

Description

The present invention relates generally to the connection and disconnection of high voltage electrical connector elements in the field and pertains, more specifically, to an assembly tool for facilitating the installation of a bushing assembly within an electrical connector and the subsequent appropriate seating of the electrical connector upon a terminal of an electrical apparatus, preferably from a remote location through the use of an insulated implement, such as a hot-stick.

In US-A-4,202,591, there is described a high voltage electrical connector of the type employed to connect a high voltage cable to the terminal of an electrical apparatus, such as a transformer, in a power distribution circuit. The electrical connector is provided with a bushing assembly which enables a ground connection to be made so as to ground the terminal without disconnecting the electrical connector. Also disclosed in US-A-4202591 is a tool for grounding the electrical connector and then disconnecting the electrical connector from the terminal.

European patent application No: EP-A-0092616 describes an attachment arrangement which facilitates attachment and securing of a bushing assembly to an electrical connector to a terminal of an electrical apparatus, the attachment arrangement including sequentially operated threaded elements and minimum torque responsive devices for assuring that the sequence of operation of the threaded elements will secure the bushing assembly appropriately to the electrical connector and then will secure the electrical connector to the terminal.

US-A-2984133 describes a torque limiting tool wherein the shaft of a screw driver is drivably coupled to a handle by means of a torque limiting device. When a predetermined torque is exceeded, the shaft rotates relative to the handle to avoid overtightening.

Objects of the present invention are to provide a tool which:—

(a) facilitates the installation of a bushing assembly within an electrical connector and the subsequent connection of the electrical connector to a terminal of a high voltage electrical apparatus;

(b) can be used in connection with an insulated implement, such as a hot-stick, for operation from a remote location, to effect connection or disconnection of the electrical connector and the terminal;

(c) indicates to the operator when the electrical connector is appropriately seated upon the terminal and the connection is completed correctly;

(d) enables the application of a sufficient removal torque for disconnecting the electrical connector from the terminal;

(e) is relatively simple in construction and is easy to use in the field; and

(f) is rugged and durable so as to perform satisfactorily under conditions encountered in the

field over a relatively long and useful service life.

In accordance with the invention, besides providing torque limiting means which enable relative rotation between first and second members when a predetermined torque is exceeded, direct coupling means further drivably couple the first and second members to enable the latter relative rotation to take place in one direction, but also to ensure that the first and second members rotate as a unit in the opposite direction when the drive is reversed.

An embodiment of the invention will now be described with reference to the accompanying drawing, in which:

Fig. 1 is an elevational view, partially sectioned, of a tool constructed in accordance with an embodiment of the invention.

Fig. 2 is a fragmentary elevational view of a portion of the tool of Fig. 1 taken in the direction of arrow 2:

Fig. 3 is a fragmentary elevational cross-sectional view, in slightly reduced scale, showing portions of a bushing assembly about to be installed within an electrical connector:

Fig. 4 is a fragmentary elevational cross-sectional view similar to Fig. 3, but with the bushing assembly partially installed;

Fig. 5 is a fragmentary elevational cross-sectional view showing the bushing assembly fully installed within the electrical connector, the installation having been facilitated by the tool shown in the figure in slightly reduced scale;

Fig. 6 is a fragmentary elevational cross-sectional view similar to Fig. 5, but showing the electrical connector partially installed upon the terminal of an electrical apparatus; and

Fig. 7 is a fragmentary elevational cross-sectional view similar to Fig. 6, but with the electrical connector fully connected to the terminal.

Referring now to the drawing, and especially to Figs. 1 and 2 thereof, a tool constructed in accordance with an embodiment of the invention is shown at 10 and is seen to include an operating member in the form of elongate rod 12 having a wrenching configuration in the form of a hexagonal key 14 at the lowermost end 16 of the rod 12 and wrenching means in the form of a hexagonal drive head 18 adjacent the uppermost end 20 of rod 12. A projection 22 at the uppermost end 20 of rod 12 has a square cross-sectional configuration and is received within a complementary square socket 24 within a cylindrical first body member 26 of tool 10. A pin 28 secures the rod 12 to the first body member 26.

An attachment means in the form of a pad eye 30, which includes a ring 32 and a plate 34, is affixed to a cylindrical second body member 36 is coupled to first body member 26 by means which will be explained in greater detail below. Pad eye 30 enables tool 10 to be attached to an insulated implement, such as a hot-stick, in the manner explained fully in US-A-4,202,591, so that tool 10 may be operated by an operator (not shown) from a remote location.

The operation of tool 10 is best understood by

(24)

reference to the functions performed by the tool. Turning now to Figs. 3 through 7, there is illustrated an installation procedure in which a bushing assembly 40 is attached and secured within an electrical connector in the form of a T-shaped receptacle 42, and the receptacle 42 is connected to a terminal 44 (see Figs. 6 and 7) of a high voltage apparatus, such as a transformer (not shown). The installation procedure is described in detail in the aforesaid European patent application, serial No. EP-A-0092616 and portions of the procedure are repeated herein to illustrate the use of tool 10 in the procedure.

Referring first to Figs. 3 and 4, receptacle 42 is affixed to the terminus of a high voltage cable, in the manner illustrated in the aforesaid patent, and an electrical terminal contact 50 having an integral lug 52 is attached to the conductor of the cable. Lug 52 is to be connected to the terminal 44 to complete a distribution circuit.

A composite body 54 surrounds the contact 50 and provides an axially extending receptacle recess 56 within which terminal 44 is to be received. A second axially extending recess 58, opposite to the first recess 56, is to receive interface bushing assembly 40 which is constructed to enable direct connection between the terminal 44 and a commonly available electrical connector, such as an elbow receptacle (not shown).

Bushing assembly 40 includes a generally tubular housing 60 having a body member 62 of dielectric material, such as an insulating elastomer, and a central tubular member 64 of conductive material, such as copper or aluminum. The upper end portion 66 of the bushing assembly 40 is essentially the same as that shown in the aforesaid patent. Thus, a female contact assembly 68 is located within the tubular member 64 and includes a female contact element 72 which can receive a complementary male contact element (not shown) for completing an electrical circuit to tubular member 64 is provided with an extension in the form of an axially extending tubular extension of a threaded connection 82 at the upper end 84 of tubular extension member 80. The lower end 86 of tubular extension member 80 includes a land 88 for purposes which will be described in greater detail below.

A coupling member 90 is received within extension member 80, adjacent lower end 86, and is coupled to extension member 80, adjacent lower end 86, and is coupled to extension member 80 by means of an external thread 92 which extends axially to upper end 94, of coupling member 90 and engages a complementary internal thread 96 in extension member 80. A further external thread 98 extends along the coupling member 90 adjacent the lower end 100 thereof and a collar 102 is located axially between the external threads 92 and 98.

Prior to the installation of bushing assembly 40 within the recess 58 of receptacle 42, coupling member 90 projects beyond the lower end 86 of extension member 80, and the lower end 104 of

body member 62 of bushing assembly 40, with collar 102 spaced axially from lower ends 86 and 104, as illustrated in Fig. 3. In this manner, external thread 98 is spaced far enough downwardly from the tapered portion 106 of the body member 62 of bushing assembly 40 to enable external thread 98 to be engaged with a complementary threaded aperture 108 in lug 52 of contact 50, as seen in Fig. 3, without resistance which might otherwise occur if the tapered portion 106 of the body member 62 were to contact the corresponding tapered portion 110 of recess 58. Thus, external thread 98 of coupling member 90 may be threaded into threaded aperture 108 merely by turning bushing assembly 40 manually to advance external thread 98 into threaded aperture 108. Such advancement is continued until a sufficient axial length of thread 98 is engaged within threaded aperture 108 to provide the holding strength necessary to complete the installation of bushing member 40, as described below, and preferably until a stop shoulder 112 on collar 102 is seated against lug 52, as seen in Fig. 4.

Preferably, manual turning of bushing assembly 40 will advance the coupling member 90 into threaded aperture 108 until stop shoulder 112 is seated properly against lug 52. A locking means is provided between the external thread 92 and the internal thread 96 to lock the coupling member 90 and the tubular extension member 80 against movement relative to one another during threading of the coupling member 90 into the lug 52, at least until the aforesaid sufficient axial length of thread 98 is engaged within threaded aperture 108. The locking means is in the form of a pellet 114 of synthetic resin material, such as nylon, placed within a recess 116 in the wall 118 of coupling member 90 and compressed against internal thread 96 of tubular extension member 80 to establish a prevailing torque which preferably is great enough to preclude the unwanted relative movement. In order to effect continued rotation of the bushing assembly 40, preferably after stop shoulder 112 is seated against lug 52, the prevailing torque provided by pellet 114 is overcome so that downward movement of the tapered body portion 106 into complementary tapered portion 110 of recess 58 can be continued. Thus, the pellet 114 provides a locking means which is responsive to a minimum torque, the minimum torque being of a predetermined value which will assure that the coupling member 90 is sufficiently engaged with lug 52, and preferably engaged up to the position where stop shoulder 112 is seated against the lug 52 before tubular extension member 80 will move relative to coupling member 90. Pellet 114 assures that the minimum torque necessary to engage coupling member 90 properly in lug 52 and preferably to seat coupling member 90 against lug 52 will be reached before extension member 80 moves relative to coupling member 90.

Upon proper seating of coupling member 90 within lug 52, as seen in Fig. 4, further rotation of

25

bushing assembly 40 will overcome the lock provided by pellet 114 and the tapered body portion 106 of the bushing assembly 40 will begin to engage complementary tapered portion 110 of recess 58. Continued downward movement of the bushing assembly 40 will seat the bushing assembly 40 within the receptacle 42; however, such continued downward movement will meet with considerable resistance as a result of the interference fit which must be established between the complementary tapered portions 106 and 110 in order to attain the desired watertight seal and dielectric properties along the interface between the engaged tapered portions. Since the body member 62 of bushing assembly 40 is constructed of elastomeric materials, it becomes impractical to grip the bushing assembly externally to exert the forces necessary to continue turning the bushing assembly as the resistance to turning increases with downward movement. Thus, an internal wrenching means is provided for facilitating the continued rotation of the bushing assembly 40, as follows.

Turning now to Figs. 4 and 5, coupling member 90 has a control bore 120 passing through the coupling member 90 from end 94 to end 100. A threaded fastener in the form of a bolt 122 extends axially within the bore 120 and has a head 124 and a thread 126. A securing means in the form of a pin 130 extends radially through an aperture 132 in the wall of tubular member 64 and into a corresponding hole 134 in the head 124 of bolt 122, the pin 130 having a flanged end 136 which serves to locate the pin 130 radially within aperture 132. Tubular extension member 80 overlaps the aperture 132 thereby capturing flanged end 136 of pin 130 within aperture 132. Bolt 122 thus is fixed in the retracted position illustrated in Figs. 4 and 5.

A socket 138 in head 124 of bolt 122 provides a hexagonal wrenching configuration located along the central axis A of the bushing assembly 40. Tool 10, having elongate rod 12 with complementary hexagonal key 14, is lowered through the female contact assembly 68 and tubular member 64, along axis A, as seen in Fig. 5, and key 14 is inserted into socket 138. Once the rod 12 of the tool 10 is coupled with the head 124 of bolt 122, as shown in Fig. 5, a wrench 150 is engaged with drive head 18 to effect rotation of rod 12 about axis A. Concomitant rotation will be imparted to bushing assembly 40 by virtue of the fact that bolt head 124 is secured to tubular member 64 by pin 130. Wrenching forces then are applied and transmitted to move bushing assembly 40 downwardly until the land 88 and the lower end 86 of the tubular extension member 80 is seated against lug 52, as shown in Fig. 5, the collar 102 fitting within a corresponding recess 154 at the lower end 86 of extension member 80. If stop shoulder 112 of collar 102 has not yet been seated properly against lug 52, downward movement of extension member 80 now will carry coupling member 90 downwardly to assure proper seating of the coupling member 90 within lug 52. Once

the land 88 is seated properly, the bushing assembly 40 will be seated within the receptacle 42 with the appropriate interference fit.

It is important that the bushing assembly 40 not be overtightened; that is, the land 88 must not gaul the lug 52 and excessive forces should not be developed along the interface between the complementary tapered portions 106 and 110. At the same time, it is important that at least a minimum torque is applied sufficient to assure proper seating of bushing assembly 40 within receptacle 42. In order to preclude the application of excessive wrenching forces upon the bushing assembly 40, while assuring that the necessary minimum wrenching forces are applied, the shear strength of pin 130 is chosen so that pin 130 will shear in response to the application by tool 10 of a torque in excess of a given value determined by the minimum torque required for the appropriate seating of bushing assembly 40 within receptacle 42 and the maximum torque which can be tolerated. Thus, pin 130 serves as a securing means for securing the head 124 of bolt 122 to tubular member 64 for applying wrenching torque, and the securing means releases in response to exceeding a given torque to preclude the application of an excessive torque to the connection between the bushing assembly 40 and the lug 52 while assuring that the necessary minimum torque is applied.

Once the pin 130 is sheared, bolt 122 is free to move axially downwardly within tubular extension member 80 and coupling member 90, as seen in Fig. 6. It is noted that axially upward movement of bolt 122 is restricted by a lip 156 which projects radially inwardly to preclude movement of bolt 122 upwardly into tubular member 64 beyond lip 156. The receptacle 42, with bushing assembly 40 in place therein, ordinarily will be placed upon terminal 44 with the bolt 122 aligned axially with a threaded aperture 158 in terminal 44. Upon freeing of the bolt 122 by shearing of the pin 130, the bolt 122 will drop to the position illustrated in Fig. 6, in preparation for connection of the receptacle 42 to terminal 44. It is noted that pin 130 has been sheared by the torque applied by wrench 150 directly through drive head 18 to rod 12 and consequently to pin 130 through bolt head 124. In order to complete the connection of receptacle 42 to terminal 44, bolt 122 is threaded into aperture 158 of terminal 44, as shown in Fig. 7. In the completed connection, the head 124 of bolt 122 bears against washers 159 which rest upon the upper end 94 of coupling member 90 such that bolt 122 lugs lug 52 in place upon terminal 44 with an appropriate interference fit established at the interface between the recess 56 of the receptacle 42 and the corresponding outer surface 160 of the terminal 44. Tool 10 is operated to complete the connection between the receptacle 42 and the corresponding outer surface 160 of the terminal 44. Tool 10 is operated to complete the connection between the receptacle 42 and the terminal

26

44 and to assure the operator that the appropriate interference fit has been established.

In order to complete the connection between the receptacle 42 and terminal 44, the operator will remove wrench 150 from drive head 18 and will attach an insulated implement, such as a hot-stick, (not shown) to pad eye 30 so that the tool 10 can be rotated about axis A through manipulation of the insulated implement. Pad eye 30 is affixed to second body member 34 of tool 10 which, in turn, is coupled to first body member 26 so that, ordinarily, rotation of pad eye 30 will result in concomitant rotation of rod 12 and hexagonal key 14 to move receptacle 42 downwardly into engagement with terminal 44. As the outer surface 160 of the terminal 44 is engaged in an interference fit with recess 56 of the receptacle 42, the torque required for continued turning and further downward movement is increased, since a certain predetermined torque must be reached in order to assure that lug 52 properly electrically contacts the conductor 162 of terminal 44 and the appropriate interference fit is attained between the receptacle 42 and the terminal 44, tool 10 provides a torque responsive coupling device between pad eye 30 and rod 12 for indicating to the operator when the predetermined torque has been reached.

Thus, first body member 26 includes therein a torque limiting mechanism 170 which is coupled to second body member 36 and allows second body member 36 to rotate relative to first body member 26 when the torque applied to pad eye 30 exceeds the aforesaid predetermined torque. The operator knows that he must continue to apply more and more torque to the pad eye 30 as long as both the first and second body members 26 and 36 continue to turn together. As soon as the operator observes that the second body member 36 is rotating relative to the first body member 26, he knows that the connection is completed, with the appropriate contact made between the receptacle 42 and the terminal 44, and rotation can be discontinued. The same torque limiting mechanism 170 also serves to preclude over-tightening of the connection.

Torque limiting mechanism 170 is best illustrated in Fig. 1. First body member 26 includes a cylindrical bore 172 having a bottom 174. A plurality of load bearing elements, shown in the form of balls 176 are located in a ring around the bottom 174, each ball ordinarily being seated within a complementary recess 178 in the bottom 174 of bore 172. A drive disk 180 rests upon balls 176 and includes a plurality of recesses 182 corresponding to the number of balls 176 and being complementary thereto so that each ball 176 ordinarily is seated within a recess 182, as well as within a recess 178. Resilient biasing means in the form of a spring washer 184 is urged against the drive disk 180 by a retainer 186 which is threaded axially into bore 172 and against the spring washer 184 to bias the drive disk 180 against the balls 176. A drive shaft 190 is integral with drive disk 180 at lower end 192 of the drive

shaft 190 and extends upwardly to an upper end 194 where the drive shaft 190 is received within a complementary socket 196 in second body member 36 and is affixed to the second body member 36, as by a spring pin 198.

Upon rotation of pad eye 30 and second body member 36, drive shaft 190 will be rotated and will cause drive disk 180 to rotate. As long as the torque necessary to rotate rod 12 remains below the predetermined torque, drive disk 180 will be coupled to first body member 26 by virtue of balls 176 in recesses 178 and 182. However, when the torque necessary to rotate rod 12 exceeds the predetermined torque, further rotation of drive disk 180 will be resisted by balls 176 and drive disk 180 will be urged axially upwardly against the bias of spring washer 184 to enable drive disk 180 to ride over the balls 176 to continue to be rotated in response to rotation of second body member 36 and drive shaft 190, while the first body member 26, and rod 12, remain stationary. The value of the torque at which relative rotation is permitted between the first and second body members 26 and 36 is determined by the axial biasing force of spring washer 184 and may be set by appropriate adjustment of the axial position of retainer 186. Once the axial position is determined, retainer 186 is locked into place by a threaded locking member 188 which is threaded into bore 172 and abutted with retainer 186 to lock retainer 186 in place. A set screw 199 assures that locking member 188 is fixed in place relative to first body member 26.

When it is desired to employ tool 10 to remove bolt 122 from threaded aperture 158 of terminal 44, it may become necessary to exert a torque upon bolt 122 greater than the predetermined torque with which the bolt 122 was tightened. Since such removal also should be accomplished from a remote location through the manipulation of tool 10 with an insulated implement, such as a hot-stick, tool 10 is provided with means for directly coupling the first body member 26 with the second body member 36 when the pad eye 30 is rotated in a direction opposite to the direction of rotation employed during the above-described installation procedure.

As best seen in Figs. 1 and 2, the direct coupling means includes a drive tooth 200 located within a hole 202 in second body member 36 and resiliently biased by a helical spring 204 downwardly into a groove 206 located in a plate 208 placed between the first and second body members 26 and 36. Plate 208 is secured for rotation with first body member 26 by virtue of a post 210 projecting upwardly from locking member 188 and engaging a complementary drive aperture 212 in plate 208. Post 210 is integral with locking member 188 and has a square cross-sectional configuration which engages a complementary square plan configuration of drive aperture 212 so that plate 208 and first body member 26 will rotate as a unit. As best seen in Fig. 2, groove 206 has a ramp 214 at one

circumferential boundary and an axial shoulder 216 at the opposed circumferential boundary.

Upon connection of receptacle 42 with terminal 44, bolt 122 is rotated by rotation of tool 10 in the direction of arrow 220 in Figs. 1 and 2. As long as the predetermined torque, for which torque limiting mechanism 170 is set, is not exceeded first and second body members 26 and 36 will rotate as a unit. When the connection is completed, the predetermined torque will be exceeded and second body member 36 will begin to rotate relative to first body member 26. Drive tooth 200 will then be moved with second body member 36 toward ramp 214 and, since ramp 214 is inclined, drive tooth 200 will ride up ramp 214 to be retracted into hole 202, against the bias of spring 204, so as to ride along plate 208, as seen in Fig. 7, thereby permitting rotation of second body member 36 relative to first body member 26.

Upon disconnection of receptacle 42 from terminal 44, bolt 122 will be rotated by rotation of tool 10 in the direction of arrow 222 in Figs. 1 and 2. Since it probably will be necessary to exceed the aforesaid predetermined torque, second body portion 26, carrying drive tooth 200 toward axial shoulder 216. Once drive tooth 200 abuts axial shoulder 216, second body member 36 will be locked for rotation with plate 208 which, in turn, is engaged for rotation with first body member 26. Thus, sufficient torque will be transmitted to rod 12 from pad eye 30 to loosen bolt 122 for removal and disconnection of receptacle 42 from terminal 44.

It will be seen that tool 10 provides a relatively simple, yet rugged device for use in the field by a workman for attaching and securing a bushing assembly 40 to a receptacle 42, for connecting the receptacle with a terminal 44 with the desired interference fit, from a remote location utilizing an insulated implement, such as a hot-stick, and for disconnecting the receptacle from the terminal from a remote location.

It is to be understood that the above-detailed description of an embodiment of the invention is provided by way of example only. Various details of design and construction may be modified without departing from the scope of the invention as set forth in the appended claims.

Claims

1. A torque limiting tool (10) comprising a rod (12), one end of the rod (12) being secured for rotation with a first member (26), the other end of the rod having workpiece engaging means (14), and a second member (36) which is drivably coupled to said first member (26) by torque limiting means (170) which enables said second member (36) to rotate relative to said first member (26) when a predetermined torque is exceeded, characterised in that said second member (36) is further drivably coupled to said first member (26) by direct coupling means (200—206) which enables said second member to rotate in one direction relative to said first

member (26) when said predetermined torque is exceeded, but which ensures that said first and second members (26, 36) rotate as a unit, in an opposite direction, when the drive is reversed.

2. A tool according to claim 1, characterised in that said direct coupling means comprises a drive tooth (200) which is resiliently biased (204) towards a groove (206) having a ramp (214) at one end and a stop shoulder (216) at an opposite end, said tooth (200) riding over the ramp (214) to enable relative rotation between said first and second members, and said tooth (200) abutting the stop shoulder (216) to prevent said relative rotation when the drive is reversed.

3. A tool according to either claim 1 or 2, characterised in that said torque limiting means (170) is retained in a cylindrical bore (172) within said first member (26), said torque limiting means (170) including a drive shaft (190) which extends towards, and is received within said first member (26), a plate (208) being provided between said first and second members (26, 36) said drive shaft (190) extending rotatably through said plate (208) and being drivably secured to said second member (36), said direct coupling means (200—206) being located between said second member (36) and said plate (208).

Patentansprüche

1. Drehmomentbegrenzendes Werkzeug (10) mit einer Stange (12), wobei das eine Ende der Stange (12) drehfest mit einem ersten Teil (26) verbunden ist, während das andere Ende der Stange mit einer an einem Werkstück angreifenden Vorrichtung (14) versehen ist, und mit einem zweiten Teil (36), das mit dem ersten Teil (26) über eine Einrichtung (170) zur Drehmomentbegrenzung in Antriebsverbindung steht, welche eine Drehung des zweiten Teils (36) relativ zum ersten Teil (26) ermöglicht, wenn ein vorbestimmtes Drehmoment überschritten wird, dadurch gekennzeichnet, daß das zweite Teil (36) mit dem ersten Teil (26) ferner über eine Einrichtung (200—206) zur Direktkupplung in Antriebsverbindung steht, welche eine Drehung des zweiten Teils relativ zum ersten Teil (26) in der einen Richtung ermöglicht, wenn das vorbestimmte Drehmoment überschritten wird, jedoch gewährleistet, daß die beiden Teile (26, 36) sich in einer entgegengesetzten Richtung als Einheit drehen, wenn der Antrieb umgekehrt wird.

2. Werkzeug nach Anspruch 1, dadurch gekennzeichnet, daß die Einrichtung zur Direktkupplung einen Antriebsnocken (200) enthält, der federnd (204) zu einer Ausnehmung (206) gedrückt wird, die am einen Ende eine schräge Flanke (214) und an einem entgegengesetzten Ende eine Anschlagshulter (216) hat, wobei der Nocken (200) über die schräge Flanke (214) gleitet, um eine Relativdrehung zwischen dem ersten und dem zweiten Teil zu ermöglichen, während der Nocken (200) gegen die Anschlagshulter (216)

circumferential boundary and an axial shoulder 16 at the opposed circumferential boundary.

Upon connection of receptacle 42 with terminal 44, bolt 122 is rotated by rotation of tool 10 in the direction of arrow 220 in Figs. 1 and 2. As long as the predetermined torque, for which torque limiting mechanism 170 is set, is not exceeded first and second body members 26 and 36 will rotate as a unit. When the connection is completed, the predetermined torque will be exceeded and second body member 36 will begin to rotate relative to first body member 26. Drive tooth 200 will then be moved with second body member 36 toward ramp 214 and, since ramp 214 is inclined, drive tooth 200 will ride up ramp 214 to be retracted into hole 202, against the bias of spring 204, so as to ride along plate 208, as seen in Fig. 7, thereby permitting rotation of second body member 36 relative to first body member 26.

Upon disconnection of receptacle 42 from terminal 44, bolt 122 will be rotated by rotation of tool 10 in the direction of arrow 222 in Figs. 1 and 2. Since it probably will be necessary to exceed the aforesaid predetermined torque, second body portion 26, carrying drive tooth 200 toward axial shoulder 216. Once drive tooth 200 abuts axial shoulder 216, second body member 36 will be locked for rotation with plate 208 which, in turn, is engaged for rotation with first body member 26. Thus, sufficient torque will be transmitted to rod 12 from pad eye 30 to loosen bolt 122 for removal and disconnection of receptacle 42 from terminal 44.

It will be seen that tool 10 provides a relatively simple, yet rugged device for use in the field by a workman for attaching and securing a bushing assembly 40 to a receptacle 42, for connecting the receptacle with a terminal 44 with the desired interference fit, from a remote location utilizing an insulated implement, such as a hot-stick, and for disconnecting the receptacle from the terminal from a remote location.

It is to be understood that the above-detailed description of an embodiment of the invention is provided by way of example only. Various details of design and construction may be modified without departing from the scope of the invention as set forth in the appended claims.

Claims

1. A torque limiting tool (10) comprising a rod (12), one end of the rod (12) being secured for rotation with a first member (26), the other end of the rod having workpiece engaging means (14), and a second member (36) which is drivably coupled to said first member (26) by torque limiting means (170) which enables said second member (36) to rotate relative to said first member (26) when a predetermined torque is exceeded, characterised in that said second member (36) is further drivably coupled to said first member (26) by direct coupling means (200—206) which enables said second member to rotate in one direction relative to said first

member (26) when said predetermined torque is exceeded, but which ensures that said first and second members (26, 36) rotate as a unit, in an opposite direction, when the drive is reversed.

2. A tool according to claim 1, characterised in that said direct coupling means comprises a drive tooth (200) which is resiliently biased (204) towards a groove (206) having a ramp (214) at one end and a stop shoulder (216) at an opposite end, said tooth (200) riding over the ramp (214) to enable relative rotation between said first and second members, and said tooth (200) abutting the stop shoulder (216) to prevent said relative rotation when the drive is reversed.

3. A tool according to either claim 1 or 2, characterised in that said torque limiting means (170) is retained in a cylindrical bore (172) within said first member (26), said torque limiting means (170) including a drive shaft (190) which extends towards, and is received within said first member (26), a plate (208) being provided between said first and second members (26, 36) said drive shaft (190) extending rotatably through said plate (208) and being drivably secured to said second member (36), said direct coupling means (200—206) being located between said second member (36) and said plate (208).

Patentansprüche

1. Drehmomentbegrenzendes Werkzeug (10) mit einer Stange (12), wobei das eine Ende der Stange (12) drehfest mit einem ersten Teil (26) verbunden ist, während das andere Ende der Stange mit einer an einem Werkstück angreifenden Vorrichtung (14) versehen ist, und mit einem zweiten Teil (36), das mit dem ersten Teil (26) über eine Einrichtung (170) zur Drehmomentbegrenzung in Antriebsverbindung steht, welche eine Drehung des zweiten Teils (36) relativ zum ersten Teil (26) ermöglicht, wenn ein vorbestimmtes Drehmoment überschritten wird, dadurch gekennzeichnet, daß das zweite Teil (36) mit dem ersten Teil (26) ferner über eine Einrichtung (200—206) zur Direktkupplung in Antriebsverbindung steht, welche eine Drehung des zweiten Teils relativ zum ersten Teil (26) in der einen Richtung ermöglicht, wenn das vorbestimmte Drehmoment überschritten wird, jedoch gewährleistet, daß die beiden Teile (26, 36) sich in einer entgegengesetzten Richtung als Einheit drehen, wenn der Antrieb umgekehrt wird.

2. Werkzeug nach Anspruch 1, dadurch gekennzeichnet, daß die Einrichtung zur Direktkupplung einen Antriebsnocken (200) enthält, der federnd (204) zu einer Ausnehmung (206) gedrückt wird, die am einen Ende eine schräge Flanke (214) und an einem entgegengesetzten Ende eine Anschlagschulter (216) hat, wobei der Nocken (200) über die schräge Flanke (214) gleitet, um eine Relativedrehung zwischen dem ersten und dem zweiten Teil zu ermöglichen, während der Nocken (200) gegen die Anschlagschulter (216)



stößt, um die Relativedrehung zu verhindern, wenn der Antrieb umgekehrt wird.

3. Werkzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Einrichtung (170) zur Drehmomentbegrenzung in einer zylindrischen Bohrung (172) innerhalb des ersten Teils gehalten wird, daß diese Einrichtung (170) zur Drehmomentbegrenzung eine Antriebswelle (190) aufweist, die sich in Richtung zu dem ersten Teil (26) und in dieses hinein erstreckt, daß sich zwischen dem ersten und dem zweiten Teil (26, 36) eine Platte (208) befindet, daß sich die Antriebswelle (190) drehbar durch diese Platte (208) erstreckt und antriebsfest mit dem zweiten Teil (36) verbunden ist, und daß die Einrichtung (200—206) zur Direktkupplung sich zwischen dem zweiten Teil (36) und der Platte (208) befindet.

Revendications

1. Outil (10) limiteur de couple comportant une tige (12), l'une des extrémités de la tige (12) étant assujettie en rotation à une première partie (26), l'autre extrémité de la tige présentant des moyens (14) de venue en prise avec une pièce, et une seconde partie (36) qui est en liaison d'entraînement avec ladite première partie (26) par des moyens (170) limiteurs de couple, qui permettent à ladite seconde partie (36) de tourner par rapport à ladite première partie (26) lorsqu'un couple prédéterminé est dépassé, caractérisé par le fait que ladite seconde partie (36) est par ailleurs en liaison d'entraînement avec ladite première partie (26) par des moyens d'accouplement direct (200—

206) qui autorisent ladite seconde partie à tourner dans un premier sens par rapport à ladite première partie (26) lorsque ledit couple prédéterminé est dépassé, mais qui assurent que lesdites première et seconde parties (26—36) tournent d'un seul bloc, dans un sens opposé, lorsque l'entraînement est inversé.

2. Outil selon la revendication 1, caractérisé par le fait que lesdits moyens d'accouplement direct comprennent une dent d'entraînement (200) qui est repoussée élastiquement (204) vers une gorge (206) possédant une rampe (214) à une extrémité et un épaulement de butée (216) à une extrémité opposée, ladite dent (200) glissant sur la rampe (214) pour autoriser la rotation relative entre lesdites première et seconde parties, et cette dent (200) venant se plaquer contre l'épaulement de butée (216) afin d'interdire ladite rotation relative lorsque l'entraînement est inversé.

3. Outil selon l'une des revendications 1 ou 2, caractérisé par le fait que lesdits moyens (170) limiteurs de couple sont retenus dans une creusure cylindrique (172) dans ladite première partie (26) lesdits moyens (170) limiteurs de couple comportant un arbre d'entraînement (190) qui s'étend vers et est reçu dans ladite première partie (26), une plaque (208) étant prévue entre lesdites première et seconde parties (26, 36), ledit arbre d'entraînement (190) traversant ladite plaque (208) avec faculté de rotation et étant assujéti à ladite seconde partie (36) avec faculté d'entraînement, lesdits moyens d'accouplement direct (200—206) étant interposés entre ladite seconde partie (36) et ladite plaque (208).

