United States Patent

Kelly

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[54] SHIELDED HEAVY DUTY CABLE CONNECTOR

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[52] **U.S. Cl.**.....**339/42,** 339/40, 339/60 R, 339/61 R, 339/113 R, 339/184 R

[51] **Int. Cl.**.....**H01r 13/44,** H01r 13/62

[58] **Field of Search**..339/40, 42, 47, 49, 59 R, 59 M, 339/60 R, 60 C, 60 M, 61 R, 61 M, 113, 184 R, 184 M, 186 R, 186 M

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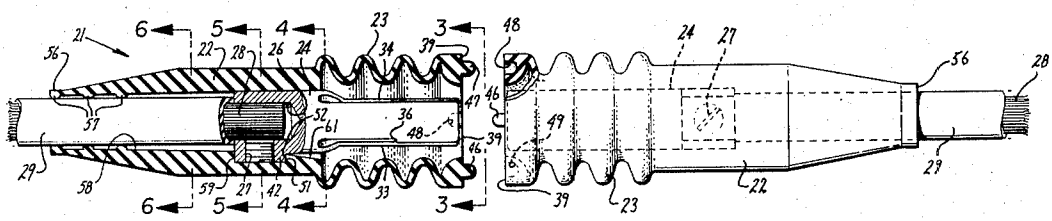
[57] **ABSTRACT**

A heavy duty electrical cable connector having an electrically insulating housing and an electrical terminal mounted therein in a fixed predetermined orientation to the housing, the housing being provided with a shielding sleeve around the terminal, and indexing means provided on the sleeve to mate with a second connector and index the terminal for electrical connection to the second connector is disclosed. Preferably a pair of connectors each having axially resiliently compressible sleeves thereon and formed to secure the terminals against movement of the housing relative to the terminals is provided. The indexing means may be a pair of mating protrusions and recesses formed in the end walls of the sleeves, allowing both connectors to be identically formed.

4 Claims, 6 Drawing Figures



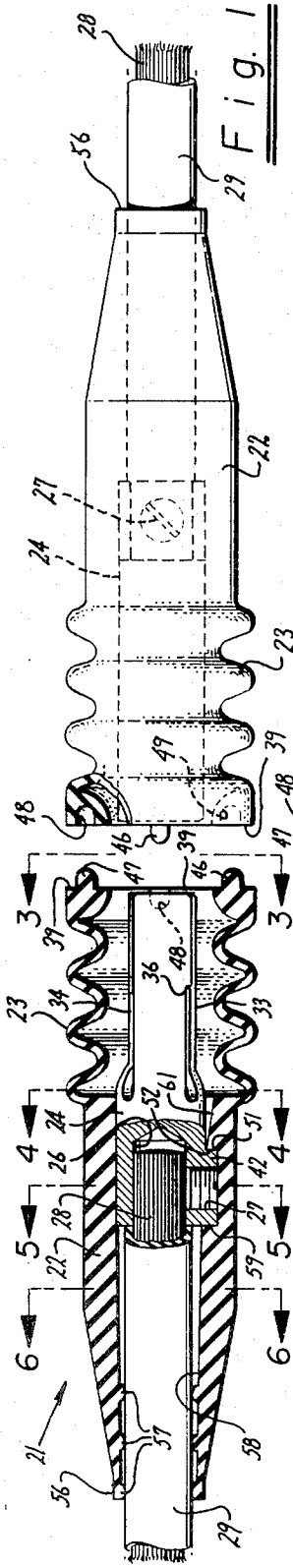


Fig. 1

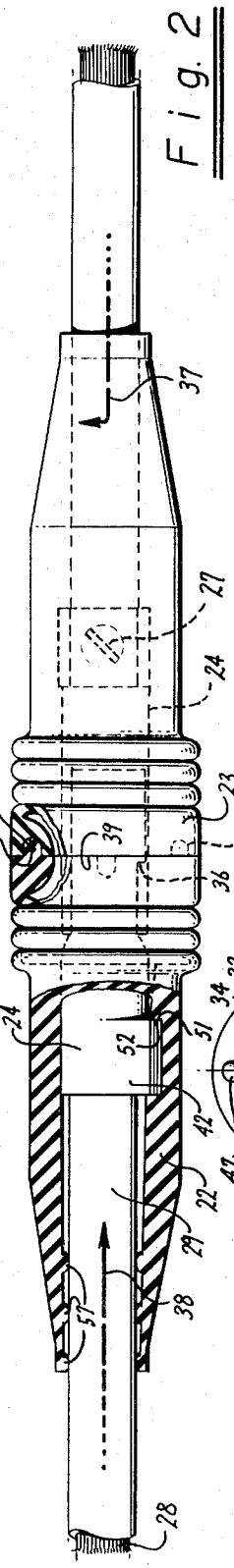


Fig. 2

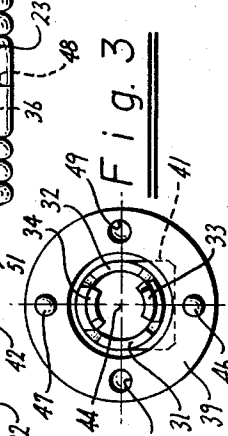


Fig. 3

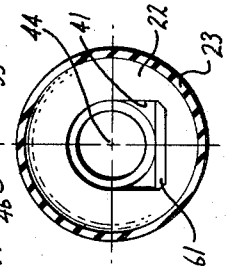


Fig. 4

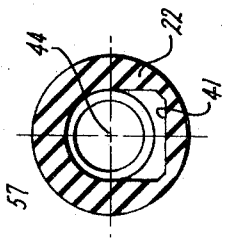


Fig. 5

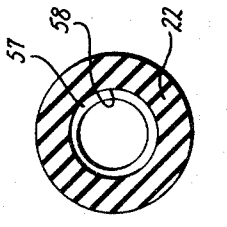


Fig. 6

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SHIELDED HEAVY DUTY CABLE CONNECTOR

BACKGROUND OF INVENTION

This invention relates to heavy duty electrical cable connectors which are employed to electrically connect heavy duty cables in which large current or voltage flows exist. More particularly, the present invention relates to cable connectors which include electrically insulating shielding, usually in the form of an accordion pleated sleeve, which acts as a safety and protective device at the point of connection of the cable ends.

Heavy duty cables of substantial length are commonly employed in connection with the welding industry, wherein hundreds of feet of cable must be temporarily deployed from a power source to a remote welding site. Another application of heavy duty cables occurs in the temporary provision of power at wharves and docks in the ship building industry. The distances involved usually require the connection of several lengths of heavy duty cable in end-to-end relation.

It has been previously found to be advantageous to construct the heavy duty cable connectors with electrical terminals which afford a bayonet-type of connection to enable a rapid joining and separation of the cable ends. In addition, it has been found advantageous to form the electrical terminals with a universal type of bayonet connections so that all terminals are interchangeable. This eliminates the problem of having male and female terminals. Still further, since the universal bayonet-type connection commonly employed protrudes from the connector housing, electrically insulating shielding sleeves have been integrally molded with the housing so as to extend coaxially with the terminals. These shielding sleeves are usually accordion pleated and formed for axial compression and subsequent resilient expansion to shield the terminal when disconnected and yet allow axial advancement of two terminals into engagement during connection.

Present shielded heavy duty cables, however, have been found to have several defects in construction. First, the shielding sleeve acts as a visual barrier, as well as an electrically insulating one, to viewing of the electrical terminal. Thus, angular orientation of the bayonet elements of the terminal to a position allowing connection to a second terminal is very difficult to judge due to the visual barrier. Accordingly, those using the connectors in the field will often look down the ends of the terminals or pull the shielding back partially in order to determine how to mate the terminals. This practice has been found to be very dangerous, since the cables may be connected to an electrical source with the power on when the connection is being made. Therefore, the user, who may be working outside and under adverse climatic conditions, will be subjected to a substantial risk of electrical shock and the equipment may be subject to possible shorting as a result of this type of heavy duty cable connector construction.

Another defect of shielded cable connectors previously employed has been that the electrically insulating housing tends to creep or move relative to the terminals under the resilient force of the compressible sleeves when the connectors are joined together. Thus, the accordion pleated sleeves tend to push the body of the connector in a direction away from the ends of the cables which are joined. This creeping action has been found to be highly unsatisfactory since it reduces the pressure between the end-abutting sleeves, affording a greater opportunity for moisture to enter between the ends of the sleeves into the terminals, and additionally resulting in a substantial portion of each of the terminals being exposed upon disconnection, since the body of the connector has moved away from the end of the terminal. Once again, therefore, the possibility for injury or shorting has been increased.

Accordingly, it is the object of the present invention to provide a shielded heavy duty cable connector which can be rapidly and easily connected to another shielded connector.

It is another object of the present invention to provide a shielded heavy duty cable connector in which the elements are secure against relative movement under conditions of repeated and extended use.

It is another object of the present invention to provide a shielded heavy duty cable connector which is easy to manufacture and durable.

The present invention has other objects and features of advantage which will be more fully set forth hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view, in cross section and partially fragmented, of two electrical shielded heavy duty cable connectors constructed in accordance with the present invention and in alignment for connection.

FIG. 2 is a side view, in cross section and partailly fragmented, illustrating the joining of the cable connectors of FIG. 1.

FIG. 3 is an end view of the cable connector taken along the line 3—3 of FIG. 1.

FIG. 4 is a cross sectional view of the cable connector taken along the line 4—4 in FIG. 1.

FIG. 5 is a cross sectional view of the cable connector taken along the line 5—5 of FIG. 1.

FIG. 6 is a cross sectional view of the cable connector taken along the line 6—6 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, there is illustrated a shielded heavy duty cable connector, generally designated **21**, which is formed with an electrically insulating housing **22** having an accordion pleated electrically insulating sleeve **23** preferably integrally formed therewith. Mounted in housing **22** is an electrically conducting terminal **24** formed with recess or cavity **26** and fastener **27** to secure an electrical cable **28** which is stripped of its insulating coating **29** to allow securement to the terminal.

There are a number of electrical terminals which would be satisfactory for use in the cable connector of the present invention. The terminal illustrated in the drawings is a bayonet-type which protrudes from the body to which the cable **28** is connected, and is not a male-female type of connector. Instead, the connector illustrated is comprised of four protruding tines or fingers **31–34** which are formed to interfit with another connector similarly having four protruding tines. As best may be seen in FIG. 3, tines **33** and **34** are of a diameter small enough so that their outside surface will fit inside the internal diameter of tines **31** and **32**. The

bayonet connection is provided by the notches or shoulders **36** in tines **31** and **32**. Thus, the connection is formed as shown by the arrows in FIG. **2** by axially engaging opposed tines or fingers and then imparting a slight rotational twist as indicated by arrow **37** so as to cause an interfitting of shoulders **36**.

As will readily be seen in FIG. **1**, the shielding sleeve means **23** substantially surrounds terminal **24** prior to connection of the two connectors. This is highly desirable since it reduces the incidence of electrical shock and shorting. Sleeve **23** is further formed with pleats so as to be compressible along the axis **38** of advancement of the two connectors into engagement, which is coincident with the arrow on FIG. **2**. Sleeve **23**, however, acts as a visual barrier which prevents viewing of the tines **31–34** of the terminal in order to determine the location of the various tines and the notches **36**. Accordingly, it has been common practice to have the user of the connector engage the end surface **39** of sleeve **23** and to compress the sleeve in order to determine the angular orientation of the tines **31–34** and notch **36**. Once the tines are visible, they may be properly intermeshed with the tines of another connector. This practice, however, can be extremely dangerous if the electrical line is "hot," which is not unlikely when several hundred feet of line are deployed and several men are involved with the installation and use of the line.

Accordingly, it is a feature of the present invention to provide a shielded heavy duty cable connector which can be rapidly connected to another connector without endangering the safety of the user. In the connector of the present invention this may be accomplished by providing a securement means in housing **22** which will secure terminal **24** in a fixed predetermined angular orientation about the axis of advancement of the housing during connection. This may best be seen by reference to FIGS. **3**, **4** and **5** wherein housing **22** is formed with a cavity or pocket **41** into which a protrusion **42** on terminal **24** mates. The interfitting of protrusion **42** into pocket **24** in housing **22** results in an orientation about the central longitudinal axis **44**, which is coincident with the axis of advancement of the connectors into engagement. As will be seen in FIGS. **3**, **4** and **5**, protrusion **42** is formed so as to prevent twisting of terminal **24** about axis **44** during rotation of the connectors as indicated by arrow **37** upon connection and reverse rotation upon disconnection. Therefore, the terminal is secured in fixed predetermined angular orientation relative to housing **22** and sleeve **23**.

Once the terminal is indexed with relation to the sleeves, indexing the sleeves with relation to each other will correspondingly result in the terminals being indexed for connection. It is a feature of the present invention, therefore, to provide indexing means preferably comprised of protrusions **46** and **47** in end surface **39** of the sleeve. Protrusions **46** and **47**, as best may be seen in FIG. **3**, are spaced approximately 180° apart about axis **44**, and end surface **39** is further provided with indexing recesses **48** and **49**, which are similarly spaced approximately 180° apart and 90° from the protrusions. The combination of protrusions and recesses providing an indexing means for the connector of the present invention allows both the right and left connectors, as illustrated in FIGS. **1** and **2**, to be formed in exactly the same manner. This is true because the tines **31–34** of the terminals must be rotated by 90° before they can be joined together. The large diameter tines **31** and **32** will fit over the small diameter tines **33** and **34**, if a second connector is rotated by 90° before connection. Rotation of housing **22** of the left connector in FIG. **1**, including sleeve **23**, by 90° is required for protrusions **46** and **47** to mate with recesses **48** and **49** of the right connector. Thus, instead of pulling the sleeve back in order to view the tines of the terminals, the user of the connectors can merely view the protrusions **46** and **47** and rotate them until they are in a position to mate with recesses **48** and **49**. When they are in such a mating orientation, the connectors may be axially urged toward each other as indicated by arrow **38**, and the tines will interfit for connection. When the connectors have been urged to a position as shown in FIG. **2**, they may be relatively rotated as indicated by arrow **37** and locked in connected position. Sleeve **23** is flexible enough so that the small amount of rotation required to lock the respective notches **36** for connection will not urge the protrusion **46** and **47** out of mating engagement with recesses **48** and **49**. Therefore an indexing means is provided which is formed to position the terminals in angularly indexed relation to each other for electrical connection without endangering the safety of the user or shorting of the line.

It should be noted further that one problem that has occurred in connection with heavy duty shielded cable connectors has been that the shielding, in collapsed position, will sometimes allow moisture into the connector terminals. Thus, end surfaces **39** may slip relative to one another under the compressive forces of the sleeves or impact from some object. The mating of the indexing protrusions and recesses of the present invention further insures that the end surfaces **39** do not slip relative to one another and, therefore, resists entry of moisture or water into the area of the terminals.

It is another important feature of the cable connector of the present invention that the connector not be subject to displacement of the shielding, during repeated use, to a position endangering the user. The sleeve **23** is most commonly formed of a synthetic rubber which is molded integrally with housing body **22**. This results in an axially resiliently compressible sleeve structure. When the connectors are connected as shown in FIG. **2**, the resilient nature of the rubber tends to urge the connector housings down the respective cables. In prior connector constructions the housings would creep down the cable away from the compressed sleeves. When the cables are disconnected the sleeves were found to be displaced way from the ends of the tines, exposing the same. This created a safety hazard. In the heavy duty cable connector of the present invention the securement means or pocket **41** and protrusion **42** are preferably further formed to secure the terminal relative to the housing so that the housing will not move under urging of the resilient sleeve in a direction opposite to the advancement of the terminals during connection. Thus, shoulder **51** of the terminal is engaged by an oppositely facing shoulder **52** of housing **22** which prevents the housing from being pushed away from the mated ends of the sleeves.

Assembly of the heavy duty cable connector of the present invention may be rapidly and easily accomplished. As was previously indicated, housing **22** is preferably integrally molded from a synthetic or natural rubber or other insulating material. Terminal **24** may be of a one piece construction or have the tines **31–34** formed as one piece and joined to the body which includes fastener **27** and cable receiving bore **26**. The cable is preferably pulled through the end **56** past O-rings **57**, which are formed in a tapered bore **58** to accept and receive cables of various diameters. Once the cable is pulled past the end **39** of sleeve **23**, the protective covering **29** can be removed from the end of the cable and terminal **24** mounted thereto by fastener **27**. The cable may be pulled back down bore **58** until the back shoulder **59** of terminal **24** engages the body of the housing **22**. The body of the housing adjacent pocket **41** is preferably formed with a tapered surface **61** to facilitate urging of the terminal into pocket **41**. The resilient nature of body **22** allows a sufficient flexure so that the terminal may be snapped into pocket **41** in indexed relation to the housing, and accordingly, index protrusions **46** and **47** for mating engagement and electrical connection to a similarly formed terminal. As will be understood, while bayonet-type terminals are highly advantageous in the construction of the present invention other types of terminals may be employed. If a male-female terminal combination is used, shielding on the female connector would not, in all probability, be necessary and indexing means would be formed directly in the housing body rather than a shielding sleeve.

What is claimed is:

1. In a first heavy duty electrical cable connector including an electrically insulating first housing and an electrically conducting first terminal mounted in said first housing, said first terminal being formed for securement of an electrical cable thereto and being formed for electrical connection to a second terminal mounted in a second connector upon orientation of said terminals in a predetermined relative angular relation about the axis of advancement of said terminals into electrical connection, said first housing including electrically insulating terminal shielding sleeve means extending from said housing to at least partially shield said terminal, the improvement comprising:

securement means affixed to said first housing and formed to secure said first terminal in fixed predetermined angular orientation about said axis of advancement in said first housing;

first indexing means affixed to said shielding means, said first indexing means being formed by at least one recess and one protrusion in the end surface of said sleeve means to interfit in mating engagement with a portion of said second connector and being further formed to position said first terminal in angularly indexed relation to said second terminal in said second connector for electrical connection thereto upon orientation of said first indexing means for mating engagement with said portion; and

said sleeve means is further formed for resilient angular displacement about said axis of advancement while said protrusions are in mating engagement with said recesses to allow relative rotation of said connectors for bayonet connection of said terminals.

2. In a pair of heavy duty electrical cable connectors formed for securement in end-to-end relation and including first and second electrically insulating housings and first and second electrically conductive terminals mounted respectively in said housings, said terminals each being formed for securement of an electrical cable thereto and being further formed for bayonet connection to each other to form an electrical connection upon orientation of said terminals in end-to-end relation in a predetermined relative angular relation about the axis of advancement of said terminals during connection, said first and second housings each being provided with resiliently axially compressible and angularly flexible electrically insulating terminal shielding sleeves extending from said housing to provide a shield for said terminals, the improvement comprising:

securement means affixed to each of said housings and formed to secure each of said terminals in a fixed predetermined angular orientation about said axis of connection in the respective housings in which said terminals are mounted; and

indexing means formed in the end surface of said sleeve means and in the housing of the remaining connector, said indexing means being formed by at least one protrusion in the end surface of one of said sleeves and at least one mating recess in the remaining of said sleeves for interfitting mating engagement of said sleeves, said protrusion being visually apparent from the side of said connectors during mating with said recess, and said protrusion and recess being formed to position said first and second terminals in relative angularly indexed relation for bayonet connection upon orientation of said protrusion and recess for mating engagement of said sleeves.

3. A pair of heavy duty electrical cable connectors as defined in claim **2** wherein,

each connector is identically formed with said indexing means being provided by a pair of opposed protrusions and a pair of opposed recesses in each end of said sleeves, and said terminals are formed for bayonet connection upon rotation of said connectors through an angle of 90° until said protrusions of each connector are aligned with said recesses of each connector.

4. A pair of heavy duty electrical cable connectors as defined in claim **3** wherein,

said connectors are mounted together with said protrusions and recesses in mating relation and said terminals interengaged.

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