

Description

The present invention relates to electrical interconnection devices and methods and, more particularly, to such devices and methods using integral molding. The invention is particularly suited to the field of mass termination connectors.

In the art of electrical connectors or electrical interconnection devices for cables and the like, the term cable termination typically means a connector that is or can be used at the end or at an intermediate portion of a cable to connect the conductor or conductors thereof to an external member or members, such as another connector, cable termination, printed circuit board, or the like. Such external member usually is part of or can be connected to at least part of another electrical device, circuit, or the like; the objective is to effect electrical interconnections of respective circuits, lines, conductors, etc. A cable termination assembly is usually referred to as a combination of a cable termination with an electrical cable. Sometimes the terms cable termination and cable termination assembly equivalently are interchanged, depending on context.

The invention is described in detail below with respect to a multiconductor cable termination assembly. Such cable termination assembly may be used to connect the conductors of a multiconductor cable, for example, a flat ribbon multiconductor cable (or any other electrical cable) to an external member, e.g., as was noted above. The actual cable termination may take the form of a socket or female connector type structure, a card edge connector, and other forms that are well known, as well as those forms that may be developed in the future. It will be appreciated, nevertheless, that the principles of the invention may be used with a cable having only a single conductor or an assemblage of cables, each having one or more conductors.

Multiconductor electrical cable termination assemblies have been available in unassembled form requiring mechanical assembly thereof, which includes the mechanical clamping of the termination properly to secure the various elements of the termination and the cable, and also have been available as a permanent preassembled and molded integral structural combination. Examples of such cable termination assemblies are found in U.S. Patent No. 3,444,506 and in U.S. Patent No. 4,030,799, respectively.

In both such patents and the techniques disclosed therein, the junctions or connections of contacts with respective conductors of the cable are made by part of the contacts piercing through the cable insulation to engage a respective conductor. Such a connection is referred to as an insulation

displacement connection (IDC).

Unfortunately, contamination of the IDC junctions, e.g., due to dirt, corrosion and the like, can detrimentally affect the junction, e.g., causing a high impedance, an open circuit or the like. The mechanically assembled types of prior cable terminations are particularly susceptible to such consequences. The directly molded cable termination assemblies are less susceptible to contamination because of a molded hermetic seal or near hermetic seal surrounding the junctions of the cable conductors and contacts. Examples of such directly molded cable termination assemblies are presented in the '799 patent.

One common aspect of both the mechanically assembled cable termination assemblies and the directly molded type is the required assembling step or steps and the separate parts fabrications. These are labor and time consuming and, thus, are relatively expensive. For example, the mechanically assembled devices require the separate molding of several parts followed by assembling thereof. Even in the directly molded device of the '799 patent, to make a socket connector illustrated therein it is necessary to provide a separately molded cover, to install it over the contacts, and then to secure it, e.g., by ultrasonic welding, to the molding base. It would be desirable to minimize such mechanical assembly and welding steps and attendant costs. Such elimination of the welding is most desirable because the weld is an area of low strength, and to help assure success of a weld it often is necessary to make the parts of the connector of relatively expensive virgin plastic material.

Several types of electrical contacts are available for use in electrical connectors, such as male and female contacts. A connector or cable termination using male or female contacts would be categorized, respectively, as a male or a female connector. A typical example of a male contact is that known as a pin contact. A pin contact usually is a relatively rigid straight member that is not particularly compliant relative to a female contact. Pin contacts often are inserted into female contacts to make electrical connections therewith; sometimes pin contacts are inserted into holes in a printed circuit board and usually are soldered in place to connect with printed circuits on the board. Another example effectively of a male contact would be the printed circuit traces or portions on a printed circuit board to which an edge board connector or the like may be connected. A female contact may be of the cantilever type, fork type, box type, resilient wiping type, bow type, and so on. Usually a female contact is relatively resilient and relatively compliant compared to a male contact. When a male contact and a female contact are moved relative to each other or are inserted relative to each other, usually

there is some deformation of the female contact in response to engagement with the male contact, and often there is a wiping of the contacts against each other as they are brought together to form an electrical connection therebetween.

In the '799 patent a molding method is disclosed which sometimes is referred to as insert molding. For such insert molding method, electrical contacts are placed in a mold, a multiconductor cable is placed relative to the contacts and mold, the mold is closed to effect IDC connections of the cable conductors and contacts and to close the mold cavity, and the molding material then is injected into the mold. The fork contacts mentioned are generally planar contacts in that the major extent thereof is in two directions or dimensions (height and width), and the thickness is relatively small; this characteristic makes the fork contacts particularly useful for insert molding.

Other types of electrical contacts are referred to as three-dimensional contacts. An example is that used in some connectors sold by Minnesota Mining and Manufacturing Company and sometimes referred to as a Hi-Rel contact. Such contact has an inverted U-shape. One leg of the U is connected to a base portion of the contact, which base portion in turn is connected to an IDC portion. The other leg of the U is bent out of the plane of the first leg and base to form a resiliently deformable cantilever contacting portion. The contact ordinarily is placed relative to a socket, cell or chamber into which a pin contact may be inserted to engage the cantilever arm or contacting portion. There are a number of advantages to such three-dimensional contacts, including, for example, the relatively large surface available to engage an inserted pin contact and the relatively large compliance factor allowing a large bending capability of the cantilever contacting portion without overstressing the same.

International Application WO-A-88/01946 discloses a cable termination assembly which comprises plural electrical contacts having a longitudinal axis, and comprising a connection portion for connecting to a conductor of a multi conductor electric cable, a contacting portion for contacting an external member, and a base portion between said connection portion and said contacting portion, together with a cap including a chamber containing a contacting portion and having an insertion opening at one end to permit entry of an external member for connection to said contacting portion. A strain relief body may be molded directly to at least part of the cable and the electrical contact.

In accordance with the present invention there is provided a cable termination assembly comprising an electrical cable including at least one conductor, at least one electrical contact, said elec-

trical contact having a longitudinal axis, and comprising a connection portion for connecting with a conductor to form a junction therewith, a contacting portion for contacting an external member when in engagement therewith, and a base portion between said connection portion and said contacting portion, and a cap including a chamber in which at least part of said contacting portion is positioned, and an insertion opening at one end of said chamber to permit entry of an external member for electrical connection to said contacting portion, and a strain relief body directly molded to at least part of said cable, and said electrical contact characterised in that said cap has a support land at the end of the chamber opposite the insertion opening for engaging with an offset or bend (55) provided on said base portion to support said electrical contact at least along said longitudinal axis during connecting of said connection portion to such conductor; and that said strain relief body is further directly molded to at least part of said cap to form an integral structure therewith.

Advantageously said offset is placed in the chamber opposite the insertion end and is adapted for blocking the entry of molding material into said chamber of said cap during molding of said strain relief body to prevent said molding material from interfering with operation of said contacting portion.

Advantageously said contact base portion has an offset between said contacting portion and said connecting portion, and said support land has a sloped surface to support said electrical contact during connecting of said connection portion to a conductor of a cable.

Conveniently said strain relief body is molded directly to at least part of said electrical contact, said junction and such conductor, and offset (55) of the said contact base portion is cooperative with said cap to block entry of molding material into at least part of said chamber during molding of said strain relief body to prevent said molding material from interfering with the operation of said contacting portion.

Conveniently said base portion is formed for blocking molten material from entering said chamber and comprises a offset or bend for fitting in one end of said chamber to prevent the flow of molding material during molding of said strain relief body in a way that would interfere with operation of said contacting portion and rests on a sloped surface formed in said cap.

Advantageously said cable comprises a multiconductor flat ribbon-type cable, and said cap supports a plurality of electrical contacts.

Conveniently all of the junctions are encapsulated in a hermetic environment as the material of the strain relief body is compatible with the cable insulation material to form a chemical bond.

Conveniently said connection portion comprises an insulation displacement connection for insulation displacement connection with a conductor.

Advantageously said support cap chamber is provided with walls for guiding a pin contact into engagement with said contacting portion in said chamber, and said contact base portion comprises an offset positioned to interfere with and to limit the travel of such an inserted pin contact inserted to engage said contacting portion of said electrical contact.

Advantageously said electric contact is a three-dimensional contact.

Conveniently said three dimensional contact comprises a U-shaped connection portion.

Such merging, at least in part, is possible by using a cooperative relation between the contacts and the cover or cap of the cable termination assembly to shut off cells in the cover where working (contacting) portions of the contacts are located. This shut off function allows the strain relief body to be molded directly to the cover, contacts, junctions and cable.

The junctions of such cable termination assembly are secure, the molded strain relief assuring that the contacts and cable are held in relatively fixed positions; and the junctions of the contacts and cable conductors are hermetically sealed within the strain relief body to avoid contamination that otherwise potentially could damage the conductivity or effectiveness of connection. The strain relief body holds the cable, contacts, and cover securely as an integral structure providing a strong cable termination assembly.

The various features of the invention may be used in electrical connectors, primarily of the cable termination or cable termination assembly type, as well as with other electrical connectors. The features of the invention may be used to effect an interconnection of the conductor of a single conductor cable to an external member or to connect plural conductors of a multiconductor cable or assemblage of cables to respective external members. The invention is useful primarily with female-type contacts, socket connectors, card edge connectors, as are described herein; however, the principles of the invention may be employed with contacts other than those of the female type and with other connectors as well.

The foregoing and other objects, advantages and aspects of the invention will become more apparent from the following description.

Fig. 1 is a side elevation view of a cable termination assembly according to the present invention;

Figs. 2 and 3 are, respectively, top and bottom views of the cable termination assembly looking

in the direction of the respective arrows of Fig. 1;

Fig. 4 is an end elevational section view looking generally in the direction of the arrows 4-4 of Fig. 1;

Fig. 5 is a section view of the cable termination assembly of Fig. 1 looking in the direction of the arrows 5-5, the contacts not being shown;

Fig. 6 is a partial side elevational section view looking generally in the direction of the arrows 6-6 of Fig. 2;

Fig. 7 is an end elevation view of the cover for the cable termination assembly;

Fig. 8 is a side elevation view of the cover for the cable termination assembly, the right-hand portion of the figure being broken away in section;

Figs. 9 and 10 are, respectively, top and bottom views of the cover of Fig. 8 looking generally in the direction of the respective arrows thereof;

Fig. 11 is a section view of the cover looking in the direction of the arrows 11-11 of Fig. 9;

Fig. 12 is an end elevation view of the cover looking in the direction of the arrows 12-12 of Fig. 8;

Fig. 13 is a front elevation view of an electrical contact for use in the cable termination assembly of the invention, such electrical contact being shown supported from a breakaway carrier strip;

Figs. 14 and 15 are, respectively, left and right end elevation views of the contact of Fig. 13 looking generally in the direction of respective arrows;

Figs. 16 and 17 are, respectively, top and bottom views of the contact of Fig. 13 looking generally in the direction of the respective arrows;

Fig. 18 is a back elevation view of the contact of Fig. 13;

Fig. 19 is an enlarged fragmentary top view of the cover similar to the illustration of Fig. 9 but also showing a top section view of the installed electrical contacts;

Fig. 20 is an enlarged section view of the cover with contacts installed, one contact being resiliently deformed by an inserted pin contact; and

Figs. 21 and 22 are, respectively, partial schematic front and end views of a molding machine for making cable termination assemblies according to the invention.

Referring, now, in detail, to the drawings, wherein like reference numerals designate like parts in the several figures, and initially to Figs. 1 through 7, a cable termination assembly in accordance with the present invention is designated 10. The cable termination assembly includes a cable termination 11 and a multiconductor flat ribbon

cable 12, for example, of conventional type. Such cable 12 includes a plurality of electrical conductors 13 arranged in a generally flat, spaced-apart, parallel-extending arrangement and held relative to each other by the cable insulation 14. The conductors may be copper, aluminum, or other conductive material. The insulation 14 may be polyvinyl chloride (PVC) or other material capable of providing an electrical insulation function desired. Although the cable is shown as a multiconductor cable, principles of the invention may be employed with a single conductor cable. Moreover, although the multiconductor cable preferably is in the form of a flat ribbon cable, the cable configuration may be of other style, and, in fact, the multiconductor cable may be formed of a plurality of single conductor cables assembled together.

The cable termination assembly 10 is capable of effecting a mass termination function for the plurality of conductors 13 in the multiconductor cable 12.

The cable termination assembly 10 includes the cable termination 11 and cable 13 and the cable termination 11 includes a plurality of electrical contacts 15, a cap 16, and strain relief 17. The cap 16 serves as a preliminary support for the contacts 15 prior to molding of the strain relief body 17. The cap 16 also provides a plurality of cells 20 to guide pin contacts or the like for engagement with respective contacts 15 and to help support the electrical contacts 15 for such engagement. The electrical contacts 15 are electrically connected relatively permanently to respective conductors 13 of the cable 12 at respective insulation displacement connection (IDC) junctions 21; and the electrical contacts 15 also include a portion for relatively non-permanently connecting with another member, such as a pin contact, that can be inserted to engage and can be removed from engagement with respect to the electrical contact. The strain relief body 17 is directly molded about part of the contacts 15, part of the cap 16, and the junctions 21 to form therewith an integral structure as is described further below.

Details of the cap 16 are illustrated in Figs. 1 through 12. The cap preferably is formed by plastic injection molding techniques. The material of which the cap is made may be plastic or other material that can be plastic injection molded, such material may include glass fiber material for reinforcement, as is well known. Various steps, polarizing, keying, etc., means may be provided at the outer surface or surfaces (or elsewhere) in the cap 16. For example, a step 22, a slot 23, and a pin for angular indicator 24 are illustrated in Fig. 1 for such purposes.

Within the cap 16 are formed a plurality of cells 20. Such cells or chambers 20 are formed in

such a way as to provide desired support and positioning functions for the contacts 15 and to guide a pin contact or other external member in to the cell for making an electrical connection with the contacts 15 therein. At the front end 25 of the cap 16 are tapered holes or openings leading into the contacting area 27 of each cell into which a pin contact can be inserted for electrical connection with a respective electrical contact 15. Such electrical connection ordinarily is non-permanent, especially relative to the permanency of the IDC junctions 21, in that in the usual case it is expected that the pin contact could be withdrawn from the cell 20.

Each cell 20 includes both the contacting area 27, a positioning area 30, and a land support 31. The contacting area 27 is where a pin contact may be inserted to engage the electrical contact 15. The positioning area 30 helps to position the contact 15 properly in the cell 20 for the further steps described below in manufacturing the cable termination assembly 10 and for proper orientation of the contact 15 for subsequent use of the cable termination assembly 10. The land support 31 provides a contact support function described in greater detail below.

Referring specifically to Figs. 8-11, details of the cap 16 are specifically illustrated. The contacting area 27 of each cell 20 extends fully between the front 25 and the back 32 of the cap 16. The positioning area 30 of each cell extends from a location adjacent a land 33 relatively proximate the front 25 (but just behind the juncture of the tapered opening 26 with the contacting area 27) to the back 32 of the cap 16. For purposes of this description, the length of each cell is the vertical direction with respect to Fig. 8; the width of each cell is the horizontal direction depicted in Fig. 8, and the thickness of each cell is the dimension into or normal with respect to the plane of the paper relative to the illustration of Fig. 8. The thickness and width of the contacting area 27 are approximately equal to form a generally square cross-sectional area normal to the height of each contacting area 27 of each cell 20. The width of the positioning area 30 is about the same as the width of the contacting area 27. However, the thickness of the positioning area 30 is smaller than the thickness of the contacting area to provide a relatively close fit for part of the contact 15 to accomplish the desired positioning function described further below.

At the back 32 each cell 20 has a relatively large rectangular 34 (Fig. 9 and 11). The land 31 slopes to provide a gradual lead in from the thick area of such opening 34 in line with the positioning area 30 to the relatively thinner part of such positioning area 30. As is seen in Fig. 11, such land 31

is the start of rib 35 that extends to the land 33 adjacent the opening 26 to each cell 20.

At the back 32 of the cap 16, are a pair of ribs 36, which extend along the width of the cap. The ribs have a slightly tapered cross section as is seen in Figs. 11 and 12, for example, being relatively thin proximate the back 32 of the cap and relatively thicker more remote from the back 32. The strain relief body 17 is molded directly to the back end 32 of the cap 16, and such molding material tends to knit with such ribs 36 and to hold thereto due to the mentioned tapered cross section of the ribs. The cells 20 are arranged in dual-in-line presentation, and a divider wall 37 separates the respective rows of cells. The divider wall 37 extends to the front end 25 of the cap 16 but is recessed at the back end 32, as is seen, for example, at 38 in Figs. 9 and 11. Such recess 38 in the wall 37 further provides for the flow of plastic therein during molding of the strain relief body 17 to assure secure attachment of the strain relief body and the cap 16.

An advantage to the cap 16 of the present invention and to the overall cable termination assembly 10 is that although the cap 16 is a relatively complex part that requires a relatively complex mold in order to effect plastic injection molding thereof, such molding of a complex part is relatively inexpensive and efficient after the mold has been made because only plastic is molded. Insert molding is unnecessary. The contacts 15 themselves are not molded as part of the cap 16. Moreover, since the cap 16 is formed with relatively complex surfaces, the contacts 15 may be relatively uncomplicated, and this further reduces cost of the cable termination assembly 10.

The cap 16 provides a number of functions. For example, the cap, which also may be considered a cover or a housing, covers or houses part of each of the contacts 15. The cap 16 also provides a positioning function cooperating with the contacts 15 to assure proper positioning thereof both for purposes of manufacturing the cable termination assembly 10 and for use thereof. In connection with the method for making the cable termination assembly 10, the cap 16 temporarily provides a support function serving as a support body for the contacts both during the insulation displacement connection step at which time the junctions 21 are formed and during the molding of the strain relief body 17. The cap 16 also provides guidance for external members, such as pin contacts, which are inserted into cells 20 and cooperates with the contacts 15 to avoid over-stressing of electrical contacts 15. Furthermore, since part of the contacts directly engage surfaces in the cap 16, such as within the positioning area 30 and at the support land 31, and since part of the contacts engage the

molded strain relief 17, forces applied to the contacts are relatively well distributed or spread out in the cap and strain relief. Such forces may be imposed by the insertion or withdrawal of a pin contact relative to a cell 20 and contact 15 therein; and such force distribution helps to minimize any damaging impact of the force on the contact 15 itself and/or on the junction 21 thereof. These and other functions of the cap 16 will be evident from the description herein.

Referring to Figs. 13-18, the electrical contact 15 is illustrated in detail. Preferably, each of the electrical contacts 15 is the same.

Electrical contact 15 includes an IDC terminal portion 40, a base 41, a support leg 42, a cantilever support 43, and a cantilever contacting portion 44. The contact 15, and other identical contacts, may be die cut from a strip of material, and such contacts may be carried by a carrier strip 45 attached at a frangible connection 46 to the contacts in a manner that is well known. The carrier strip 45 is connected to the back end 47 of the contacts proximate the IDC terminal portion 40. The cantilever support 43 is at the front end 48 of the contact 15, and the cantilever contacting portion 44 extends from such cantilever support 43 partly toward the back end 47 terminating prior to reaching the base 41. The contact 15 may be die cut or otherwise cut from strip material, such as beryllium copper material, and the various bends and curves in the contact may be formed by stamping the same using generally conventional techniques.

At the back end 47 of the contact 15, the IDC terminal portion 40 may be of relatively conventional design. Such portion 40 includes, for example, a pair of generally parallel legs 50 having pointed tips 51 and sloped surfaces 52 leading to a groove 53 between the legs. The pointed tips 51 may be used to facilitate penetrating the insulation of a cable, and the sloped surfaces 52 guide the cable conductor into the groove 53 for engagement with legs 50 to form an electrical junction 21 therewith.

The base 41 is relatively wider than the IDC terminal portion 40 and has primarily three functions. One of those functions is the joining of the IDC terminal portion 40 and the working end 54 of the contact. The working end 54 includes the support leg 42, cantilever support 43, and cantilever contacting portion 44. The other very important function of the base 41 is to cooperate with the side walls of the opening 34 at the back of each cell 20 to shut off the forward portion of the cell blocking the flow of plastic into the latter during the molding of the strain relief body 17. Accordingly, such base provides a shut off for the cap at the respective cells 20 to prevent the molded strain relief material from interfering with the working end

54 of the contact. A third function of the base 41 is to limit maximum insertion of a pin contact into a cell 20 to prevent such pin contact from being inserted too far into the cell and creating damage to the mechanical structure of a cable termination assembly and/or causing a short circuit with a conductor 13 of the cable 12.

Consistent with and enabling performance of the aforementioned functions, the base 41 includes an offset or bend 55. Due to such offset 55 and to the bending of the cantilever contacting portion 44 out of the plane of the support leg 42 and cantilever support 43, in particular, the contact 15 is considered a three-dimensional contact (compared to the generally planar nature of a conventional fork contact disclosed in the '799 patent mentioned above.)

A generally U-shape configuration is defined by the support leg 42, cantilever support 43 and cantilever contacting portion 44, as is seen in Figs. 13 and 18, for example. The support leg 42 extends generally linearly from the base 41 but preferably is generally coparallel or coaxial with respect to the linear extent of the IDC terminal portion 40. Such coparallel extent, though, is not a restriction on the contact, and the support leg 42 may be bent to extend non-linearly or otherwise, depending on circumstances and desired use. Nevertheless, the linear extent is preferred in order to facilitate insertion, retention, and positioning relative to the linear extending positioning area 30 in a cell 20 of the cap 16. For the same reasons, the cantilever support 43 preferably extends in generally coplanar relation to the support leg 42.

On the other hand, the cantilever contacting portion 44 is bent to extend in cantilever relation out of the plane of the support leg 42 and cantilever support 43, as is seen in Figs. 14 and 15, for example. The cantilever contact portion 44 is bent relative to the plane of the cantilever support 43 at a bend 56. A further bend 57 defines a contacting area 58 of the cantilever contacting portion 44 where actual electrical connecting engagement is made with a pin contact or other external member inserted into a cell 20 of the cable termination assembly 10, as is seen in the illustration of Fig. 20, for example.

The IDC terminal portion 40 is offset relative to the cantilever contacting portion 44, as is seen in Fig. 13, for example. The extent of such offset is represented by the relation of axis line 60 through the center of the groove 53 to the axis line 61, which is drawn along the center of the cantilever contacting portion 44. Such offset relation facilitates relatively closely packing the contacts 15 and use thereof with relatively close-packed or closely positioned conductors 13 in a dual-in-line cable termination assembly arrangement, as is described,

for example, in the above-mentioned '799 patent. Thus, for example, with the contacts 15 that are adjacent to each other but are in opposite rows of the dual-in-line arrangement as is illustrated in Fig. 4, the IDC terminal portion 40 of one of those contacts would form an electrical junction 21 with one of the conductors 13, and the other of the two contacts illustrated in the cable termination assembly 10 of Fig. 4 would form a junction 21 with a conductor that is immediately adjacent to the previously-mentioned conductor 13; and so on.

A sub-assembly of electrical contacts 15 and the cap 16 prior to molding of the strain relief body 17 thereto is illustrated in Figs. 19 and 20. To assemble such sub-assembly the contacts 15 are inserted into respective cells 20 of cap 16. Such insertion may be facilitated by allowing the plurality of contacts 15 to remain fastened to the carrier strip 45 so that an entire row of contacts may be inserted into an entire row of cells 20, after which the carrier strip 45 may be broken away at the frangible connection 46 and discarded.

To insert a contact 15 in a cell 20, the cantilever support 43 is aligned with the opening 34 at the back of a cell such that the support leg 42 is aligned to slide into the positioning area 30 and the cantilever contacting portion 44 is aligned to slide into the contacting area 27 of the cell. The offset arrangement of the cells 20 in the two rows thereof formed in the cap 16 and the offset 55 at the base 41 of each contact help to assure that the spacing of the IDC terminal portions 40 of the contacts in one of the two parallel rows thereof are relatively far from the IDC terminal portions 40 of the contacts in the other row, as is seen in Fig. 4 and 20, for example. This arrangement helps to assure maximum integrity of the insulation 14 of the cable 12 and proper connections of the contacts 15 to respective conductors 13 of the cable 12. Such spacing also helps to assure flow of plastic molding material with respect to the cable 12, contacts 15, and cap 16 to achieve secure integral connection of such parts and encapsulation and hermetic sealing of the junctions 21.

Further insertion of the contact 15 into a cell 20 will place the front end 47, and, in particular, the leading end of the cantilever support 43, with engagement with the land or relatively proximate the land 33 at the front end of the positioning area 30 of the cell 20. Importantly, upon full or substantially full insertion of the contact 15 with respect to a cell 20 places part of the offset or bend 55 of the contact base 41 in direct confronting engagement with the sloped surface of the support land 31. Preferably, the offset 55 in the contact base 41 is formed by a pair of obtuse angles 62, 63 coupled by a linear extent 64 of the base 41. Such obtuse bends ordinarily will encounter relatively smaller

stress in the material of the contact than right angle bends; and this helps to assure the integrity and longevity of the contact. The shape of the support land 31 preferably is configured to fit relatively closely in engagement with the offset 55 of the contact base 41 and is, accordingly, sloped at the same angle at which the offset 55 is sloped, as is depicted Figs. 4, 15, and 20, for example. The close fit and engagement of the contact 15 at the offset 55 and support land 31 enables the latter to support the contact during the insulation displacement connection process described further below and to distribute stress. Moreover, the relatively close fit of the contact support leg 42 and cantilever support 43 in the cell 20 further helps assure correct positioning and support for the contacts during such IDC step and during molding of the strain relief body 17 and to distribute stress.

Importantly, the base 41, and, more particularly, the area of the offset 55 thereof, fits rather closely in the opening 34 at the back of the cell 20, as is seen, for example, in Fig. 19. The area of the offset 55 and/or part of the contact base 41 substantially completely fills the opening 34 of a cell and the amount of clearance between the edges of the contact 15 and the side walls of such opening 34, as viewed in Fig. 19, is adequately small so that the flow of plastic beyond the offset 55 into the cell 20 will be blocked. For example, such clearance between the offset 55 and the walls defining the opening 34 to each cell may be on the order of from about 0.001 to about 0.002 inch. Such clearance is adequately small ordinarily to prevent the flow of plastic down into the cell 20 during molding of the strain relief body 17.

Furthermore, due to the relatively close fit of the offset 55 relative to the walls of the opening 34, the relatively close fit of the support leg 42 in the positioning are 30 of the cell 20, and the width of the cantilever support 43 of the contact, including the overhang 65 thereof, and the engagement of the support land 31 with the offset 55, such contacts will be held relatively securely both during the IDC step and the injection molding step described further below and will have forces applied to the contacts distributed into the cap 16 and strain relief body 17.

Turning to Figs. 21 and 22, the apparatus and method for making the cable termination assembly 10 are illustrated. The apparatus is in the form of a molding machine generally designated 70, which includes a mold 71 having an A half 71A and a B half 71B. The mold half 71B has a recess or cavity 72 into which the cap 16 of the cable termination assembly 10 may be placed in relatively close-fitting relation. Preferably, such close fit prevents flow of plastic into the B half of the mold 71 about the sides and ends of the cap. The contacts 15 are

installed in the cap 16 either before the cap is placed in the mold half 71B or afterwards. Such contacts are inserted fully into the respective cells 20 to the positions illustrated, for example, in Figs. 4, 6, and 20 to complete the sub-assembly of the contacts 15 and cap 16 described above. The IDC terminal portions 40 of the contacts 15 are exposed for insulation displacement connection with respective conductors 13 of the cable 12 upon closure of the mold 71. In Fig. 21 the illustration is simplified by showing only the contacts 15 in one of the rows of a dual-in-line arrangement otherwise illustrated and described in this application. Both rows of contacts are illustrated in Fig. 22, though.

The cable 12 is positioned relative to the IDC terminal portions 40 of the contacts 15 to align the respective conductors above the IDC slots 53, as is seen in Fig. 21. Thereafter, the mold 71 may be closed using hydraulics or other power source of the molding machine 70, bringing the A half 71A and the B half 71B together. As the mold is closed, respective pairs of cores 73 tend to urge the cable 12 toward the IDC terminal portions 40 to force the pointed tips 51 to pierce through the cable insulation 14 and also to force the conductors 13 into respective IDC grooves 53 to make effective electrical connections or junctions between each conductor and a respective contact. During such closure of the mold 71 effecting the mentioned IDC function, the contacts 15 are held relatively securely in the relative positions illustrated in the drawings by the cap 16. The arrangement of cores 73 is seen more clearly in Fig. 22. Each pair of cores 73 presses the cable down toward the aligned respective IDC terminal portions 40 of a given contact. The two cores forming a pair thereof aligned with a respective contact preferably are adequately spaced to allow flow of molding material therebetween as the strain relief body 17 is molded to encapsulate the junction 21.

Grooves at one side one or both of the A and B halves of the mold are designated 74. Such grooves facilitate passage of the cable 13 between the mold halves when the halves are closed while a tight fit of the mold halves with the cable is made to prevent leakage of molding material during the molding of the strain relief body 17.

With the mold 71 closed a mold cavity is formed bounded in part by the mold halves 71A, 71B and by the back end 32 of the cap 16 and contacts 15 sub-assembly. The molding machine 70 injects plastic or other molding material (which, if desired, may include glass or other reinforcing or filling material) into the mold cavity to form the molded strain relief body 17. Such molding material flows about at least part of the cable, about the IDC terminal portions of the contacts 15, about the junctions 21 of the conductors 13 and contacts

15 (the molding material, accordingly, flowing between the various core pairs 73), and the molding material flowing further about the knit ribs 36, into the recess 38, and to a limited extent, as permitted by the location of the offset bends 55 of the contacts 15 into part 75 (Fig. 4) of the openings 34 of the cells 20.

Upon solidification of the molding material 17 or other curing thereof, the same forms with the cable 13, contacts 15, and cap 16 a substantially integral structure of the cable termination assembly 10. The mold 71 then may be opened to withdraw the cores 73 (leaving the recesses 75 seen in Fig. 2 in the back end of the strain relief body 17) while the junctions 21 remain substantially fully encapsulated and in hermetically sealed relation within the molded strain relief body 17. The cable termination assembly 10 then may be removed from the mold 71, for example, by withdrawing the cap 16 from the recess 72 and the mold half 71B.

According to the preferred embodiment, the material of which the strain relief body 17 is molded and that of which the cable insulation 14 is formed are compatible so that the two chemically bond during the molding step described. Also, preferably the material of which the strain relief body 17 is molded and that of which the cap 16 is made are the same or are compatible to achieve chemical bonding thereof during such molding step described. Further, the temperature at which molding occurs preferably is adequately high to purge or otherwise to eliminate oxygen and moisture from the areas of the junctions 21. Such oxygen-free and moisture-free environment preferably is maintained by a hermetic seal of the junctions 21 achieved by the encapsulation thereof in the strain relief body 17 and helps to prevent electrolytic action at the junction; therefore, interaction or reaction of the materials of which the conductors 13 and contacts 15 are made, even if different, will be eliminated or at least minimized.

It will be appreciated that the above-described method making the cable termination assembly 10 effects facile mass termination of the conductors of a multi-conductor cable. Since the strain relief body 17 is molded directly to the cap 16, there is no need separately to fasten a cap to a molded strain relief body, e.g., by ultrasonic welding, or the like, as is described in the '799 patent. Furthermore, since there is no need to effect a separate ultrasonic welding function, relatively less expensive materials, such as re-grind or those including re-grind materials, can be used to make the cap 16 and strain relief body 17, thus reducing the cost for the cable termination assembly 10.

Additionally, it should be understood that the parts of the invention and the method described above enable the IDC step and the molding of a

strain relief body essentially to be carried out as part of the same process in making a cable termination or cable termination assembly that uses a three-dimensional contact.

In using the cable termination assembly 10 of the invention, as is illustrated in Figs. 4, 6, and 20, for example, an external member, such as pin contact 80 (Fig. 20) may be inserted into the opening 26 of one of the cells 20 (or a plurality of such pin contacts or other external members can be inserted simultaneously into respective cells 20). During such insertion the leading end of such contact 80 engages the cantilever contacting portion 44 of the contact 15 and tends to push the same lightly out of the way permitting further insertion of the pin contact. The cantilever contacting portion deforms resiliently and tends to wipe against the surface of the inserted pin contact 80 to form a good electrical connection therewith. Such wiping may effect a cleaning of the surfaces of the contacting area 58 of the cantilever contacting portion 44 and the confronting surfaces of the pin contact 80 further to enhance the effectiveness of the electrical connection therebetween.

A feature of the three-dimensional cantilever contact 15 and cooperation thereof with the wall 37 of the cap 16 is that excessive deformation of the cantilever contacting portion 44 by a pin contact 80 cannot bend the cantilever contacting portion beyond engagement thereof with the wall 37; this prevents over-stressing of the contact 15 beyond its elastic limit that could otherwise damage the same. Another feature of the three-dimensional cantilever contact arrangement of the invention is that the electrical connection of the cantilever contacting portion 44 and the pin contact 80 can be made with the burr-free side of the pin contact. (As is known, pin contacts 80 sometimes are made by stamping the same from rolled stock, and it is desirable to effect electrical connections with the burr-free side of such contacts.)

Another feature of the contacts 15 and the use thereof in the preferred cable termination assembly just described is that the offset 55 in each contact blocks and prevents insertion of leading end of a pin contact 80 beyond such offset bend. The strength of such blocking function further is enhanced by the molded material of the strain relief body 17 behind such offset 55. Such blocking function prevents a pin contact 80 from being inserted too far into a cell 20 such that the pin contact might penetrate the insulation of the cable 12 and cause a short circuit with one or more of the cable conductors.

Additionally, in view of the nature of a cantilever-type contact and of the support provided by the wall 37 to prevent over-stressing of the contact, the contacts 15 will have a relatively high

level of compliance. Thus, a cable termination assembly 10 in accordance with the invention would be able to tolerate a relatively large degree of misalignment or mis-positioning of pin contacts 80 inserted into the respective cells 20 and will be able to accept a relatively large range of sizes of pin contacts, both in terms of cross-sectional size (due to compliance of the contact) and contact length (due to the stop function provided by the offset bend 55).

While the invention is illustrated and described above with reference to multiconductor electrical cable termination 11 located at an end of the multiconductor electrical conductor 12, it will be apparent that such a termination also may be provided in accordance with the invention at a location on a multiconductor electrical cable intermediate the ends thereof.

Although the invention has been shown and described with respect to a particular preferred embodiment, it is obvious that equivalent alterations and modifications will occur to others skilled in the art upon the reading the understanding of this specification. Thus, for example only, although the invention has been illustrated and described with respect to socket type connector, it will be appreciated that features of the invention may be employed in card edge and other types of connectors. Also, the junctions 21 may be other than IDC junctions, such as soldered connections, welded connections, and so on. Further, the contacts 15 may be fork contacts or other contacts that are two dimensional or three dimensional. Additionally, the relation of the contacts 15 with cells 20 may be other than the cooperation of the base 41 and offset 55 thereof with opening 34 to provide the shut off function for a contact containing cell; but, preferably, there should be a cooperative relation of the contact 15 with the cap 16 to effect such shut off.

Claims

1. A cable termination assembly comprising an electrical cable (12) including at least one conductor (13), at least one electrical contact (15), a said electrical contact (15) having a longitudinal axis, and comprising a connection portion for connecting with a conductor (13) to form a junction (21) therewith, a contacting portion for contacting an external member (80) when in engagement therewith, and a base portion (41) between said connection portion and said contacting portion, and a cap (16) including a chamber (20) in which at least part of said contacting portion is positioned, and an insertion opening (26) at one end of said chamber (20) to permit entry of an external member (80) for electrical connection to said contacting portion, and a strain relief body (17) directly molded to at least part of said cable 12, and said electrical contact (15) characterised in that said cap (16) has a support land (31) at the end of the chamber opposite the insertion opening (26) for engaging with an offset or bend (55) provided on said base portion (41) to support said electrical contact (15) at least along said longitudinal axis during connecting of said connection portion to such conductor (12);
and that said strain relief body is further directly molded to at least part of said cap (16) to form an integral structure therewith.
2. The assembly of claim 1, wherein said offset (55) is placed in the chamber (20) opposite the insertion end (26) and is adapted for blocking the entry of molding material into said chamber (20) of said cap (16) during molding of said strain relief body (17) to prevent said molding material from interfering with operation of said contacting portion.
3. The assembly of claim 1 or 2 wherein said contact base portion (41) has an offset (55) between said contacting portion and said connecting portion, and said support land (31) has a sloped surface to support said electrical contact (15) during connecting of said connection portion to a conductor (13) of a cable (12).
4. The assembly of claims 1-3, wherein said strain relief body (17) is molded directly to at least part of said electrical contact (15), said junction (21) and such conductor (13), and said offset (55) of the contact base portion (41) is cooperative with said cap (16) to block entry of molding material into at least part of said chamber (20) during molding of said strain relief body (17) to prevent said molding material from interfering with the operation of said contacting portion.
5. The assembly of claim 1, wherein said base portion (41) is formed for blocking molten material from entering said chamber (20) and comprises a offset or bend (55) for fitting in one end of said chamber (20) to prevent the flow of molding material during molding of said strain relief body (17) in a way that would interfere with operation of said contacting portion and rests on a sloped surface (31) formed in said cap (16).
6. The assembly of claims 1, 2 or 5, wherein said cable comprises a multiconductor flat ribbon-type cable (12), and said cap (16) supports a

level of compliance. Thus, a cable termination assembly 10 in accordance with the invention would be able to tolerate a relatively large degree of misalignment or mis-positioning of pin contacts 80 inserted into the respective cells 20 and will be able to accept a relatively large range of sizes of pin contacts, both in terms of cross-sectional size (due to compliance of the contact) and contact length (due to the stop function provided by the offset bend 55).

While the invention is illustrated and described above with reference to multiconductor electrical cable termination 11 located at an end of the multiconductor electrical conductor 12, it will be apparent that such a termination also may be provided in accordance with the invention at a location on a multiconductor electrical cable intermediate the ends thereof.

Although the invention has been shown and described with respect to a particular preferred embodiment, it is obvious that equivalent alterations and modifications will occur to others skilled in the art upon the reading the understanding of this specification. Thus, for example only, although the invention has been illustrated and described with respect to socket type connector, it will be appreciated that features of the invention may be employed in card edge and other types of connectors. Also, the junctions 21 may be other than IDC junctions, such as soldered connections, welded connections, and so on. Further, the contacts 15 may be fork contacts or other contacts that are two dimensional or three dimensional. Additionally, the relation of the contacts 15 with cells 20 may be other than the cooperation of the base 41 and offset 55 thereof with opening 34 to provide the shut off function for a contact containing cell; but, preferably, there should be a cooperative relation of the contact 15 with the cap 16 to effect such shut off.

Claims

1. A cable termination assembly comprising an electrical cable (12) including at least one conductor (13), at least one electrical contact (15), a said electrical contact (15) having a longitudinal axis, and comprising a connection portion for connecting with a conductor (13) to form a junction (21) therewith, a contacting portion for contacting an external member (80) when in engagement therewith, and a base portion (41) between said connection portion and said contacting portion, and a cap (16) including a chamber (20) in which at least part of said contacting portion is positioned, and an insertion opening (26) at one end of said chamber (20) to permit entry of an external member (80) for electrical connection to said contacting portion, and a strain relief body (17) directly molded to at least part of said cable 12, and said electrical contact (15) characterised in that said cap (16) has a support land (31) at the end of the chamber opposite the insertion opening (26) for engaging with an offset or bend (55) provided on said base portion (41) to support said electrical contact (15) at least along said longitudinal axis during connecting of said connection portion to such conductor (12); and that said strain relief body is further directly molded to at least part of said cap (16) to form an integral structure therewith.
2. The assembly of claim 1, wherein said offset (55) is placed in the chamber (20) opposite the insertion end (26) and is adapted for blocking the entry of molding material into said chamber (20) of said cap (16) during molding of said strain relief body (17) to prevent said molding material from interfering with operation of said contacting portion.
3. The assembly of claim 1 or 2 wherein said contact base portion (41) has an offset (55) between said contacting portion and said connecting portion, and said support land (31) has a sloped surface to support said electrical contact (15) during connecting of said connection portion to a conductor (13) of a cable (12).
4. The assembly of claims 1-3, wherein said strain relief body (17) is molded directly to at least part of said electrical contact (15), said junction (21) and such conductor (13), and said offset (55) of the contact base portion (41) is cooperative with said cap (16) to block entry of molding material into at least part of said chamber (20) during molding of said strain relief body (17) to prevent said molding material from interfering with the operation of said contacting portion.
5. The assembly of claim 1, wherein said base portion (41) is formed for blocking molten material from entering said chamber (20) and comprises a offset or bend (55) for fitting in one end of said chamber (20) to prevent the flow of molding material during molding of said strain relief body (17) in a way that would interfere with operation of said contacting portion and rests on a sloped surface (31) formed in said cap (16).
6. The assembly of claims 1, 2 or 5, wherein said cable comprises a multiconductor flat ribbon-type cable (12), and said cap (16) supports a



plurality of electrical contacts (15).

7. The assembly of claim 6 wherein all of the junctions (21) are encapsulated in a hermetic environment as the material of the strain relief body (17) is compatible with the cable insulation material (14) to form a chemical bond. 5
8. The assembly of claims 1-7, wherein said connection portion comprises an insulation displacement connection (53) for insulation displacement connection with a conductor (13). 10
9. The assembly of claims 1-8, wherein said support cap chamber (20) is provided with walls (26) for guiding a pin contact into engagement with said contacting portion (44) in said chamber (20), and said contact base portion (41) comprises an offset (55) positioned to interfere with and to limit the travel of such an inserted pin contact (80) inserted to engage said contacting portion (44) of said electrical contact (15). 15
10. The assembly of claims 1-9, wherein said electrical contact (15) is a three-dimensional contact. 20
11. The assembly of claim 10, wherein said three-dimensional contact comprises a U-shaped connection portion (40). 25

Patentansprüche

1. Ein Kabelendzusammenbau, der ein elektrisches Kabel (12) umfaßt, mit mindestens einem Stromleiter (13), mindestens einem elektrischen Kontakt (15), einem genannten elektrischen Kontakt (15) mit einer Längsachse, und ferner umfaßt der Kabelendzusammenbau einen Verbindungsteil zur Verbindung mit einem Stromleiter (13), um so damit eine Verbindungsstelle (21) zu bilden, einen Kontaktteil zum Kontakt mit einem externen Element (80), wenn er sich damit im Eingriff befindet, und einen Basisteil (41) zwischen dem genannten Verbindungsteil und dem genannten Kontaktteil, und eine Abdeckung (16) mit einer Kammer (20), in der zumindest ein Teil des genannten Kontaktteils positioniert ist, und eine Einführungsöffnung (26) an einem Ende der genannten Kammer (20), um so ein Einführen eines externen Elements (80) zu ermöglichen, für eine elektrische Verbindung mit dem genannten Kontaktteil, und mit einem Zugentlastungskörper (17), der direkt an wenigstens einem Teil des genannten Kabels (12) geformt ist, und wobei der genannte elektrische Kon-

takt (15) dadurch gekennzeichnet ist, daß die genannte Abdeckung (16) an dem Ende der Kammer, das gegenüber der Einführungsöffnung (26) liegt, eine Auflage-Anschlußfläche (31) aufweist, die mit einem Versatz bzw. einer Biegung (55) eingreift, der bzw. die an dem genannten Basisteil (41) bereitgestellt ist, um durch diesen Eingriff den elektrischen Kontakt (15) zumindest entlang der genannten Längsachse zu halten, und zwar während der Verbindung des genannten Verbindungsteils mit einem solchen Stromleiter (12); und dadurch gekennzeichnet, daß der genannte Zugentlastungskörper ferner direkt an wenigstens einem Teil der genannten Abdeckung (16) geformt ist, um damit einen integralen Aufbau zu bilden.

2. Zusammenbau nach Anspruch 1, dadurch gekennzeichnet, daß der genannte Versatz (55) in der Kammer (20) positioniert ist, und zwar gegenüber dem Einführungsende (26), und daß der Versatz so adaptiert ist, daß er den Eintritt von Formungsmaterial in die genannte Kammer (20) der genannten Abdeckung (26) während des Formens des genannten Zugentlastungskörpers (17) sperrt, um so zu vermeiden, daß Formungsmaterial die Funktionsweise des genannten Kontaktteils beeinflusst.
3. Zusammenbau nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der genannte Kontaktbasisteil (41) zwischen dem genannten Kontaktteil und dem genannten Verbindungsteil einen Versatz (55) aufweist, und daß die genannte Auflage-Anschlußfläche (31) eine geneigte Oberfläche aufweist, um den genannten elektrischen Kontakt (15) während des Verbindens des genannten Verbindungsteils mit einem Stromleiter (13) eines Kabels (12) zu halten.
4. Zusammenbau nach den Ansprüchen 1-3, dadurch gekennzeichnet, daß der genannte Zugentlastungskörper (17) direkt an wenigstens einem Teil des genannten elektrischen Kontakts (15), der genannten Verbindungsstelle (21) und einem solchen Stromleiter (13) geformt ist, und wobei der genannte Versatz (55) des Kontaktbasisteils (41) mit der genannten Abdeckung (16) zusammenwirkt, um während der Formung des genannten Zugentlastungskörpers (17) den Eintritt von Formungsmaterial in wenigstens einen Teil der genannten Kammer (20) zu sperren, um so zu vermeiden, daß das genannte Formungsmaterial die Funktionsweise des genannten Kontaktteils beeinflusst.



5. Zusammenbau nach Anspruch 1, dadurch gekennzeichnet, daß der genannte Basisteil (41) gebildet ist, um einen Eintritt von geschmolzenem Material in die Kammer (20) zu sperren, und daß der Basisteil einen Versatz bzw. eine Biegung (55) umfaßt, welcher bzw. welche so in ein Ende der genannten Kammer (20) paßt, daß während der Formung des genannten Zugentlastungskörpers (17) ein Strom von Formungsmaterial vermieden wird, der die Funktionsweise des genannten Kontaktteils beeinflussen würde, und auf einer geneigten Oberfläche (31) aufsitzt, die in der genannten Abdeckung (16) gebildet ist. 5
6. Zusammenbau nach Anspruch 1, 2 oder 5, dadurch gekennzeichnet, daß das genannte Kabel ein Mehrfachleiter-Flachbandkabel (12) aufweist, und daß die genannte Abdeckung (16) eine Mehrzahl von elektrischen Kontakten (15) hält. 10
7. Zusammenbau nach Anspruch 6, dadurch gekennzeichnet, daß alle Verbindungsstellen (21) in einer hermetischen Umgebung eingekapselt sind, da das Material des Zugentlastungskörpers (17) verträglich zu dem Kabelisoliermaterial (14) ist, um so eine chemische Bindung zu bilden. 15
8. Zusammenbau gemäß den Ansprüchen 1-7, dadurch gekennzeichnet, daß der genannte Verbindungsstück eine Isolierungsverschiebungs-Verbindung (53) für eine Isolierungsverschiebungs-Verbindung mit einem Stromleiter (13) umfaßt. 20
9. Zusammenbau gemäß den Ansprüchen 1-8, dadurch gekennzeichnet, daß die genannte Halteabdeckungs-Kammer (20) mit Wänden (26) versehen ist, um so einen Stiftkontakt in Kontakt mit dem genannten Kontaktteil (44) in der genannten Kammer (20) zu führen, und daß der genannte Kontaktbasisteil (41) einen Versatz (55) umfaßt, der so positioniert ist, daß er Verschiebungen eines solchen eingeführten Stiftkontakts (80) stört und begrenzt, wobei der Stiftkontakt eingeführt worden ist, um in Kontakt mit dem genannten Kontaktteil (44) des genannten elektrischen Kontakts (15) zu geraten. 25
10. Zusammenbau gemäß den Ansprüchen 1-9, dadurch gekennzeichnet, daß der genannte elektrische Kontakt (15) einen dreidimensionalen Kontakt darstellt. 30

11. Zusammenbau nach Anspruch 10, dadurch gekennzeichnet, daß der genannte dreidimensionale Kontakt einen U-förmigen Verbindungsteil (40) aufweist. 35

Revendications

1. Dispositif de terminaison de câble, comprenant un câble électrique (12) ayant au moins un conducteur (13), au moins un contact électrique (15), ledit contact électrique (15) ayant un axe longitudinal et comportant une partie de connexion à connecter avec un conducteur (13) pour former une jonction (21) avec ce dernier, une partie de contact pour venir en contact avec un élément extérieur (80) lors de l'accouplement avec ce dernier, et une partie de base (41) située entre ladite partie de connexion et ladite partie de contact, et un chapeau (16) comportant une chambre (20) dans laquelle ladite partie de contact est située au moins partiellement, et un orifice d'insertion (26) prévu à une extrémité de ladite chambre (20) pour permettre l'entrée d'un élément extérieur (80) en vue de sa connexion électrique à ladite partie de contact, et un corps d'absorption des contraintes ou de relaxation (17) moulé directement sur au moins une partie du dit câble (12) et dudit contact électrique (15), caractérisé en ce que ledit chapeau (16) comporte un relief d'appui (31) situé à l'extrémité de la chambre opposée à l'orifice d'insertion (26) pour recevoir une région déviée ou coudée (55) prévue sur ladite partie de base (41), afin de supporter ledit contact électrique (15) au moins le long dudit axe longitudinal pendant la connexion de ladite partie de connexion à un conducteur (13); 40
- et en ce que ledit corps de relaxation est en outre directement moulé sur au moins une partie dudit chapeau (16) pour former une structure unitaire avec ce dernier.
2. Dispositif suivant la revendication 1, dans lequel ladite région coudée (55) est située, dans la chambre (20), à l'opposé de l'extrémité d'insertion (26) et elle est agencée de manière à obturer l'entrée de matière de moulage dans ladite chambre (20) dudit chapeau (16) pendant le moulage dudit corps de relaxation (17), afin d'empêcher la dite matière de moulage d'interférer avec le fonctionnement de ladite partie de contact. 45
3. Dispositif suivant la revendication 1 ou 2, dans lequel ladite partie de base (41) du contact comporte une région coudée (55) entre ladite partie de contact et ladite partie de connexion, 50



et ledit relief d'appui (31) présente une surface inclinée pour supporter ledit contact électrique (15) pendant la connexion de ladite partie de connexion à un conducteur (13) d'un câble (12).

4. Dispositif suivant les revendications 1 à 3, dans lequel ledit corps de relaxation (17) est moulé directement sur au moins une partie dudit contact électrique (15), de ladite jonction (21) et d'un conducteur (13), et ladite région coudée (55) de la partie de base (41) du contact coopère avec ledit chapeau (16) pour empêcher l'entrée de matière de moulage dans au moins une partie de ladite chambre (20) pendant le moulage dudit corps de relaxation (17), afin d'éviter que ladite matière de moulage interfère avec le fonctionnement de ladite partie de contact.

5. Dispositif suivant la revendication 1, dans lequel ladite partie de base (41) est formée de manière à empêcher la matière moulée d'entrer dans ladite chambre (20) et elle comprend une région déviée ou coudée (55) s'ajustant dans une extrémité de ladite chambre (20) pour empêcher l'écoulement de matière de moulage, lors du moulage dudit corps de relaxation (17), d'une manière qui interférerait avec le fonctionnement de ladite partie de contact, et elle repose sur une surface inclinée (31) prévue dans ledit chapeau (16).

6. Dispositif suivant les revendications 1, 2 ou 5, dans lequel ledit câble est un câble du type à ruban plat multiconducteur (12), et ledit chapeau (16) supporte une pluralité de contacts électriques (15).

7. Dispositif suivant la revendication 6, dans lequel toutes les jonctions (21) sont encapsulées dans un environnement hermétique lorsque la matière du corps de relaxation (17) est compatible avec la matière d'isolation (14) du câble pour engendrer une liaison chimique.

8. Dispositif suivant les revendications 1 à 7, dans lequel ladite partie de connexion comprend une connexion à déplacement d'isolation (53), pour la connexion par déplacement d'isolation avec un conducteur (13).

9. Dispositif suivant les revendications 1 à 8, dans lequel la chambre (20) du chapeau support comporte des parois (26) pour guider un contact à broche en prise avec ladite partie de contact (44) dans ladite chambre (20), et ladite partie de base (41) du contact comprend une

région coudée (55) située de manière à interférer et à limiter la course d'un tel contact à broche inséré (80) lors de son insertion pour venir en prise avec ladite partie de contact (44) dudit contact électrique (15).

10. Dispositif suivant les revendications 1 à 9, dans lequel ledit contact électrique (15) est un contact tridimensionnel.

11. Dispositif suivant la revendication 10, dans lequel ledit contact tridimensionnel comprend une partie de connexion en forme de U (40).

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