

[54] **CURRENT INTERRUPTING SAFE  
BREAK TERMINATOR**  
[72] Inventors: **Edwin A. Link, Waukesha; Edward  
L. Sankey, New Berlin, both of Wis.**  
[73] Assignee: **RTE Corporation, Waukesha, Wis.**  
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337/197, 201, 205, 224, 263; 339/45, 59, 60,  
60 C, 61, 111, 143**

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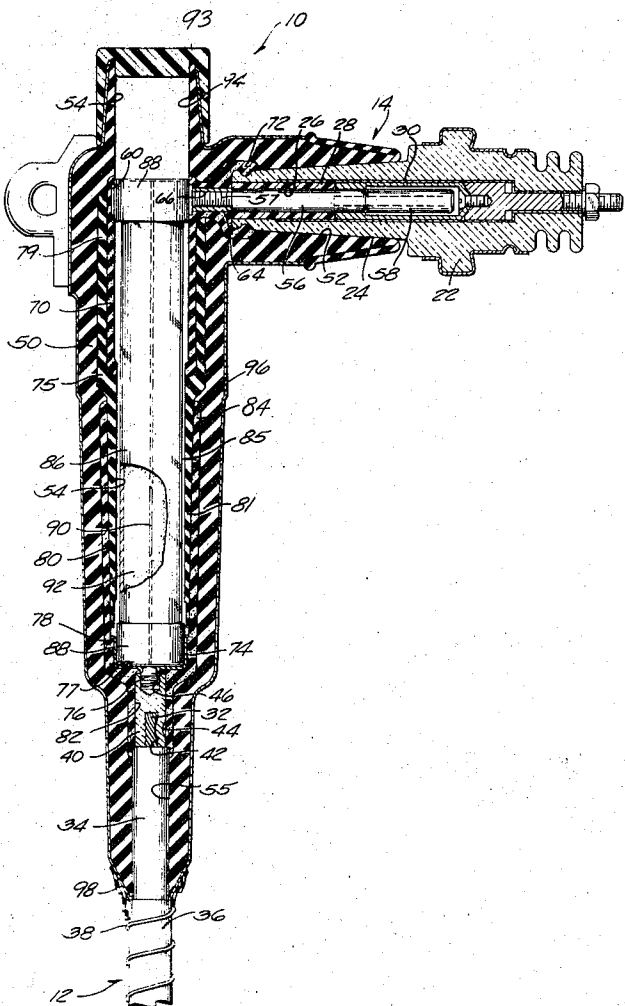
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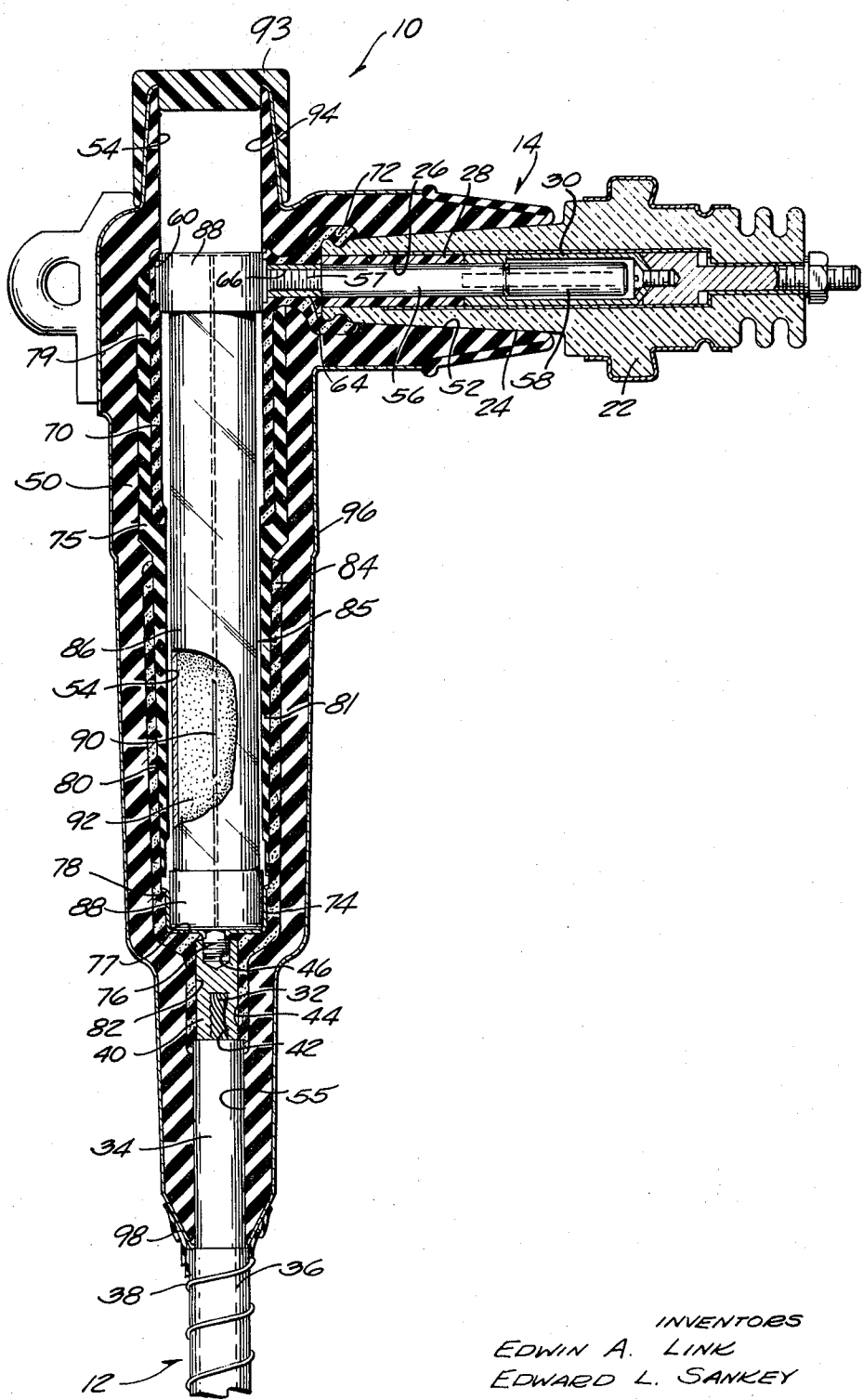
*Primary Examiner*—**Bernard A. Gilheany**  
*Assistant Examiner*—**Dewitt M. Morgan**  
*Attorney*—**Ronald E. Barry and James E. Nilles**

[57] **ABSTRACT**

A current interrupting connector for connecting a high voltage shielded cable to underground distribution apparatus, the connector including a housing formed of resilient insulating material and having a connection recess for an electrically conductive element and a cable termination passage sealed at both ends for housing a removable non-expulsive or non-gas forming interrupter. Electrical connectors are provided in the passage for connecting the interrupter to the electrically conductive element and to the high voltage cable. Each of the connectors is molded into electrically conductive sleeves which also surround and electrically shield the interrupter.

**7 Claims, 1 Drawing Figure**





INVENTORS  
EDWIN A. LINK  
EDWARD L. SANKEY

## CURRENT INTERRUPTING SAFE BREAK TERMINATOR

### BACKGROUND OF THE INVENTION

Underground distribution systems are rapidly replacing the conventional overhead distribution system. Due to the low inductance of underground cables, high fault currents can and do occur in these systems. These fault currents often reach a magnitude of 10,000 to 30,000 amps and must be interrupted prior to or at the termination of the cable with the distribution transformer. In a conventional distribution system, fault currents are interrupted by an overhead fuse of the expulsive type, however, this type of fuse is not adaptable to underground use. In the underground system, a "shielded" system is required for safety (dead front).

### SUMMARY OF THE INVENTION

The invention described herein provides a current interrupting connector for interrupting high fault currents which is adaptable to an underground distribution system. This connector incorporates the features of a safe break terminator of the type shown in application Ser. No. 748,142. The connector includes an insulating housing in the form of a termination elbow used in the safe break terminator and a replaceable interrupter which is sealed in the housing. Depending upon fault current magnitude, various interrupters could be employed such as a sand fuse, oil fuse cutout or a vacuum interrupter. The housing is provided with a termination passage with electrical connectors mounted in a spaced relation in the passage to electrically engage the interrupter. One of the connectors is connected to an electrically conductive element which is adapted to be connected to a bushing for the terminator. The other connector is connected to the high voltage cable.

Other objects and advantages of the present invention will become apparent from the following description when read in connection with the accompanying drawing, in which an elevational view is shown of the current interrupting connector mounted on the bushing for a transformer.

### DESCRIPTION OF THE INVENTION

Although the disclosure hereof is detailed and exact to enable those skilled in the art to practice the invention, the physical embodiments herein disclosed merely exemplify the invention which may be embodied in other specific structure.

The current interrupting connector 10 of this invention is used to interrupt fault currents at the electrical connection of a high voltage cable 12 to a bushing 14 provided on a wall of an underground distribution transformer. The bushing 14 forms one part of an electrical connector of the type shown in application Ser. No. 748,142 and includes a housing 22 formed of electrically insulating material having a tapered outer surface 24 and a connection inlet 26. An insulating member 28 of arc extinguishing material is positioned within the connection inlet 26 in coaxial alignment with an electrically conductive sleeve 30 which is connected to electrical apparatus within the transformer.

The high voltage cable 12 includes an electrical conductor 32, either solid or stranded, a cable insulation 34, a semiconductive sheath 36, and an electrically

conductive stranding 38. The cable 12 is prepared for termination by removing the stranding 38 and stripping off the semiconductive sheath 36 to expose a portion of the cable insulation 34. The cable insulation 34 is cut away to expose a predetermined length of the conductor 32. A terminal lug 40 having an axially extending opening 42 at one end is secured to cable 12 by inserting the exposed conductor 32 into the opening 42 and crimping the lug at 44 to secure the lug to the conductor 32. A threaded aperture 46 is provided at the other end of the lug 40.

In accordance with the invention, the current interrupting connector 10 includes a housing 50 in the form of an elbow formed from a resilient insulating material such as clay filled, ethylene propylene terpolymer available under Du Pont's trademark "Nordel" and has a connection recess 52 and a cable termination passage 54 having a reduced diameter section 55. The connection recess 52 is tapered for mating engagement with the outer surface 24 of the housing 22 of the bushing to form a seal on connection. An electrically conductive element 56 having a threaded portion 57 is positioned in the recess 52 for telescopic engagement with the electrically conductive sleeve 30. An insulating member 58 of arc extinguishing material is provided on the end of the conductive element 56 which cooperates with the insulating member 28 in the connection inlet 26 to extinguish the arc on disconnection as described in application Ser. No. 748,142.

Means are provided in the passage 54 for supporting the electrically conductive element 56 in the recess 52. Such means includes an electrically conductive ring 60 having on one side a break or split and on the other side a boss 64 having a threaded aperture 66. The threaded portion 57 of the electrically conductive element 56 is threadedly received in threaded aperture 66.

The ring 60 is supported in the passage 54 by means of a first inner member 70 which is molded in the form of a sleeve from a resilient electrically conductive material such as an ethylene propylene terpolymer available under Du Pont's trademark "Nordel." The inner member 70 includes a portion 72 which forms the inner end of the connection recess 52 and seals the connection recess 52 from the passage 54. The inner member 70 also surrounds the boss 64 and provides an electrical shield around the ring 60 and along a portion of the inside of the passage 54.

Cable termination is provided in the passage 54 by means of an electrical connector 74 having a threaded boss 76 which is threadedly received in the threaded aperture 46 in the terminal lug 40. The electrical connector 74 has a flat base 77 and upwardly extending tangs 78 which converge slightly toward the center of the passage 54.

The connector 74 is supported in the passage 54 by means of a second inner member 80 molded in the form of a sleeve from a resilient electrically conductive material. The second inner member 80 includes a first portion 82 having an inside diameter slightly smaller than the diameter of terminal lug 40 to provide a tight fit on insertion of the terminal lug 40 into the elbow. A good electrical contact is thereby provided between the terminal lug 40 and the inner member 80. The remaining or second portion 84 of the inner member 80 extends axially along a portion of the passage 54 terminating short of the inner member 70.

Means are provided in the cable termination passage 54 to insulate the first member 70 from the second inner member 80 to break the electrically conductive path formed by the inner members 70 and 80 between the split ring 60 and the connector 74. Such means is in the form of a tubular sleeve 75 formed of an electrically insulating material such as Nordel and having a first portion 79, contiguous with the outer surface of the first inner member 70 and a second portion 81 which covers the inner surface of the second inner member 80.

Fault currents in the cable 12 are interrupted by means of a non-expulsive or non-gas forming interrupter 85 which is removably positioned in the passage 54. The interrupter 85 preferably comprises a sand filled type fuse having an insulating tubular body 86 with an electrically conductive cap 88 at each end. The conductive caps 88 are connected by a fuse link 90 provided within the tubular insulating body 86 which is completely filled with sand 92. The interrupter 85 is a conventional type fuse and is capable of interrupting fault currents above 10,000 amperes. Other types of non-expulsive interrupters can also be used depending upon the magnitude of the contemplated fault current such as an oil fuse cutout or a vacuum interrupter.

The electrical circuit between the ring 60 and the electrical connector 74 is completed by inserting the interrupter 85 into the passage 54 until one of the caps 88 is seated against the base 77 of the connector 74 and the other cap 88 is positioned in the split ring 60. In this regard, the split ring 60 has an internal diameter slightly smaller than the outside diameter of the cap 88 to allow the fuse 85 to be inserted through the split ring 60 into the passage 54. The inherent resiliency of the ring 60 will produce an electrical connection between the ring 60 and the caps 88. The tangs 78 on the conductor 74 are bent inward slightly to provide an inherent bias for electrically engaging the cap 88 on the fuse 85.

The cable termination passage 54 is sealed at the open end by means of a cap 93 having a tapered inner surface 94 which matingly engages the outer surface of the housing. The other end of the passage 54 is sealed by means of the engagement of the section 55 with the cable insulation 34. The internal diameter of the section 55 is slightly smaller than the outside diameter of the cable insulation 34.

The outer surface of the housing 50 is electrically shielded by coating the housing with an electrically conductive material 96. An electrically conductive tape 98 is wound around the housing to connect the electrically conductive material 96 to the conductive sheath 36 on the cable 12. The integrity of insulation from the apparatus to the cable will be continuous when the connector 10 is mounted on the bushing 14.

Various of the features of the invention are set forth in the following claims:

What is claimed is:

1. An electrical connector for connecting a high voltage shielded cable to an electrically conductive element positioned within a bushing for an underground electrical apparatus, said connector comprising,  
a housing formed from a resilient dielectric insulating material and having a passage therein,  
an electrically conductive member positioned in said housing and adapted to be connected to the electrically conductive element in the bushing,

means for interrupting current removably positioned in said passage,

first means for electrically connecting said current interrupting means to said electrically conductive member and second means for electrically connecting said current interrupting means to a high voltage shielded cable,

a first inner member formed of an electrically conductive material disposed within and extending axially along a portion of said passage to electrically shield one of said first means and said second means and the corresponding portion of said current interrupting means.

2. The electrical connector according to claim 1 including a second member formed of an electrically conductive material disposed within and extending along a portion of said passage to electrically shield the other of said first means and said second means and the corresponding portion of said current interrupting means and means for electrically insulating said first inner member from said second inner member.

3. An electrical connector for connecting a high voltage shielded cable to an electrically conductive element positioned within a bushing for an underground electrical apparatus, the bushing including an arc extinguishing member at the entry end of the conductive element, said connector comprising

a housing formed from a resilient dielectric insulating material and having a recess which is adapted to sealingly engage the bushing,

an electrically conductive member positioned in said housing and adapted to be connected to the electrically conductive element in the bushing,

an insulating member of arc extinguishing material on the end of said electrically conductive member, means for interrupting current removably positioned in said housing,

first means for electrically connecting said current interrupting means to said electrically conductive member,

said second means for electrically connecting said current interrupting means to the high voltage shielded cable,

a first inner member formed of an electrically conductive material disposed between said first means and said housing to electrically shield a first portion of said current interrupting means,

and a second member formed of an electrically conductive material disposed between said second means and said housing to electrically shield a second portion of said current interrupting means.

4. A connector according to claim 1 wherein said current interrupting means comprises

a sand filled fuse having an insulating housing, an electrically conductive cap at each end of said housing,

a fuse link within said housing electrically connected to said caps,

and sand completely filling said housing.

5. A current limiting unit according to claim 4 wherein said first electrically connecting means comprises

a split ring having an internal diameter slightly smaller than the outside diameter of said caps and a boss integral with said ring for supporting said electrically conductive member.

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6. A current limiting unit according to claim 4 wherein said second electrically connecting means comprises

a base having a number of inwardly disposed tangs to engage one of said caps.

7. An electrical connector for connecting a high voltage cable to a receptacle having an electrically conductive sleeve connected to a high voltage conductor, and an insulating sleeve or arc extinguishing material at the entry end of the electrically conductive sleeve, said connector comprising,

an insulating housing having a connection recess adapted to matingly engage said receptacle and a cable termination passage, said housing being formed from a resilient insulating material,

a pair of electrically conductive connectors supported in a spaced relation in said passage, an electrically conductive element positioned in said recess for insertion into the electrically conductive sleeve and secured to one of said connectors,

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an insulating member of arc extinguishing material on the end of said element,

means for terminating a cable secured to the other of said connectors,

means for interrupting fault currents removably positioned in said passage in electrical contact with said connectors,

means for sealing said passage,

a first inner member formed of an electrically conductive material disposed between one of said pair of electrically conductive connectors and said insulating housing to electrically shield a portion of said current interrupting means,

and a second inner member formed of an electrically conductive material disposed between the other of said pair of electrically conductive connectors and said insulating housing to electrically shield the other portion of said current interrupting means.

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