

PORTED HARDWARE FOR OVERHEAD ELECTRICAL CABLES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the priority benefit of U.S. Provisional Patent Application No. 62/952,113 filed on December 20, 2019, which is incorporated herein by reference in its entirety.

FIELD

[0002] This disclosure relates to the field of overhead electrical cables, and particularly to hardware components that are used to install and support overhead electrical cables for the transmission and distribution of electricity.

SUMMARY

[0003] In one embodiment, a termination arrangement for an overhead electrical cable is disclosed. The termination arrangement comprises a gripping element configured to grip a strength member of an overhead electrical cable and a connector operatively attached to the gripping element. The connector comprises a connector body and a connector body bore extending longitudinally from a first aperture in a distal end of the connector body toward a proximal end of the connector body.

[0004] In another embodiment, a method for terminating an overhead electrical cable comprising a central strength member and a plurality of conductive strands wrapped around the strength member, is disclosed. The method includes the steps of separating an end portion of the strength member from the conductive strands, inserting the end portion of the strength member into a termination arrangement, the termination arrangement comprising a connector having a connector body and a connector body bore, wherein the step of inserting the strength member includes placing the end portion of the strength member at least partially into the connector body bore.

[0005] In another embodiment, a method for interrogating an overhead electrical cable through a termination arrangement is disclosed where the overhead electrical cable has a strength member comprising interrogation elements and a plurality of conductive strands wrapped around the strength member. The method includes the steps of separating an end segment of the strength member from the conductive strands, operatively securing a termination arrangement to the overhead electrical cable, where the termination arrangement includes a gripping element configured to grip the strength member and a connector operatively attached to the gripping element, the connector comprising a connector body and a connector body bore extending longitudinally from a first aperture in a proximal end of the connector body toward a distal end of the connector body. The step of operatively securing the termination arrangement to the overhead electrical cable includes securing a first portion of the end segment of the strength member with the gripping element and placing a second portion of the end segment of the strength member into the connector body bore. Interrogation of the strength member may be carried out by operatively linking (e.g., contacting directly or indirectly) an interrogation device to the end of the strength member. During the interrogation, the strength member may be fully disposed within the termination arrangement or may extend beyond the termination arrangement.

[0006] These and other embodiments of the present disclosure will be apparent from the following description.

DESCRIPTION OF THE DRAWINGS

[0007] **FIG. 1** illustrates a portion of an overhead electrical transmission line.

[0008] **FIG. 2** illustrates a cross-sectional view of an assembled termination arrangement according to the prior art.

[0009] **FIG. 3** illustrates a perspective view of an assembled and crimped termination arrangement according to the prior art.

[0010] **FIG. 4** illustrates an overhead electrical cable including sensing elements disposed within a strength member.

[0011] **FIGS. 5A – 5E** illustrate a termination arrangement according to an embodiment the present disclosure in various states of assembly.

[0012] **FIG. 6A – 6B** illustrate a termination arrangement according to an embodiment of the present disclosure.

[0013] **FIGS. 7A - 7C** illustrate a termination arrangement according to an embodiment of the present disclosure.

[0014] **FIGS. 8A – 8C** illustrate a termination arrangement according to an embodiment of the present disclosure.

[0015] **FIG. 9** illustrates a splice arrangement according to an embodiment of the present disclosure.

[0016] **FIG. 10** illustrates a splice arrangement according to an embodiment of the present disclosure.

[0017] **FIGS. 11A - 11B** illustrate a splice arrangement according to an embodiment of the present disclosure.

[0018] **FIG. 12** illustrates a termination arrangement according to an embodiment of the present disclosure.

DESCRIPTION OF THE EMBODIMENTS

[0019] **FIG. 1** illustrates a portion of an overhead electrical transmission line **100** for the transmission of electricity. Overhead electrical transmission and distribution lines are constructed by elevating bare electrical cables (e.g., electrical cable **104a**) above the terrain using support towers (e.g., pylons) such as support towers **102a/102b/102c**. The transmission and distribution lines may span many miles, requiring extremely long lengths of electrical cable and many support towers. Some of the support towers are referred to as dead-end towers or anchor towers, such as tower **102a**. Such towers are located at termination points, e.g., power substations or locations where the electrical line is routed underground. Dead-end towers, such as tower **102a**, may also be required where the

electrical line changes direction (e.g., makes a turn), or at regular intervals in a long, straight line path. In such instances, the overhead electrical cable must be terminated and secured to the dead-end tower under high tension. As illustrated in **FIG. 1**, electrical cable **104a** is secured to tower **102a** using a dead end **106a** termination structure.

[0020] Another termination structure is referred to as a splice. While the length of a single segment of overhead cable may cover several thousand feet, a power grid requires several hundreds or even thousands of miles of electrical cable. To span these distances, the linemen must often splice (e.g., couple) two smaller cable segments together. Thus, one or more splices may be placed between two dead ends of an overhead cable installation. The splice functions as both a mechanical junction that holds the two ends of the cables together and an electrical junction allowing the electric current to flow through the splice. As illustrated in **FIG. 1**, a splice **108b** operatively connects electrical cable **104b** to electrical cable **104c** to form a mechanical junction and a continuous electrical pathway.

[0021] **FIG. 2** illustrates a cross-section of a termination arrangement (e.g., a dead-end) for use with a bare overhead electrical cable, e.g., such as dead-end **106a** in **FIG. 1**. The termination arrangement **200** illustrated in **FIG. 2** is similar to that illustrated and described in PCT Publication No. WO 2005/041358 by Bryant and in U.S. Patent No. 8,022,301 by Bryant et al., each of which is incorporated herein by reference in its entirety.

[0022] Broadly characterized, the termination arrangement **200** illustrated in **FIG. 2** includes a gripping element **210** and a connector **220** for anchoring the termination arrangement **200** to a dead-end structure (e.g., to a tower), not illustrated, e.g., with a fastener **226** (e.g., an eyebolt) disposed at a proximal end of the termination arrangement **200**. At the end of the termination arrangement **200**, opposite the fastener **226**, the termination arrangement **200** is operatively connected to a bare overhead electrical cable **260** that includes an electrical conductor **262** (e.g., comprising conductive strands) that surrounds and is supported by a strength member **264**, e.g., a fiber-reinforced composite strength member.

[0023] The gripping element **210** tightly grips the strength member **264** to secure the overhead electrical cable **260** to the termination arrangement **200**. As illustrated in **FIG.**

2, the gripping element **210** includes a compression-type fitting (e.g., a wedge-type fitting), specifically a collet **212** having a lumen **216** (e.g., a bore) that surrounds and grips onto the strength member **264**. The collet **212** is disposed in a collet housing **214**, and as the electrical cable **260** is tensioned (e.g., is pulled onto support towers), friction develops between the strength member **264** and the collet **212** as the collet **212** is pulled further into the collet housing **214**. The conical (outer) shape of the collet **212** and the mating inner funnel shape of the collet housing **214** create increased compression on the strength member **264**, ensuring that the strength member **264** does not slip out of the collet **212** and therefore that the overhead electrical cable **260** is secured to the termination arrangement **200**.

[0024] As illustrated in **FIG. 2**, an outer sleeve **240** is disposed over the gripping element **210** and includes a conductive body **244** to facilitate electrical conduction between the electrical conductor **262** and a jumper plate **246**. An inner sleeve **248** (e.g., a conductive inner sleeve) may be placed between the conductor **262** and the conductive body **244** to facilitate the electrical connection between the conductor **262** and the conductive body **244**. The conductive body **244** may be fabricated from aluminum, and the jumper plate **246** may be welded onto the conductive body **244**, for example. The jumper plate **246** is configured to attach to a connection plate **272** to facilitate electrical conduction between the electrical conductor **262** and another conductor, e.g., another electrical cable (not illustrated) that is in electrical communication with the connector plate **272**.

[0025] The connector **220** includes a fastener **226** and gripping element mating threads **228** disposed at a gripping element end of the connector **220**, with a connector body **222** disposed between the fastener **226** and the gripping element mating threads **228**. The gripping element mating threads **228** are configured to operatively mate with connector mating threads **218** of the collet housing **214** to facilitate movement of the connector **220** toward the collet **212**, pushing the collet **212** into the collet housing **214**, when the threads **218** and **228** are engaged and the connector **220** is rotated relative to the collet housing **214**. This strengthens the grip of the collet **212** onto the strength member **264**, further securing the overhead electrical cable **260** to the termination

arrangement **200**. The fastener **226** is configured to be attached to a dead-end structure, e.g., to a dead-end tower, to secure the termination arrangement **200** and the electrical cable **260**, to the dead-end structure.

[0026] **FIG. 3** illustrates a perspective view of a termination arrangement, similar to the termination arrangement of **FIG. 2**, that has been crimped onto an overhead electrical cable. The termination arrangement **300** includes a connector having a fastener **326** that extends outwardly from a proximal end of an outer sleeve **340**. A jumper plate **326** is integrally formed with the conductive body **342** for electrical connection to a connection plate (e.g., see **FIG. 2**). As illustrated in **FIG. 3**, the outer sleeve **340** is crimped over (e.g., onto) two regions of the underlying structure, namely crimped sleeve region **340b** and crimped sleeve region **340a**. The crimped sleeve region **340b** is generally situated over an intermediate portion of the underlying connector (e.g., see **FIG. 2**), and the crimped sleeve region **340a** is generally situated over a portion of the overhead electrical cable **380**. The compressive forces placed onto the outer sleeve **340** during the crimping operation are transferred to the underlying components, i.e., to the connector under the crimped region **340b** and to the overhead electrical cable **380** under the crimped region **340a** to permanently secure the termination arrangement **300** to the electrical cable **380**.

[0027] The termination arrangements broadly described with respect to **FIGS. 2** and **3** can be utilized with various bare overhead electrical cable configurations. The termination arrangements illustrated in **FIGS. 2** and **3** are particularly useful with overhead electrical cables having a fiber-reinforced composite strength member. For example, a compression wedge gripping element, e.g., having a collet disposed in a collet housing (e.g., **FIG. 2**), enables a fiber-reinforced composite strength member to be gripped under a high compressive force without significant risk of fracturing the composite material.

[0028] **FIG. 4** illustrates an overhead electrical cable **480** (e.g., a bare overhead electrical cable) that includes a strength member **484** fabricated from a fiber-reinforced composite material. The electrical cable **480** includes a conductor **482** comprising a first plurality of conductive strands **482a** that are helically wrapped around (e.g., stranded around) a strength member **484**. A second plurality of conductive strands **482b** are wrapped around the first conductive strands. The conductive strands **482a/482b** may be

fabricated from conductive metals such as copper or aluminum, and for use in bare overhead electrical cables are typically are fabricated from aluminum. The conductive materials, e.g., aluminum, and do not have sufficient mechanical properties (e.g., sufficient tensile strength) to be self-supporting when strung between support towers to form an overhead electrical line for transmission and/or distribution of electricity. Therefore, the strength member **484** supports the electrical conductor **482** when the overhead electrical cable **480** is strung between support towers under high mechanical tension.

[0029] The strength member **484** illustrated in **FIG. 4** is a fiber-reinforced composite strength member, e.g., comprising a plurality of reinforcing fibers disposed in a binding matrix. As illustrated in **FIG. 4**, the strength member includes an inner section **484a** comprising substantially continuous reinforcing carbon fibers disposed in a polymer binding matrix. An insulative layer **484b** surrounds the inner section **484a** and may include substantially continuous reinforcing glass fibers in a polymer binding matrix for example. An overhead electrical cable of this configuration is available under the trademark ACCC® (CTC Global Corp., Irvine, CA), and is described in U.S. Patent No. 7,368,162 by Hiel et al., which is incorporated herein by reference in its entirety. Such fiber-reinforced composite strength members may include of a single fiber-reinforced composite strength element (e.g., a single rod) as is illustrated in **FIG. 4**. Alternatively, the composite strength member may be comprised of a plurality of individual fiber-reinforced composite strength elements (e.g., individual rods) that are operatively combined (e.g., twisted or stranded together) to form the strength member. Examples of such multi-element composite strength members include, but are not limited to: the multi-element aluminum matrix composite strength member illustrated in U.S. Patent No. 6,245,425 by McCullough et al.; the multi-element carbon fiber strength member illustrated in U.S. Patent No. 6,015,953 by Tosaka et al.; and the multi-element strength member illustrated in U.S. Patent No. 9,685,257 by Daniel et al. Each of these U.S. patents is incorporated herein by reference in its entirety. Other configurations and materials (e.g., other fibers and/or matrix materials) may be used for the fiber-reinforced composite strength member.

[0030] In the overhead electrical cable illustrated in **FIG. 4**, the strength member **484** also includes a plurality of interrogation elements, namely optical fibers **484c**, embedded within the strength member, e.g., embedded within the inner section **484a**. It has been suggested that such embedded optical fibers **486c** may be utilized for communications (e.g., data transfer), or may be utilized to interrogate (e.g., to inspect) the strength member **484** to determine a condition of the strength member **484** and/or of the electrical cable **480**. For example, it has been suggested that OTDR (optical time domain reflectometry) may be used to assess the temperature or stress state of the strength member **484** along its length. Another example of interrogation elements being used in an overhead electrical cable is illustrated in International Patent Publication No. WO 2019/168998 by Dong et al., which is incorporated herein by reference in its entirety.

[0031] No matter the function of the interrogation elements, e.g., the optical fibers, it will be necessary to access the interrogation elements, e.g., to reliably introduce light into the ends of the optical fibers, and to detect and/or analyze light emanating from the optical fibers. However, as can be seen in **FIGS. 2 and 3**, when the overhead electrical cable is terminated at a dead end (i.e., using a termination arrangement described above), the end of the strength member, and therefore the ends of the optical fibers, can no longer be accessed to pass a signal into the optical fibers and/or to detect a light signal emanating from the optical fibers.

[0032] It is an object of the present disclosure to provide hardware such as a termination arrangement (e.g., a dead-end or a splice) for use with an overhead electrical cable that enables access to an end of the strength member and to optical fibers or similar interrogation elements disposed therein, even after the overhead electrical cable has been installed, e.g., after a span of the overhead electrical cable has been strung and terminated.

[0033] **FIGS. 5A – 5E** illustrate such a termination arrangement according to one embodiment. The termination arrangement **500** is illustrated in the various forms of assembly from the exploded view of **FIG. 5A** to the assembled view of **FIG. 5D** for better illustration of the embodiment. **FIG. 5A** illustrates a partial assembly including a gripping element **510** that comprises a collet **512** disposed in a collet housing **514**. An end

segment **564'** of the strength member **564** is separated from the conductive strands **582** (e.g., by stripping away the conductive strands **582**) and is placed through the collet **512**, e.g., through the collet bore, so that the end segment **564'** extends for a length out of the proximal end of the collet **512** and past a proximal end of the collet housing **514**.

[0034] A connector **520** having a connector body **522** is operatively attached to the gripping element **510** by placing the connector body bore **524** over the end segment **564'** and moving the connector **520** toward the gripping element **510**. As the connector **520** and the gripping element **510** come together, the gripping element mating threads **528** and the connector mating threads **518** on the collet housing **514** come together and are engaged by relative rotation of the connector **520** and the gripping element **510**. As the connector/element are rotated, the threads force the connector **520** into engagement with the collet **512**, forcing the collet **512** into the collet housing **514** and increasing the pressure (e.g., the grip) of the collet **512** onto the strength member **564**. See FIG. 5B.

[0035] As a result, the end segment **564'** of the strength member **564** extends past the gripping element **510** and into the connector body bore **524**. As illustrated in FIGS. 5A to 5D, the strength member end segment **564'** extends into the bore **524** but does not extend past the proximal end (i.e., the fastener end) of the bore **524**. As can be seen in FIG. 5B, the end of the strength member **564** is accessible using the proximal aperture **532**, i.e., the aperture **532** in the proximal end of the connector body **522**. This feature is enabled by the connector body bore **524** and by the connector body aperture **532**, which exposes the end of the strength member **564**.

[0036] As illustrated in FIG. 5C, a fastener **526** (e.g., an eyebolt) is provided to complete the termination arrangement **500**. To enable access to the end of the strength member **564**, the fastener **526** is removable from the connector body **522**. Stated another way, the fastener **526** is not permanently affixed to the connector body **522**, and is not integrally formed with (e.g., cast with) the connector body **522**. As illustrated in FIG. 5C, the fastener **526** is threadably engaged with the connector body **522** using fastener mating threads **536** and connector body mating threads **537**. In this manner, the fastener **526** can be securely attached to the connector body **522** and can be readily detached

from the connector body **522** to access the end of the strength member **564**. The assembled termination arrangement **500** is illustrated in **FIG. 5D**.

[0037] In the event that it is desired to access the end of the strength member **564** after installation of the termination arrangement (e.g., onto a support structure), it may be necessary to maintain tension on the overhead electrical cable **560** to prevent the cable from sagging toward the ground to an undesirable height. In this regard, the termination arrangement illustrated in **FIGS. 5A to 5D** includes a sling coupling **538**. The sling coupling **538** enables the termination arrangement to be temporarily secured to a support structure by attaching a sling (e.g., a high strength rope) to the support structure and to the termination arrangement **500**, e.g., by placing the rope through the sling coupling **538**. As illustrated in **FIGS. 5A – 5D**, the sling coupling **538** is integrally formed with the connector body **522**. It will be appreciated that the sling connector **538** may be formed in other parts of the termination arrangement **500**, provided that it remains securely attached to the termination arrangement when the fastener **526** is detached from the connector body **522**, e.g., as illustrated in **FIG. 5C**. For example, the sling coupling could be affixed (e.g., integrally formed with) the outer sleeve **540**.

[0038] **FIG. 5E** schematically illustrates one example of how the termination arrangement illustrated in **FIGS. 5A - 5D** may be utilized to facilitate interrogation of the strength member using an interrogation system. In the embodiment illustrated in **FIG. 5E**, two interrogation instruments are illustrated, namely a detector **580D** and an emitter **580E**. Depending upon the interrogation system utilized it may only be necessary to utilize a single instrument, e.g., an instrument connected at only one end of the strength member **564**. In other systems it may be necessary to place an interrogation instrument at both ends of the strength member **564**. For example, in certain embodiments, it may be necessary or desirable to place the emitter **580E** at one end of the strength member and the detector **580D** at the other end of the strength member.

[0039] In any event, the emitter **580E** and the detector **580D** each include an instrument body **582D/582E** housing, e.g., instrument electronics such as a light emitter in the emitter body **582E** (e.g., LED light, coherent light, etc.) and a detector in the detector body **582D** (e.g., a CCD sensor or the like). Each of the instruments also includes a

connection portion **584D/584E** that is configured to be secured to the connector body **522** so that the instrument may be placed in communication (e.g., optical communication) with the strength member **564**, e.g., with optical fibers associated with the strength member (see **FIG. 4**). As illustrated in **FIG. 5E**, the connection portion **584D/584E** include connector body mating threads **586D/586D** that are configured (e.g., sized) in the same manner as connector body mating threads **537** to engage the fastener mating threads **536**. Thus, in operation, the fastener **526** may be removed (e.g., after securing the termination arrangement using sling coupling **538**) to expose the end of the strength member **564** through aperture **532**. One or more instruments **580D/580E** may then be secured to the connector body and used to interrogate the strength member **564** by emitting and/or detecting a signal through the aperture **532**. After interrogation of the strength member is complete, the fastener **526** may be reattached to the connector body **522** and again secured to the support tower or other structure.

[0040] In an alternative arrangement, an emitter instrument and/or a detector instrument may be placed within the fastener, e.g., within the eyebolt, thereby obviating the need to remove the fastener to carry out the interrogation of the strength members. Power may be supplied to the instruments using an electrical connection extending through the fastener. See **FIG. 10** below, for example.

[0041] **FIGS. 6A** and **6B** illustrate another embodiment of a termination arrangement according to the present disclosure. The termination arrangement **600** is similar in structure to the termination arrangement **500** and generally includes a gripping element **610** that is operatively attached to a connector body **620** having a connector body bore through which the strength member **664** is placed substantially as illustrated in **FIGS. 5A - 5E**. As compared to the embodiment illustrated in **FIGS. 5A - 5E**, the fastener **626** is a clevis-type fastener having a clevis base **627** and two spaced-apart clevis prongs **629a/629b** extending from the base **627**. A clevis aperture **631** extends through both prongs to enable a bolt to be affixed to the prongs for connection to a dead-end structure.

[0042] In the embodiment illustrated in **FIGS. 6A** and **6B**, it is not necessary to remove the fastener **626** to access the end of the strength member **664** due to the accessibility of the aperture **632** between the prongs **629a/629b**. A cover **634** may be removably

attached over the aperture **632** to seal the aperture **632** and protect the end of the strength member **664**. For example, the cover **634** may be threaded, friction fit, and/or held in place by one or more fasteners. In the embodiment illustrated in **FIGS. 6A** and **6B**, the clevis aperture **631** is offset from a longitudinal axis of the strength member **664**, e.g., offset from the longitudinal axis of the connector body bore. More particularly, the clevis aperture **631** is centrally disposed in the prongs **629a/629b**, and the prongs are disposed at an angle with respect to the connector **620**. In this manner, the end of the strength member **664** may be accessed (e.g., after removal of the cover **634**) without necessitating the detachment of the termination arrangement **600** from the support structure, as is described with the embodiment illustrated in **FIGS. 5A – 5D**.

[0043] **FIGS. 6A** and **6B** also illustrate two interrogation instruments, a detector **680D** and an emitter **680E** that may function in a manner similar to instruments **580D/580E** in **FIG. 5E**. The instruments **680D/680E** each include a connection portion **684D/684E** that is configured to be secured to the connector **620** so that the instrument may be placed in communication (e.g., optical communication) with the strength member **664**, e.g., with optical fibers associated with the strength member (see **FIG. 4**). As illustrated in **FIGS. 6A** and **6B**, the connection portions **684D/684E** enable the instruments to be operatively connected to the connector **620** (e.g., in a manner similar to the cover **634**) such that the clevis prongs **629a/629b** do not interfere with the instrument bodies **682a/682b**.

[0044] **FIGS. 7A** to **7C** illustrate further embodiments of a termination arrangement according to the present disclosure. The termination arrangement **700a** illustrated in **FIG. 7A** is structurally similar to the termination arrangements illustrated above and includes a gripping element **710a**, a connector **720a** and an outer sleeve **740a**, where the end segment **764'** of the strength member **764** extends through the connector body **722a**. As illustrated in **FIG. 7A**, the aperture **732a** is offset (e.g., angled) with respect to the strength member **764**, e.g., is offset with respect to the bore **722a** extending through the connector body **722a**. As illustrated in **FIG. 7A**, the aperture **732a** is substantially orthogonal to the bore **722a** (e.g., at about 90° relative to the bore). Also, the aperture **732a** is disposed near the interface of the connector body **722a** and the fastener **726a**, and the fastener is integrally formed with the connector body **722a**, i.e., is not removable from the connector

body **722a**. To facilitate the transmission of a signal (e.g., a light signal) through the aperture **732a** and into an end surface of the strength member segment **764'**, a reflective surface **739a** (e.g., a mirror) is positioned at the interface between the aperture **732a** and the bore **724a**. To reflect the signal through an aperture that lies substantially orthogonal with the bore, the reflective surface **739a** may be disposed at an angle of about 45° relative to the bore **722a**. The reflective surface **739a** may include, for example, a glass mirror or a highly reflective metal surface. In one implementation, the bore **724a** comprises a step (e.g., a shoulder) near the proximal end to prevent the end of the strength member **764** from abutting against the reflective surface **739a** when the strength member is inserted into the bore **724a**. For example, the distance between the shoulder and the reflective surface **739a** may be selected to match the desired focal length for the interrogation instrument(s).

[0045] As with the termination arrangement illustrated in **FIGS. 6A** and **6B**, it will be appreciated that the strength member **764a** may be interrogated without removing the fastener **726a** from the connector body **722a**, i.e., without removing the termination arrangement **700a** from the support structure. In this regard, the cover **734a** may be removed and the instruments **780E/780D** may be operatively attached over the aperture **732a** to interrogate the strength member **764a** as described above.

[0046] The embodiment illustrated in **FIG. 7B** is similar to the embodiment illustrated in **FIG. 7A**, but where the aperture **732b** (e.g., the interrogation port) is disposed in the connector body **722b** and under the outer sleeve **740b**. In this regard, an aperture **733b** is also formed in the outer sleeve **740b** to enable access to the aperture **732b** and to the reflective surface **739b**. The cover **734b** is configured to be inserted into and seal against both the outer sleeve aperture **733b** and the connector body aperture **732b** to prevent ingress of contaminants and/or moisture into the termination arrangement **700b**.

[0047] The embodiment illustrated in **FIG. 7C** is similar to the embodiment illustrated in **FIG. 7B**, but rather than a reflective surface a sleeve **741c** (e.g., a tubular member) connects the collet housing **714c** to the fastener **726c**. Stated another way, the sleeve **741c** replaces all or a portion of the connector body. The sleeve **741c** includes a sleeve aperture **735c** that may be aligned with the sleeve aperture **733c** to enable access to the

sleeve interior **747c** and therefore to the end segment **764'** of the strength member **764**. Although the sleeve interior **747c** could be provided with a reflective surface as illustrated in **FIGS. 7A** and **7B**, the sleeve interior **747c** may have a sufficient volume to insert an emitter or detector device into the sleeve interior **747c** directly to enable interrogation of the strength member **764**.

[0048] During installation, the fastener (e.g., the eyebolt) typically must be aligned in a vertical fashion as illustrated in **FIGS. 7A - 7C**. Therefore, it is also preferred that the apertures (e.g., apertures **732a**, **732b** and **735c**) be positioned to face generally upwardly when the eyebolt is so aligned, i.e., as illustrated in the figures. The jumper plate typically must be positioned downwardly as illustrated, and therefore it is preferred that the apertures in the outer sleeve (e.g., apertures **733b** and **733c**) be placed on the opposite side of the sleeve so that they generally face upwardly when the jumper plate is positioned as illustrated in the figures,

[0049] **FIGS. 8A to 8C** illustrate another embodiment of a termination arrangement according to the present disclosure. Referring to **FIG. 8A**, the termination arrangement **800** includes a gripping element **810**, a connector **820** and an outer sleeve **840**, where the fastener **826** is integrally formed with the connector body **822**. A connector body bore **824** extends through the connector body **822** from a distal end of the connector body **822**, i.e., adjacent the gripping element **810**, to an aperture **832** in the base of the fastener **826**. As can be seen in **FIG. 8B**, the end segment **864'** of the strength member **864** may extend past the aperture **832** such that the end surface of the segment **864'** can be readily accessed for interrogation using an interrogation instrument. The end surface of the segment **864'** may be covered (e.g., using a removable cap or by coating) to protect the end surface and the optical fibers (**FIG. 4**) from exposure when the strength member **864** is not being interrogated. In the embodiment illustrated in **FIG. 8C**, the end segment **864'** of the strength member **864** terminates within the connector body **822** and the interrogation device **880D/880E** includes an extension **884c** (e.g., a light guiding tube) that is configured to be inserted down the bore **824** and in close proximity to the end surface of the end segment **864'** to facilitate the interrogation. A cover (not illustrated) may be placed over the aperture **832** when interrogation is not being carried out.

[0050] Because the body often houses a battery and related circuitry, the body is often too large to be placed within the fastener aperture **831**. Of note in **FIGS. 8A - 8C**, the interrogation device **880D/880C** is configured to enable interrogation of the strength member without removal of the fastener **826**. In this regard, the interrogation signal is emitted/detected at an angle relative to the device body so that the entire device body does not have to be inserted into the fastener aperture **831**. Although illustrated as being disposed at an angle of about 90°, other angles and configurations may be utilized to enable interrogation without removal of the fastener. Further, the termination arrangement **800** may be assembled such that the end segment **864'** of the strength member, e.g., strength member **864** in **FIG. 8B**, extends past the fastener **826** (e.g., through the aperture **831**) such that an angled emitter or detector is not necessary to operatively access the end of the strength member **864b**. Thus, the end segment **864'** may extend well beyond the end of the fastener **826** to facilitate access to the strength member **864b**. For example, the end segment **864'** of the strength member **864** may extend beyond the aperture **832** by several millimeters or by several meters as may be desired. After interrogation of the strength member **864** is completed, the end segment of the strength member may be cut to reduce or eliminate the portion of the end segment that extends past the fastener **826**, e.g., past the aperture **832**.

[0051] Although illustrated as being implemented with an eyebolt-type fastener, it will also be appreciated that the embodiment illustrated in **FIGS. 8A - 8C** may be implemented with a clevis-type fastener, e.g., a fastener of the type illustrated in **FIGS. 6A to 6B**. In such an implementation, the clevis aperture may be offset (e.g., as illustrated in **FIGS. 6A and 6B**), or may be in line with the connector body bore, e.g., where the prongs are not angled relative to the connector body bore.

[0052] One advantage of the embodiment illustrated in **FIGS. 8A to 8C** is that the interrogation instruments may be simplified, e.g., it will not be necessary to design the interrogation instruments to fit to a specific aperture configuration. For example, the interrogation instruments may be the same instruments that are utilized to interrogate the strength member before installation of the termination arrangement, e.g., prior to or during installation of the overhead electrical cable onto the support towers.

[0053] In the foregoing embodiments of a termination arrangement, particularly the embodiment illustrated in **FIG. 7C**, the interrogation device (e.g., the emitter and/or detector components) may be placed within the termination arrangement (e.g., within the sleeve interior **747c**) and the cover placed over the aperture(s) to seal the components within the termination arrangement. Power for the device may be supplied by a battery or by inductive coupling using current passing through the outer sleeve. An antenna with associated circuitry may also be supplied to enable wireless transmission to control the interrogation device and/or to receive data from the interrogation device using a hand-held device, for example a tablet having a touchscreen display. If the device is in need of replacement, e.g., due to aging, the interior may be accessed by removing the cover and replacing the component(s).

[0054] The present disclosure also relates to splice arrangements for use with overhead electrical cables, such as splice **108b** illustrated in **FIG. 1**. A splice arrangement for use with a fiber-reinforced composite strength member is disclosed, for example, in US Patent No. 7,019,217 by Bryant, which is incorporated herein by reference in its entirety. Although a splice maintains electrical conductivity between the two cable segments, the strength members of the two segments are separated within the splice. That is, there is a discontinuity of the strength member within the splice lying between two dead ends. Because of this discontinuity, the entire length of the cable between the two dead ends cannot be interrogated (e.g., using optical fibers) by using interrogation devices attached only at the termination arrangements. Thus, the present disclosure includes embodiments of a splice arrangement that permit interrogation of the strength member, e.g., from the splice to each of the dead ends, so that the entire length of the cable can be interrogated.

[0055] **FIG. 9** illustrates one embodiment of such a splice arrangement. Splice arrangements will often include hardware components that are structurally similar to the components of a termination arrangement, e.g., as described above, and include two sets of the components at each end of the splice arrangement to grip the two cables. Referring to **FIG. 9**, the splice arrangement **900** includes two splice portions **902a** and **902b** at opposite ends of splice arrangement **900**, where the splice portion **902a** secures overhead

electrical cable **960a** and the splice portion **902b** secures overhead electrical cable **960b**. Because splice portions **902a** and **902b** are substantially identical, only splice portion **902a** will be described in more detail.

[0056] As noted above, the gripping hardware in the splice arrangement may be substantially similar to the gripping hardware used in the termination arrangements. Thus, the splice includes a gripping element **910a** having a collet **912a** disposed in a collet housing **914a**. The strength member **964a** of the overhead electrical cable **960a** extends past the conductor **962a** and into a lumen **916a** where it is gripped by the collet **912a**.

[0057] To physically secure the first splice portion **902a** to the second splice portion **902b**, and thereby secure the first cable **960a** to the second cable **960b**, a connector assembly **920** is utilized. The connector assembly **920** includes a central connector body **922** and collet mating threads **926a/926b** disposed at each end of the connector body **922**, where the collet mating threads are configured to mate with connector threads disposed on the collet housing **914** to compress the collet **912** into the housing **914**. The connector assembly **920** also includes a connector assembly bore **924a/924b** extending through the assembly, e.g., through the entire assembly, to enable the strength members to extend close to the center of the body **922** to enable interrogation of the strength members **964a** and **964b**.

[0058] The splice arrangement **900** also includes a conductive body **944** to facilitate electrical connection between the overhead cable **960a** and the overhead cable **960b**. In the embodiment illustrated in **FIG. 9**, the conductive body includes two mating conductive body portions **944a** and **944b** that are joined at a pair of mating flanges **946a** and **946b**. The flanges **946a/946b** may be secured to each other using two or more flange bolts **948a/948b** that extend through bolt apertures in the flanges **946a/946b**. Alternatively, a ferrule may be used to secure the mating flanges **946a/946b**. Typically, the conductive body **944** will be crimped onto the underlying hardware and/or onto the electrical conductor. For example, crimps may be placed over the connector body **920**, over the gripping element **910** and/or over the electrical cable **960a/960b** to further secure the physical and electrical connection between the two cables.

[0059] To interrogate one or both of the strength members **960a/960b** after installation of the overhead electrical line including the splice arrangement, the bolts **948a/948b** may be removed and the conductive body portions **944a/944b** separated. To temporarily hold the two portions of the splice arrangement together, the flanges **946a/946b** may be provided with additional apertures or hooks to enable a high strength rope to connect to the flanges and hold the portions together under tension.

[0060] Another embodiment of a splice arrangement is illustrated in **FIG. 10**. In the embodiment illustrated in **FIG. 10**, many of the hardware components are the same or substantially similar to the hardware components illustrated in **FIG. 9**, including the gripping element **1010a** including a collet **1012a** and a collet housing **1014a**. In the embodiment illustrated in **FIG. 10**, the conductive body **1044** is fabricated from a single (e.g., unitary) body and extends over the first and second splice portions **1002a/1002b**.

[0061] In the embodiment illustrated in **FIG. 10**, an emitter device **1080** (e.g., an LED, coherent light source or the like) is contained within the connector assembly **1020** in a manner such that the emitter device **1080** may emit light into the end of each of the strength members **1064a** and **1064b**. Thus, a detector may be placed at opposite ends of the strength members **1064a/1064b** (e.g., through a termination arrangement described above) to detect and/or analyze the light signal emanating from the emitter **1080** and through the optical fiber(s) (**FIG. 3**). In an alternative arrangement, the connector assembly may include a detector (e.g., a photodiode or the like) and the emitter may be placed at the termination of the overhead cables.

[0062] In any event, power may be supplied to the emitter **1080** using electrical contacts **1078a** and **1078b**. For example, to conduct the interrogation, a portable power source such as a battery may be attached to the electrical contacts **1078a/1078b** to power the emitter. The electrical contacts extend through the conductive body **1044** and into the connector assembly **1020**. The port(s) where the contacts **1078a/1078b** pass through the conductive body **1044** may be sealed to prevent the ingress of contamination into the splice arrangement **1000**.

[0063] Another embodiment of a splice arrangement is illustrated in **FIG. 11A**. As with the embodiments illustrated in **FIGS. 9** and **10**, the splice arrangement **1100A**

includes two splice portions **1102a** and **1102b** to secure two electrical cables **1160a** and **1160b**. Each splice portion includes a collet-type gripping element, e.g., gripping element **1110a** includes a collet **1112a** housed in a collet housing **1114a** to grip the strength member **1164a**.

[0064] The splice arrangement **1100A** includes a conductive body **1144** that is a single piece (e.g., is unitary) that extends over both gripping elements **1110b**. The conductive body **1144** also includes an interrogation port **1170** to enable access to the ends of the strength members **1164a/1164b** within the splice arrangement. An interrogation sleeve **1172** is placed within the port **1170** to facilitate the emission and/or detection of light signals to/from the strength members **1164a/1164b**. The interrogation sleeve **1172** is in the form of a round cylinder, e.g., having a sidewall and an aperture **1174** extending therethrough. A reflective surface **1139** (e.g., a mirror) at the bottom of the aperture **1174** is provided to enable a light signal emanating from the strength member to be reflected upwardly for detection through the aperture **1174**. Advantageously, the interrogation sleeve **1172** may be rotated, e.g., about threads **1176**, so that the reflective surface faces the opposite strength member **1164b**. In this manner, both strength members **1164a/1164b** may be readily interrogated by simply rotating the sleeve **1172** into the desired position. A cap may be provided on the top of the sleeve **1172** to prevent ingress of contamination when the sleeve is not in use.

[0065] Because the gripping elements **1110a/1110b** are not joined within the splice arrangement (e.g., as in **FIG. 9**), the physical joining of the cables is achieved by crimping the conductive body **1144** onto each of the gripping elements **1110a/1110b**. To enhance the ability of the crimp to secure the gripping elements **1110a/1110b**, the gripping elements are provided with ribs **1128a/1128b** or a similar surface feature such that the crimping will cause the conductive body **1144** to deform into the gaps between the ribs **1128a/1128b**.

[0066] The embodiment of a splice arrangement illustrated in **FIG. 11B** is similar to the termination arrangement illustrated in **FIG. 7C**. Specifically, the splice arrangement **1100B** includes a sleeve **1141b** replaces all or a portion of the connector body that connects the two gripping elements **1110ab** and **1110bb**. The sleeve **1141b** includes a

sleeve aperture **1135b** that may be aligned with the sleeve aperture **1133b** to enable access to the sleeve interior **1147b** and therefore to the ends of the strength members **1164ab** and **1164bb**. Although the sleeve interior **1147b** could be provided with a reflective surface as illustrated in **FIG. 11A**, the sleeve interior **1147b** may have a sufficient volume to insert an emitter or detector device into the sleeve interior **1147b** directly to enable interrogation of the strength members **1164ab** and **1164bb**.

[0067] In the foregoing embodiments, particularly the embodiment illustrated in **FIG. 11B**, the components (e.g., the emitter and/or detector components) may be placed within the splice arrangement (e.g., within the sleeve interior **1147b**) and the cover placed over the apertures to seal the components within the splice arrangement. Power for the device may be supplied by a battery or by inductive coupling using current passing through the outer sleeve. An antenna with associated circuitry may also be supplied to enable wireless transmission to control the interrogation device and/or to receive data from the interrogation device using a hand-held device, for example a tablet having a touchscreen display. If the device needs replacement, e.g., due to aging, the interior may be accessed by removing the cover and replacing the component(s). In any event, although the device secured within the splice arrangement may be an emitter and detector, it may be preferred to place an emitter within the splice with a detector placed at the termination arrangement at the opposite end of the strength member.

[0068] Another embodiment of a termination arrangement is illustrated in **FIG. 12**. This type of termination arrangement **1200** is sometimes referred to as a helical dead end. See, for example, US Patent Application No. 2019/0081470 by Ma et al., which is incorporated herein by reference in its entirety. In this arrangement, structural rods or strands **1211** are helically wrapped around the cable **1260** to grip onto the cable ~~1260~~, and ~~1260~~ and are formed into a loop **1226** at the distal end of the arrangement **1200**. In this arrangement, to enable interrogation of the strength member **1264**, a portion **1211a** of the structural strands are wrapped around a portion of the strength member that has been stripped of the overlying conductor strands. The end of the strength member **1264** extends beyond the strands **1211** and is exposed to enable interrogation. The exposed

end of the strength member may be capped or sealed when interrogation is not being carried out to prevent damage to the end of the strength member.

[0069] The foregoing embodiments are presented to illustrate termination arrangements and a splice arrangements that facilitate the interrogation of overhead electrical cables during and/or after installation of the electrical line (e.g., a distribution line or a transmission line). As such, the foregoing embodiments are subject to various modifications that are not specifically illustrated above. For example, the gripping elements are illustrated as comprising a collet-type grip having a collet and a collet housing. However, other types of gripping elements may be utilized. For example, a gripping element may include a direct compression device such as that illustrated in US Patent No. 6,805,596 by Quesnel et al. and assigned to Alcoa Fujikura Limited, which is incorporated herein by reference in its entirety.

[0070] In the embodiments of a termination arrangement, the jumper plate is illustrated as being disposed at the very proximal end of the conductive body. However, other arrangements are possible such as a “shark-fin” arrangement wherein the jumper plate is disposed closer to the middle of the conductive body.

[0071] The foregoing termination arrangements and splice arrangements may be utilized with a variety of electrical cables having strength members, particularly fiber-reinforced composite strength members. Interrogation techniques may include laser-based techniques such as optical time domain reflectometry (OTDR), or incoherent light techniques such as those disclosed in International Patent Publication No. WO 2019/168998 by Dong et al., which is incorporated herein by reference in its entirety.

[0072] It will be appreciated that the foregoing disclosure also relates to methods for securing an overhead electrical cable to a termination arrangement (e.g., to a dead-end), and to methods for interrogating a strength member through the hardware. The interrogation may occur after the overhead electrical cable has been fully tensioned and secured by the hardware, e.g., secured to a support tower as illustrated in **FIG. 1**. In one embodiment, a method for terminating an overhead electrical cable comprising a central strength member and a plurality of conductive strands wrapped around the strength member, the method comprising the steps of separating an end portion of the strength

member from the conductive strands, inserting the end portion of the strength member into a termination arrangement, the termination arrangement comprising a connector having a connector body and a connector body bore, wherein the step of inserting the strength member includes placing the end portion of the strength member at least partially into the connector body bore.

[0073] In another embodiment, a method for interrogating an overhead electrical cable through a termination arrangement is disclosed where the overhead electrical cable has a strength member comprising interrogation elements and a plurality of conductive strands wrapped around the strength member. The method may include the steps of separating an end segment of the strength member from the conductive strands, operatively securing a termination arrangement to the overhead electrical cable, where the termination arrangement includes a gripping element configured to grip the strength member and a connector operatively attached to the gripping element, the connector comprising a connector body and a connector body bore extending longitudinally from a first aperture in a proximal end of the connector body toward a distal end of the connector body. The step of operatively securing the termination arrangement to the overhead electrical cable includes securing a first portion of the end segment of the strength member with the gripping element and placing a second portion of the end segment of the strength member into the connector body bore. Interrogation of the strength member may be carried out by operatively linking (e.g., contacting directly or indirectly) an interrogation device to the end of the strength member. During the interrogation, the strength member may be fully disposed within the termination arrangement (see **FIG. 5E** for example) or may extend beyond the termination arrangement (see **FIG. 8B** for example).

[0074] While various embodiments termination arrangements and methods for the termination and interrogation of an overhead electrical cable have been described in detail, it is apparent that modifications and adaptations of those embodiments will occur to those skilled in the art. However, it is to be expressly understood that such modifications and adaptations are within the spirit and scope of the present disclosure.

What is Claimed is:

1. A termination arrangement for an overhead electrical cable, comprising:
 - a gripping element configured to grip a strength member of an overhead electrical cable;
 - a connector operatively attached to the gripping element, the connector comprising:
 - a connector body; and
 - a connector body bore extending longitudinally from a first aperture in a proximal end of the connector body toward a distal end of the connector body.
2. The termination arrangement recited in Claim 1, comprising a fastener operatively affixed to the proximal end of the connector body.
3. The termination arrangement recited in any one of Claims 1 or 2, wherein the gripping element comprises a compression wedge.
4. The termination arrangement recited in Claim 3, wherein the compression wedge comprises a collet disposed within a collet housing.
5. The termination arrangement recited in Claim 4, wherein the connector body is operatively attached to the collet housing.
6. The termination arrangement recited in Claim 5, wherein the connector body is threadably engaged with the collet housing.
7. The termination arrangement recited in any one of Claims 1 to 6, comprising an outer sleeve disposed over at least the gripping element.
8. The termination arrangement recited Claim 7, wherein the outer sleeve surrounds at least a portion of the connector body.
9. The termination arrangement recited in any one of Claims 7 to 8, wherein the outer sleeve comprises a conductive body.

10. The termination arrangement recited in any one of Claims 7 to 9, wherein the outer sleeve comprises a jumper plate operatively attached to the conductive body.

11. The termination arrangement recited in Claim 10, wherein the jumper plate is operatively attached to the conductive body near a proximal end of the outer sleeve.

12. The termination arrangement recited in any one of Claims 1 to 11, wherein the connector body bore extends through the connector body from the first connector body aperture in the proximal end of the connector body to a second aperture near the distal end of the connector.

13. The termination arrangement recited in Claim 12, wherein the connector body bore is sized and shaped to receive the strength member of an overhead electrical cable.

14. The termination arrangement recited in any one of Claims 1 to 13, wherein the connector body bore has a substantially circular cross-section and has a diameter of at least about 6 mm.

15. The termination arrangement recited in any one of Claims 12 to 14, wherein the connector bore has a diameter of not greater than about 18 mm.

16. The termination arrangement recited in any one of Claims 12 to 15, comprising a removable cover operatively disposed over the second aperture.

17. The termination arrangement recited in Claim 16, wherein the removable cover is secured over the second aperture using at least one threaded fastener.

18. The termination arrangement recited in Claim 16, wherein the removable cover is threadably engaged with the second aperture.

19. The termination arrangement recited in Claim 16, wherein the removable cover is friction fit into the second aperture.

20. The termination arrangement recited in any one of Claims 1 to 19, wherein the fastener comprises an eyebolt.

21. The termination arrangement recited in Claim 20, wherein the eyebolt is permanently affixed to the connector body.

22. The termination arrangement recited in Claim 21, comprising an eyebolt bore extending through a base of the eyebolt, wherein the eyebolt bore lies along the longitudinal axis of the connector body bore.

23. The termination arrangement recited in Claim 22, wherein the eyebolt bore has substantially the same size and cross-section as the connector body bore.

24. The termination arrangement recited in any one of Claims 12 to 19, wherein the fastener comprises a clevis having a base and two spaced-apart clevis prongs extending from the base.

25. The termination arrangement recited in Claim 24, wherein the second aperture is disposed through the base and between the two spaced-apart prongs.

26. The termination arrangement recited in any one of Claims 24 or 25, wherein each of the two spaced-apart prongs comprises a bolt aperture disposed near a proximal end of the prong.

27. The termination arrangement recited in any one of Claims 25 or 26, wherein each of the bolt apertures are offset from the longitudinal axis of the connector body.

28. The termination arrangement recited in any one of Claims 12 to 19, wherein the fastener is detachable from and re-attachable to the connector body.

29. The termination arrangement recited in Claim 28, wherein the fastener is threadably engaged with the connector body.

30. The termination arrangement recited in Claim 28, wherein the fastener is bolted to the connector body.

31. The termination arrangement recited in any one of Claims 28 to 30, wherein the fastener comprises a clevis having a base and two spaced-apart prongs extending from the base.

32. The termination arrangement recited in any one of Claims 28 to 30, wherein the fastener comprises an eyebolt comprising a base and a closed loop extending from the base.

33. The termination arrangement recited in any one of Claims 28 to 32, further comprising a sling coupling.

34. The termination arrangement recited in Claim 33, wherein the sling coupling is affixed to the connector body.

35. The termination arrangement recited in Claim 34, wherein the sling coupling is permanently affixed to the connector body.

36. The termination arrangement recited in any one of Claims 33 to 35, wherein the sling coupling comprises a closed loop.

37. The termination arrangement recited in any one of Claims 1 to 11, wherein the connector body bore is in operative communication with a non-longitudinal bore that is disposed at an angle of less than 180° relative to the connector body bore.

38. The termination arrangement recited in Claim 37, wherein the non-longitudinal bore is disposed at an angle of from about 70° to about 130° relative to the connector body bore.

39. The termination arrangement recited in any one of Claims 37 or 38, comprising a non-longitudinal bore aperture disposed at an end of the non-longitudinal bore.

40. The termination arrangement recited in any one of Claims 37 to 39, further comprising a second non-longitudinal bore that is disposed at an angle of less than 180° relative to the connector body bore.

41. The termination arrangement recited in any one of Claims 37 to 40, comprising a reflective element disposed at an interface between the connector body bore and the non-longitudinal bore, where the reflective element is configured to reflect light between the connector body bore and the non-longitudinal bore.

42. The termination arrangement recited in any one of Claims 39 to 41, comprising a removable cover operatively disposed over non-longitudinal bore aperture.

43. The termination arrangement recited in Claim 42, wherein the removable cover is secured over non-longitudinal bore aperture using at least a first threaded fastener.

44. The termination arrangement recited in Claim 42, wherein the removable cover is threadably engaged with the non-longitudinal bore aperture.

45. The termination arrangement recited in Claim 42, wherein the removable cover is friction fit into the non-longitudinal bore aperture.

46. The termination arrangement recited in any one of Claims 37 to 45, wherein the connector body bore terminates before a distal end of the connector body.

47. The termination arrangement recited in any one of Claims 37 to 45, wherein the connector body bore extends to the distal end of the connector body.

48. A method for terminating an overhead electrical cable comprising a central strength member and a plurality of conductive strands wrapped around the strength member, the method comprising the steps of:

separating an end portion of the strength member from the conductive strands;

inserting the end portion of the strength member into a termination arrangement, the termination arrangement comprising a connector having a connector body and a connector body bore,

wherein the step of inserting the strength member includes placing the end portion of the strength member at least partially into the connector body bore.

49. The method recited in Claim 48, wherein the inserting step includes inserting the end portion of the strength member into a gripping member.

50. The method recited in Claim 49, wherein the gripping member comprises a collet and a collet housing.

51. The method recited in any one of Claims 48 to 50, comprising the step of placing an outer sleeve over at least a portion of the connector body.

52. The method recited in Claim 51, comprising the step of compressing the outer sleeve onto the connector body.

53. The method recited in any one of Claims 48 to 52, wherein the connector body bore extends through the connector body from the first connector body aperture in the proximal end of the connector body to a second aperture near the distal end of the connector.

54. A method for interrogating an overhead electrical cable through a termination arrangement, the overhead electrical cable having a strength member comprising interrogation elements and a plurality of conductive strands wrapped around the strength member, comprising the steps of:

separating an end segment of the strength member from the conductive strands;

operatively securing a termination arrangement to the overhead electrical cable, the termination arrangement comprising:

a gripping element configured to grip the strength member;

a connector operatively attached to the gripping element, the connector comprising a connector body and a connector body bore extending longitudinally from a first aperture in a proximal end of the connector body toward a distal end of the connector body,

wherein the step of operatively securing the termination arrangement to the overhead electrical cable comprises:

securing a first portion of the end segment of the strength member with the gripping element; and

placing a second portion of the end segment of the strength member into the connector body bore, and

interrogating the strength member by operatively linking an interrogation device to the end of the strength member.

55. The method recited in Claim 54, wherein the strength member is fully disposed within the termination arrangement during the interrogation step.

56. The method recited in Claim 54, wherein the strength member extends beyond the termination arrangement during the interrogation step.