving end 32 of connector 10 defines a rearwardly opening circular passage 34, more clearly shown in Figures 8 and 9, which permits entry of cable 12 into connector 10.

Housing base 22 supports therein a termination sub-assembly 40. Referring additionally to Figure 3 termination sub-assembly 40 is shown. Termination sub-assembly 40 includes a termination support member 42 formed of a suitably insulative plastic such as polyester, which supports a plurality of electrical contacts 44. Each of contacts 44 are elongate electrically conductive metallic members formed of beryllium-copper having a connection end 46 and a termination end 48. Connection end 46 includes a cantilevered element 50 for making mating resilient electrical engagement with similar contacts in the mating jack connector. Termination end 48 includes blade type insulation displacing contact (IDC) portions 52 which, as will be described in further detail hereinbelow, are constructed for insulation displacing termination with conductors 18 of cable 12.

In the present illustrative embodiment contacts 44 are positioned in two longitudinally aligned transversely spaced rows. Insulation displacing contact portions 52 of the lower row extend in a direction opposite of the insulation displacing contact portions 52 of the upper row. Contacts 44 further include a matable shunting mechanism 54 along a central extent 56 thereof. Shunting mechanism 54 permits the shunting engagement of the upper row of contacts 44 to the lower row of contacts 44. The operation of a shunting mechanism 54 of this type is shown and described in copending patent application Serial No. 08/013,452 filed on February 4, 1993 entitled "Vertically Aligned Electrical Connector Components" which is assigned to the assignee of the present invention.

Support member 42 of termination sub-assembly 40 includes a forward interconnection end 58 and a rear termination support end 60. Support member 42 supports contacts 44 in individual electrical isolation providing upper and lower forward platforms 62 and 64 which support the connection end 46 of contacts 44.

As contacts 44 are maintained in close proximity in support member 42, it becomes necessary to shield individual contact pairs from adjacent contact pairs. Shown in Figure 2 is an internal contact shield 66. Shield 66 is a die cast metallic member formed of

zinc which is insertable over support member 42 from the interconnector end 58 thereof. Contact shield 66 serves to shield pairs of contacts 44 from one another both laterally and vertically. Contact shield 66 includes upper and lower shield platforms 68 and 70 which provide effective vertical shielding as between the connection ends 46 of contacts 44. Further, contact shield 66 includes a transverse wall 72 separating lateral pairs of contacts 44. Transverse wall 72 is especially effective in shielding the central portion 56 of contacts 44 including shunting mechanism 54 which extends to shunt vertically spaced contacts 44. Contact shield 66 further includes a plurality of extending contact bumps 74. As will be described in further detail hereinbelow, contact bumps 74 extend for engagement with metallically plated housing 20 of connector 10. This establishes electrical path continuity between housing 20 and contact shield 66. Contact shield 66 further includes an extending ground element 76 which extends for grounding electrical engagement with cable shield 16, as will be described in further detail hereinbelow, to maintain electrical ground continuity between cable shield 16 and contact shield 66.

Cable 12 is terminated to termination sub-assembly 40 prior to the insertion of termination sub-assembly 40 into base 22 of housing 20. Extending insulated conductors 18 of cable 12 are positioned for insulation displacing connection with IDC portions 52 of contacts 44. In order to accurately align conductors 18 with insulation displacing portion 52, the present invention provides a pair of polycarbonate conductor holding blocks 80 which are removably positionable with respect to support member 42. Each holding block 80 is sized to be accommodated within a recess 61 and 63 at the termination end 60 of support member 42. Further each holding block 80 is designed for positionable receipt over the upper and lower rows of contacts 44.

Referring additionally to Figures 4 and 5, each holding block 80 includes plural elongate contact slots 82 which are designed for accommodating insulation displacing contact portions 52 of contacts 44 upon attachment of holding block 80 to support member 42. Each holding block 80 includes individual slots 82 for uniquely accommodating each insulation displacing contact portion 52. Holding block 80 further includes plural elongate conductor passageways 84 which are in individual communication with slots 82. Each passageway 84 accommodates one conductor 18 of cable 12. In order to support conductor 18 for accurate alignment adjacent insulation displacing contact portion 52 for proper insulation displacing connection therewith, holding block 80 includes plural alignment fingers 86 extending into passageway 84. Fingers 86 help support conductors 18 adjacent an upper extent of passageway 84. The walls of holding block 80 defining passageway 84 include an upper V-shaped flattened surface 88.

Fingers 86 extend toward the apex 88a of V-shaped surface 88 so as to permit the location of conductor 18 within the apex 88a of V-shaped surface 88.

As shown particularly with respect to Figure 4, the arrangement of fingers 86 and V-shaped surface 88 serves to locate conductor 18 at a position off-centered with respect to passageway 84. The fingers 86 engage the insulation of conductor 18. As the insulation of conductor 18 is deformable, the fingers 86 hold conductor 18 securely in passageway 84. Fingers 86 may also be resiliently deformable to further frictionally secure the conductor 18 in position for electrical termination with IDC portions 52 of contacts 44. The interaction between fingers 86 and conductor 18 permits proper location of conductor 18 and also accommodates various sizes of conductors.

Additionally, in order to facilitate entry of the individual conductors 18 into the individual passageways 84 holding block 80 includes a tapered funnel entry surface 85 surrounding two adjacent passageways 84. Funnel entry surface 85 is generally oval and tapers inwardly toward passageway 84 to provide a smooth inwardly directed surface against which conductors 18 may be inserted. Funnel entry surface 85 serves to lead conductors 18 into proper position within passageway 84.

In order to properly position holding block 80 with respect to support member 42, a ratcheting inter-lock system is employed. Holding block 80 includes a projecting detent element 90 on each longitudinal side thereof. Support member 42 includes inwardly directed ladder-type detent receiving elements 92. Detent receiving elements 92 are positioned on opposed internal side surfaces 42a of support member 42 within recesses 61 and 63. Each detent receiving element 92 includes a tapered lead-in surface 94 and plural positioning elements 96 which permit the holding block 80 to be supported in multiple positions within support member 42. Initially, holding block 80 is supported below lead-in surface 94. In this position, conductors 18 may be inserted into passageways 84 to align the conductors over insulation displacing contact portions 52. The holding block 80 may be snapped down to either of the next two positions to secure the conductors 18 against, but not in electrical connection with, IDC portions 52. Two intermediate positions are provided so as to properly position various sizes of conductors which are contemplated to be terminated by the connector of the present invention. Holding block 80 may be snapped down to a final position forcing IDC portions 52 fully through slots 82 and past passageway 84 to make insulation displacing connection with conductors 18. In this final position holding block 80 securely supports conductors 18 in insulation displacing electrical connection with contacts 44.

It is contemplated that both holding blocks 80

may be simultaneously moved from an initial position to a final terminated position under the actuation of a suitable tool such as pliers (not shown). Movement in this manner will provide for the mass termination of all eight conductors 18 with the associated insulation displacing contact portions 52.

While projecting detent element 90 effectively cooperates with detent receiving elements 92 to provide multiposition retention of holding block 80 with respect to support member 42, the intermediate positions provided thereby are limited to supporting conductors of the two sizes which are most typically employed with the connector of the present invention. However, it is contemplated that there may be need to terminate other various sized conductors with the connector of the present invention. Accordingly, there is need to provide conductor support prior to termination for conductors in a wide range of conductor sizes.

Referring now to Figures 10-12, a further embodiment of the holding block of the present invention is shown. With respect to the description of the embodiments shown in Figures 10-12, similar reference numerals will be used to denote similar components. Holding block 80' is substantially similar to holding block 80 shown and described above. One holding block 80' is designed for slidable receipt over upper and lower rows of contacts 44. Each holding block 80' (one of which is shown in Figure 10) includes plural elongate contact slots 82' which are designed for accommodating insulation displacing contact portions 52 of contacts 44. Each holding block 80' includes plural elongate conductor passageways 84' which are in individual communication with slots 82'. Each end 83' of holding block 80' includes a longitudinal vertically disposed channel 85' having a projecting detent element 90' at the lower end thereof. In a manner similar to that described above with respect to the embodiment shown in Figure 3, channel 85' and detent element 90' cooperate with inwardly directed ladder-type detent receiving elements 92 of support member 42 so as to permit support of holding block 80' at multiple discrete positions within support member 42. As above described, this permits two intermediate positions to be provided so that holding block 80' may temporarily accommodate two sizes of cable adjacent to the insulation displacing portions 52 of contact 44 prior to final termination. However, it is desirable to support holding block 80' through a range of positions within support member 42 so as to permit temporary accommodation and support of conductors of numerous sizes. The embodiment shown in Figures 10-12 contemplates providing cooperating frictional attachment between holding block 80' and support member 42 continuously between a position where the conductors 18 (Fig. 1) may be inserted in passageways 84' in an unimpeded manner and a final position where the conductors are terminated on IDC portions 52 of contacts 44. As used herein throughout, the terms "continuously supported" or "continuously positioned" refer to the fact that holding block 80' may be supported within recess 61 of support member 42 at any position therealong. Whereas with the embodiment shown in Figure 3, plural positioning elements 96 of each detent receiving element 92 provide plural finite distinct support positions for holding block 80 with respect to support member 42, the present invention provides for "infinite adjustment" of the holding block 80' with respect to support member 42. In order to enable such continuous positioning of holdi4ng block 80' within recess 61 of support member 42, holding block 80' has been modified to include a pair of opposed inwardly directed ribs 9 9' extending along either side of each of channels 85'.

Referring more particularly to Figures 11 and 12, ribs 99' are generally wedge-shaped each having a facing apex 97'. While channel 85' has a width extent which is wider than the width of ladder-type detent receiving elements 92 (Fig. 10) ribs 99' extend inwardly therefrom so as to provide an interference fit between ribs 99' and the sidewalls 92a of detent receiving element 92. As shown particularly in Figure 12, upon insertion of holding block 80' into support member 42, the apices 97' of ribs 99' contact and engage the sidewalls 92a of detent receiving element 92. This frictional engagement is sufficient to hold holding block 80' at a fixed position with respect to support member 42. While detent element 90' still cooperates with detent receiving element 92 to permit the discrete multiple positioning of holding block 80' with respect to support member 42, the continuous frictional engagement between ribs 99' and the sidewalls 92a allows continuous positioning of holding block 80' with respect to support member 42. Thus, the position of holding block 80' with respect to support member 42 may be fixed at any location within recess 61.

With reference to Figure 10, the operation of the embodiment shown therein may be described. Holding block 80' is initially supported at an upper location within recess 61 of support member 42 so that each detent element 90' engages lead-in surface 94 of support member 42. In order to facilitate slidable insertion of the holding block 80' into recess 61 of support member 42, the lower end 95' of each channel 85' is outwardly tapered. In this position, conductors 18 (Fig. 1) may be inserted in an unimpeded manner into passageways 84' to align the conductors over the insulation displacing contact portions 52 of contacts 44. The holding block 80' may then be urged down under manual finger pressure until the conductors 18 inserted therein engage the upper extents of IDC portions 52. This engagement is sufficient to frictionally retain the conductors against the IDC portions 52 without piercing the insulation and placing the conductors in electrical connection with the IDC portions 52. This intermediate position temporarily holds and

secures the conductors within passageway 84' enabling the installer to likewise terminate the conductors at the opposite end of support member 42. This intermediate position where conductors 18 are supported against, but not in electrical connection with, IDC portions 52 is variable depending upon the size of conductors 18. The particular intermediate position for any conductor may or may not coincide with the discrete positions defined by the spaced apart positioning elements 96 in a manner described above. The frictional engagement between ribs 99' and sidewalls 92a permit the continuous positioning of holding block 80' at any position within support element 42 without regard to engagement of detent element 90' with plural positioning elements 96.

In a manner similar to that described hereinabove, holding block 80' may be further inserted into recess 61 and may be snapped down to a final position forcing IDC portions 52 fully through slots 82' past passageways 84' to make insulation displacing connection with conductors 18. As above described, it is contemplated that a pair of holding blocks 80' supported at either opposed side of support element 42 may be simultaneously terminated over oppositely directed contacts 44 by actuation of a suitable tool.

While as described above with respect to the embodiment shown in Figures 3, 4 and 5, holding block 80 includes plural fingers 86 extending into passageways 84 to help support conductors therein, the present invention permits support of the conductors against the upper extent of IDC portions 52 at any continuous position therealong and therefore the embodiments shown in Figure 10, need not include fingers extending into the passageways 84'. Elimination of the fingers permits easier insertion of conductors 18 into passageways 84' and also results in manufacturing expediency.

Referring again to the embodiment shown in Figures 1-5, with termination sub-assembly fully assembled and terminated to conductors 18 of cable 12, the termination sub-assembly 40 and cable 12 may be inserted into base 22 of housing 20. Termination subassembly 40 is inserted into base 22 adjacent connection end 30 thereof. Upon insertion of termination sub-assembly 40 into base 22, cable 12 is inserted into cable receiving end 32 of housing 20 and extends through passage 34 at the rear end thereof.

The cable receiving end 32 of housing 20 includes a two-component strain relief device 100 which helps secure cable 12 in housing 20. Strain relief device 100 which is shown in more detail in Figure 6 includes a pair of mating generally hermaphroditic strain relief components 102 and 104. Strain relief component 102 is referred to as a stationary component and is fixedly positioned in a channel 106 (Fig. 8) in base 22 adjacent cable receiving end 32. Strain relief component 104 is movably positioned within a similarly disposed slot in cover 24. Strain relief components 102 and 104 are generally U-shaped members having a bottom wall 102a and 104a respectively and upwardly extending sidewalls or legs 102b, 102c and 104b, 104c. Legs 102c, 104c are deflectable and include inwardly directed ratchet teeth 102d and 104d respectively. Legs 102c and 104c include outwardly directed ratchet teeth 102e, 104e respectively. The hermaphroditic strain relief components 102 and 104 are positioned so that leg 102b of component 102 engages leg 104c of component 104 and similarly leg 102c of component 102 engages leg 104b of component 104. The positioning of ratchet teeth 102d, 104d and 102e, 104e permit the movable one-way ratchet engagement of component 102 with respect to component 104. The deflectability of legs 102c and 104c permits such ratchet movement of components 102 and 104. The internal surfaces of legs 102c, 104c as well as the internal surfaces of bottom walls 102a and 104a are generally curved so as to form a circular opening 108 which is generally concentric with passage 34 of housing 20.

As component 104 moves with respect component 102, opening 108 defined therebetween will be reduced in size in order to frictionally secure jacket 14 of cable 12 therebetween. In order to assist in this frictional securement, ribs 110 are provided on the internal surface of each bottom wall 102a and 104a. These ribs provide increased localized friction against the cable jacket 14.

Component 104 may also include a frangibly removable cap 112 which is attached to component 104 by a flexible web 114. Cap 112 includes inwardly directed protrusions 116 which are insertable into recesses 118 adjacent bottom wall 104a of component 104 for snap fit engagement therewithin.

Strain relief device 100 operates in the following manner. Strain relief component 102 is fixedly positioned within base 22 of housing 20. Strain relief component 104 is inserted into the slot in cover 24. Cover 24 is then positioned over and snap fitted on to base 22. In this position legs 102b, 104b and 102c and 104c are only in initial engagement. In order to provide strain relief for cable 12 within connector 10, strain relief component 104 is manually pushed down into housing 10 through cover 24 to provide for ratchet engagement of the respective teeth of legs 102b, 104b and 102c, 104c. Component 104 is pushed downward toward component 102 until the cable is secured within opening 108 which is continually decreasing in size by the movement of component 104 with respect to component 102. If cable 12 is of relatively small diameter, cap 112 may be attached to component 104 and be used as a pressing surface. With such relatively small cables, cap 112 will also function as a stop preventing over-insertion of component 104 and the possible of crushing of cable 12. In terminating larger cables, cap 112 may extend

above the surface of cover 24 as component 104 need not be inserted as deeply into base 20. In this situation in order to maintain a flat profile of cover 24, cap 112 may be frangibly removed from component 104 and discarded.

Prior to installation of cable 12, cable shield 16 is folded back over an extent of jacket 14. Thus the cable shield will also be secured between strain relief components 102 and 104. As the connector 10 is metallized, conductive continuity may be established between cable shield 16 and housing 20. Additionally, as contact shield 66 is in electrical engagement with metallized housing 20 through extending bumps 74 thereon, conductive continuity is maintained between cable shield 16 and contact shield 66 through metallized housing 20. However, in order to provide further redundant direct conductive continuity between cable shield 16 and contact shield 66, a ground clip 120 is employed.

Ground clip 120 which is shown in more detail in Figure 7 is positioned adjacent strain relief device 100 for engagement with cable shield 16 upon strain relief termination of cable 12 in housing 20. Ground clip 120 is an elongate member formed of conductive metal such as plated copper. Ground clip 120 includes a cable engagement extent 122, an opposed contact shield engaging extent 124 and a central mounting surface 126. Cable engagement extent 122 includes a transversely arcuate cable engaging surface 128 for positioning of cable 12 thereon. Shield engagement extent 124 includes a deflectable cantilevered arm 130 for engagement with extending ground element 76 of contact shield 66. Ground clip 120 is positioned within housing base 22 so that cable engagement extent 122 overlies fixed strain relief component 102. Ground clip 120 is secured within base 22 employing a pair of inwardly directed deflectable locking barbs 132 at central mounting surface 126. An appropriate post (not shown) extends from a wall of base 22 to be received between locking barbs 132 to secure ground clip 120 thereat. Shield engagement extent 124 extends toward connection end 30 of housing 20 for engagement with ground element 76 of contact shield 66 upon insertion of contact shield 66 into base 22. Cantilevered arm 130 is deflectable so as to resiliently engage an end 76a (Fig. 2) of contact shield 66 upon termination of cable 12 in housing 20. Ground clip 120 establishes electrical continuity between cable shield 16 and contact shield 66 directly without need to employ the metallic plating of housing 20 to establish such continuity.

Referring now to Figures 8 and 9 the latching of connector 10 to a mating connector is shown. Connector 10, which as above mentioned is a plug connector, may be mechanically and electrically mated with a complementary jack connector shown schematically as jack connector 150. Connector 10 is designed for repeated connection and disconnection with jack connector 150. In order to provide for such repeated connections and disconnections, connector 10 includes a deflectable latch 140 extending therefrom. Connector 10 which is shown in a position rotated 180° from that shown in Figure 1, includes latch 140 extending from a side wall of housing base 22. Latch 140 is generally a deflectable cantilevered member having a distal latching surface 142, a proximal manual actuating surface 144 and a central transition surface 146. Latching surface 142 and manual actuating surface 144 extend generally longitudinal to connector housing 20. Latching surface 142 and manual actuation surface 144 are vertically spaced apart being connected by transversely extending transition surface 146. The particular shape of latch 140 provides for a low profile configuration of the latch. Connector 10 generally has a rectangular body profile defined by base 22 and cover 24. Employing an extending simple cantilevered arm which would extend from housing 20, would require the distal end of the latch to be substantially outward of the rectangular body profile of connector 10. This would result in the presentation of a wider body profile which would be generally unacceptable for use with compact components. Also in order to appropriately latch such an extending arm a greater degree of deflection would be required. The latch 140 of the present invention overcomes these disadvantages by providing a latching surface 142 which is within the body profile of housing 20 upon latching engagement with connector 150.

Connector 10 is connected to jack connector 150 in the following manner. The connection end 30 of connector 10 is inserted into jack connector 150, latch 140 which is designed to downwardly deflect upon insertion into connector 150, engages a downwardly ramped latch element 152 of connector 150. This engagement forces latching surface 142 under ramped latch element 152. An opening 148 in latching surface 142 rides over ramped latch element 152 and into locked position therewith.

Referring to Figure 9 the latched position of connector 10 with respect to connector 150 is shown. Latching surface 142 is secured within connector 150 with opening 148 in latching surface 142 surrounding latch element 152 to secure connectors 10 and 150 in latching engagement. In order to release the latch 150 and disconnect connector 10 from connector 150 manual actuation surface 144 is depressed. Since manual actuation surface 144 is positioned in the plane above the plane of latching surface 142, the manual actuation surface 144 may be easily manipulated by the user. By depressing manual actuation surface 144 latching surface 142 is moved away from ramped latch element 152 permitting disconnection of connector 10 from connector 150.

The present invention thus provides a low profile latch almost entirely within the body profile of connec-

tor 10 with only manual actuation surface 144 slightly extending above the body profile of connector 10 to facilitate manual actuation and release of connector 10 from connector 150.

Various changes to the foregoing described and shown structures would now be evident to those skilled in the art. Accordingly the particularly disclosed scope of the invention is set forth in the following claims.

Claims

1. An electrical connector for terminating discrete insulated electrical conductors of a multi-conductor cable comprising:

   an electrically insulative connector housing;

   plural electrical contacts supported in said housing, said contacts having insulation displacing contact portions for effecting insulation displacing electrical connection with said conductors;

   a conductor holding block having plural conductor receiving passages for individually accommodating said conductors and plural contact slots in individual communication with said conductor receiving passages for accommodating said insulation displacing contacts portions;

   said holding block being movably supported by said housing for movement from a conductor receiving position permitting unrestricted insertion of said conductors into said passages to a termination position wherein said insulation displacing electrical connection is effected; and

   said holding block and said housing including cooperative securement elements for supporting said holding block with respect to said housing at an intermediate position between said conductor receiving position and said termination position, said intermediate position defining a temporary conductor support position for retentively supporting said conductors against said insulation displacing contact portions without effecting said insulation displacing connection.

2. An electrical connector of claim 1, wherein said cooperative securement elements define plural, discrete positions in which said holding block is supported with respect to said housing including said conductor receiving position and said termination position.

3. An electrical connector of claim 2, wherein said cooperative securement elements further support said holding block with respect to said housing in plural intermediate positions including:

   a first intermediate position for accommodating conductors of a given size; and

   a second intermediate position for accommodating conductors of a size different from said given size.

4. An electrical connector of claim 3, wherein said cooperative securement elements include:

   said holding block including a detent member extending therefrom; and

   said housing including plural spaced detent receiving elements each engageable with said detent member of said holding block for captively supporting said holding block in said plural, discrete positions.

5. An electrical connector of any one of claims 1 to 4, wherein said cooperative securement elements frictionally support said holding block with respect to said housing at continuous positions between said conductor receiving position and said termination position, one of said continuous positions defining said temporary conductor support position.

6. An electrical connector of claim 5, wherein said cooperative securement elements comprise:

   said connector housing including an extending member and said holding block including a channel for frictional receipt of said extending member.

7. An electrical connector of claim 6, wherein said extending member includes opposed sidewalls and wherein said channel includes channel walls having opposed inwardly directed ribs, said ribs being dimensioned for frictional engagement with said sidewalls of said extending member.

8. An electrical connector of claim 7, wherein said frictional engagement between said ribs and said sidewalls permits positioning of said holding block at any position between said conductor receiving position and said termination position.

9. An electrical connector of claim 7, wherein each said channel includes an outwardly tapered end to facilitate insertion of said extending members thereinto.

10. An electrical connector of any one of claims 1 to 9, wherein said holding block further includes one or more conductor engaging fingers extending into each said passage for frictionally supporting said insulated conductors in non-movable disposition within said passages.

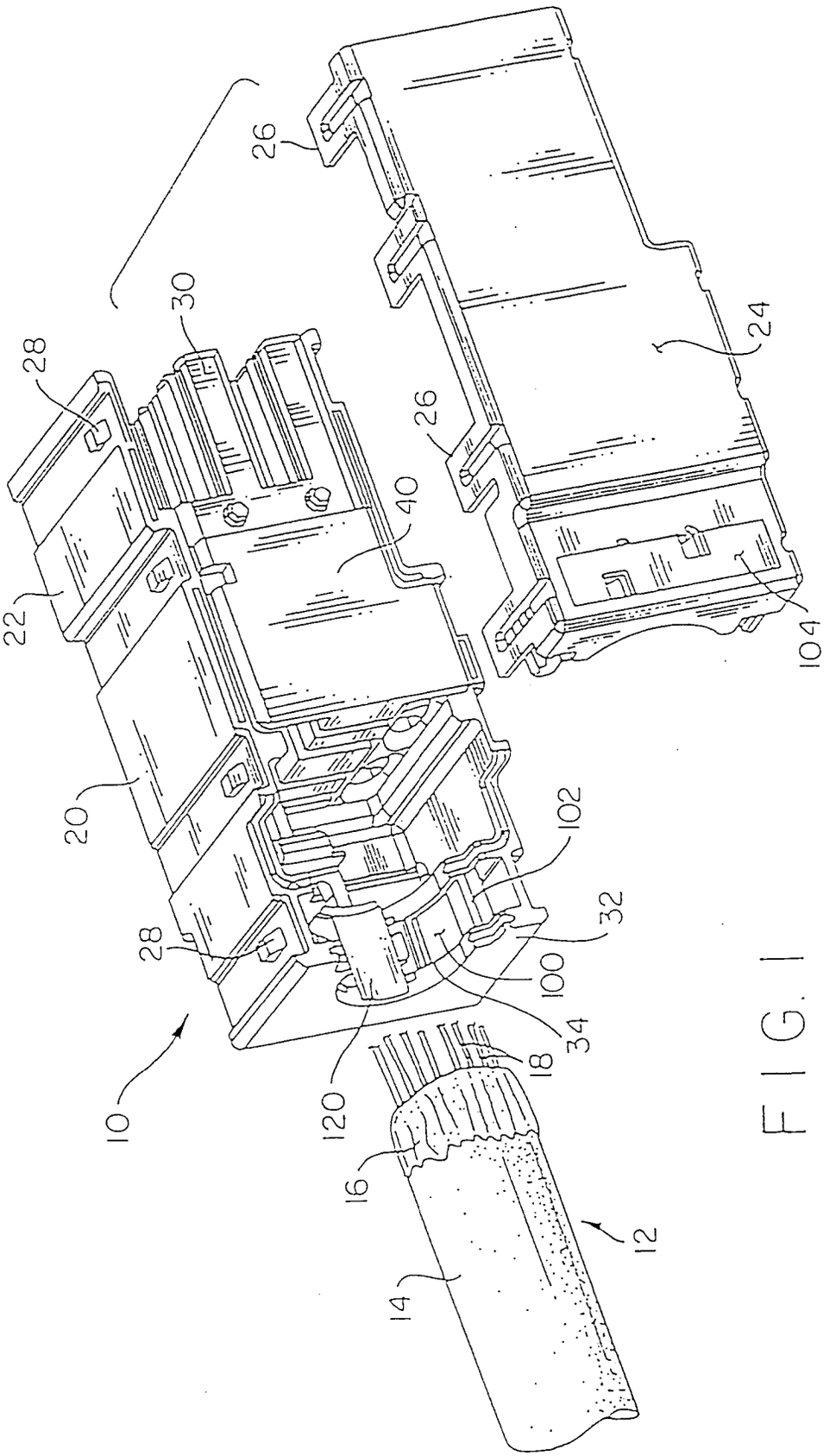


FIG. 1

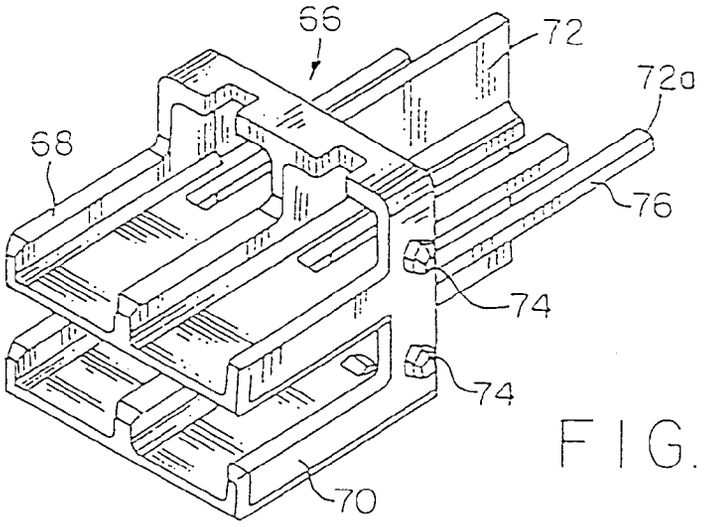
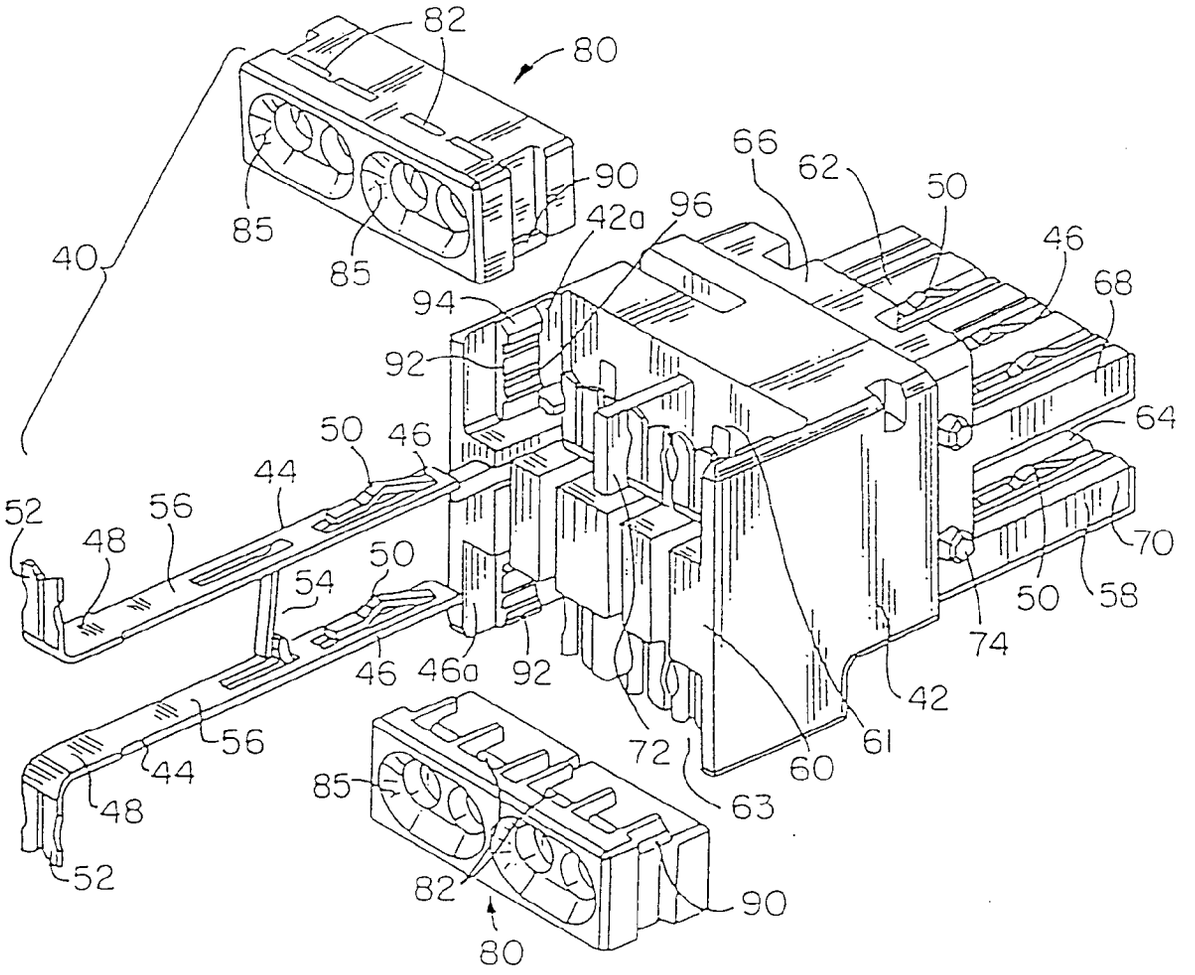

66
72
72a
68
76
74
74
70

FIG. 2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85
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48
54
50
70
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52
82
90
80

FIG. 3

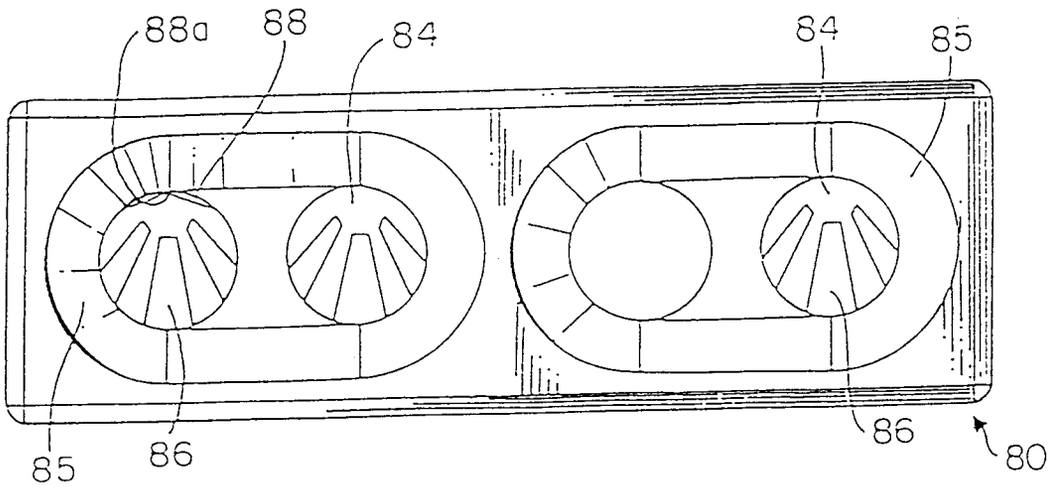


FIG. 4

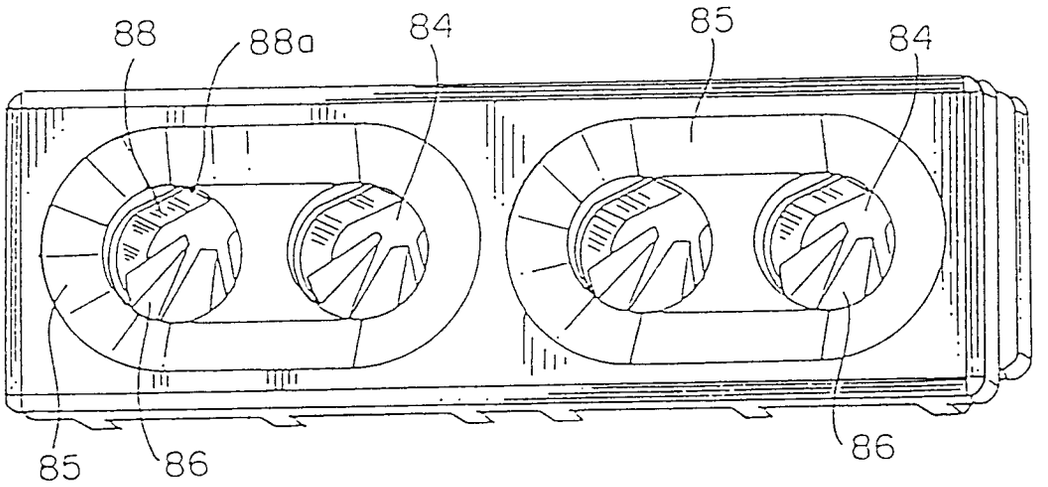
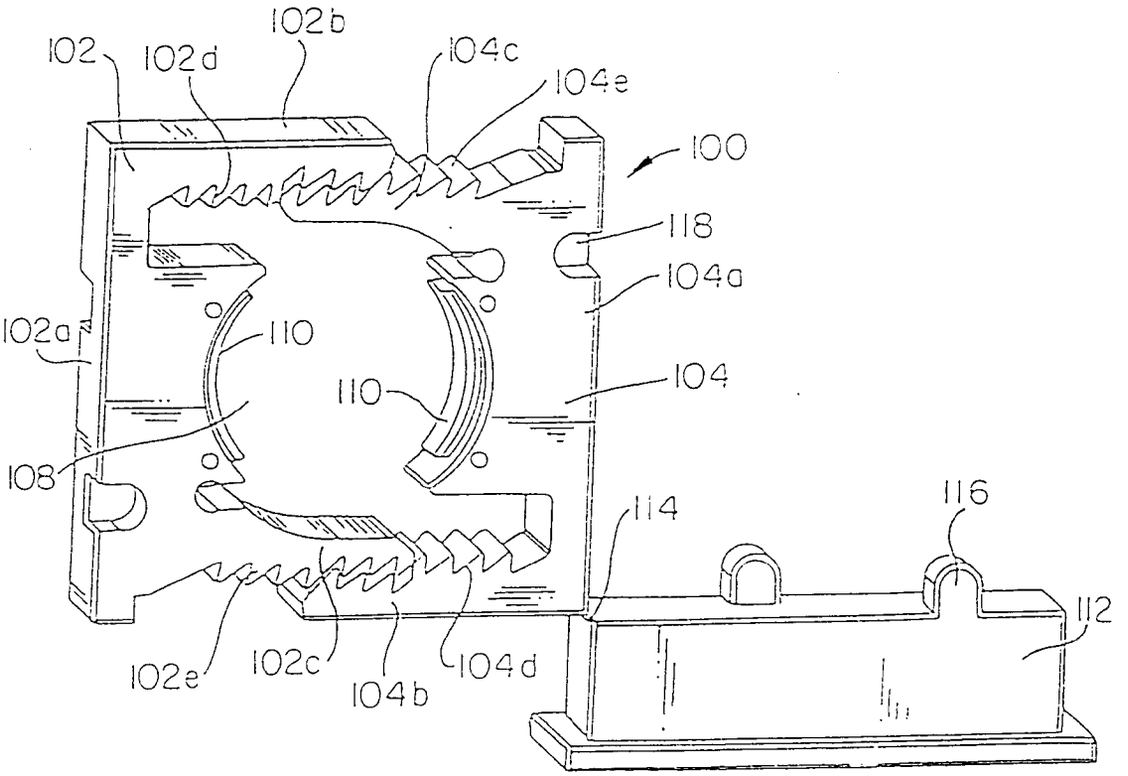


FIG. 5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104b
104d

FIG. 6

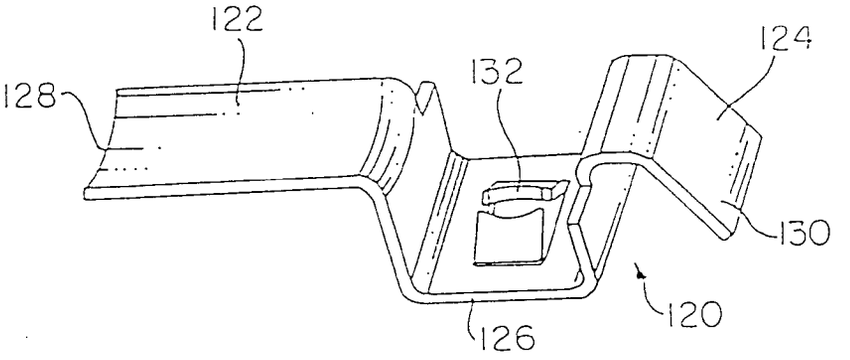
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FIG. 7

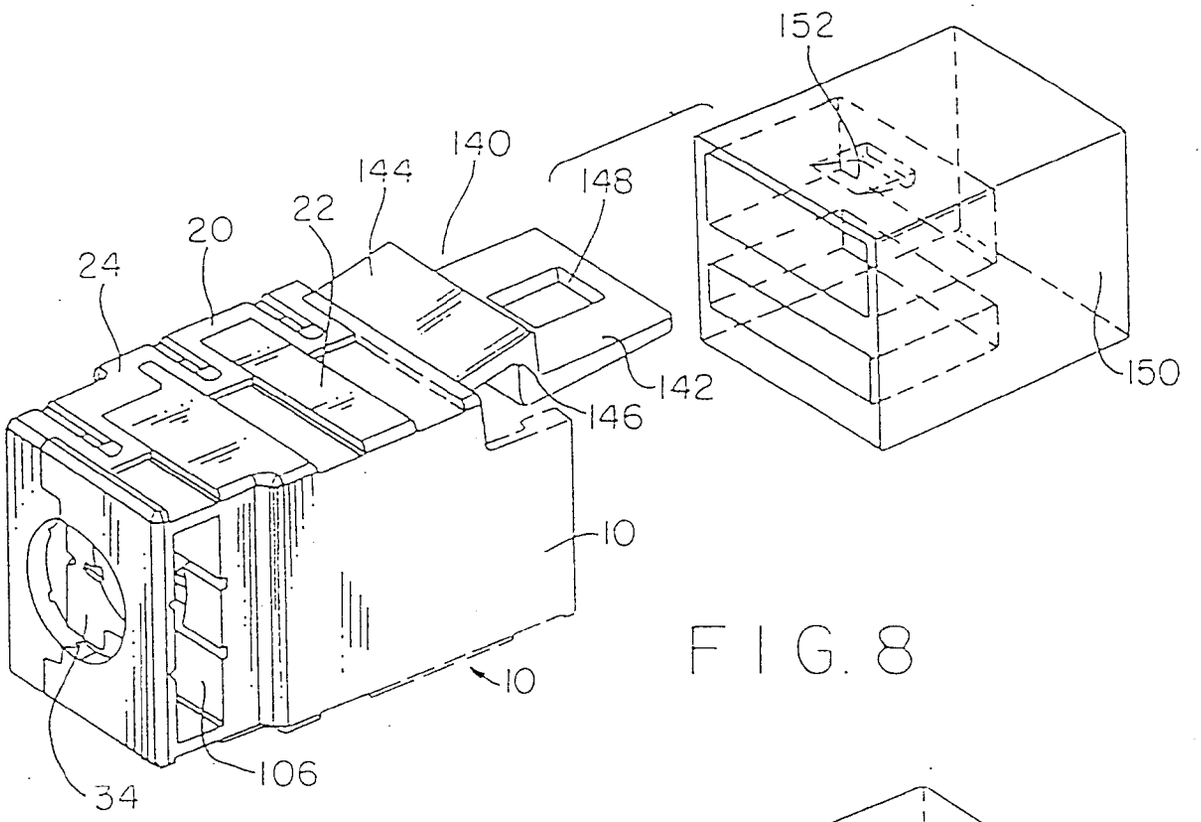
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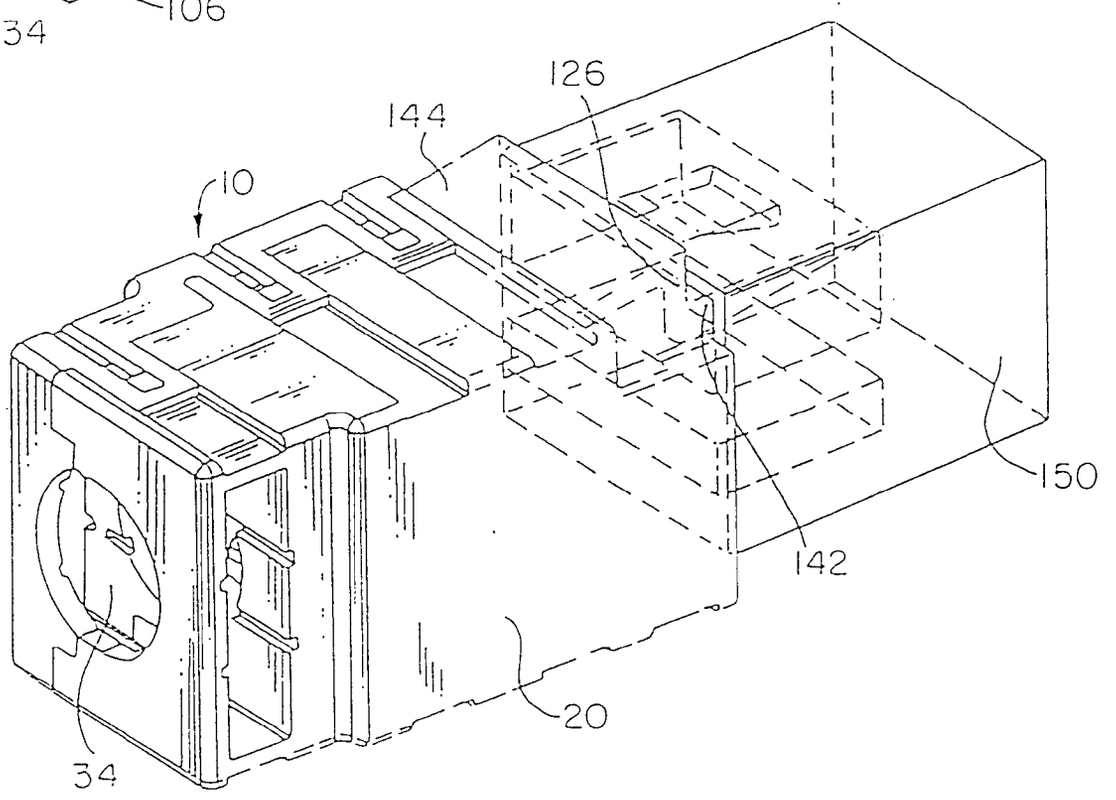
FIG. 8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142
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FIG. 9

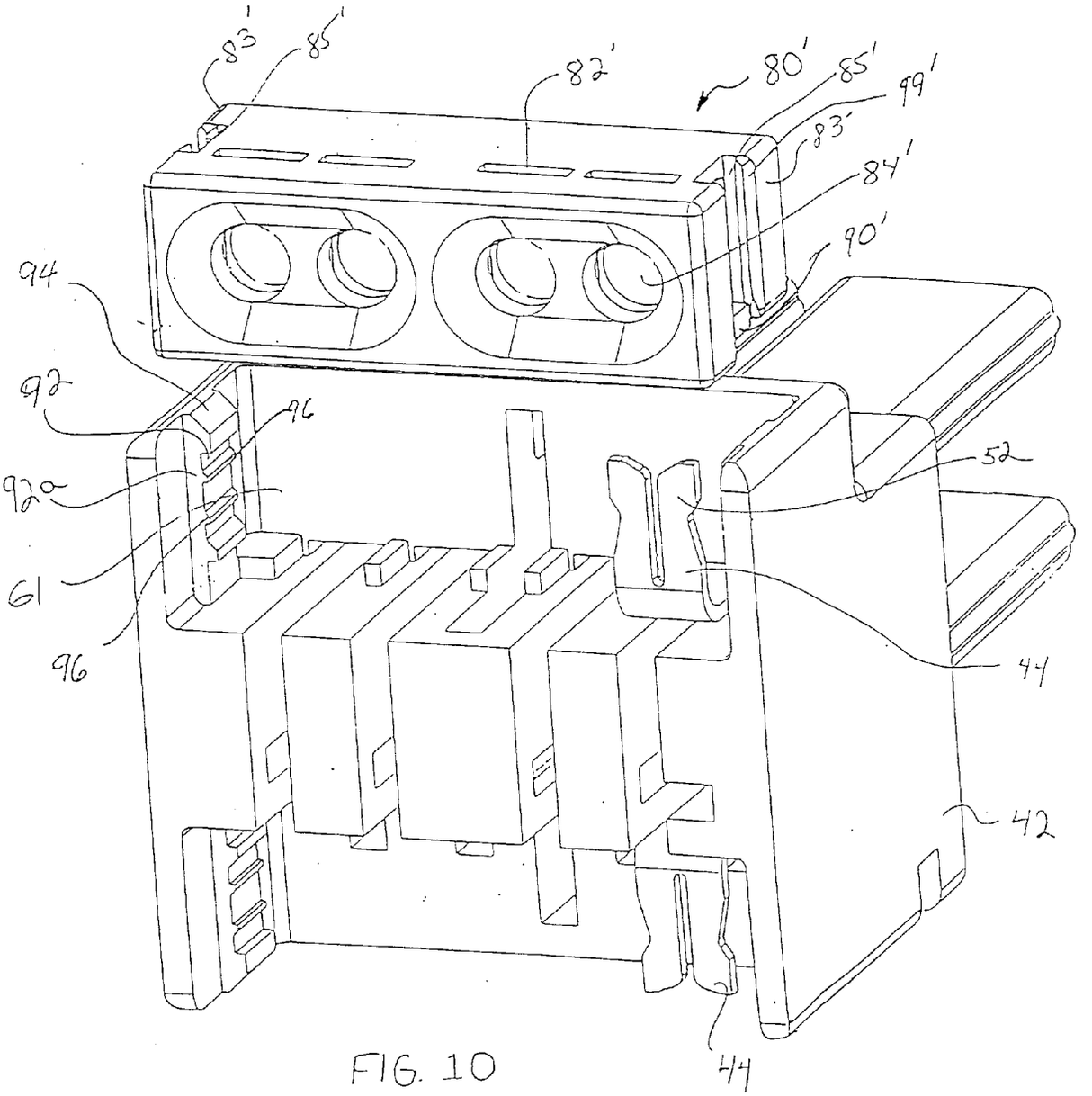

FIG. 10

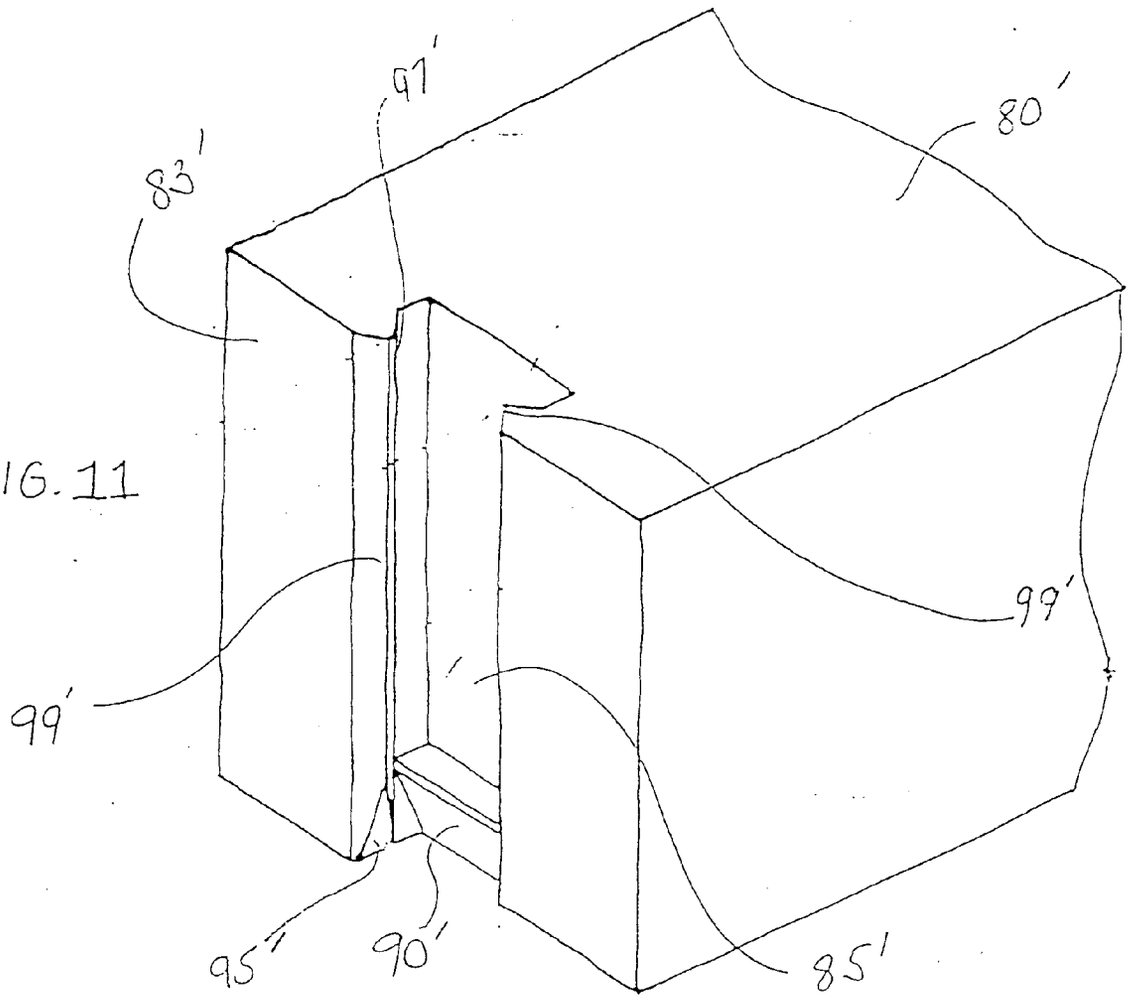

FIG. 11

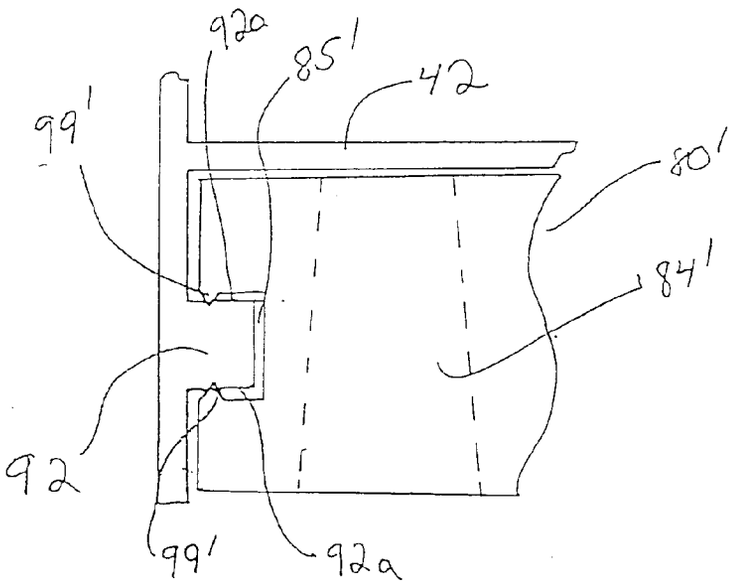

FIG. 12

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 8369

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE-U-93 10 211 (LEONHARDY GMBH) * claim 2 *	1,2	H01R4/24
Y		3-5	
Y	US-A-3 804 971 (MINNESOTA MINING AND MANUFACTURING COMPANY) * column 4, line 44 - line 68 *	3-5	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 February 1995	Libberecht, L

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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P : intermediate document

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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