United States Patent

Klosin

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[45] **June 6, 1972**

[54] ELECTRICAL CONNECTOR

[72] Inventor: **John J. Klosin,** P.O. Box 0320, East Brunswick, N.J. 08816

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[21] Appl. No.: **5,011**

[52] **U.S. Cl.** .....**339/97 C,** 339/276 R

[51] **Int. Cl.** **H01r 11/20**

[58] **Field of Search** 339/95, 97–99, 339/276

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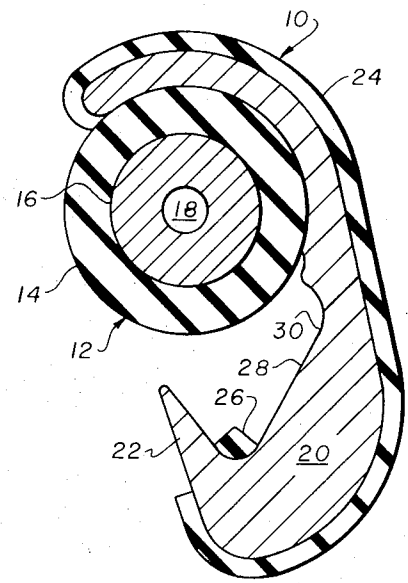
Primary Examiner—Joseph H. McGlynn
Attorney—Lerner, David & Littenberg

[57] **ABSTRACT**

An electrical connector for cables and the like having a current carrying means, a deformable attaching body adapted to at least partially surround a length of the cable, and at least one tooth-shaped penetrating member in electrical contact with the current carrying means of the connector. The attaching body is positioned about the cable and fixed to the cable by means of a compression tool or the like which at least partially deforms the attaching body causing the penetrating member to pierce the cable insulation and contact the inner conductive core of the cable. All external surfaces of the connector may be fully insulated including the penetrating members. Insulation on the connector may be used to seal the connection between the connector and the cable to provide a weatherproof insulated connection.

21 Claims, 23 Drawing Figures



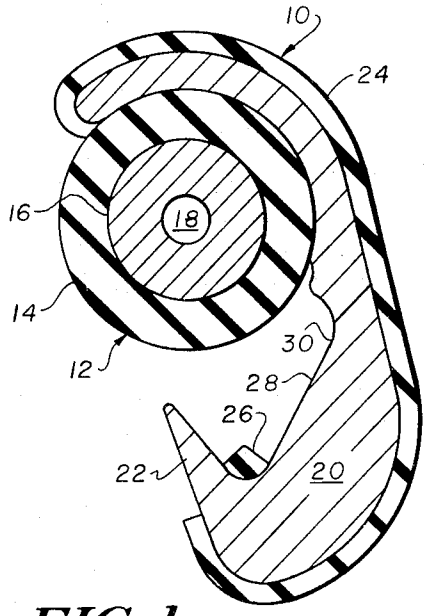


FIG. 1

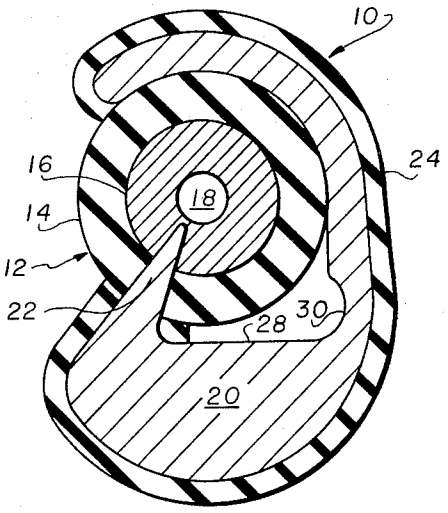


FIG. 2

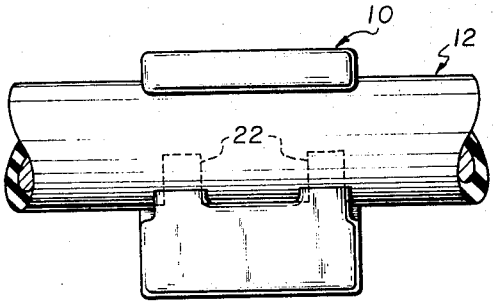


FIG. 3

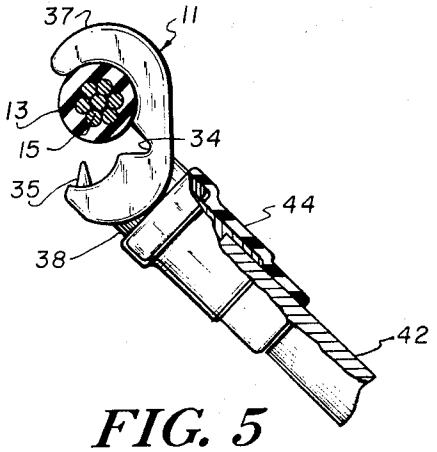


FIG. 5

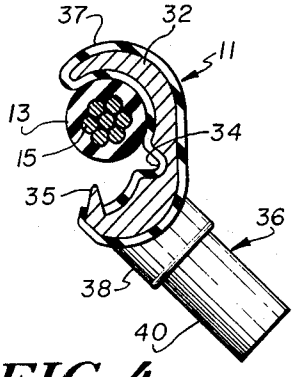


FIG. 4

INVENTOR.
JOHN J. KLOSIN
BY Laurence D. Lerner
ATTORNEY

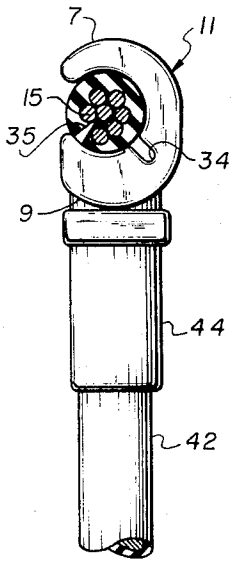


FIG. 6

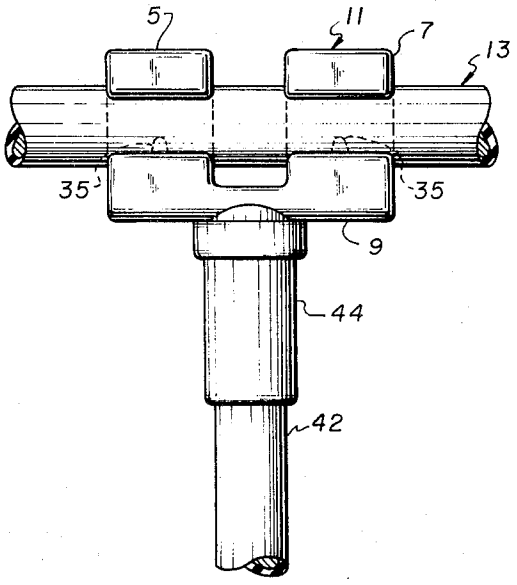


FIG. 7

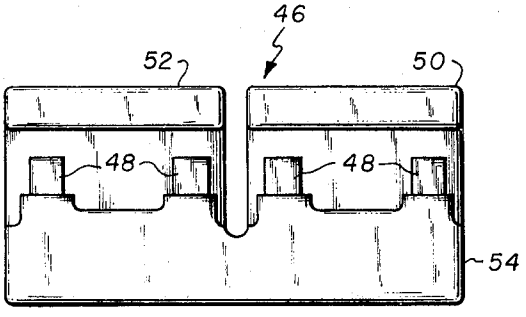


FIG. 8

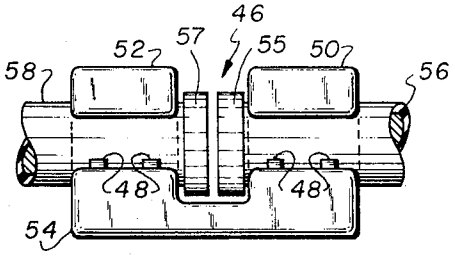


FIG. 9

INVENTOR.
JOHN J. KLOSIN
BY Lawrence J. Fenner
ATTORNEY

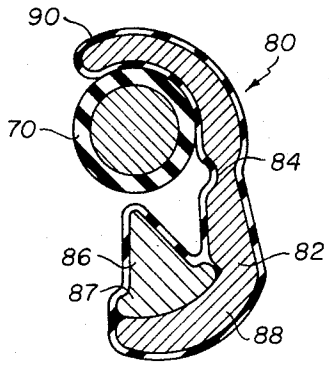


FIG. 10

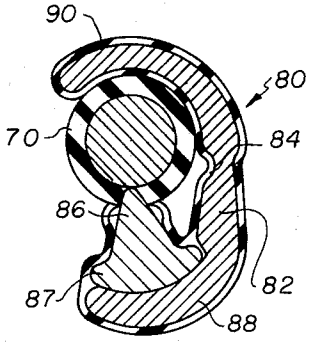


FIG. 11

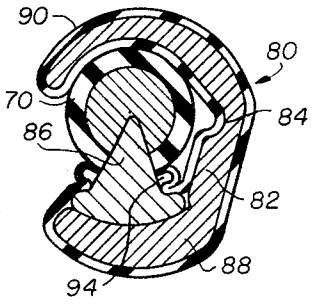


FIG. 12

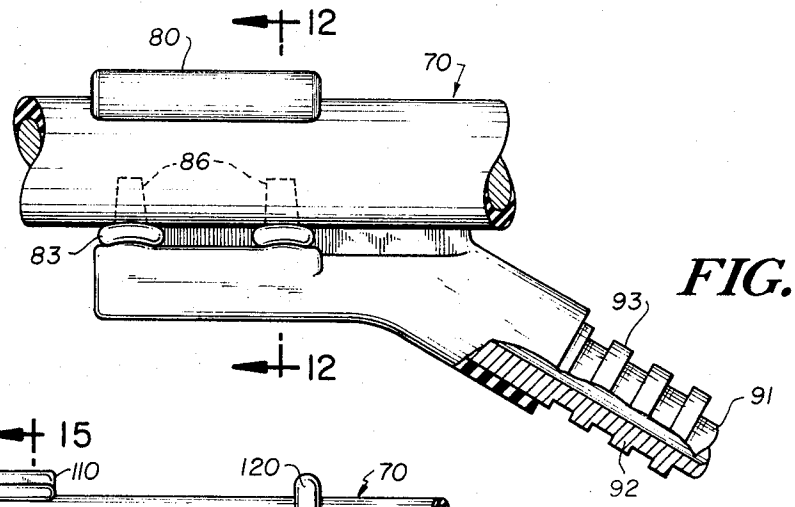


FIG. 13

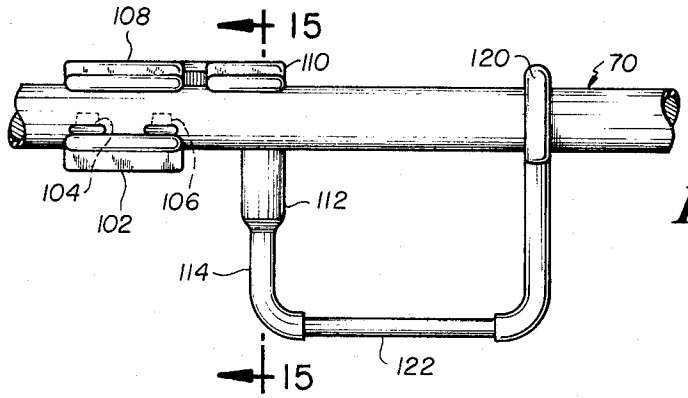


FIG. 14

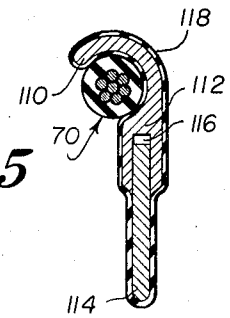


FIG. 15

INVENTOR.
JOHN J. KLOSIN
BY Laurence J. Leeman
ATTORNEY

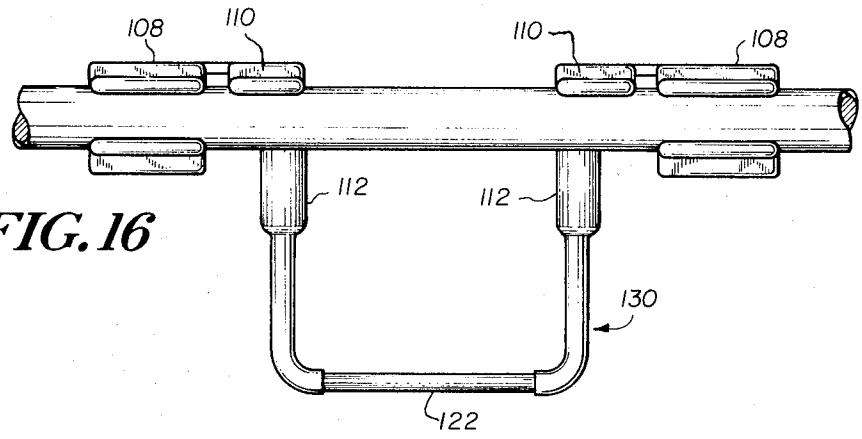


FIG. 16

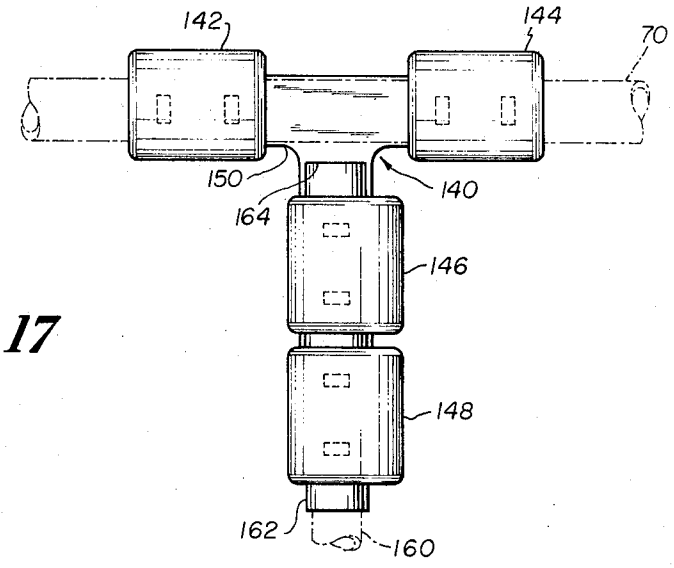


FIG. 17

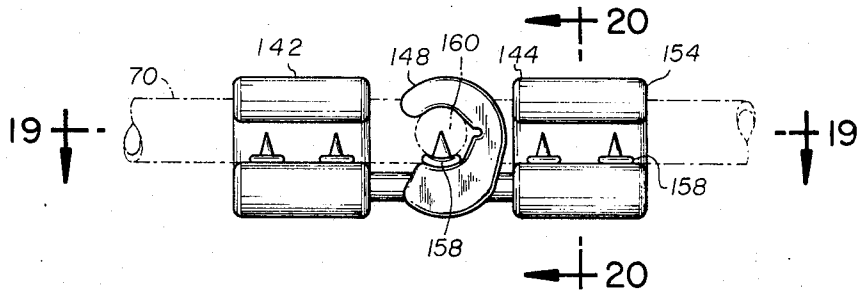


FIG. 18

INVENTOR.
JOHN J. KLOSIN
BY
ATTORNEY

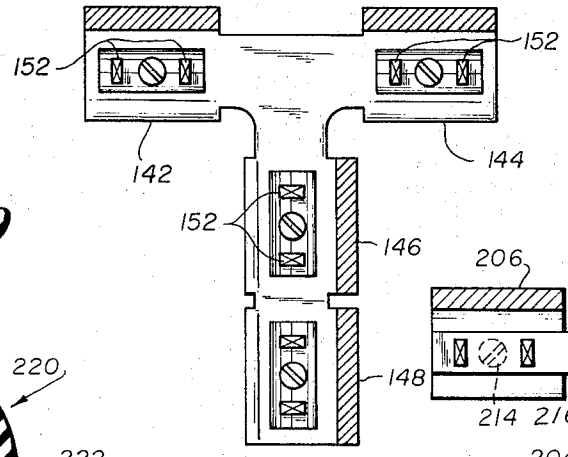


FIG. 19

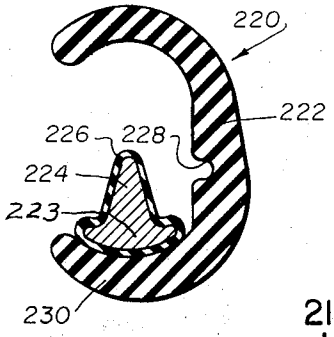


FIG. 23

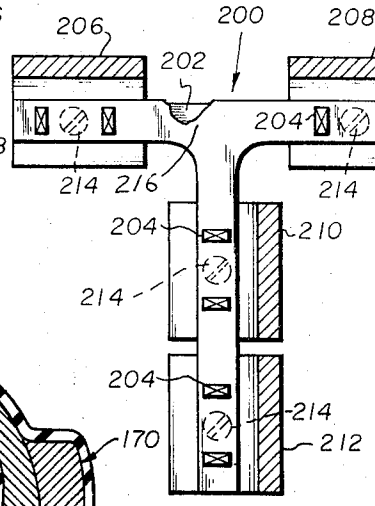


FIG. 22

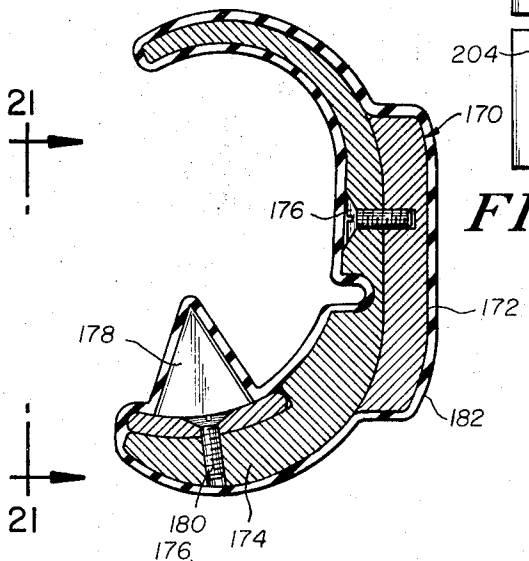


FIG. 20

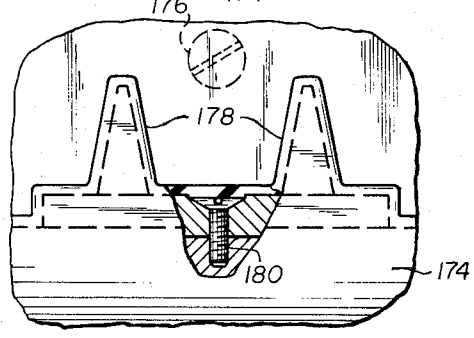


FIG. 21

INVENTOR.
JOHN J. KLOSIN

BY Laurence D. Lerner

ATTORNEY

ELECTRICAL CONNECTOR

BACKGROUND OF THE INVENTION

The present invention will be described with reference to problems found in the electrical utility field though the invention may be used whenever an electrical connection to an electrical conductor is to be made and for any type of electrical connection such as taps, splices, junctions, etc.

Though insulated primary distribution circuits have been operated at voltages ranging from 2,000 to 5,000 volts for many years, many major utilities have now increased, or will be increasing, the voltage of such circuits to voltages approaching 15,000 volts. Some operating systems are installing insulated primary distribution circuits at 23,000 volts.

It has been the practice, in wiring to the lower voltage primary circuits, to first strip the main cable insulation to bare the conductor metal, then install the connector, and thereafter insulate the resultant joint. Such reinsulation is usually accomplished by taping. Electrical linemen often maintained circuits of up to 5,000 volts in accordance with the aforesaid practice, while the circuits are energized, by insulating themselves from the main cable or conductor through the use of rubber gloves covered by leather gauntlets.

Maintenance of high voltage circuits exceeding 5,000 volts has always been more difficult. In view of the safety problems involved in working at these elevated voltages, connectors are applied remotely using insulated live line tools 6 to 12 feet in length. To avoid the problem of stripping cable insulation and re-insulating an electrical connection, many of the high voltage lines are made using bare uninsulated conductors. Screw-type clamps can then be applied to the bare conductor by securing the clamps in the live line tool, hooking the clamp over the conductor, and then fixing the clamp to the conductor by rotating the live line tool until the joint is tight.

Making electrical connections to insulated high voltage circuits above 5,000 volts is more difficult since it requires stripping of the cable insulation. It is also necessary to re-insulate and weather-seal the connection after it has been completed. The reinsulation is extremely important in insulated primary circuits since the conductors are closely spaced and rely on the insulation around each conductor to maintain the potential between phases. An uninsulated connection would therefore cause a short-circuit to an adjacent phase. It is also important to weather-seal the connection since any trapped moisture or contaminants in the cable could cause corrosion and ultimately destroy the conductor.

Present practice in making connections to these insulated cables varies. One common practice is to spread the conductors apart where connections must be made. The conductors are then stripped using the live line tools that operate appropriate stripping tools and then the same clamps used on uninsulated circuits are applied. The clamps are left uninsulated because the space between phases becomes the insulation just as it is in uninsulated circuits.

The problem of stripping the conductors, even when dead, has been further complicated by the present extensive use of greatly improved plastic cable insulations. Many of the new insulating materials, like high density polyethylene, are substantially rigid and hard. While these insulations have tremendous appeal because they resist abrasion from trees and tree limbs much better than conventional rubber insulation, they are extremely difficult to remove from the conductor. Thus, special expensive stripping tools are required. In some areas such insulations are burned off with propane torches. The insulation applied to the newer cables is often not as adequate as the insulation which has been stripped off.

SUMMARY OF THE INVENTION

This invention provides an electrical connector for an insulated electrical conductor. The present connector permits an insulated electrical connection to be made by merely fixing the connector to the line conductor. The connector thus eliminates the need for insulation stripping and since it can be pre-insulated also eliminates the need for reinsulation after the connection is made. Further, the connector may be installed by a workman located at a safe distance from a high voltage line by the use of standard tools with insulated extensions of, for example, 4 to 6 feet long. Thus, the connector can be gripped by a tool, placed over the line, and fixed into place. Safety is promoted whenever the connector is used since the conductor is not bared.

The connector comprises a conductive element, a deformable attaching body adapted to at least partially surround the live cable to be tapped and a rigid conductive penetrating member electrically connected to the conductive element of the connector. The conductive components of the connector may be completely insulated along at least their outer surfaces when installed on the line cable to provide an insulated connection after the connection is completed. The penetrating member is disposed in the connector so that, upon at least a partial deformation of the attaching body, the penetrating member will pierce the cable insulation and contact the electrically conductive core thereof

When the penetrating member and other conductive components of the connection are fully covered with insulation, the process of fixing the attaching body to the cable causes the penetrating member to pierce its own insulation as it progresses into the cable. This stripped insulation is formed into a weather-proof sealing means between the conducting portions of the connector and the cable.

Accordingly, it is an object of the present invention to provide an improved electrical connector for cables.

Yet, another object of the present invention is to provide an improved electrical connector for cables and the like which can be safely installed in high voltage circuits.

Still another object of the present invention is to provide an electrical connector for cables and the like which can be easily installed in high voltage lines and operate with high reliability.

A further object of the present invention is to provide an improved electrical connector for cables and the like which is highly adaptable to a wide variety of installations.

Yet another object of the present invention is to provide an improved electrical connector for cables and the like which can be easily installed by workmen who are positioned remotely from the point of the connection.

Still another object of the present invention is to provide an improved electrical connector for cables and the like which can be installed on insulated lines without requiring the stripping of the insulation from the line to be tapped.

A further object of the present invention is to provide an improved electrical connector for cables and the like which can be installed on an insulated line and requires no re-insulation after the installation.

Yet another object of the present invention is to provide an improved electrical connector for cables and the like which connector when installed will provide a self-insulating connection.

A further object of the present invention is to provide an improved electrical connector for cables and the like which when installed on an insulated cable will provide a weather proof installation.

Still a further object of the present invention is to provide an improved electrical connector for cables and the like which can be fabricated from relatively simple components requiring a minimum of manufacturing processes.

A further object of the present invention is to provide an improved electrical connector for cables and the like which can be fabricated from standard relatively inexpensive materials used in the electrical industry.

Still a further object of the present invention is an improved electrical connector for cables and the like which can be used to join two or more cables.

Other objects and advantages will be apparent from the following description of the embodiments of the invention, and the novelty features will be particularly pointed out hereinafter in connection with the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view in cross section of a connector in accordance with the invention positioned about an electrical conductor;

FIG. 2 is a side elevational cross sectional view of the connector of FIG. 1 after having been compressed to make the connection;

FIG. 3 is a front elevational view of the connection of FIG. 2;

FIG. 4 is a side elevational view of a connector in accordance with the invention with the connector body shown in cross section;

FIG. 5 is a side elevational view of the connector of FIG. 4 in partial section;

FIG. 6 is a side elevational view of the connector of FIG. 5 shown after connection to an electrical conductor;

FIG. 7 is a front elevational view of the connection of FIG. 6;

FIG. 8 is a front elevational view of a splice connector in accordance with the invention;

FIG. 9 is a front elevational view of the splice connector of FIG. 8 shown connected to two electrical conductors;

FIG. 10 is a side elevational view in cross-section of another embodiment of a connector built in accordance with the teachings of the present invention positioned about an electrical conductor;

FIG. 11 is a side elevational cross-sectional view of the connector of FIG. 10 after having been partially compressed to make the connection.

FIG. 12 is a side elevational cross-section view of the connector of FIG. 10 after completion of the connection;

FIG. 13 is a front elevational view of the connector of FIG. 12;

FIG. 14 is a front elevational view of another embodiment of the invention adapted to provide a temporary connection to a conductor;

FIG. 15 is a side elevational view along Line 15—15 of FIG. 14;

FIG. 16 is a front elevational view of a modification of the connector shown in FIG. 14;

FIG. 17 is a front elevation of another embodiment of a connector build in accordance with the invention in the form of a T shape;

FIG. 18 is a bottom view of FIG. 17;

FIG. 19 is a sectional view along lines 19—19 of FIG. 17;

FIG. 20 is a cross-sectional view of a connector built in accordance with the invention showing the construction of the penetrating member;

FIG. 21 is a view along lines 21—21 of FIG. 20, partially in section.

FIG. 22 is a top view, partially in section, of another embodiment of a T-shaped connector built in accordance with the teachings of the present invention.

FIG. 23 is a cross sectional view of another embodiment of a connector built in accordance with the teachings of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1, 2 and 3, a connector 10 in accordance with a preferred embodiment of the invention is shown. The connector 10 is shown in FIG. 1 before connection to an electrical conductor 12 and in FIGS. 2 and 3 after connection thereto. Electrical conductors with which the invention would generally be used comprise an insulating outer layer or layers and an electrically conductive inner core. The inner core may comprise strands of material, solid material, etc. As shown in FIGS. 1–3, the electrical conductor 12 has an insulating coating made up of two layers 14 and 16 of insulating material which surround a solid inner conductive core 18.

The connector 10 comprises an attaching body 20 made from a fairly rigid, malleable, electrically conductive material, such as aluminum, as shown in the drawings. It is generally C-shaped in cross-section though it could be of many other shapes as will be discussed hereinafter. Connected to the attaching body 20, or integral therewith as shown, are two tooth-like penetrating members 22. The penetrating members need not be restricted in shape. They could be a solid ridge of penetrating material, be wedge-shaped, conical, or any other configuration adequate to pierce the insulation.

A layer of insulating material 24 covers the outer surfaces of the attaching body 20. In addition, insulating material 26 may be disposed between the inner end of the penetrating members 22 and the lower portion of the inner surface 28. It will be noted from FIG. 2 that the insulating material 26 functions to provide a positive seal for the electrical conductor 12 when the connection is completed. The attaching body 20 also comprises a weakened portion 30, the function of which will be more fully discussed hereinbelow.

To form a connection, the connector 10 is positioned about the electrical conductor 12 as shown in FIG. 1. A compression tool (not shown) of the type well known in the art equipped with suitable dies to handle the connector 10 is then disposed about the connector. In the alternative, the connector could first be positioned in a compression tool which tool may be disposed on the end of a live line pole.

The connection is made by operating the compression tool to deform the attaching body, thereby closing the body about the conductor. The penetrating members 22 thereby pierce the insulating layers 14 and 16 and contact the core 18.

The weakened portion 30 of the attaching body 20 is positioned and constructed to facilitate bending thereabout so that, upon deformation of the body the penetrating members pivot about the weakened area and enter the layers of insulation 14 and 16 of the electrical conductor in a direction toward the center of the electrical conductor and continue in such direction until contacting the inner core 18, at which predetermined distance the dies of the compression tool touch, preventing further penetration.

Referring now to FIGS. 4–7, a tap connector 11 in accordance with the invention is shown. It will be seen in FIG. 7 that the connection 11 differs from the connections shown in FIGS. 1–3 in that it has separate C-shaped attaching bodies 5 and 7 joined by a common bottom frame portion 9. Weakened portions 34 are provided (only one being shown) which function similarly to the weakened portion 30 of the embodiment of FIG. 1. Tooth-like penetrating members 35 extend from the inner periphery of the bottom portion of each attaching body.

An insulating layer 37 completely covers the connector 11. The insulating layer 37 provides an additional safety factor in insulating the weakened area 34 as well as the interior area adjacent thereto which areas do not contact the electrical conductor after a connection is made and thus would otherwise provide a "live" surface.

A tap wire connecting member 36 of rigid, conductive material is shown connected to the frame portion 9 though it could be connected to either attaching body. The juncture of the tap wire connecting member 26 and the frame portion 9 is covered by a layer of insulating material 38. A bared portion 40 of the tap wire connecting member 36 is provided for connection to a tap wire 42, the tap wire being shown in FIGS. 5–7 after connection to the connecting member 36.

The tap wire connecting member 36 could be in the form of an attaching body in accordance with the present invention whereby a compression tool could be used to attach the tap wire connector 11 to the tap wire 42 and to attach the connector 11 to the main line 13.

An insulating boot 44 is provided for insulating the connection between the tap wire 42 and the tap wire connecting member 36. This is accomplished by first sliding the boot 44 back along the tap wire 42, then connecting the tap wire to the connecting member 36, and thereafter sliding the insulating boot 44 over the connection.

The electrical conductor or main line 13 is of the stranded cable type including an electrically conductive core comprising a plurality of strands 15 of conductive material. Such strands are usually woven together in a helical pattern. If the

lay of the strands is known and special connectors are desired for a particular application, the penetrating members **35** can be spaced to conform with the cable lay to thereby enter between strands at a like point in the helix. It will be seen in FIG. **6** that the penetrating members **35** enter between strands. Thus, the penetrating members **35** can have relatively blunt ends which push the contacted strands aside providing both closer compacting of the strands **15** for better electrical contact and also an area contact between the strands and the penetrating members **35**.

After the tap wire **42** has been connected to the tap wire connector **36**, the connector **11** is positioned about the main line **13** and clamped to form a connection therewith in the manner previously described, the completed assembly being shown in FIGS. **6** and **7**.

A splice connector **46** in accordance with the invention is shown in FIGS. **8** and **9**. The splice connector **46** comprises a plurality of tooth-like penetrating members **48**. The illustrated splice connector **46** comprises separate attaching bodies **50** and **52** joined by a common frame bottom-portion **54**.

A completed splice is shown in FIG. **9** in which an electrical conductor **56** is clamped in the attaching body **50** and an electrical conductor **58** is clamped in the attaching body **52**. To seal the ends of the cables from moisture, cable caps **55** and **57** are installed before assembly on cables **56** and **58** respectively. The frame **54** via the penetrators **48** electrically attaching bodies **50** and **52** connects the electrical conductors **56** and **58** to each other. Caps **57** and **55** could also be extended along the length of the connectors and secured by pressure from attaching bodies **52** and **50** respectively.

Referring now to FIGS. **10**, **11** and **12** another embodiment of a tap connector built in accordance with the teachings of the invention is shown. The tap connector generally indicated as **80** comprises a deformable attaching body **82** having a weakened portion **84** similar to the embodiment of the connector shown in FIG. **1**. A separate penetrating member **86** with a broad base section **87** is mounted in the lower portion **88** of the attaching body. An insulating layer **90** covers the entire attaching body **82** including the penetrating member **86**. Thus, when the connector of FIG. **10** is compressed around insulated cable **70** to penetrate the cable **70** as shown in FIGS. **11** and **12**, the insulating layer **90** covering the penetrating member **86** prior to its penetration of cable **70** is compressed toward base **87** of penetrating member **86** to form an insulating cushion **94** which further seals the connection.

Since the insulating cushion **94** is formed by the stripping of the insulation **90** back along the penetrating member **86** as the penetrating member enters the conductor **70**, the insulating cushion, when formed, surrounds the entrance of the penetrating member **86** into the conductor **70**. As the connection is completed, as shown in FIG. **12**, the insulating cushion **94** is compressed between the lower portion **88** of the attaching body and the conductor **70** to provide a weather tight seal for the connection, as well as to electrically insulate the connection.

As shown in FIGS. **10**, **11**, and **12**, the separate penetrating member **86** has an enlarged base section **87**. It should be mentioned, however, that the shape of the penetrating member is not a critical factor in the formation of the insulating cushion. Therefore, a suitable penetrating member could be made from a wide selection of shapes.

FIG. **13** illustrates a modification of the connector of FIG. **10** shown in a side view. In this modification the tap connector **80** utilizes two penetrating members **86** which are shown penetrating the cable **70**. The tap additionally comprises a lead off segment **91** having a cylindrical hole **92** drilled axially therein into which the bare ends of a take-off cable (not shown) may be inserted. This take-off cable is sealed into the lead off portion by a clamping procedure well known in the art which produces crimp rings **93** in the lead off segment.

Connectors which allow a tap line to be detached from the conductor can be built in accordance with the present invention. FIGS. **14**, **15** and **16** illustrate two embodiments of connectors for detachable tap lines.

In FIG. **14**, a connector for detachable tap lines, shown generally as **100**, has an attaching body **102** with two penetrating teeth **104** and **106** connected to a conductor **70**. The upper portion **108** of attaching body **102** has an extension **110** which runs along the top of the conductor and then turns downward into a lead off section **112**. A U-shaped attaching bar **114**, formed from a conductive material, is connected into a receiving passage **116** in the lead off section. The attaching body **102**, the upper extension **100**, the lead off section **112**, and the attaching bar **114** are all coated with an insulating layer **118**. The other end of attaching bar **114** is bent into a hook shaped section **120** and is hung onto the conductor **70** to provide additional support for the connector.

The lower portion **122** of the U-shaped attaching bar **114** is stripped of the insulating layer **118** to expose the conductive material which is in electrical contact with the conductor by means of the attaching body previously described. The exposed portion of the attaching bar provides a suitable surface to which a detachable tap line can be connected by means of screw connectors or other well known connectors operated by workmen from relatively remote locations using "live line poles."

A second embodiment of a connector for detachable tap lines is shown generally as **130** in FIG. **16**. This connector is similar to that shown in FIGS. **14** and **15** with the exception that the right hand portion of the connector is symmetrical with the left hand portion of the connector thereby doubling all of the components shown on the left hand side of FIG. **14**, namely, the attaching body **120**, the upper extension **110**, and the lead off section **112**. This symmetrical connector has a capacity to carry twice the current load of that carried by the connector shown in FIGS. **14** and **15**, since the number of attaching bodies has been doubled and accordingly the number of penetrating members which contact the conductors have also been doubled.

FIGS. **17**, **18** and **19** show an embodiment of a T-shaped connector generally indicated as **140**. As seen in FIG. **17** the connector has an attaching body **142** in the upper left hand portion of the T, an attaching body **144** in the upper right hand portion of the T, and attaching bodies **146** and **148** in the stem of the T. The attaching bodies are joined together by a frame **150** of conductive material. Each attaching body has a separate set of penetrating members all similarly numbered as **152** and shown in FIG. **19**. Any portion of the connector or the entire connector, as shown in FIGS. **17**, **18** and **19**, is coated with a layer of insulation **154** as previously described in the embodiment of the invention shown in FIGS. **10**, **11** and **12**.

In a manner similar to that described above, the layer of insulation **154** will be stripped from the penetrating members **152** as the attaching bodies are deformed and the penetrating members enter the connector **70**. The stripped insulation will form insulating cushions designated as **158** and shown in FIG. **18**, insulating and weatherproofing the connections made to the conductor.

As shown in FIG. **17** the connector is being utilized to tap a conductor **70** and to transmit the power from conductor **70** to a take off line **160** which is in turn fastened to the connector through the lower attaching bodies **146** and **148**. A protective sleeve **162** is fitted over the end of the take off cable **160** prior to its installation in the connector to prevent the entrance of moisture into the cable strands that are exposed in the end **164** of the cable **160**.

As seen in FIG. **19**, there are two attaching bodies **146** and **148** in the stem section of the T to equal the two attaching bodies **142** and **144** located in the arms of the T. Therefore, there will be equal facilities to draw the current from conductor **70** and to transmit this current into the take off cable **160**.

It should be pointed out that this embodiment is ideally suited for use as a junction box. As shown in FIG. **19**, attaching bodies **142** and **144** in the arms of the T could be attached to separate conductors in a manner similar to that shown in FIG. **9**, and a third conducting line could be attached and joined by attaching it to either or both of the attaching

bodies **146** and **148** and the stem of the T. This configuration would allow the joining of three separate conductors. It should further be pointed out that the same principle can be used to make an X-shaped connector which could join four conductor cables, etc.

FIGS. **20** and **21** show a cross section view of a connector generally indicated as **170**. The connector has a frame **172** to which is secured an attaching body **174** by a screw means **176**. A penetrating member **178** is in turn connected to the bottom of the attaching body **174** by a screw means **180**. The entire assembly is coated with a layer of insulating material indicated as **182**.

This assembly illustrates the fact that the entire connector need not be fabricated from a single piece of material nor even from the same type of material. For example, harder materials can be used to form the penetrating members while softer, or cheaper, or more easily fabricated materials can be used for other parts of the connector. Additionally, other well known attaching means other than screws, such as welding, riveting, etc., could be used to secure the components of the conductor.

FIGS. **22** and **23** show embodiments of the invention in which the penetrating member is connected directly to the current carrying means, and the deformable attaching body is attached to the current carrying means by conventional fastening means, and not directly connected to the penetrating member.

FIG. **23** shows a cross sectional view of a connector indicated generally as **220** having a deformable attaching body **222** fabricated from an electrical insulating material, connected to a current carrying means **223** referred to as a "buss" member, by conventional fastening means (not shown). A penetrating member **224** is shown as being integrally formed with and extending directly from current carrying means **223**. Of course, the penetrating member could be attached to the current carrying means in the same manner that the penetrating member is connected to the attaching body in FIG. **20**. The "buss" member **223** and penetrating member **224** are completely coated with a layer of insulation **226**. Attaching body **222** need not be fabricated from a conductive material because in this construction of the connector there is no direct connection between the penetrating member and the attaching body. Therefore, the attaching body would have to be insulated only when it is fabricated from a conductive material.

Attaching body **222** has a weakened portion **228** which performs the same function as the other weakened sections of the attaching bodies previously described. The attaching body is connected at its bottom portion **230** to "buss" member **223** by any convenient attaching means (not shown) as previously described.

It should be noted that the connection shown in FIG. **23** is very similar in cross section to the connector shown in FIG. **10**. It should be apparent, therefore, that the connection shown in FIG. **10** could be constructed using a "buss" member in the same manner as the connector shown in FIG. **23**.

FIG. **22** shows a connector, generally indicated as **200**, for connecting a plurality of lines. The connector is constructed in a manner similar to the connector shown in FIGS. **23** and **10**. In this construction, the "buss" member forms the T frame **202** of the connector, and the penetrating members **204**, cast with the "buss" member **202** as a single unit, extend directly from the "buss" member. Deformable attaching bodies **206** and **208** on the left and right arms respectively of the T shaped connector **200** and deformable attaching bodies **210** and **212** on the upper and lower sections respectively of the leg of the T-shaped connector are all secured to "buss" member **202** by means of screws **214**. The entire surface of connector **200** is covered with a layer of insulation **216**.

It will be appreciated from the foregoing that an electrical connector built in accordance with the invention can be used to form any type of electrical connection with an electrical conductor having an outer insulation layer. Further, the connecting operation itself is greatly simplified since it eliminates the requirement for stripping the insulating layer from the conductor and then reinsulating and weatherproofing the connection after it has been made. Additionally, the safety features of the conductor are considerable.

It will be understood that various changes in the details of the materials and arrangements of parts which have been herein described and illustrated in order to explain the nature of the invention may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

I claim:

1. An electrical connector for electrical conductors having an outer layer of insulating material and an inner core of electrically conductive material, said connector comprising:

means to carry current;

a deformable attaching body operatively associated with said means to carry current and adapted for disposition about a conductor; and

at least one penetrating member of electrically conductive material in electrical communication with said means to carry current, said penetrating member disposed and adapted to penetrate said outer layer of insulating material to contact the inner conductive core of the conductor upon deformation of the attaching body about the conductor so that current will be carried from the core of the conductor to said means to carry current, a layer of insulating material, covering the entire connector.

2. An electrical connector for electrical conductors having an outer layer of insulating material and an inner core of electrically conductive material, said connector comprising:

means to carry current;

a deformable attaching body operatively associated with said means to carry current and adapted for disposition about a conductor; and

at least one penetrating member of electrically conductive material in electrical communication with said means to carry current, a layer of insulation covering at least said penetrating member and the exposed surfaces of said connector adjacent thereto.

3. The combination claimed in claim **2** wherein said deformable body is shaped to partially conform to the shape of the conductor with said penetrating member being disposed with relation to said connector so that the insulation on said penetrating member will be stripped from said penetrating member by the conductor to form an insulating cushion between said connector and the insulating layer of said conductor upon deformation of said attaching body about said conductor.

4. The combination claimed in claim **3** wherein said attaching body has a weakened portion adapted to give upon said deformation of said attaching body to cause said penetrating member to penetrate said conductor in a direction toward the center of the conductor.

5. A combination claimed in claim **3** wherein said penetrating member has a relatively rounded end disposed remotely from said attaching body, said remote end adapted to provide an area contact with said electrically conductive inner core of said conductor upon deformation of the attaching body about the conductor.

6. The combination claimed in claim **3** further comprising a plurality of penetrating members spaced to conform to a predetermined cable lay of a multi-strand conductor.

7. The combination claimed in claim **3** wherein said deformable attaching body is made from electrically conductive material.

8. The combination claimed in claim **7** wherein said connector is made from aluminum.

9. The combination claimed in claim **3** wherein said deformable attaching body is generally C-shaped in cross section.

10. The combination claimed in claim **9** wherein said penetrating member is connected to said attaching body on the inner part of said C cross section near one end of said C.

11. The combination claimed in claim 3 wherein said means to carry current includes a tap wire connecting member of conductive material electrically communicated with said penetrating member.

12. The combination claimed in claim 11 wherein said tap wire connecting member comprises:

a. a lead off segment of electrically conductive material electrically communicated to said deformable attaching body; and

b. a passage in said lead off segment adapted to receive a take off cable.

13. The combination claimed in claim 3 further comprising:

a plurality of penetrating members disposed in spaced relation to provide means for penetrating a plurality of electrical conductors;

a plurality of deformable attaching bodies operatively associated with said plurality of penetrating members and connected to said means to carry current so that deformation of said plurality of deformable attaching bodies will cause said plurality of penetrating members to penetrate a plurality of conductors and electrically connect said plurality of conductors through said means to carry current,

said plurality of penetrating members being connected to said means to carry current,

said penetrating members being connected to said deformable attaching bodies,

said deformable attaching bodies being shaped to partially conform to the shape of the conductor with said penetrating members being disposed with relation to said connector so that the insulation on said penetrating members will be stripped from said penetrating members by the conductor to form an insulating cushion between said connector and the insulating layer of said conductor upon deformation of said deformable attaching bodies about said conductor.

14. The combination claimed in claim 13 further comprising a layer of insulation at least partially covering said connector.

15. The combination claimed in claim 13 further comprising a layer of insulation covering the entire connector.

16. The combination claimed in claim 13 wherein said connector is made from aluminum.

17. The combination claimed in claim 13 wherein:

said means to carry current include frame means; and

each of said plurality of penetrating members is operatively connected to an operatively associated deformable attaching body.

18. The combination claimed in claim 13 wherein said means to carry current include a "buss" member.

19. The combination claimed in claim 13 wherein said means to carry current includes an attaching bar.

20. The combination claimed in claim 11 further comprising an attaching bar connected to said tap wire connecting member.

21. The combination claimed in claim 20 wherein said attaching bar includes a hook shaped portion adapted to fit over a conductor and to be supported thereby.

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