United States Patent

Kelly

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[45] **Sept. 5, 1972**

[54] **HEAVY DUTY CABLE CONNECTOR**

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[21] Appl. No.: **71,443**

[52] **U.S. Cl.** .....**339/59 R,** 339/113 L, 339/217 S

[51] **Int. Cl.** **H01r 13/40**

[58] **Field of Search**.....339/59–61, 217 S, 339/113

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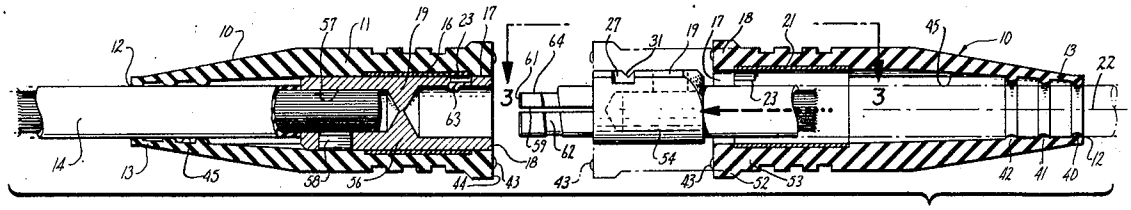
Primary Examiner—Joseph H. McGlynn

Attorney—Warren, Rubin, Brucker & Chickering

[57] **ABSTRACT**

A heavy duty electrical cable connector having an electrically insulating housing formed with a first opening to receive an electrical cable, an internal cavity communicating with the first opening and formed for mounting of a connector holder therein, and a second opening communicating with the cavity through which a connector terminal may be secured in the housing. A connector holder, preferably a metallic insert integrally molded into the housing, is provided and formed with a resiliently biased terminal retaining portion for detachably fastening the connector terminal in the housing. The holder and housing are formed to secure the holder against any movement in the housing, which completely encloses the holder to prevent electrical shock through contact with the human body.

1 Claim, 8 Drawing Figures



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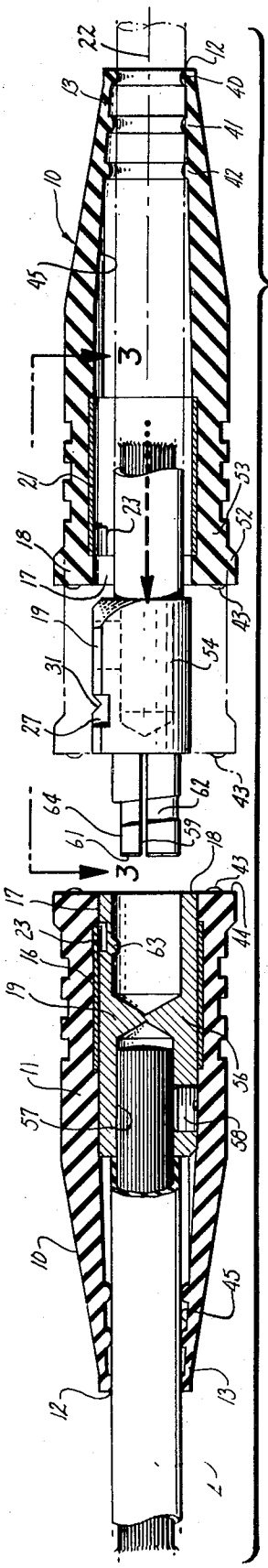


Fig. 1

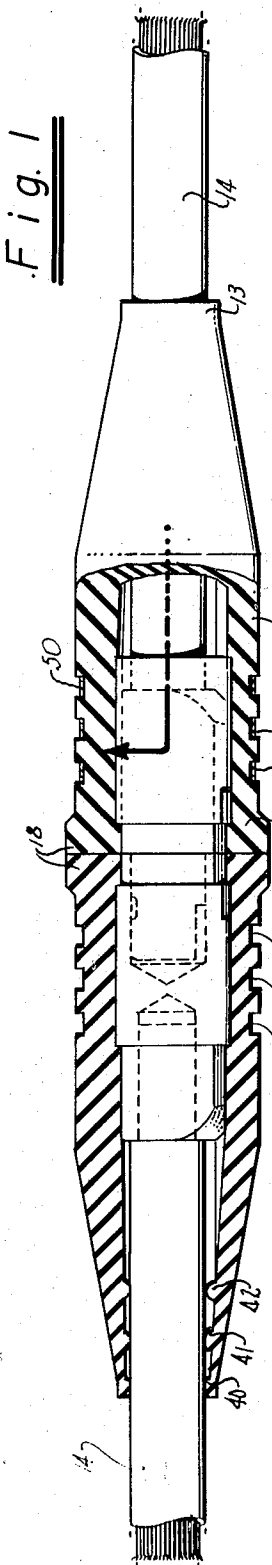


Fig. 2

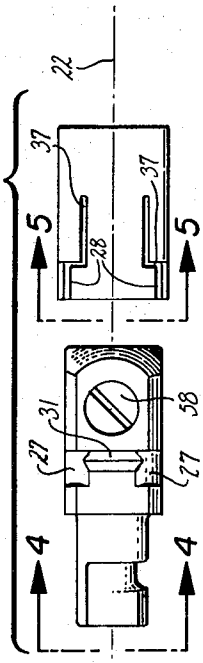


Fig. 3

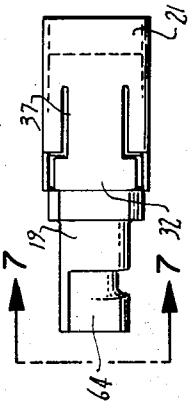


Fig. 6

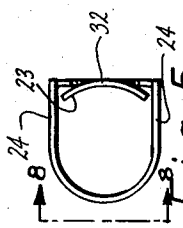


Fig. 5

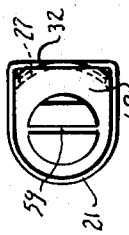


Fig. 7

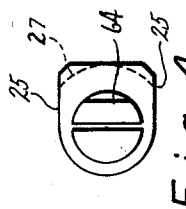


Fig. 4

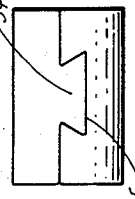


Fig. 8

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HEAVY DUTY CABLE CONNECTOR

BACKGROUND OF THE INVENTION

This invention relates to heavy duty electrical cable connectors which may be used in instances requiring large current or voltage flows under varied external circumstances and, more particularly, relates to cable connectors whose parts are mounted such that a connection may be readily made without adjustment of any portion thereof and wherein the electrical parts are shielded from contact with the human body.

Heavy duty cables of substantial length which may be moved from place to place and carry high current or voltage are presently in wide-spread use in industry. One place where such cables are commonly employed is in the welding industry where hundreds of feet of cable must be temporarily deployed from a power source to a remote welding site. The length of the cable usually requires that several pieces of cable be connected in end-to-end relation by heavy duty cable connectors. Moreover, such cables are often used in applications where they are exposed to the elements, for example, on piers or in shipyards.

Heavy duty cable connectors which are currently available are constructed in several manners. In one form a screw is provided which may be tightened down to secure an electrical cable to the connector. This screw, however, is directly accessible from the outer portion of the insulated connector housing, permitting one to come directly into contact with a high voltage or high amperage source should the screw be inadvertently touched by the human body while the cable is carrying electrical current. Furthermore, even in connectors in which the screw is positioned in an indentation in the housing, this exposed area is susceptible to contact with a number of external physical conditions, such as water or electrically conducting objects, which may be either shorted to ground or in contact with some portion of the human body.

In other connectors currently available the electrical cable is connected to the terminal portion of the cable connector in a manner which allows the terminal or the cable to be susceptible to movement, either linearly or in a rotational fashion when the cable connector is engaged or disengaged from another cable connector or upon the violent flexing of the cable. Such movement may result in the disconnection of the cable connector or the disconnection of the electrical line from the connector under conditions wherein the electrical line is carrying a large current or voltage.

Other cable connectors are designed to accept only cables of one size, causing the users and the marketers to have to stock a number of connectors of differing size to adequately cover the need for cable connectors.

Still other cable connectors do not allow removal of the connecting terminal and replacement of the same without replacement of the entire connector. Since the equipment of different manufacturers is often intermixed and there are several types of connector terminal configurations, there is often a need in the field to change terminals to accommodate the equipment available.

It has been further found that the insulating housings of the currently marketed cable connectors are constructed to afford a poor gripping surface. Thus, there exists the possibility that in making a cable connection

with the available connectors, one's hand may slip into the area wherein live electrical elements are to be encountered and thereby receive an electrical shock.

Furthermore, in commonly constructed electrical cable connectors there are to be found seams or holes which permit moisture and the like to pass from the exterior portion of the connector to the interior portion where such moisture may react with the components of the cable connector or provide an electrically conducting path from the interior of the connector to the exterior portion whereby shorting or shocking may occur.

Accordingly, it is an object of the present invention to provide a heavy duty cable connector which provides a positive and safe connection of cables in end-to-end relation.

It is a further object of the present invention to provide a heavy duty cable connector which can be easily and rapidly mounted on a cable end.

It is another object of the present invention to provide a heavy duty cable connector which is formed to positively secure and yet easily release a variety of connector terminals for interchanging of the same.

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

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 2 is a side view, in cross section, and partially fragmented illustrating the joining of two electrical cable connectors.

FIG. 3 is a side view of the terminal connector and terminal holder of the present invention taken along the line 3—3 in FIG. 1.

FIG. 4 is an end view of the terminal taken along the line 4—4 of FIG. 3.

FIG. 5 is an end view of the terminal holder taken along the line 5—5 of FIG. 3.

FIG. 6 is a top plan view of a terminal seated in terminal holder.

FIG. 7 is an end view taken along the line 7—7 of FIG. 6.

FIG. 8 is a side view of the terminal holder taken along line 8—8 of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawing, a heavy duty electrical cable connector **10** is illustrated having an electrically insulated housing **11** formed with a first opening **12** at a first end **13** thereof so as to receive an electrical cable **14**. The housing has an internal cavity **16** in communication with the first opening, and the housing is further formed with a second opening **17** at a second end **18**, which opening is similarly in communication with the cavity **16** so as to permit a connector terminal **19** to be inserted into a connector holder **21** through the second opening in the housing. The connector holder is fixedly mounted in cavity **16**, preferably integrally molded therein, and is formed with a resiliently biased terminal retaining portion **23**, (as best seen in FIGS. **1** and **5**) for detachably fastening the connector terminal in housing **11**.

As will be more fully set forth hereinafter, terminal 19 connects the two cables in end-to-end relation by a cam action on rotation of the connector as shown in FIG. 2. In past connector constructions such rotation sometimes caused the outer housing to turn or slip relative to the terminal resulting in faulty connection of the cables. In the present invention, holder 21 is preferably constructed such that a portion thereof, such as walls 24, are of non-circular cross section, and a corresponding portion, such as walls 25, of the terminal are of similar construction so that the terminal may be secured in the holder against rotation about the longitudinal axis thereof. Similarly, cavity 16 of housing 11 is non-circular in cross section so that rotation of the holder within the housing and about axis 22 can be prevented.

In order to retain the terminal in housing 11, holder 21 is preferably formed with a T-shaped tab or retaining portion 23. Tab 23 is resiliently, downwardly biased to engage shoulders formed by notches 27 in the terminal. Thus, the arcuate end 32 of tab 23 mates with notches 27 to lock the terminal against movement along axis 22.

Preferably, the length of the tab side walls 28 are substantially the same but slightly less than spacing between the oppositely facing shoulders of notch 27 so that there results a snug and secure fit when the tab is resiliently biased within the notch.

It is a feature of the cable connector of the present invention that the connector terminal may be removed from the connector for replacement or repair. In order to effect removal of the terminal, a second notch 31 is formed in terminal 19 adjacent notches 27. Notch 31 is constructed with steep side walls so as to permit the resting and movement therein of a tool, such as a screwdriver (not shown). Removal of terminal 19 requires that end 28 of tab 23 be lifted out of notches 27. Thus, notch 31 is provided in part to allow a tool to be positioned between tab 23 and the terminal to pry the tab out of the notch. In addition, the tab includes an arcuate portion 32 which is formed and dimensioned to remain apart from the area of notch 31 upon seating of the terminal in holder 21. Arcuate portion 32 is situated adjacent the second end 18 of the housing, and the housing is flexible between the second end and the portion covering tab 23 so as to allow passage of the tool from the exterior of the housing to arcuate portion 32. Thus, arcuate portion 32 cooperates with notch 31 to enable the tool to pry the biased tab 23 from notch 27. Still further, notch 31 may be used to pry terminal 19 axially from housing 11 after tab 23 is disengaged from the terminal.

As constructed herein holder 21 is preferably formed from resilient metal sheet and is permanently deformed into the shape shown in the drawings. In order to allow the holder to be formed from sheet material, the ends thereof may be fastened by means of a tongue 34 fixedly pressed into a groove portion 35 of the opposite end (FIG. 8). The tab is formed from the sheet and is defined by cutaway portions 37 formed on either side thereof so as to cause said tab to be relatively spaced in relation to the remainder of the sheet on three sides thereof. Thus, tab 23 may be more readily displaced and thereby disengaged by means of a tool from the notch 27.

In order to accommodate a variety of cables of differing diameter while maintaining a seal between the cable and the cable connector, it is a feature of the present invention that opening 12 is formed with at least two concentric axially spaced apart sealing rings, here illustrated as three such rings, 40–42. The first ring 40 is of a diameter less than that of the second ring 41, and the second ring is of a diameter less than the adjacent third ring 42. The variation in the internal diameters of rings 40, 41, and 42 is accomplished in part by tapering the internal passageway 45 outwardly from end 13 to cavity 16. Thus, cables of a diameter larger than the first ring diameter but smaller than or equal to the second ring diameter may be sealed at end opening 12 by cutting away, such as by means of a shears or knife, that portion of the housing including first ring 40. The resultant opening is of a larger diameter, because of tapered passageway 45, maybe selected to be substantially equal to the diameter of the electrical cable. The cut-away end 13 of housing 11 exposes No. 9, another sealing ring which will engage the exterior surface of cable 14 to resist the passage of moisture down the cable and into the housing to terminal 19. Prior heavy duty cable connectors have lacked adequate protection against moisture entering the connector with the result that corrosion of the connection between the end of cable 14 and terminal 19 occurs, and shorting is a constant danger.

It is another feature of the present invention to provide means at end 18 of the connector housing for resisting the entrance of moisture into the connector. The exterior portion of end opening 18 may be formed with a protruding annular portion 43 adjacent the periphery 44 thereof such that the annular portion may abut against an identically shaped annular portion 43 formed on a second housing. There is thus formed upon the joining of such cable connectors, a sealing ring about the area wherein the terminal of one connector passes through to the terminal of the adjoining connector.

In order to facilitate a more positive and safe manual engagement of the connector of the present invention housing 11 is further formed with gripping means on the exterior portion thereof. Grooves or annual recesses 47–49 insure proper retention of the cable connector in the human hand upon assemblage and disassemblage with another cable connector. It should be noted that a color coded band or element, such as a piece of adhering tape, may be inserted into one or more of the grooves so as to provide a color coding for size, voltage, amperage, project, owner, or other identification. Grooves 47, 48, and 49 are formed of a depth to receive a color coded band 59 without detracting from the ability of the housing body to provide a gripping surface. The housing body is further preferably provided with a guard portion 52 having a circumference greater than that of the adjacent exterior portion 53 of the housing body so as to further prevent slippage of the hand from the housing portion into the area of the electrically conductive terminal portion.

The housing and terminal holding configurations of the present invention may be used to secure a male, female, or neutral type of terminal to the electrically insulated housing. As shown in the drawings, male ter-

minal 54 is secured in the left housing. One form of terminal, which is presently in use and does not form a part of the present invention, includes a male terminal having a slit 59 in the exterior portion 61 thereof as well as a groove 62 formed to secure the connector to a second connector having a female terminal with a hemispherical-like protrusion 63 in the interior portion thereof. The male portion is formed with a flat indented surface 64 so as to permit a first portion of the groove 62 to be placed in contact with the protrusion 63, and thereafter, the cable connectors are turned (as indicated in FIG. 2) such that the male protrusion proceeds by cam action inwardly into the internal cavity of the female terminal. The groove and protrusion securely hold the connectors in place with the opposed end sealing rings 43 in abutting relation. Disengagement of the connectors is accomplished by turning the connectors in the opposite direction and thereafter pulling the male from the female terminal when the protrusion is adjacent the flat surface 64.

In operation, electrical cable 14 is passed through a properly dimensioned first end opening 13. The cable is then passed through cavity 16, wherein the connector holder is fixedly secured, and through second end opening 18. Sealing rings 40–42 may be moistened to allow passage of cable 14 to second end 18. The cable is stripped of its protective covering adjacent the cable end and the exposed wire or cable is thereafter inserted into the cavity or recess 57 in the terminal and secured therein by means of a locking screw 58. Alternatively, solder may be introduced through the screw opening in place of a screw to secure the wire to the terminal. The cable is then gently pulled while the terminal may gently pushed so as to seat the terminal within connector holder 21 until the resiliently biased retaining portion 23 automatically snaps into engagement with the complementary notched element 27 of the terminal. Thus, the terminal is automatically secured against all movement within the connector holder and the housing. A pair of connectors may be joined by inserting one into the other and turning them to effect a cam-acting connection. To remove a terminal from the cable a tool is placed between the flexible housing section at opening 18 and terminal 19 so as to fit under arcuate end 32 of tab 23. The tool may then be used to lift the tab from notches 27 and pry the terminal by leverage applied to the terminal through notch 31 from the holder and housing. Thereafter, the lock screw 58 may be loosened so as to permit the disengagement of the cable from the terminal, and the cable may be utilized in the same manner again or for other purposes.

In construction, housing 11 is formed of a moldable, electrically insulating material, such as natural or synthetic rubbers. Housing 11 is preferably molded about a metallic, resilient holder 21 so as to result in a one-piece construction of the housing and holder wherein there are no seams which pass to the exterior surface of the housing. The metallic insert or terminal holder affords sufficient strength to resist substantial axial loads which may be generated by the cam-acting connection of the terminals or axial loads on the cables. When the axial loads are not high; for example, when smaller cables or bayonet connecting terminals are used or infrequent axial loads on the cables are encountered, the terminal holder may be formed of non-metallic materials such as plastics. In addition, tab 23 can be integrally molded inside cavity 16 as a solid resilient protrusion formed of the same material as housing 11; namely, natural or synthetic rubbers. The terminal may consist of a single piece of brass or other electrically conductive metal which has been machined or otherwise formed as described herein. When the connector holder is formed from a metal sheet, it may be formed from a piece of 1/64 inch steel so as to have the resilient, springy characteristics necessary for the tab portion.

Although I have disclosed the aforementioned cable connector in terms of a particular apparatus, it is understood that the device described may be formed in other manners without deviating from the claims herein.

What is claimed is:

1. In a heavy duty electrical cable connector, including an electrically insulating housing formed with a first opening at a first end thereof to receive an electrical cable, an internal cavity communicating with said first opening and formed with means for securement of an electrical terminal therein, and a second opening at a second end thereof communicating with said cavity to allow electrical connection to said terminal; and an electrical terminal fixedly mounted in said cavity against relative rotation and axial withdrawal therefrom, the improvement wherein:

said housing is formed with annular recessed gripping means on the exterior portion thereof to insure positive manual engagement of said housing and is formed with a guard portion adjacent said second end having a circumference greater than that of said adjacent exterior portion of said housing to prevent contact by the human hand with said terminal, said recessed gripping means being further formed of sufficient depth to receive a color coded tape element therein while still maintaining a recess in said housing, and a color coded tape element mounted in said recess.

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