

Description

1. Field of the Invention

This invention relates to connector apparatus. In particular it relates to connector apparatus arranged to interconnect optical fiber cables and to connect optical fiber cables with circuit boards.

Background of the Invention

Optical fiber cables are being used with increasing frequency in the Communications and Electronic Industry to transmit and receive voice, data and information signals. Optical fiber cables, as used in the communications industry, consist of a number of light carrying conductors or fibers that may individually appear in the cable or appear as polymer ribbons each holding an array of the fibers. Typically, each light carrying fiber comprises a filamentary core region having a high index of refraction that is surrounded by a cladding region having a lower index of refraction. The fiber is then coated with a polymer material.

In interconnecting optical fiber cables it is necessary to align the filamentary core regions of two corresponding fibers and abut the ends together to obtain a low coupling loss. Substrate devices are oftentimes used to terminate the fibers which are each positioned in parallel channels formed on one chip substrate with another chip substrate positioned on top thereof to form the substrate device. One end of the substrate device is polished such that the ends of the fibers are located in the end perpendicular to the end planar surface of the substrate device. In interconnecting optical fiber cables the polished end of one substrate device terminating fibers of a cable is aligned with and abutted against the polished end of another substrate device terminating fibers of a second cable. Both substrate devices are mechanically locked together to prevent one substrate device from being disengaged with the other. In another arrangement complex electrical switching apparatus is arranged to hold several substrate devices and mechanically switch one substrate device in and out of substrate devices alignment with another substrate device for the purpose of interconnecting optical fiber cables together.

Communication and electronic systems often include plug-in type of circuit boards that are inserted into equipment mounting apparatus to engage backplanes for interconnecting the circuit boards with inter apparatus cabling. Although component apparatus for modulating and demodulating signals onto optical fibers may be assembled on plug-in circuit boards a problem arises with the aforementioned interconnection locking and switching apparatus in enabling plug-in circuit boards to be installed in equipment mounting apparatus without requiring the operation of switching or the assembly and disassembly of connector locking apparatus. Similarly, a problem arises in the use of locking and switching apparatus to interconnect optical fiber cables together so that equipment mounting frames may

be easily installed at a system location and quickly coupled together to form a working system.

The foregoing is achieved by connector apparatus arranged for use in enabling optical fiber cables to be slidably coupled together and for enabling optical apparatus installed on a plug-in circuit board to be slidably coupled with an optical fiber cable terminated on a backplane as the circuit board is installed in equipment mounting apparatus.

According to the present invention there is provided apparatus for interconnecting optical fiber cables as defined in claim 1.

In the exemplary embodiment of the invention a connector for interconnecting optical fiber cables comprises apparatus for universally mounting substrate devices terminating light carrying fibers of the optical fiber cables. The connector apparatus is further arranged for separably receiving the universally mounting apparatus and applying spring forces on the terminating substrate devices to axially align and optically couple together corresponding fibers terminated on the substrate devices.

In accordance with another feature of the invention, the connector apparatus for interconnecting light carrying fibers of optical fiber cables comprises a pair of plug members each having a truncated pyramid configured member arranged to accept one of the fibers and support a substrate device terminating the fibers with universal movement of the substrate device about a center line of the plug member.

Description of the Drawing

The invention will be more apparent from a description of the drawing in which:

FIG. 1 illustrates connector apparatus embodying the principles of the instant invention.

FIG. 2 sets forth an exploded view of members of the connector apparatus set forth in FIG. 1 for terminating a first optical fiber cable.

FIG. 3 sets forth a detailed view of apparatus for enabling universal movement of a fiber terminating substrate device.

FIG. 4 is a partial sectional view of the assembled optical cable terminating members set forth in FIG. 2.

FIG. 5 sets forth an exploded view of the members of the connector apparatus set forth in FIG. 1 for terminating a second optical fiber cable and for terminating light carrying fibers coupled with a circuit board.

FIG. 6 is a partial sectional view of the assembled optical fiber cable and circuit board fiber terminating members set forth in FIG. 5.

FIG. 7 is a sectional view of the optical fiber connector sleeve member set forth in FIGS. 1, 2 and 4.

FIG. 8 is a perspective view illustrating the position of the arcuate spring members of the optical fiber connector sleeve member set forth in FIGS. 1, 2, 4 and 7.

FIG. 9 is a perspective view illustrating

assembly of an optical fiber terminating substrate device, and

FIG. 10 is a sectional view of the assembled optical fiber connector set forth in FIG. 1.

Description of the Invention

Apparatus Description

Referring to the drawing and more specifically to FIG. 1 of the drawing, connector apparatus 1 set forth therein is intended for use in interconnecting optical fiber cable 2 with optical fiber cable 3. In another embodiment of the invention connector apparatus 1 may be used to couple optical fiber 2 with a backplane 6 of equipment mounting apparatus that is arranged to slidably receive plug-in circuit board 5. Backplane 6 has a row and column configuration of pins 61 used to terminate conductors of conventional multiwire cable or printed wiring circuitry of backplane 6. Connector 4 is arranged so that when plug-in circuit board 5 is inserted into guide member 60 of the equipment mounting apparatus, terminals of connector 4 engage corresponding ones of pins 61 and establish a conventional electric circuit therefrom through connector 4 terminals with circuitry of circuit board 5.

Optical fiber connector apparatus 1, hereinafter referred to as connector 1, comprises a pair of plug members 11, 12 each arranged to hold and support a substrate 21 terminating light carrying fibers of optical fiber cables 2, 3. One plug member, for example plug member 12, may be used to terminate an optical cable 2 with backplane 6 and another plug member 11 may be combined with connector 4 of plug-in circuit board 5 and used to terminate light carrying fibers coupled with the apparatus of circuit board 5. In addition, connector 1 comprises a sleeve member 10 that is arranged to slidably receive substrates 21 of plug members 11 and 12 and apply spring forces on substrates 21, 31 to axially align and optically couple together corresponding ones of the fibers terminated on substrate 21 and 31.

Referring now to FIG. 9 of the drawing, substrate 21 consists of a pair of chip devices 210, 211 constructed of silicon or similar type of material to form a generally rectangular configuration. Each chip device 210, 211 has a number of parallel channels 2100 formed on one surface thereof to each receive an individual light carrying fiber 20 or a light carrying fiber 20 located in a ribbon of optical fiber cable 2. Both chip devices 210, 211 are joined together sandwiching fibers 20 between them to form substrate 21. The end is then polished to form a planar surface containing the end of each fiber 20 which is positioned flush and in the plane of the planar end surface. Substrate 31 is identical to substrate 21.

As set forth in FIG. 2, plug member 12 comprises a generally truncated pyramid configured member 1215. Truncated pyramid member 1215, FIG. 3, has a keyed base section 12150 and is formed with a slot 12153 extending from base section 12150 along the side thereof to truncated end section 12154. In assembly, the fibers or fiber

carrying ribbon of optical fiber cable 2 are positioned in and accepted by slot 12153 such that substrate 21 is supported at the truncated end 12154 with the polished end of substrate 21 extending perpendicularly outward with, respect to base section 12150. Plug member 12 also has a retaining member 121, FIG. 2 of the drawing, intended for use in holding pyramid member 1215 such that supported substrate 21 is positioned to extend along a central axis thereof. Retaining member 121 has a generally rectangular configuration having an inner chamber sized to receive spacer member 1214 and truncated pyramid member 1215. Spacer member 1214, set forth in detail in FIG. 3 of the drawing, has a pair of spherically tipped pins 12141, 12142 formed thereon with each pin projecting perpendicularly outward from opposite sides of one surface of spacer member 1214. Similarly, a pair of pins 12151, 12152 each project perpendicularly outward from opposite sides of the bottom surface of pyramid base section 12150. Spacer member 1214, and pyramid member 1215, FIG. 2, are assembled within retaining member 121, FIG. 2, with spacer member 1214 positioned adjacent the pyramid base section 12150 and the end of retaining member 121 with pins 12141, 12142 rotated at right angles with respect to pins 12151, 12152. Spacer member pins 12141, 12142 act in concert with pyramid member pins 12151, 12152 to enable universal movement of fiber terminating substrate 21 about the central axis of retaining member 121. Although pins 12141, 12142 and 12151, 12152 are located on spacer member 1214 and pyramid member 1215 respectively, other arrangements would work equally well. For example, pins located on the edges of the rear wall of retaining plug 121 and the surface of pyramid member base section 1214 would enable spacer member to allow universal movement of substrate 21.

Retaining member 121, FIG. 2, also has a slot 1211 formed along one side thereof to enable the ribbon or fibers of an optical fiber cable to be located initially in the chamber so that spacer member 1214 and pyramid member 1215 can be aligned with and subsequently inserted into retaining member 121. Opposite surfaces of retaining member 121 are provided with a raised surface 1210 used for positioning retaining member 121 within housing 120 so that inclined tab 1212 can engage a corresponding opening 1203 of housing member 120.

Plug member 12 also includes housing member 120 which is arranged to receive sleeve member 10 in combination with retaining member 121 and truncated pyramid member 1215 coupled with the fibers of optical fiber cable 2. Housing member 120 has a first section 1201 with an outer surface seized for slidable insertion through a hole of a backplane such as backplane 6. Tabs 1204 positioned around the outer surface of section 1201 snaps in position after housing member 120 has been inserted into backplane 6 and locks housing member 120 into position. Sections 1200 and

1201 have interconnected internal chambers 1205 and 1206 with chamber 1205 sized for slidably receiving sleeve member 10 and retaining member 121 with fiber terminating substrate 21 engaged with sleeve member 10. Alignment channels 1202 are formed on opposite surfaces of section 1200 to receive raised surfaces 1210 of retaining member 121 and thereby enable inclined tab 1212 to engage corresponding hole 1203. Chamber 1206 is sized to slidably receive plug member 11 such that a fiber terminating substrate 31 of plug member 11 may be engaged with sleeve member 10 to optically couple together optical fiber cables 2 and 3.

Plug member 11, set forth in FIG. 5, is used for holding and supporting substrate 31 used to terminate the fibers or ribbon of another optical fiber cable 3, or may as set forth in one embodiment of the invention, terminate fibers coupled with component apparatus located on circuit board 5. The apparatus comprises another truncated generally pyramid configured member 1108 constructed in the manner of pyramid member 1215 to accept fibers and support terminating substrate 31 at the truncated end thereof. A generally rectangularly configured retaining member 110 has a rear section 1100 extended into a smaller front section 1101 sized for slidable insertion, FIG. 2, into chamber 1206 of housing 120, Channel 1104, FIG. 5, extends from a front opening through retaining member 110 to an opening in the end of rear section 1100 and is sized to receive pyramid member 1108 and spacer 1109. In addition, plug member 11 may also include a spring assembly 1107 having a spiral spring 11070 abutted with spring seating member 11071 and spring retaining member 11072. Spring assembly 1107 is positioned in retaining member channel 1104 with spring seating member 11071 adjacent spacer member 1109 and with spring retaining member raised sections 110720 inserted into guide channels 1102 so as to enable tab members 110721 to engage holes 1103 and thereby lock spring retaining member 11072 within retaining member 110.

As set forth in FIG. 6, the assembled plug member 11 holds pyramid member 1108 which supports fiber terminating substrate 31 positioned and extended along the center line of retaining member 110. Similarly to plug member 12, pins located on one surface of spacer member 1109 and positioned at right angles with respect to pins located on the base of pyramid member 1108 enable universal movement of fiber terminating substrate 31 about the center line of retaining member 110. Spiral spring assembly 1107 positioned adjacent spacer member 1109 exerts a force along the retaining member center line against spacer member 1109 to normally maintain the base of pyramid member 1108 in a fully extended position biased against retaining tabs 1110. The light carrying fibers or the ribbon carrying the fibers are protected by a bend radius limiter 32 which serves to prevent the flexing of fibers and ribbon extending outward the ends of

plug members 11, 12 from exceeding a predefined radius of curvature.

The bottom surface of retaining member 110 may have perpendicular split pins 1111 extending therefrom for use, FIG. 1, in affixing plug member 11 to circuit board 5. Plug member 11 may be located adjacent or formed as a part of connector 4 mounted on an edge of circuit board 5. Insertion of plug-in circuit board 5 into equipment mounting apparatus enables connector 4 and plug member 11 to slidably engage pins 61 and plug member 12, respectively, so that the circuitry and component apparatus located on circuit board 5 may be interconnected with the circuitry of backplane 6 and optical fiber cable 2.

Connector 1 also includes sleeve member 10 that is arranged to slidably receive and apply quadrantal spring forces against fiber terminating substrates 21, 31 to axially align and optically couple together corresponding fibers terminated on substrates 21, 31. Sleeve member 10, FIG. 2, has a generally rectangular body 100 with one end 101 sized for insertion into the chamber of retaining member 121 of plug member 12 and with the opposite end 102 sized for slidable insertion into the chamber of retaining member 110 of plug member 11. End 101 has pin members 1011 extending vertically outward from the surface thereof for use in aligning sleeve member 10 with respect to housing 120.

Referring now to FIG. 7 of the drawing, sleeve member 10 has an inner channel 1000 formed along a center axis with openings 1010, 1020 at each end sized to slidably engage the truncated end of pyramid members 1215, 1108 and supported fiber termination substrates 21, 31. Positioned within inner channel 1000 are four spring members 103, 104, 105, 106 arranged to slidably engage fiber terminating substrates 21, 31 and apply quadrantal forces thereto to axially align and optically couple the ends of the fibers terminated on substrates 21, 31. Each spring member 103, 104, 105, 106 is a generally rectangular spring constructed of any one of a number of resilient materials and is of a type commonly referred to as a leaf spring. A spring member, such as spring member 103, FIG. 8, has a center arcuate section 1030 extended toward the center line of sleeve member 10 and has each end formed into a curved section 1031, 1032 used to pre-bias and hold spring member 103 in sleeve member channel 1000. The other spring member 104 of the first pair of spring members 103, 104 is positioned within sleeve member channel 1000 directly, opposite sleeve member 103 with the center arcuate section thereof extended toward the center line of sleeve member 10 to normally rest against arcuate section 1030 of spring member 103 in the relaxed state.

A second pair of springs 105, 106 is positioned in sleeve member channel 1000 directly opposite each other with their respective arcuate sections extended toward the sleeve member center line and rotated to form a right angle with the first pair of spring members 103, 104. In the relaxed state

the arcuate sections of the second pair of spring members 105, 106 extend toward the center line of sleeve member 10 and normally rest on the relaxed arcuate sections of the first pair of spring member 103, 104. The slidable insertion of the fiber terminating substrates 21, 31 in the appropriate ends of sleeve member 10 result in the engagement of substrates 21, 31 with the first pair of spring members 103, 104. Spring members 103, 104 are compressed and apply forces to the top and bottom surfaces of both substrates 21 and 31 and operate to position the polished ends of substrates 21, 31 together with the row of fibers terminated in substrate 21 vertically aligned with the row of fibers terminated in substrate 31. As the first pair of spring members 103, 104 are compressed the second pair of spring members 105, 106 are released to exert a second pair of forces at right angles with respect to the first pair of forces against the sides of both substrates to horizontally align each fiber on substrate 21 with a corresponding fiber on substrate 31. The combined action of spring members 103, 104, 105, 106 generate quadrantal forces that are applied to substrates 21, 31 slidably inserted in sleeve member 10 to axially align and optically couple together light carrying fibers of optical fiber cables 2, 3.

Apparatus Assembly

Referring to FIG. 2 of the drawing, plug member 12 is assembled by aligning pins 1011 of sleeve member 10 with alignment channels formed on each side of the inner chamber 1205 of housing member 120. Sleeve member 10 is then inserted into housing member 120 such that alignment pins 1011 are located at the end of chamber 1205 with sleeve member end section 102 extended through chamber 1206 perpendicularly outward from housing member 120. Truncated pyramid 1215 with supported substrate 21 terminating fibers of optical fiber cable 2 is assembled with spacer member 1214 in retaining member 121. Raised surfaces 1210 of retaining member 121 are then aligned with alignment channels 1202 and retaining member 121 inserted in chamber 1205 of housing member 120 with the truncated end of pyramid member 1215 and supported substrate 21 slidably inserted in end section 101 of sleeve 10. Housing member 120 is then inserted into backplane with tabs 1204, FIG. 1, securing housing member 120, sleeve member 10, and optical fiber cable 2 to backplane 6.

Plug member 11, FIG. 5, is assembled by inserting truncated pyramid member 1108 and supported substrate 31 terminating fibers of optical fiber cable 3 into channel 1104 of retaining member 110 with the base of pyramid member 1108 engaging tab sections 1110. Spacing member 1109 and spring assembly 1107 are positioned in channel 1104 adjacent pyramid member 1108 with spring retaining member 11072 in alignment slot 1102. Tab 110721 of spring retaining member 11072 engages hole 1103 to secure pyramid member 1108, space

member 1109 and spring assembly 1107 in retaining member 110. Plug member 11 may, if desired, be mounted on circuit board 5, FIG. 1, by locating pin members 1111 into holes of the circuit board or circuit board connector 4. As plug-in circuit board 5 is inserted into equipment mounting apparatus an edge of circuit board 5 moves in a channel of alignment member 60 so that end section 102 of sleeve member 10 enters the open end of plug member 11. Supported substrate 31, FIG. 10, is slidably inserted into an end opening of sleeve member 10 to engage the spring members located in the channel of sleeve member 10. As plug member 11 is engaged with plug member 12 the truncated end of pyramid member 1108 partially enters the end of sleeve member 10 spiral spring 11070 compresses to exert a force along the center line of retaining member 110 against the base of pyramid member 1108. Sleeve spring members 103, 104, 105, 106 apply quadrantal forces, FIG. 8 on the surfaces of universally mounted substrates 21 and, 31 such that the substrate ends are vertically and horizontally aligned with each fiber of cable 2 terminated on substrate 21 axially aligned and optically coupled with a corresponding fiber of cable 3 terminated on substrate 31. In the fully engaged positions, the end section 1101 of retaining member 110, FIG. 10, is inserted in chamber 1206 of housing member 120 and compressed spiral spring assembly 1107 maintains the end of substrate 31 abutted against the end of substrate 21. To disengage, plug member 11 and circuit board 5 is withdrawn to remove the end of retaining member 110 from housing member 120 and thereby disengage fiber terminating substrate 31 from the end of sleeve member 10.

Summary of the Invention

It is obvious from the foregoing that the facility, economy and efficiency of connectors may be substantially enhanced by a connector apparatus arranged for enabling optical fiber cables to be slidably coupled together. It is further obvious from the foregoing that a connector apparatus arranged for enabling optical fibers coupled with apparatus on plug-in circuit boards to be slidably coupled with optical fibers terminated on the equipment mounting apparatus backplanes by axially aligning and optically coupling together the fibers, improves the use of optical apparatus in electronic and communication networks.

While the apparatus of the invention has been disclosed in an optical fiber system it is to be understood that a light carrying fiber is a conductor of signals and that the present embodiment is intended to be illustrative of the principles of the invention.

Claims

1. Apparatus for interconnecting optical fiber cables characterised by a plug member (11, 12) being associated with each cable with each plug member mounting a pair of mutually parallel

the arcuate sections of the second pair of spring members 105, 106 extend toward the center line of sleeve member 10 and normally rest on the relaxed arcuate sections of the first pair of spring member 103, 104. The slidable insertion of the fiber terminating substrates 21, 31 in the appropriate ends of sleeve member 10 result in the engagement of substrates 21, 31 with the first pair of spring members 103, 104. Spring members 103, 104 are compressed and apply forces to the top and bottom surfaces of both substrates 21 and 31 and operate to position the polished ends of substrates 21, 31 together with the row of fibers terminated in substrate 21 vertically aligned with the row of fibers terminated in substrate 31. As the first pair of spring members 103, 104 are compressed the second pair of spring members 105, 106 are released to exert a second pair of forces at right angles with respect to the first pair of forces against the sides of both substrates to horizontally align each fiber on substrate 21 with a corresponding fiber on substrate 31. The combined action of spring members 103, 104, 105, 106 generate quadrantal forces that are applied to substrates 21, 31 slidably inserted in sleeve member 10 to axially align and optically couple together light carrying fibers of optical fiber cables 2, 3.

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member 1109 and spring assembly 1107 in retaining member 110. Plug member 11 may, if desired, be mounted on circuit board 5, FIG. 1, by locating pin members 1111 into holes of the circuit board or circuit board connector 4. As plug-in circuit board 5 is inserted into equipment mounting apparatus an edge of circuit board 5 moves in a channel of alignment member 60 so that end section 102 of sleeve member 10 enters the open end of plug member 11. Supported substrate 31, FIG. 10, is slidably inserted into an end opening of sleeve member 10 to engage the spring members located in the channel of sleeve member 10. As plug member 11 is engaged with plug member 12 the truncated end of pyramid member 1108 partially enters the end of sleeve member 10 spiral spring 11070 compresses to exert a force along the center line of retaining member 110 against the base of pyramid member 1108. Sleeve spring members 103, 104, 105, 106 apply quadrantal forces, FIG. 8 on the surfaces of universally mounted substrates 21 and, 31 such that the substrate ends are vertically and horizontally aligned with each fiber of cable 2 terminated on substrate 21 axially aligned and optically coupled with a corresponding fiber of cable 3 terminated on substrate 31. In the fully engaged positions, the end section 1101 of retaining member 110, FIG. 10, is inserted in chamber 1206 of housing member 120 and compressed spiral spring assembly 1107 maintains the end of substrate 31 abutted against the end of substrate 21. To disengage, plug member 11 and circuit board 5 is withdrawn to remove the end of retaining member 110 from housing member 120 and thereby disengage fiber terminating substrate 31 from the end of sleeve member 10.

Summary of the Invention

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While the apparatus of the invention has been disclosed in an optical fiber system it is to be understood that a light carrying fiber is a conductor of signals and that the present embodiment is intended to be illustrative of the principles of the invention.

Claims

1. Apparatus for interconnecting optical fiber cables characterised by a plug member (11, 12) being associated with each cable with each plug member mounting a pair of mutually parallel



planar substrates (210, 211) with the substrates being joined together thereby forming a substrate pair device terminating therebetween ends of light carrying fibers of the associated optical fiber cable with each plug member enabling limited relative rotational movement between the substrate pair device and plug member itself, said rotation being about two right angle axes perpendicular to an axial center line of the plug member, and sleeve means (10) containing opposed pairs of spring members (103, 104, 105, 106) which together delimit an interior passageway each end of the passageway slidably receiving a substrate pair device and applying spring forces on the received substrate pair devices to axially align the substrate pair devices and optically couple together opposing ones of the fibers terminated thereon.

2. Apparatus in accordance with claim 1, characterised in that the plug members comprise means (1108, 1215) for receiving the light carrying fibers and supporting the substrate pair devices terminating the received fibers, and means (110, 121) for holding the receiving and supporting means with the fiber terminating substrate pair devices extended along the axial center line of the plug members.

3. Apparatus in accordance with claim 2 characterised in that the plug members comprise means (1109, 1214) positioned in the holding means for enabling the limited relative rotational movement of the substrate pair devices about the axial center line of the plug members.

4. Apparatus in accordance with claim 3, characterised by means (120) for retaining one of the holding means with the supported substrate pair device thereof in engagement with the sleeve means and for enabling insertion of another one of the holding means to slidably engage the supported substrate pair device thereof with the sleeve means.

5. Apparatus in accordance with claim 4, characterised in that the other one holding means comprises means (1107) positioned therein for exerting a force along an axial line of the holding means against the held receiving and supporting means thereof to maintain the inserted substrate pair device in engagement with the sleeve spring members.

6. Apparatus in accordance with any of the foregoing claims 1-5, characterised by said opposed pairs of spring members comprising a first pair of opposing spring members (103, 104) rotated at right angles with respect to a second pair of spring members (105, 106) forming the interior passageway of said sleeve means for separably receiving the substrate pair devices and applying opposing forces thereon to axially align and optically couple together opposing ones of the fibers terminated on the received substrate pair devices, and means (120) insertable in a backplane (6) of equipment mounting apparatus for holding the sleeve means extended through the backplane and for receiving the retaining apparatus with each supported substrate pair device thereof engaged with the sleeve means.

7. Apparatus in accordance with claim 6, characterised in that the receiving means comprises a pair of members (1108, 1215) each having a base section and adjacent pyramid configured section with slots formed along one side thereof for receiving ones of the fibers and for supporting one of the substrate pair devices terminating the received fibers to extend outward from a truncated end of the pyramid section, and said holding means comprising a pair of retaining members (110, 121) for holding a truncated pyramid member therein with the supported substrate pair device thereof positioned along the axial line of the plug members.

8. Apparatus in accordance with claim 7, characterised in that the retaining apparatus further comprises spacer members (1109, 1214) positioned in the holding means adjacent one end thereof and the base section of the truncated pyramid member for enabling the limited relative rotational movement of the supported substrate pair devices.

9. Apparatus in accordance with claim 8, characterised in that the sleeve means comprises a body member (100) having an inner channel (1000) formed along an axial line thereof with an opening (1010, 1020) at each end of the body member formed for slidably receiving the supported substrate pair device and end of a truncated pyramid member, and said first and second pairs comprise opposing arcuate leaf spring members (103, 104, 105, 106).

10. Apparatus in accordance with claim 9, characterised in that the holding means comprises first and second generally rectangular sections (1201, 1200) with the first section having an outer surface for engaging the equipment apparatus backplane and with the sections having interconnected chambers (1205, 1206) for slidably receiving one of a pair of the receiving means at each end thereof and the second member chamber formed for receiving the sleeve means with the ends thereof extending into and from the chambers for receiving the supported substrate pair devices in slidable engagement with the sleeve spring members.

11. Apparatus in accordance with claim 10, characterised in that one of the holding means comprises a spiral spring member (1107) positioned along the axial line of a plug member for maintaining a force against the held truncated pyramid member to maintain the supported substrate pair device in engagement with the sleeve spring members.

12. Apparatus in accordance with any one of the foregoing claims 1-11, characterised by a first member (1215) having a generally rectangular base section adjacent a pyramid section with a slot formed along one side thereof for receiving the light carrying fibers of one optical cable and formed for supporting one substrate pair device terminating the received cable fibers to extend outward from a truncated end of the pyramid section, a second member (1108) having a generally rectangular base section adjacent a



truncated pyramid section with a slot formed along one side thereof for receiving light carrying fibers coupled with a circuit board and formed for supporting another substrate pair device terminating the received circuit board fibers to extend outward from a truncated end of the pyramid section, a first retaining member (121) for holding the first receiving and supporting member therein with the supported cable fiber terminating substrate pair device positioning along the axial center line thereof, a second retaining member (110) for holding the second receiving and supporting member therein with the supported circuit board fiber terminating substrate pair device positioned along the axial center line thereof, a pair of the spacer members (1109, 1214) each positioned in one of the first and second retaining members adjacent a corresponding first and second receiving and supporting member for enabling the limited relative rotational movement of the fiber terminating substrate pair devices, about the retaining members axial center line, said sleeve means (10) having a generally rectangular channel internally formed along an axial center line thereof with an opening at each end for separably receiving the supported substrate pair devices and truncated end of the first and second receiving and supporting members, said spring members comprising a first pair of opposed leaf spring members (103, 104) positioned in the sleeve member rectangular inner channel with each spring member having an arcuate section extending toward the sleeve member axial center line for applying a vertical aligning force on the substrate pair devices slidably inserted into the sleeve member channel, a second pair of opposed leaf spring members (105, 106) positioned in the sleeve member rectangular inner channel and rotated at a right angle with respect to the first pair of opposed leaf spring members with each spring member having an arcuate section extending toward the sleeve member axial center line for applying a horizontal aligning force on the substrate pair devices slidably inserted into the sleeve member channel, a housing member (120) having first and second generally rectangular sections with the first section having an outer surface sized for insertion through a backplane of equipment mounting apparatus and with the sections having interconnected chambers formed for receiving the sleeve member with the second section chamber sized for receiving the first one retaining member and held first receiving and supporting member with the supported cable fiber termination substrate pair device slidably engaged with the pairs of leaf spring members and with the first section chamber sized for slidably receiving the second retaining member and held second receiving and supporting member to engage the circuit board fiber terminating substrate pair device with the pairs of leaf spring members to axially align and optically couple together opposite ones of the optical cable and circuit board fibers terminated on the substrate pair devices, and a spiral spring

(1107) positioned in the second retaining member adjacent one end thereof and one of the spacer members for exerting a spring force along the second retaining member axial center line to maintain the circuit board, fiber terminating substrate pair device engaged with the leaf spring members and abutted against the optical cable fiber terminating substrate pair device.

13. Apparatus in accordance with claim 12, characterised in that the sleeve member comprises pin members (1011) extending orthogonally outward from surfaces of one end of the sleeve member at right angles with respect to adjacent ones of the pin members for aligning the sleeve member to receive the fiber terminating substrate pair devices, and wherein sidewalls of the first retaining member (121) are formed with pairs of opposite channels (1213) positioned for receiving the sleeve aligning pin members.

14. Apparatus in accordance with any of the foregoing claims 1-13 for interconnecting signal carrying conductors through a backplane of equipment mounting apparatus, characterised in that said means insertable in the backplane comprises a receptacle member (120) having first and second sections with the first section sized for engagement with the equipment mounting apparatus backplane and with the sections having interconnected chambers for holding the sleeve member extended through the backplane and with the interconnected chambers each sized for receiving one of the plug members to slidably insert the conductor terminating substrate pair devices into the sleeve member.

15. Apparatus in accordance with claim 9, characterised in that in a relaxed state, the second leaf spring members extend toward the sleeve member axial center line and normally rests on the relaxed first leaf spring members.

Patentansprüche

1. Verbindungsvorrichtung zur Verbindung optischer Faserkabel, gekennzeichnet durch folgende Merkmale:

ein Steckerglied (11, 12) ist jedem Kabel zugeordnet;

in jedem Steckerglied sind zwei zueinander parallele ebene Träger (210, 211) montiert;

die miteinander verbundenen Träger bilden eine Trägerpaarvorrichtung, zwischen welcher die Enden von lichtführenden Fasern des zugeordneten optischen Faserkabels enden;

jedes Steckerglied ermöglicht eine begrenzte relative Kippbewegung zwischen der Trägerpaarvorrichtung und dem Steckerglied selbst;

die Kippung erfolgt um zwei senkrecht zueinander stehende Achsen, die senkrecht zu einer axialen Mittellinie des Steckergliedes ausgerichtet sind;

eine Hülseineinrichtung (10) enthält sich gegenüberstehende Paare von Federgliedern (103, 104, 105, 106), die zusammen einen inneren Kanal begrenzen;

jedes Ende des Kanals empfängt eine gleitend



hineingeschobene Trägerpaarvorrichtung und übt Federkräfte auf die aufgenommenen Trägerpaarvorrichtungen aus, um die Trägerpaarvorrichtungen axial auszurichten und sich gegenüberstehende und daran endigende Fasern optisch miteinander zu koppeln.

2. Verbindungsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Steckerglieder eine Aufnahmeeinrichtung (1108, 1215) zum Empfang der lichtführenden Fasern und Stützung der Trägerpaarvorrichtungen aufweisen, mit denen die aufgenommenen Fasern enden und daß eine Halteeinrichtung (110, 121) zum Halten der Aufnahme- und Stützeinrichtung vorgesehen ist, wobei die faserendigen Substratpaarvorrichtungen entlang der axialen Mittellinie der Steckerglieder sich erstrecken.

3. Verbindungsvorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß die Steckerglieder Einrichtungen (1109, 1214) aufweisen, die in der Halteeinrichtung angeordnet sind und die begrenzte relative Drehbewegung der Trägerpaarvorrichtungen um die axiale Mittellinie der Steckerglieder ermöglichen.

4. Verbindungsvorrichtung nach Anspruch 3, gekennzeichnet durch eine Einrichtung (120) zum Halten einer der Halteeinrichtungen, wobei deren unterstützte Trägerpaarvorrichtung in Eingriff mit der Hülseinrichtung steht, und zur Ermöglichung der Einfügung einer anderen Halteeinrichtung, um deren unterstützte Trägerpaarvorrichtung mit der Hülseinrichtung in Gleitführung zu umfassen.

5. Verbindungsvorrichtung nach Anspruch 4, dadurch gekennzeichnet, daß die andere Halteeinrichtung darin angeordnete Mittel (1107) aufweist, die zur Ausübung einer Kraft entlang einer axialen Linie der Halteeinrichtung gegenüber der gehaltenen Aufnahme- und Stützeinrichtung ausübt, um die eingefügte Trägerpaarvorrichtung in Eingriff mit den Hülsefedergliedern zu halten.

6. Verbindungsvorrichtung nach einem der vorhergehenden Ansprüche 1 bis 5 dadurch gekennzeichnet, daß die sich gegenüberstehenden Paare der Federglieder ein erstes Paar von sich gegenüberstehenden Federgliedern (103, 104) aufweisen, die im rechten Winkel mit Bezug auf das zweite Paar von Federgliedern (105, 106) gedreht sind, welche den inneren Kanal der Hülseinrichtung bilden, um die Trägerpaarvorrichtungen getrennt zu empfangen und an diese sich gegenüberstehende Kraft anzulegen, um die sich gegenüberstehenden und auf den aufgenommenen Trägerpaarvorrichtungen endigenden Fasern axial auszurichten und optisch zu koppeln, und daß eine Einrichtung (120) in eine Rückwand (6) der Gerätemontagevorrichtung einfügbar ist, um die Hülseinrichtung durch die Rückwand hindurchreichend zu halten und die Rückhaltevorrichtung aufzunehmen, wobei jede unterstützte Trägerpaarvorrichtung in der Hülseinrichtung eingreift.

7. Verbindungsvorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß die Aufnahmeeinrichtung zwei Glieder (1108, 1215) aufweist, die

jeweils einen Basisabschnitt und anschließend einen pyramidenförmig geformten Abschnitt mit Schlitz entlang einer Seite aufweist, und zur Aufnahme einzelner Fasern und zur Stützung einer der Trägerpaarvorrichtungen dient, mit welcher die empfangenen Fasern enden, um sich außerhalb eines abgestumpften Endes des Pyramidenabschnitts zu erstrecken, und daß die Halteeinrichtung ein Paar von Rickhaltegliedern (110, 121) aufweist, um ein Pyramidenstumpfglied darin zu halten, wobei deren unterstützte Trägerpaarvorrichtung entlang der axialen Linie der Steckerglieder angeordnet ist.

8. Verbindungsvorrichtung nach Anspruch 7, dadurch gekennzeichnet, daß die Rückhaltevorrichtung ferner Abstandsglieder (1109, 1214) aufweist, die in der Halteeinrichtung benachbart von deren einem Ende und dem Basisabschnitt des Pyramidenstumpfgliedes angeordnet ist, um die begrenzte relative Kippbewegung der unterstützten Trägerpaarvorrichtungen zu ermöglichen.

9. Verbindungsvorrichtung nach Anspruch 8, dadurch gekennzeichnet, daß die Hülseinrichtung ein Gehäuseglied (100) mit einem inneren Kanal (1000) aufweist, der sich entlang einer axialen Linie des Gehäusegliedes erstreckt, wobei eine Öffnung (1010, 1020) an jedem Ende des Gehäusegliedes zum Hineinschieben der unterstützten Trägerpaarvorrichtung und des Endes eines Pyramidenstumpfgliedes geformt ist, und daß das erste und zweite Paar sich gegenüberstehende bogenförmige Blattfederglieder (103, 104, 105, 106) aufweisen.

10. Verbindungsvorrichtung nach Anspruch 9, dadurch gekennzeichnet, daß die Halteeinrichtung erste und zweite im großen und ganzen rechteckförmige Abschnitte (1201, 1200) aufweist, wobei der erste Abschnitt eine äußere Oberfläche zum Eingriff der Gehäuserückwand der Gerätevorrichtung aufweist und wobei die Abschnitte miteinander verbundene Kammern (1205, 1206) aufweisen, um jeweils eines des Paares der Aufnahmeeinrichtungen an jedem Ende aufzunehmen, und daß die Kammer des zweiten Gliedes zum Empfang der Hülseinrichtung geformt ist, wobei deren Enden sich in die Kammern und aus diesen heraus erstrecken, um die unterstützten Trägerpaarvorrichtungen bei gleitender Berührung der Hülsefederglieder aufzunehmen.

11. Verbindungsvorrichtung nach Anspruch 10, dadurch gekennzeichnet, daß eine der Halteeinrichtungen eine Schraubenfeder (1107) aufweist, die entlang der axialen Linie eines Steckergliedes angeordnet ist, um eine Kraft gegen das gehaltene Pyramidenstumpfglied auszuüben und so die unterstützte Trägerpaarvorrichtung in Eingriff mit den Hülsefedergliedern zu halten.

12. Verbindungsvorrichtung nach einem der Ansprüche 1 bis 11, gekennzeichnet durch folgende Merkmale:

ein erstes Glied (1215) weist, benachbart einem Pyramidenabschnitt, einen im großen und ganzen rechteckförmigen Basisabschnitt auf, der mit einem Schlitz entlang einer Seite geformt ist, um die lichtführenden Fasern des einen optischen



Kabels aufzunehmen und zur Unterstützung der einen Trägerpaarvorrichtung geformt ist, mit welcher die aufgenommenen Kabelfasern enden, um sich nach außen von einem abgestumpften Ende des Pyramidenabschnittes zu erstrecken;

ein zweites Glied (1108) weist, benachbart einem Pyramidenstumpfabschnitt, einen im großen und ganzen rechteckförmigen Basisabschnitt auf, der mit einem Schlitz entlang einer seiner Seiten geformt ist, um die lichtführenden Fasern aufzunehmen, die mit einer Schaltungsplatte gekoppelt sind, und ist zur Unterstützung einer anderen Trägerpaarvorrichtung geformt, mit welcher die aufgenommenen Fasern der Schaltungsplatte abschließen, um sich nach außen von einem abgestumpften Ende des Pyramidenabschnittes zu erstrecken;

ein erstes Rückhalteglied (121) dient zum Halten des ersten Aufnahme- und Stützgliedes, wobei die Trägerpaarvorrichtung, mit welcher die unterstützte Kabelfaser abschließt, sich entlang der axialen Mittellinie positioniert;

ein zweites Rückhalteglied (110) dient zum Halten des zweiten Aufnahme- und Stützgliedes, wobei die Trägerpaarvorrichtung, mit welcher die Fasern der unterstützten Schaltungsplatte endigen, entlang der axialen Mittellinie angeordnet ist;

ein Paar der Abstandsglieder (1109, 1214) ist jeweils in einem der ersten und zweiten Rückhalteglieder benachbart einem entsprechenden ersten und zweiten Aufnahme- und Stützglied angeordnet, um die begrenzte relative Kippbewegung der die Fasern abschließenden Trägerpaarvorrichtungen um die axiale Mittellinie der Rückhalteglieder zu ermöglichen;

die Hülseineinrichtung (10) weist einen im großen und ganzen rechteckförmigen Kanal auf, der im Inneren entlang einer axialen Mittellinie mit einer Öffnung an jedem Ende geformt ist, um die unterstützten Trägerpaarvorrichtungen und das abgestumpfte Ende der ersten und zweiten Aufnahme- und Stützglieder voneinander trennbar aufzunehmen;

die Federglieder weisen ein erstes Paar von sich gegenüberstehenden Blattfedergliedern (103, 104) auf, die im inneren rechteckförmigen Kanal des Hülsengliedes angeordnet sind, wobei jedes Federglied einen bogenförmigen Abschnitt aufweist, der sich zu der axialen Mittellinie des Hülsengliedes erstreckt, um eine vertikale ausrichtende Kraft auf die Trägerpaarvorrichtungen auszuüben, die in den Kanal des Hülsengliedes in Gleitführung eingefügt sind;

ein zweites Paar von sich gegenüberstehenden Blattfedergliedern (105, 106) ist in dem inneren rechteckförmigen Kanal des Hülsengliedes angeordnet und um einen rechten Winkel mit Bezug auf das erste Paar der sich gegenüberstehenden Blattfederglieder gedreht, wobei jedes Federglied einen bogenförmigen Abschnitt aufweist, der sich zu der axialen Mittellinie des Hülsengliedes erstreckt, um eine horizontale ausrichtende Kraft auf die Träger-

paarvorrichtungen auszuüben, die in den Kanal des Hülsengliedes in Gleitführung eingefügt sind;

ein Gehäuseglied (120) besitzt erste und zweite im großen und ganzen rechteckförmige Abschnitte, wobei der erste Abschnitt eine äußere Oberfläche aufweist, die zur Einfügung durch eine Rückwand der Gerätemontagevorrichtung ausgebildet ist und wobei die Abschnitte miteinander verbundene Kammer aufweisen, die zur Aufnahme des Hülsengliedes geformt sind, wobei die Kammer des zweiten Abschnittes zur Aufnahme des ersten einen Rückhalteglied und zum Halten des ersten Aufnahme- und Stützgliedes bemessen ist, wobei die unterstützte Trägerpaarvorrichtung mit abschließendem Kabelfaser an dem Paar der Blattfederglieder gleitend eingreift und wobei die Kammer des ersten Abschnittes zur Aufnahme des zweiten Rückhalteglied und zum Halten des zweiten Aufnahme- und Stützgliedes bemessen ist, damit die Trägerpaarvorrichtung mit abschließenden Fasern der Schaltungsplatte an den Paaren der Blattfedereinrichtungen eingreifen, um sich gegenüberstehende und mit den Trägerpaarvorrichtungen endigende Fasern des optischen Kabels und der Schaltungsplatte axial auszurichten und optisch miteinander zu koppeln;

eine Schraubenfeder (1107) ist in dem zweiten Rückhalteglied benachbart des einen Endes und des einen der Abstandsglieder angeordnet und dient zur Ausübung einer Federkraft entlang der axialen Mittellinie des zweiten Rückhaltegliedes, um die Trägerpaarvorrichtung mit endigenden Fasern der Schaltungsplatte in Anlage an den Blattfedergliedern und stumpf stoßend gegen die Trägerpaarvorrichtung mit endigenden Fasern des optischen Kabels zu halten.

13. Verbindungsvorrichtung nach Anspruch 12, dadurch gekennzeichnet, daß das Hülsenglied Stützglieder (1011) aufweist, die sich senkrecht nach außen von Oberflächen des einen Endes des Hülsengliedes im rechten Winkel mit Bezug auf benachbarte Stützglieder erstrecken, um die Hülseglieder auszurichten und die Trägerpaarvorrichtungen mit endigenden Fasern aufzunehmen, und daß die Seitenwände des ersten Rückhalteglied (121) mit Paaren von sich gegenüberstehenden Kanälen (1213) geformt sind, die zum Empfang der Hülseausrichtestiftglieder angeordnet sind.

14. Verbindungsglied nach einem der vorhergehenden Ansprüche 1 bis 13 zur Verbindung von signalführenden Leitern durch eine Rückwand der Gerätemontagevorrichtung, dadurch gekennzeichnet, daß eine in die Rückwand einfügbare Einrichtung ein Aufnahmeglied (120) aufweist, daß erste und zweite Abschnitte besitzt, daß der erste Abschnitt zum Eingriff in die Rückwand der Gerätemontagevorrichtung bemessen ist, daß die Abschnitte miteinander verbundene Kammern zum Halten des Hülsengliedes ausgestreckt durch die Rückwand besitzen und daß die miteinander verbundenen Kam-



mern jeweils zur Aufnahme eines der Steckerglieder bemessen sind, um die Trägerpaarvorrichtungen mit endigendem Leiter in das Hülsenglied einzufügen.

15. Verbindungsvorrichtung nach Anspruch 9, dadurch gekennzeichnet, daß im entspannten Zustand die zweiten Blattfederglieder sich zu der axialen Mittellinie des Hülsengliedes erstrecken und normalerweise auf den entspannten ersten Blattfedergliedern aufrufen.

Revendications

1. Dispositif pour interconnecter des câbles à fibres optiques caracterise par une fiche (11, 12) qui est associée à chaque câble, avec une paire de substrats plans mutuellement parallèles (210, 211) montée dans chaque fiche, les substrats étant joints ensemble pour former ainsi un dispositif à paire de substrats entre les substrats duquel aboutissent des extrémités de fibres de propagation de lumière du câble à fibres optiques associé, chaque fiche permettant un mouvement de rotation relatif limité entre le dispositif à paire de substrats et la fiche elle-même, cette rotation s'effectuant autour de deux axes perpendiculaires qui sont également perpendiculaires à un axe central de la fiche, et un manchon (10) contenant des paires opposées de ressorts (103, 104, 105, 106) qui délimitent ensemble un passage intérieur, chaque extrémité du passage recevant de façon glissante un dispositif à paire de substrats, et les ressorts appliquant des forces élastiques sur les dispositifs à paires de substrats qui se trouvent à l'intérieur, pour aligner axialement les dispositifs à paires de substrats et pour coupler ensemble de façon optique des fibres opposées qui aboutissent dans ces dispositifs à paires de substrats.

2. Dispositif selon la revendication 1, caracterise en ce que les fiches comprennent des moyens (1108, 1215) pour recevoir les fibres de propagation de lumière et pour supporter les dispositifs à paires de substrats qui constituent des terminaisons pour les fibres logées à l'intérieur, et des moyens (110, 121) pour retenir les moyens de réception et de support, dans une configuration dans laquelle les dispositifs à paires de substrats de terminaison de fibres s'étendent le long de l'axe central des fiches.

3. Dispositif selon la revendication 2, caracterise en ce que les fiches comprennent des moyens (1109, 1214) qui sont placés dans les moyens de retenue pour permettre le mouvement de rotation relatif limité des dispositifs à paires de substrats autour de l'axe central des fiches.

4. Dispositif selon la revendication 3, caracterise par des moyens (120) pour maintenir l'un des moyens de retenue avec son dispositif à paire de substrats supporté logé dans le manchon, et pour permettre l'insertion d'un autre des moyens de retenue pour accoupler de façon glissante son dispositif à paire de substrats supporté avec le manchon.

5. Dispositif selon la revendication 4, caracte-

rise en se que l'autre des moyens de retenue comprend des moyens (1107) qui sont placés à l'intérieur pour exercer une force dirigée le long d'un axe des moyens de retenue, contre ses moyens de réception et de support retenus, pour maintenir le dispositif à paire de substrats introduit en contact avec les ressorts du manchon.

6. Dispositif selon l'une quelconque des revendications 1 à 5 précédentes, caracterise par le fait que les paires opposées de ressorts comprennent une première paire de ressorts opposés (103, 104) qui est orientée perpendiculairement à une seconde paire de ressorts (105, 106) formant le passage intérieur du manchon, pour recevoir de façon séparable les dispositifs à paires de substrats et pour leur appliquer des forces opposées, afin d'aligner axialement et de coupler ensemble de façon optique des fibres opposées parmi les fibres qui aboutissent sur les dispositifs à paires de substrats qui sont reçus dans le manchon, et des moyens (120) qui peuvent être introduits dans une carte mère (6) d'une structure de montage d'équipements, pour retenir le manchon traversant la carte mère, et pour recevoir le dispositif de maintien, avec chaque dispositif à paire de substrats supporté logé dans le manchon.

7. Dispositif selon la revendication 6, caracterise en ce que les moyens de réception comprennent une paire d'éléments (1108, 1215) ayant chacune une section de base et une section adjacente ayant la configuration d'une pyramide, avec des fentes formées le long de l'un de ses côtés, pour recevoir certaines des fibres et pour supporter l'un des dispositifs à paires de substrats constituant la terminaison des fibres reçues, de façon que ce dispositif, s'étende vers l'extérieur à partir d'une extrémité tronquée de la section en forme de pyramide, et les moyens de retenue comprennent une paire d'éléments de maintien (110, 121) destinés à retenir à l'intérieur un élément en forme de pyramide tronquée, avec son dispositif à paire de substrats supporté positionné le long de l'axe des fiches.

8. Dispositif selon la revendication 7, caracterise en ce que le dispositif de maintien comprend en outre des éléments d'espacement (1109, 1214) qui sont positionnés dans les moyens de retenue en position adjacente à une extrémité de ceux-ci et à la section de base de l'élément en forme de pyramide tronquée, pour permettre le mouvement de rotation relatif limité des dispositifs à paires de substrats supportés.

9. Dispositif selon la revendication 8, caracterise en ce que le manchon comprend un corps (100) ayant un canal intérieur (1000) formé le long d'un axe de ce corps, avec une ouverture (1010, 1020) à chaque extrémité du corps, formée pour recevoir de façon glissante le dispositif à paire de substrats supporté et une extrémité de l'élément en forme de pyramide tronquée, et les première et seconde paires consistent en ressorts à lames courbes opposés (103, 104, 105, 106).

10. Dispositif selon la revendication 9, caracterise en ce que les moyens de retenue comprennent des première et seconde sections de forme



générale rectangulaire (1201, 1200), avec la première section comportant une surface extérieure destinée à venir en contact avec la carte mère de la structure de montage d'équipements, et ces sections comportant des chambres en communication (1205, 1206) pour recevoir de façon glissante à chaque extrémité l'un des moyens d'une paire des moyens de réception, et la seconde chambre étant formée pour recevoir le manchon avec les extrémités de celui-ci entrant et sortant des chambres, pour recevoir les dispositifs à paires de substrats supportés, en contact glissant avec les ressorts du manchon.

11. Dispositif selon la revendication 10, caractérise en ce que l'un des moyens de retenue comprend un ressort hélicoïdal (1107) qui est placé le long de l'axe d'une fiche, pour maintenir une force contre l'élément en forme de pyramide tronquée qui est retenu, afin que le dispositif à paire de substrats supporté soit maintenu en contact avec les ressorts du manchon.

12. Dispositif selon l'une quelconque des revendications 1-11 précédentes, caractérise par un premier élément (1215) ayant une section de base de forme générale rectangulaire adjacente à une section en forme de pyramide, avec une fente formée le long de l'un de ses côtés pour recevoir les fibres de propagation de lumière d'un câble optique, et formé pour supporter un dispositif à paire de substrats qui constitue la terminaison des fibres de câble reçues, de façon que ce dispositif s'étende vers l'extérieur à partir d'une extrémité tronquée de la section en forme de pyramide, un second élément (1108) ayant une section de base de forme générale rectangulaire adjacente à une section en forme de pyramide tronquée, avec une fente formée le long de l'un de ses côtés, pour recevoir des fibres de propagation de lumière qui sont couplées à une carte de circuit, et formé pour supporter un autre dispositif à paire de substrats constituant la terminaison des fibres de carte de circuit reçues, de façon que ce dispositif s'étende vers l'extérieur à partir d'une extrémité tronquée de la section en forme de pyramide, un premier élément de maintien (121) destiné à retenir à l'intérieur le premier élément de réception et de support, avec le dispositif à paire de substrats de terminaison de fibres de câble supporté positionné le long de son axe central, un second élément de maintien (110) destiné à retenir à l'intérieur le second élément de réception et de support, avec le dispositif à paire de substrats de terminaison de fibres de carte de circuit supporté positionné le long de son axe central, une paire d'éléments d'espacement (1109, 1214), chacun d'eux étant positionné dans l'un des premier et second éléments de maintien, en position adjacente à un élément correspondant parmi les premier et second éléments de réception et de support, pour permettre le mouvement de rotation relatif limité des dispositifs à paire de substrats de terminaison de fibres autour de l'axe central des éléments de retenue, le manchon (10) comportant un canal de forme générale rectangulaire, formé intérieurement le

long d'un axe central du manchon, avec une ouverture à chaque extrémité, pour recevoir de façon séparable les dispositifs à paires de substrats supportés et l'extrémité tronquée des premier et second éléments de réception et de support, les ressorts comprenant une première paire de ressorts à lame opposés (103, 104) qui sont positionnés dans le canal intérieur rectangulaire du manchon, chaque ressort ayant une section courbe qui s'étend vers l'axe central du manchon, pour appliquer une force d'alignement verticale sur les dispositifs à paires de substrats qui sont introduits de façon glissante dans le canal du manchon, et une seconde paire de ressorts à lames opposés (105, 106) qui sont positionnés dans le canal intérieur rectangulaire du manchon, cette seconde paire étant orientée perpendiculairement à la première paire de ressorts à lames opposés, chaque ressort ayant une section courbe qui s'étend vers l'axe central du manchon pour appliquer une force d'alignement horizontale sur les dispositifs à paires de substrats qui sont introduits de façon glissante dans le canal du manchon, un boîtier (120) comportant des première et seconde sections de forme générale rectangulaire, la première section ayant une surface extérieure dimensionnée pour l'insertion à travers une carte mère de la structure de montage d'équipements, et les sections comportant des chambres en communication qui sont formées pour recevoir le manchon, avec la chambre de la seconde section dimensionnée pour recevoir le premier élément de maintien et le premier élément de réception et de support retenu, avec le dispositif à paire de substrats de terminaison de fibres de câble supporté en contact glissant avec la paire de ressorts à lames, et avec la chambre de la première section dimensionnée pour recevoir de façon glissante le second élément de maintien et le second élément de réception et de support retenu, de façon que le dispositif à paire de substrats de terminaison de fibres de carte de circuit vienne en contact avec les paires de ressorts à lames, pour aligner axialement et coupler ensemble de façon optique des fibres opposées du câble optique et de la carte de circuit qui aboutissent aux dispositifs à paires de substrats, et un ressort hélicoïdal (1107) positionné dans le second élément de maintien, en position adjacente à une extrémité de ce dernier et à l'un des éléments d'espacement, pour exercer une force élastique le long de l'axe central du second élément de maintien, afin de maintenir le dispositif à paire de substrats de terminaison de fibres de carte de circuit en contact avec les ressorts à lames et appliqué contre le dispositif à paire de substrats de terminaison de fibres de câble optique.

13. Dispositif selon la revendication 12, caractérise en ce que le manchon comprend des ergots (1011) qui s'étendent perpendiculairement vers l'extérieur à partir de surfaces d'une extrémité du manchon, à angle droit par rapport à des ergots adjacents parmi les ergots qui sont destinés à aligner le manchon pour la réception des disposi-



tifs à paires de substrats de terminaison de fibres, et dans lequel des parois latérales du premier élément de maintien (121) comportent des paires de canaux opposés (1213) qui sont placées pour recevoir les ergots d'alignement du manchon.

14. Dispositif selon l'une quelconque des revendications 1-13 précédentes, pour interconnecter des conducteurs de signaux à travers une carte mère d'une structure de montage d'équipements, caractérise en ce que les moyens qui peuvent être introduits dans la carte mère comprennent un réceptacle (120) comportant des première et seconde sections, avec la première section dimensionnée pour venir en contact avec la carte

mère de la structure de montage d'équipements, et les sections comportant des chambres en communication pour retenir le manchon qui traverse la carte mère, et chacune des chambres en communication étant dimensionnée de façon à recevoir l'une des fiches pour introduire de façon glissante les dispositifs à paires de substrats de terminaison de conducteurs dans le manchon.

15. Dispositif selon la revendication 9, caractérise en ce que dans un état relâché, les seconds ressorts à lames s'étendent vers l'axe central du manchon et reposent normalement sur les premiers ressorts à lames à l'état relâché.

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