Dec. 26, 1967 C. H. RONGEY ET AL 3,360,763

PLUG AND RECEPTACLE FOR USE IN HAZARDOUS LOCATIONS

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Fig. 1.

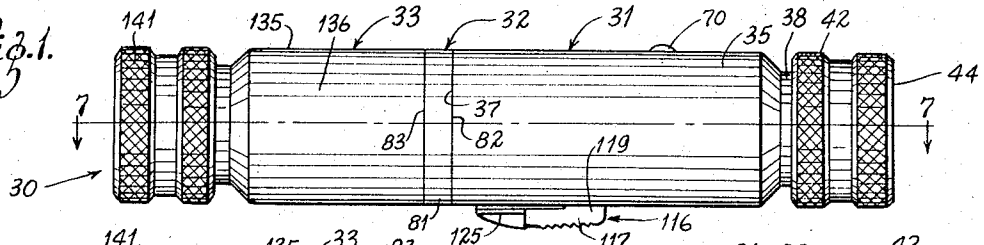


Fig. 2.

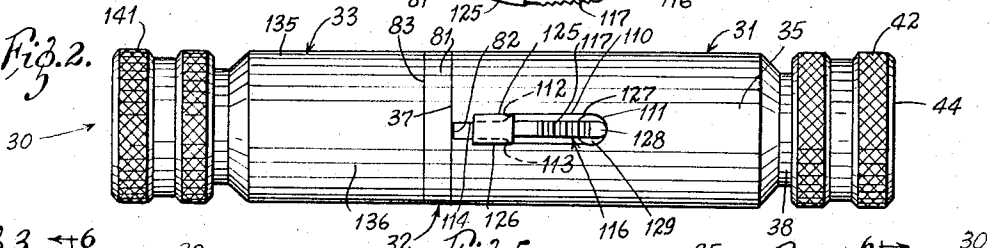


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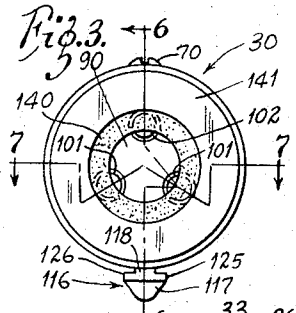


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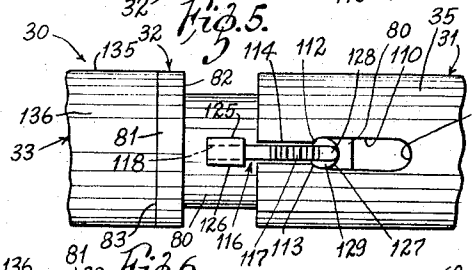


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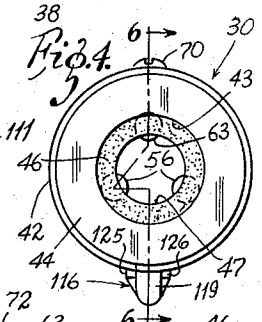


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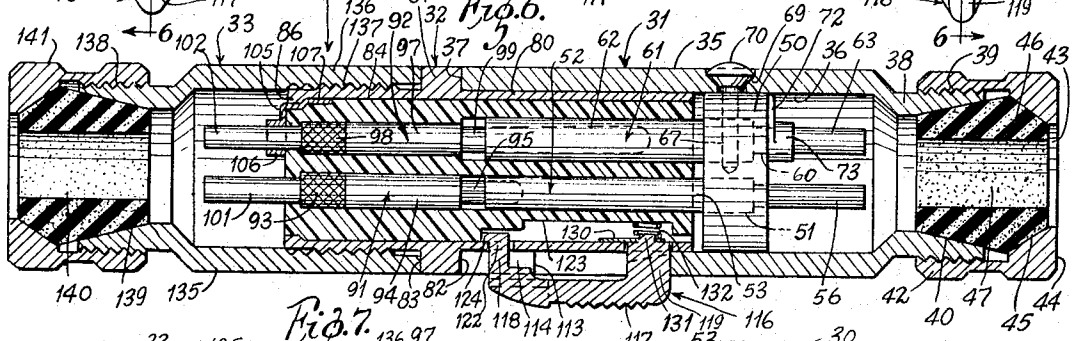


Fig. 7.

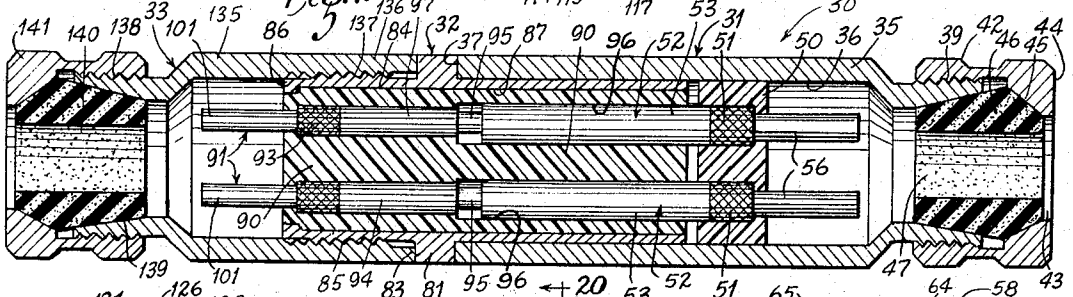


Fig. 16.

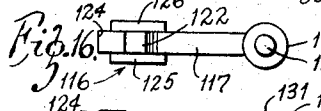


Fig. 17.

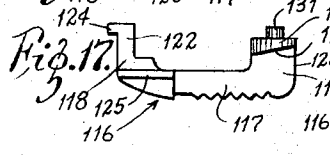


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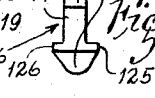
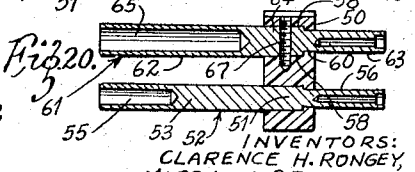


Fig. 19.



Fig. 20.



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PLUG AND RECEPTACLE FOR USE IN HAZARDOUS LOCATIONS

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Fig. 8.

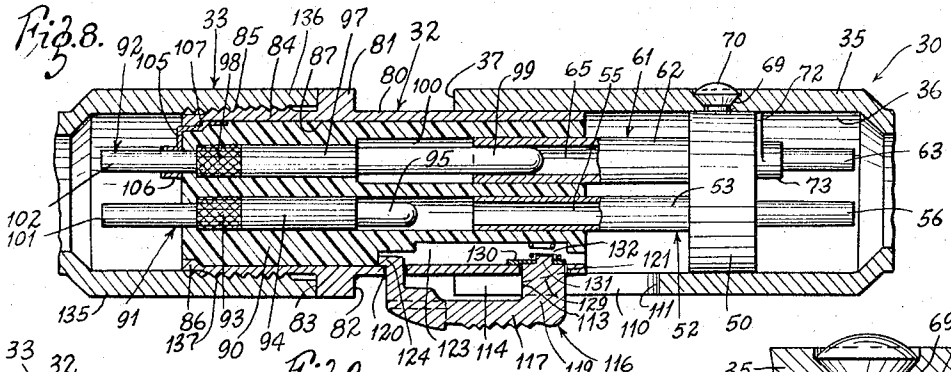


Fig. 9.

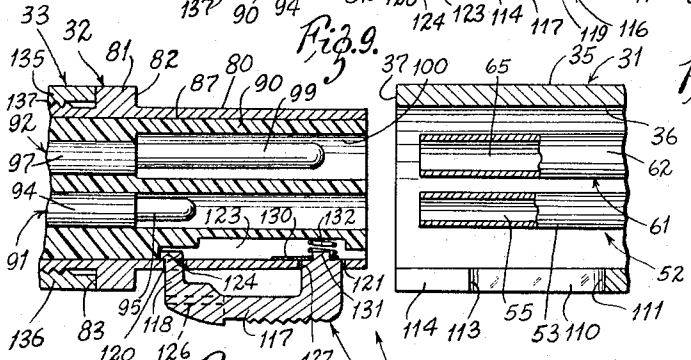


Fig. 10.

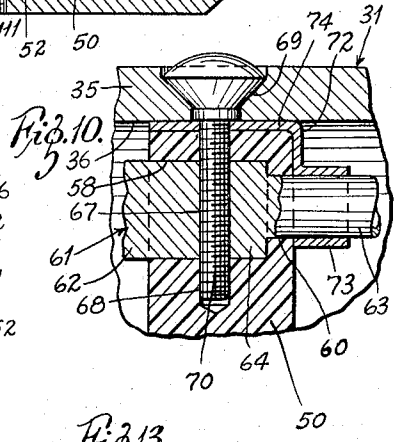


Fig. 11.

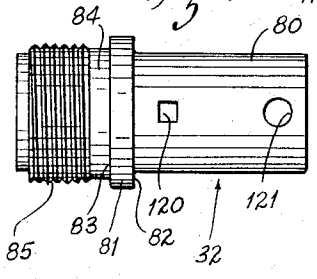


Fig. 12.

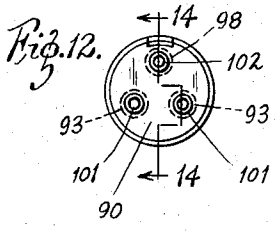


Fig. 13.

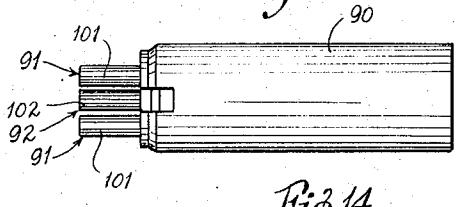


Fig. 14.

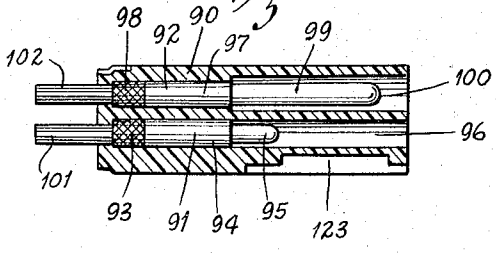
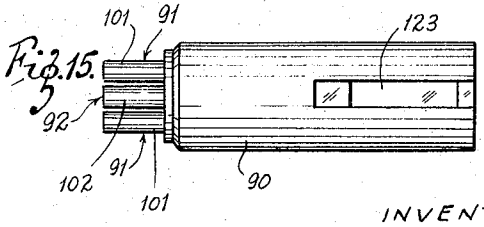


Fig. 15.



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3,360,763

PLUG AND RECEPTACLE FOR USE IN HAZARDOUS LOCATIONS

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Filed May 26, 1965, Ser. No. 458,956
4 Claims. (Cl. 339—14)

ABSTRACT OF THE DISCLOSURE

A plug and receptacle for use in hazardous locations, the plug and receptacle each being formed with a cylindrical or sleeve body sized to be telescoped together. Releasable interlocking means hold the sleeves in telescoping relationship.

Summary of the invention

In general, the invention comprises a plug and receptacle, each formed with a cylindrical or sleeve body. The sleeves are of different diameters so that they can be telescoped together. Contact elements are supported within the sleeves by insulators and are disposed to make contact when the two sleeves are pressed together in telescoped relationship. The contact elements are constructed so that they must be properly oriented before they can make contact with one another.

The sleeves are sufficiently long so that they are in telescoped relationship prior to the establishment of electrical contact between the contact elements. There is a depressible interlock button carried by one of the sleeves that cooperates with a slot in the other sleeve to prevent complete separation of the sleeves until the interlock button is depressed. However, there is a lost motion relationship between a portion of the interlock button and the slot to enable the electrical contact between the contact elements to be broken before the sleeves are completely separated from one another. The interlock button is also constructed to prevent complete separation of the sleeves until the interlock button is depressed. Thus, the plug and receptacle are designed to break the electrical contact upon the occurrence of an internal explosion or sudden withdrawal of the plug, without exposing the contact elements to the explosive atmosphere outside the telescoped sleeves.

The general object of this invention is to provide a plug and receptacle for use in a hazardous location whereing the contact elements are arranged to permit a break in the electrical contact. The plug and receptacle are constructed to prevent arcing of the contact elements to the atmosphere surrounding them even upon breaking of the electrical contact.

Another object of the invention is to provide a plug and receptacle for use in hazardous locations wherein the plug and receptacle have cooperating housing parts to enclose contact elements and wherein there is an interlock between the plug and receptacle housings to permit them to slide relative to one another for breaking the electrical contact between their contact elements, while preventing complete separation of the housing elements until the interlock is positively operated.

Another object of the invention is to provide a plug and receptacle for use in a hazardous location, with an adapter to permit the receptacle to be used as a cord connector with conducting wires connected to it or to the receptacle, wherein the adapter may be threaded into an opening in the wall of a device suitable for use in a hazardous location.

Another object of the invention is to provide a plug and receptacle for use in a hazardous location wherein the construction of parts is such that the replacement of complete contact assemblies consisting of insulators and contacts is expedient and can be done rapidly and economically.

Other objects and advantages will be apparent to those skilled in the art.

In the drawings:

FIGURE 1 is a side elevation view of the connector and receptacle assembled together with the adapter in place;

FIGURE 2 is a side elevation view of the receptacle of FIGURE 1 rotated 90°;

FIGURE 3 is a left end view of the plug and receptacle of FIGURE 1 on a slightly enlarged scale;

FIGURE 4 is a right end view of the receptacle of FIGURE 1 on a slightly enlarged scale;

FIGURE 5 is a fragmentary side elevation of the receptacle of FIGURE 2, but with the plug and receptacle shown in the positions they would occupy when electrical contact is broken but the interlock button has not released the plug and receptacle;

FIGURE 6 is a view in section taken along the line 6—6 of FIGURE 3 and of FIGURE 4;

FIGURE 7 is a view in section taken along the line 7—7of FIGURE 1 and of FIGURE 3;

FIGURE 8 is a fragmentary view in section similar to that of FIGURE 6, but showing the plug and receptacle in the positions they occupy upon breaking the electrical contact, such as upon the occurrence of an emergency, corresponding to the view of FIGURE 5;

FIGURE 9 is a fragmentary view in section similar to that of FIGURES 6 and 8, but showing the plug and receptacle completely separated;

FIGURE 10 is a fragmentary enlarged view in section showing the attachment of the insulator disk and the ground contact terminal within the plug sleeve;

FIGURE 11 is a side elevation view on a reduced scale of the receptacle sleeve with the interlock button removed;

FIGURE 12 is an end elevation view of the insulator block which is mounted within the receptacle sleeve;

FIGURE 13 is a top plan view of the insulator sleeve of FIGURE 12;

FIGURE 14 is a view in section taken along the line 14—14 of FIGURE 12;

FIGURE 15 is a bottom plan view of the insulator sleeve of FIGURE 12;

FIGURE 16 is a top plan view of the interlock button;

FIGURE 17 is a side elevation view of the interlock button;

FIGURE 18 is a rear elevation view of the interlock button;

FIGURE 19 is an end elevation view of the insulator disk and contact terminals which are mounted within the plug sleeve; and

FIGURE 20 is a view in section taken along the line 20—20 of FIGURE 19.

This assembly **30** comprises a plug **31** and a receptacle **32**. There is also an adapter **33** for converting the receptacle to a cord connector receptacle. The receptacle **32** is threaded to fit standard outlet hubs such as are used on devices which are suitable (designed) for use in said hazardous locations.

The plug **31** comprises a cylindrical aluminum shell **35** with a cylindrical inner wall **36** and ends **37** and **38**. The end **38** of the shell **35** has a reduced portion with external threads **39** and an internal diverging wall **40**.

A cap **42** is adapted to be threaded onto the end **38** of the shell **35**. The cap **42** has an opening **43** through its end **44** with a beveled surface **45** inwardly of the opening **43**. A gasket **46** is pressed against the tapered surface **40**

by the beveled surface **45** when the cap **42** is tightened onto the shell **35**. The grommet **46** has a passage **47** through it of smaller diameter than the diameter of the opening **43**. The grommet **47** is preferably of rubber or other somewhat yieldable insulating material. It is made with various inside diameters to accommodate and grip different sizes and types of cord or cable.

There is a rigid disk **50** of insulating material that fits within the space defined by the inner cylindrical wall **36**. The disk **50** is of molded plastic construction and is molded about the rough kinurled portions **51** of two female power contacts **52**. Each female power contact **52** includes a cylindrical portion **53** of about 1⅝ inch in length including the rough knurled portion **51** which is about ¼ inch in length. There is a contact recess **55** in the end of the cylindrical portion **53** of about ⅜ inch in length. A crimp-type solderless lug extension **56** of slightly smaller diameter extends from the knurled end of the cylindrical portion **53**. The contacts **52** are molded integrally with the disk as an assembly.

The disk **50** also has a recess **58** in it with a hole **60** communicating with the recess **58**. A female ground contact **61** has a cylindrical portion **62** seated within the recess **58** and a smaller diameter crimp-type solderless lug extension **63** extending through the hole **60**. The cylindrical portion **62** is about 1⅝ inches in length, including a rough or coarse knurled portion **64** of about ¼ inch in length. The crimp-type solderless lug extension **63** is about 9/16 inch in length. There is a contact recess **65** within the cylindrical portion **62** that is about 1⅛ inch in length.

As best seen in FIGURE 10, there is a threaded hole **67** through the coarse knurled portion **64** and adapted to be aligned with a tapped hole or recess **68** in the disk **50**. There is a counter-sunk hole **69** through the wall of the shell **35** for receiving the head of a set screw **70**. The screw **70** threads into or through the disk **50** and into the ground contact **61** to hold both in place within the shell **35**.

A conductive ground contact clip **72** may be used if desired. The clip **72** has a sleeve **73** that fits over the crimp-type lug extension **63** and an arm **74** that contacts the screw **70**. The clip **72** thus assures electrical contact between the shell **35** and the female ground contact **61**.

The receptacle **32** comprises an aluminum shell **80** having an annular stop flange **81** of slightly larger diameter surrounding it and defining a stop shoulder **82** on one side and a stop shoulder **83** on the other side. There is an extension **84** with external threads **85** and with an inwardly crimped end **86**. An inner wall **87** is cylindrical and of constant diameter except for the reduced diameter portion defined by the inwardly extending annular flanged portion **86**.

An insulator plug or disk **90** fits within the space defined by the inner wall **87**. The insulator plug **90** is molded about two male power contacts **91** and a male ground contact **92**. Each male power contact **91** has a knurled portion **93** forming part of a cylindrical portion **94** of about ⅞ inch in length, and has a smaller diameter contact prong portion **95** extending forwardly therefrom, of about ⅜ inch in length. There is a recess **96** in the plug **90** extending from the end of the plug and surrounding each prong **95**. Each recess **96** is slightly larger in diameter than the diameter of the female power contact **52**.

The ground contact **92** has a cylindrical portion **97** with a knurled portion **98** at its end and with a prong portion **99** extending beyond the cylindrical portion **97**. The prong portion **99** is about 1⅛ inch in length, and a recess **100** surrounds the prong **99** and is sized to receive the female ground contact **61**. There are crimp-type solderless lug extensions **101** and **102** on the power contacts **91** and the ground contact **92**, respectively.

The diameter of the prong **99** is greater than that of the prongs **95**, and the contacts **99** and **95** cannot be inserted into the recesses of the contacts **52** and **61** unless the contact **99** is aligned with the recess **65** of the contact **61**.

A ground clip **105** has a sleeve portion **106** surrounding the crimp-type lug extension **102**, with a tab **107** extending into pressed engagement between the plug **90** and the flange portion **86** of the sleeve **80**. The clip **105** thus establishes an electrical connection between the ground contact **92** and the shell **80**.

There is a slot **110** in the shell **35**. The slot **110** has a rounded end **111** and rounded corners **112** and **113** terminating in a narrower width passage **114** opening to the end **37** of the sleeve. The slot **110** and passage **114** are designed to cooperate with an interlock button **116** which is mounted on the receptacle **32**.

The interlock button **116** is made of brass or other metal, and as illustrated particularly in FIGURES 16–18, has a knurled cross member **117** extending between spaced arms **118** and **119**. The receptacle shell **80** has a pair of holes **120** and **121** through it, and the arm **118** has a portion **122** which is of a proper width to extend through the hole **120**. The insulator plug **90** has a recess **123** opposite the holes **120** and **121** so the interlock button **116** can be operated.

A rearwardly extending tab **124** hooks under the shell **80** at the end of the hole **120**. There are laterally extending wings **125** and **126** on opposite sides of the arm **118**, spaced from the outer surface of the shell **80**. The total width of the buuton at the wings **125** and **126** is greater than the width of the passage **114**. However, the arms **118** and **119** are sufficiently narrow to pass through the passage **114**.

The other arm **119** has a cylindrical base **127** the diameter of which is about equal to the width at the wings **125** and **126**. The cylindrical base meets the narrower outer arm portion **128** in an inclined camming surface **129**. The base **127** extends through the hole **121** in the shell **80** and has clip **130** pressed onto a hub **131** on the base to hold the button in place. A compression spring **132** bears against the wall of the recess **123** and against the base **127**.

When the shell **35** is over the shell **80** with the end **37** stopped against the shoulder **82**, the narrow portion **122** of the arm **118** of the interlock button **116** is positioned within the narrower width slot **114**. In this position, the wings **125** and **126** of the button **116** extend beyond the edges of the slot **114**, and the button **116** cannot be depressed. The length of the wings **125** and **126** is such that when the plug shell **35** is pulled from the receptacle shell **80** a short distance until the base **127** of the arm contacts the rounded corners **112** and **113** of the slot **110**, the shoulders **125** and **126** are beyond the slot **114** and the interlock button **116** can be depressed.

The round base **127** of the arm **119** is of larger diameter than the width of the slot **114**. The base portion **127** can slide in the slot **110** but will not fit through the slot **114**. Upon depression of the interlock button **116** against the force of the compression spring **132**, the base **127** is pressed inwardly of the shell **35** until its surface **129** is inward of the inner surface **36** of the shell **35**. The arm portion **119** beyond the base **127** being sufficiently narrow to pass through the slot **114**, the plug **31** can be separated from the receptacle **32**.

The cord connector adapter **33** comprises a tube **135** which has a cylindrical side wall **136** one end of which is provided with internal threads **137**, and the other end of which is provided with external threads **138**. There is a tapered entrance **139** at the externally threaded end for receiving a rubber or other flexible material grommet **140** which is held in place by a cap **141**. When the tube **135** is threaded onto the end **84** of the receptacle **32**, the ends of the contacts **91** and **92** are contained within the tube **135**. Connecting wires can be extended through the grommet **140** and attached to the lugs **101** and **102**.

In use, the plug and receptacle described heretofore may be used as shown in FIGURES 1 and 2, or it may be used without the adapter **33**. When the adapter **33** is removed, the threads **85** are exposed. These are standard

A.S.A. threads and can be threaded into a tapped hole in the wall of a box or other enclosure to enable attachment of wires to the lugs **101** and **102**.

If the plug and receptacle are to be used as a standard cord connector, the adapter **33** is put in position as shown in FIGURES 1 and 2, and wires are extended through the grommet **140** and are attached to the lugs **101** and **102** by use of a crimping tool. Wires are also extended through the grommet **46** and are attached to the lugs **56** and **63** by a crimping tool. If desired, the wires can be soldered instead of attached by crimping.

The electrical contact between the contacts **52** and **61** in the plug **31** and the contacts **91** and **92** in the receptacle **32** is made upon moving the shell **35** over the shell **80**. As the shell **35** is started, the end **37** thereof contacts the camming surface **129** on the base **127** of the interlock button **116** and automatically depresses that button so that the base **127** does not contact the opposite walls of the entry passage **114**.

As the shell **35** is slid along the shell **80**, the base **127** reaches the wire slot **110** and snaps to the position shown in FIGURE 8 under the force of the compression spring **132**. In this position, as FIGURE 8 shows, the ground prong **99** of the contact **93** has started within the recess **65** of the ground contact **61** to establish a ground contact, and this ground contact is transmitted through the ground clip **105** to the shell **80** and through the ground clip **72** to the shell **35**. However, contact between the prong **95** and the contact **52** has still not taken place.

When the shell **35** is slid all the way onto the shell **80** so that the end **37** contacts the shoulder **82** on the shell **80**, electrical contact is established between the prongs **95** and the recesses **55** of the contacts **52**, as shown in FIGURES 6 and 7.

There is a friction fit between the inner wall **36** of the shell **35** and the outer surface of the shell **80**, but these two shells can be slid relative to one another within the limits of the lost motion between the base **127** of the interlock button **116** and the slot **110**. The base **127** can slide between the rounded end **111** and the rounded corners **112** and **113**, as shown in FIGURES 2 and 5.

Should an explosion occur, tending to separate the shell **35** from the shell **80**, or should there be any other emergency reason to break the contact between the current carrying contacts **91** and **52**, the shells are slid to the relative positions illustrated in FIGURE 8. Again, the electrical contact between the contacts **95** and the recesses **55** in the contacts **52** is broken. However, the base **127** stops against the rounded corners **112** and **113** and prevents complete separation of the sleeves **35** and **80**, and maintains ground connection between contacts **99** and **61**. This prevents exposure of the area within these sleeves to the surrounding atmosphere where there may be explosive gases or the like.

To completely remove the shell **35** from the shell **80**, the interlock button **116** must be depressed against the force of the compression spring **132** to move the base **127** inwardly of the shell **35**. When this is done, the interlock button can slide through the entry passage **114** and the plug can be separated from the receptacle, as illustrated in FIGURE 9.

Various changes and modifications may be made within the purview of this invention as will be readily apparent to those skilled in the art. Such changes and modifications are within the scope and teaching of this invention as defined by the claims appended thereto.

What is claimed is:

1. A connector for hazardous locations comprising a plug and a receptacle formed of complementary telescoping sleeves, contact terminals including power and ground terminals supported by the plug and receptacle within the sleeves and adapted to make electrical contact when the sleeves are telescoped, releasable interlocking means to hold the sleeves in telescoping relationship, and means rendering the interlocking means yieldable to permit relative sliding of the sleeves to break electrical contact between the power terminals while preventing separation of the sleeves, the interlocking means comprising a slot in one of the sleeves, an entry to the slot from the end of the sleeve nearest the other sleeve, the entry being narrower than the slot, and a depressible button carried by the other sleeve, the button being slidable through the entry when depressed and being locked from sliding through the entry when not depressed, the contact terminals including a ground terminal in each sleeve, the ground terminals being longer than the other terminals and being sufficiently long to maintain electrical contact with one another when the sleeves are slid to their unseparated positions with the electrical contact between the hot terminals broken.

2. A connector for use in hazardous locations comprising a pair of sleeves, one sleeve being of larger diameter than the other sleeve to enable the sleeves to be telescoped together, contact sockets including a ground contact and at least one power contact supported in one sleeve and contact prongs including a ground prong and at least one power prong supported by the other sleeve and adapted to be inserted into the contact sockets to establish electrical contact therewith when the sleeves are telescoped together, the smaller diameter sleeve having means to support a depressible interlock button, the larger sleeve having an elongated slot for receiving the interlock button when the sleeves are telescoped together, a narrow entry passage leading to the slot, the interlock button having a portion which will slide in the slot but which prevents passage of the interlock button through the entry passage unless the button is depressed, the slot and the last named portion of the button having a lost motion fit enabling the sleeves to be relatively slid within restricting limits without depression of the interlock button, (and electric contact elements carried by the sleeves and adapted to establish electrical contact with one another when the sleeves are telescoped together,) the interlock button having means to prevent its depression unless the sleeves are in such relative positions as to locate said button portion at the end of the slot adjacent the entry passage, the ground contact elements being of such a length that electrical contact between them is maintained whereas the power contact elements are of such lengths that electrical contact between them is broken when the sleeves are in the last named relative positions.

3. The connector of claim **2** wherein the contact elements are fixed in molded insulator plugs supported within the sleeves, and one of the sleeves has a removable portion for enabling the receptacle to be connected into a wall opening.

4. The connector of claim **2** including means requiring proper orientation of contact elements before they can establish electrical contact with one another.

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MARVIN A. CHAMPION, *Primary Examiner.*