

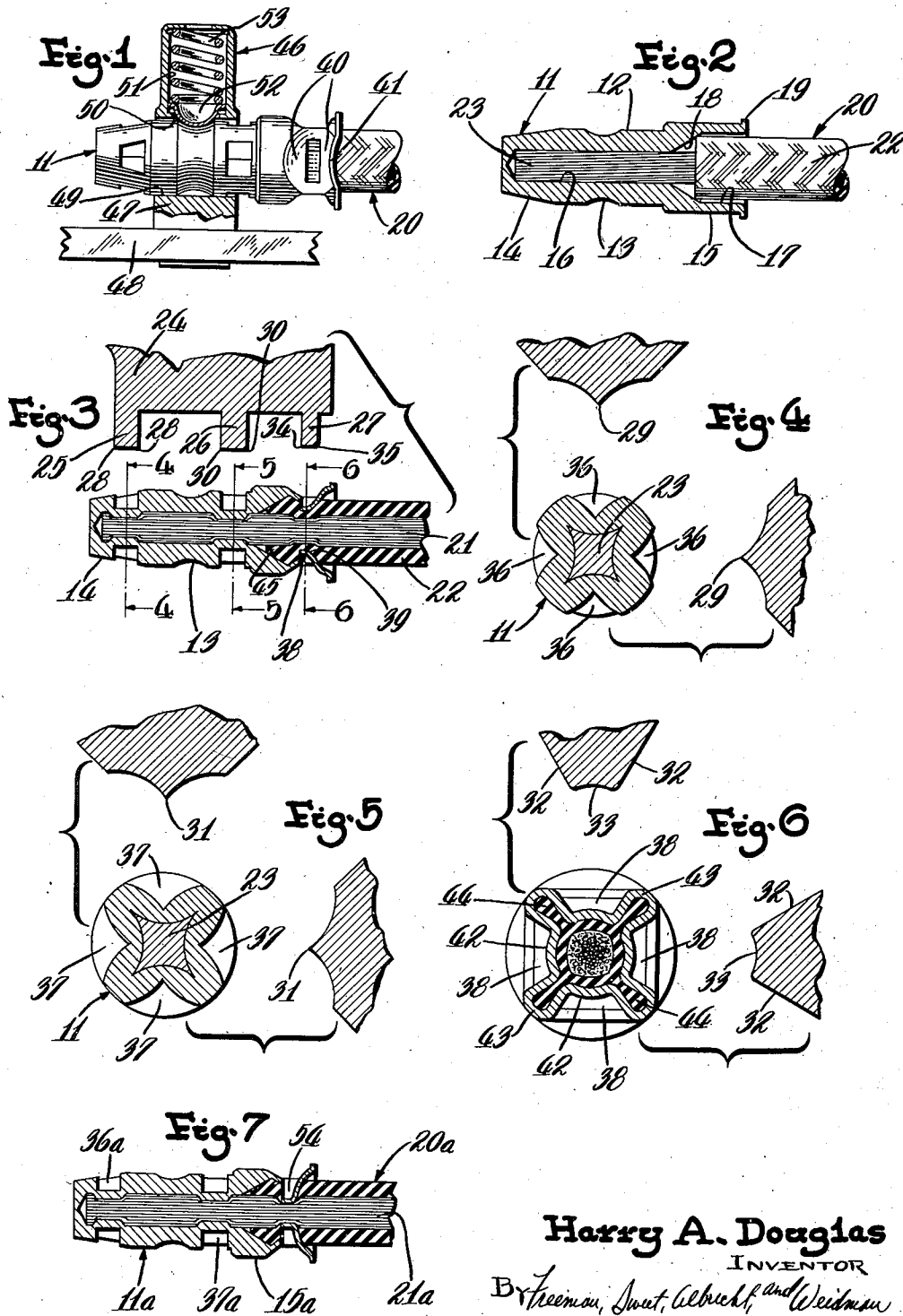
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ELECTRICAL CONNECTION MEANS.

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ELECTRICAL CONNECTION MEANS

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This invention relates to electrical connection means, more particularly to means for connecting a plug conductor terminal to an electrical conductor, and the principal object of this invention is to provide new and improved electrical connection means of these types.

In the drawing accompanying this specification and forming a part of this application, I have shown, for purposes of illustration, several forms which my invention may assume, and in this drawing:

Figure 1 is an elevational view disclosing one embodiment of the invention in operative relation with a receptacle of the so-called snap type.

Figure 2 is a longitudinal sectional view of the embodiment, illustrating a stage of assembly,

Figure 3 is a longitudinal sectional view of the embodiment as completely assembled, and further illustrating, in removed relation, one of a series of jaws for effecting connection,

Figure 4 is an enlarged transverse section corresponding to the line 4—4 of Figure 3, and also showing two of a series of jaw members for effecting one connection,

Figure 5 is an enlarged transverse section corresponding to the line 5—5 of Figure 3, and showing two of a series of jaw members for effecting another connection,

Figure 6 is an enlarged transverse sectional view corresponding to the line 6—6 of Figure 3, and showing two of a series of jaw members for effecting still another connection, and

Figure 7 is a longitudinal sectional view disclosing another embodiment of this invention.

Referring particularly to Figures 1 through 6, the embodiment of the invention therein shown comprises a body 11, preferably formed of suitable electric current conducting material. The body 11 may be shaped to provide a plug conductor terminal of the snap type, and to this end the body 11 is preferably provided with a generally cylindrical portion 12, having an annular furrow 13 formed therein. The cylindrical portion 12 at one end merges with a frusto-conical nose portion 14, and at its other end merges with an enlarged generally cylindrical portion 15. The body 11 may be provided with a recess, and as preferred and shown in Figure 2, the body 11 is axially bored, as at 16, the bore 16 extending inwardly from the enlarged portion 15, and stopping short of the extremity of the nose portion 14. Adjacent the enlarged cylindrical portion, the bore 16 is counterbored as shown at 17, to form this cylindrical portion into generally sleeve shape.

The bore 16 and the counterbore 17 are preferably joined by a tapering portion, as shown at 18 in Figure 2. If desired, the enlarged cylindrical portion 15 may be provided with a flanged extremity 19.

An insulated electrical conducting member 20 is adapted to be disposed within the axial recess formed in the body 11, and comprises an inner core 21 of current conducting material, preferably stranded wire as shown, and an outer covering 22 of insulating material, such as a covering of rubber about the core 21, followed by a covering of fabric about the rubber covering. However, it will be understood that the covering 22 may be all rubber, or any other suitable insulating covering which may be preferred. As best shown in Figure 2, the insulation is stripped from one end of the member 20, to provide a bared portion 23, and that end of the member 20 is then threaded into the axial recess in the body 11, so that the bared portion 23 is disposed in the bore 16, and the adjacent insulated portion is disposed in the counterbore 17. The shoulder formed by stripping the insulation from the conducting member may abut the wall of the tapered portion 18, as shown in Figure 2, so as to serve as a suitable means for limiting insertion of the member 20, although it will be appreciated that the tapered portion 18 provides a recess for receiving any frayed part of the insulation, so that this frayed part cannot prevent proper insertion of the bared portion 23 of the conductor member 20. It will also be obvious that abutment of the end of the bared portion 23 with the closed end of the bore 16 may serve as a means for limiting insertion of the member 20. As shown in Figure 2, the transverse size of the insulating covering 22 need not snugly fit within the counterbore 17, thereby providing for the accommodation of various sized members 20.

To secure the body 11 to the insulated conductor member 20, the body is provided with suitable indentations disposed in spaced planes generally transverse to the common axis of the bore 16 and counterbore 17. As best shown in Figure 3, the body is preferably secured to the bared portion 23 by means of a swedging action produced by a plurality of jaws 24, each of which carries jaw members 25, 26, and 27, suitable for the swedging purposes. In this embodiment it is preferred to use four jaws 24, although it will be understood that any other number of jaw members may be used.

As shown in Figure 3, each jaw member 25, 55

in longitudinal section, comprises a relatively narrow rectilinear projection extending from the jaw 24. The wall defining the length of the jaw member 25 cooperates with the extending walls of the jaw member to form relatively sharp cutting edges 28. A transverse section through two of the jaw members 25 is best shown in Figure 4, wherein it is illustrated that each of the jaw members 25 is contoured to cusp-like shape, as shown at 29. The jaw member 26 is shaped similar to the jaw member 25, in that it provides relatively sharp cutting edges 30, and the jaw member 26 is spaced from the related jaw member 25, as shown in Figure 3. Each of the jaw members 26 is contoured to cusp-like shape, as shown at 31 in Figure 5. Spaced from the jaw member 26 is the jaw member 27, and each member 27 comprises an extension of the jaw 24, the extension having side walls 32, as shown in Figure 6, tapering towards a reentrant or concave limiting wall 33. Each of the jaw members 27, at the limiting wall 33, is shaped to provide a relatively sharp cutting edge 34, and a rounded edge 35 (Figure 3).

To assemble the body 11 with the insulated conductor member 20, the latter member is disposed within the bore 16 and counterbore 17, as hereinbefore described, and with the bared portion 23 positioned within the axial bore 16, as shown in Figure 2. The body 11 is suitably positioned in a holding device (not shown) which also includes means for moving the four jaws 24 simultaneously toward the axis of the body 11, and for positioning each jaw 24 so that the jaw members 25, 26, and 27 are in registry respectively with the frustro-conical nose 14, the cylindrical portion 12, and the sleeve portion 15. When the four jaws 24 are moved toward the axis of the body 11, the cusp-like portions 29 and 31 of the jaw members 25 and 26, and the surfaces adjacent the limiting wall 33 of the jaw member 27 will be pressed into the adjacent surfaces of the body 11. After the jaw members 24 have been moved toward the axis of the body 11 a predetermined amount, the jaws 24 are returned to spaced position with respect to the body 11.

A transverse section through the indentations produced by the jaw members 25 is shown in Figure 4, and inspection of this figure will disclose that the jaw members 25 produce four indentations 36 in the nose portion 14 of the body 11, the indentations being similar in shape to the contour of the jaw members 25. It will further be noted that the pressure exerted by the jaw members 25 has been transmitted through the material of the nose portion 14 to the adjacent bared portion 23 of the conductor member 20, so that this portion, in line with the indentations 36, has been pressed from its generally circular shape to a shape similar to a polygon with reentrant sides, as best shown in Figure 4. Furthermore, this pressing or swedging action of the jaw members 25 has caused the strands of the bared portion to be pressed tightly together to substantially integral condition, and in addition, this integral portion of the bared portion 23 is pressed to have substantially integral relation with the adjacent surface of the nose portion 14. Therefore, it will be apparent that a substantially solid metal to metal connection is effected between the bared portion 23 of the conductor member 20, and the nose portion 14 of the body 11.

A transverse section through the indentations produced by the jaw members 26 is best shown in Figure 5, wherein it is illustrated that the jaw members 26 produce four indentations 37, similar to the indentations 36, and corresponding in shape to the contour of the jaw members 26. As before, the pressure exerted by the jaw members 26 has been transmitted through the material of the cylindrical portion 12 to the adjacent bared portion 23 of the conductor member 20, so that this adjacent portion has been pressed from its circular shape to a shape similar to that described in connection with the indentations produced by the jaw members 25, and this swedging action of the jaw members 26 causes the strands of the adjacent part of the bared portion to be pressed tightly together to substantially integral condition, and in addition, this integral portion is pressed to have substantially integral connection with the adjacent cylindrical portion 12. Therefore, the connections so far described provide axially spaced, substantially solid metal to metal connections between the body portion 11 and the inner core 21 of the conducting member 20.

The indentations formed by the jaw members 27 are best illustrated in Figures 1, 3, and 6. These indentations 38 are produced by the inward movement of the jaw members 27, this inward movement causing the sharp edge 34 to cut into the sleeve 15, the rounded edge 35 pressing the adjacent portions of the sleeve 15 inwardly into the insulating cover 22 of the conductor member 20 so as to firmly engage with the insulating covering 22. This pressing action will also cause the portion of the stranded wire transversely in alignment with the indentations 38 to be somewhat compressed as best shown in Figure 3. It will be apparent that part of the indentation produced by the rounded edge 35 of the jaw member 27 will be curved as shown at 39 in Figure 3, so that the free part of the conductor member 20 may be moved laterally without fraying or cutting the insulating covering 22. As best shown in Figure 1, the jaw member 27 causes the adjacent surfaces of the sleeve 15 to bend inwardly as at 40, and also, the flange 19 is caused to pucker as at 41. As best shown in Figure 6, the indentations 38 form the sleeve portion 15 so as to provide curved surfaces 42 corresponding to the limiting walls 33 of the jaw members 27. Intermediate the curved surfaces 42, the jaw members 27 form petal-like portions 43, which have their outer extremities generally aligned with the original periphery of the sleeve portion 15, the walls of the petal-like portions 43 tapering towards and merging with the curved surfaces 42. It will be obvious that the pressure of the jaw members 27 causes at least some of the insulating covering 22 to occupy spaces between the walls of the petal-like portions 39, as shown at 44. Also, some of the insulating covering 22 is displaced and pressed into the tapering recess 18 intermediate the bore 16 and the counterbore 17, as shown at 45 in Figure 3.

From the foregoing description it will be obvious that the body portion 11 has three connections with the conducting member 20, two of these connections providing substantially solid metal to metal contact between the body portion 11 and the conducting core 21, and the third connection providing connection between the sleeve 15 of the body 11 and the insulating cover 22 of the conducting member 20. With this con-

struction, the connection formed by the indentations 36 in the nose portion 14 is sealed from communication with the exterior of the body 11, by reason of the substantially integral connection formed in the cylindrical portion 12. Furthermore, the connection formed by the indentations 37 in the cylindrical portion 12, is substantially sealed from communication with the exterior of the body 11 by the connection formed by the indentation 38 in the sleeve portion 15. Therefore, no corrosive substances can enter the axial bore 16, and as a consequence, the electrical connections formed by the indentations 36 and 37 will not be subjected to corrosive action, and these connections will provide perfect electrical connection between the body 11 and the core 21 under all conditions. The connection formed by the indentations 38, in addition to its sealing function, also serves the purpose of taking up strains produced by forces which may be applied to the conductor member 20 during assembling operation with a suitable receptacle. It will be obvious that any two of the three connections described may be used to satisfy certain predetermined conditions, and also, more connections than just the three described may be used without departing from the spirit of the invention.

As shown in Figure 1, the body 11, with the connected conductor member 20, is adapted for use with a receptacle 46. The receptacle 46 may be of any suitable construction, but preferably comprises a solid portion 47 adapted for connection to a support 48 in any suitable manner. The solid portion 47 is provided with a transverse bore 49, which communicates, through an aperture 50, with a longitudinally bored portion 51 of the receptacle 46. A detent member 52 is disposed within the bore 51, and has a portion extending through the aperture 50 and into the transverse bore 49, and a spring 53 is interposed between the detent member 52 and an intumed flanged part of the bored portion 51 of the receptacle 46, to yieldably urge the detent member to operative position.

In operation, the plug conductor body 11 is inserted within the transverse bore 49 of the receptacle 46, the frusto-conical nose 14 of the plug body 11 camming the detent member 52 inwardly of the bored portion 51 to permit passage of the cylindrical part 12 of the plug body 11. When the furrow 13 of the plug body 11 is disposed adjacent the detent member 52, the latter member will snap into the furrow 13 and mechanically and electrically hold the plug body 11 in position with respect to the receptacle 46. The plug body 11 may be removed from the receptacle 46 by pulling on the free part of the conductor member 20, this pulling force causing the walls of the furrow 13 to cam the detent member 52 inwardly so as to provide for the passage of the cylindrical part 12 of the plug body 11.

Referring to Figure 7, the embodiment therein shown comprises a body 11a similar to the body 11. As in the case of the embodiment shown in Figures 1 through 6, electrical connection between the body 11a and the conductor member 20a is effected by indentations 36a and 37a. In this instance, however, indentations 54 are formed in the sleeve 15a, these indentations 54 being substantially similar to the indentations 38 of the embodiment shown in Figures 1 through 6, with the exception that the indentations 54 are pressed entirely through the insulating covering and into intimate contact with the current con-

ducting portion 21a of the conductor member 20a. If desired, the pressing force may be great enough to produce substantially solid metal to metal connection between the bared portion 23 and the adjacent portion of the indentations, similar to the connections produced by the indentations 36a and 37a. The construction of this embodiment provides three electrical connections between the body 11a and the conductor member 20a, and also provides connection to the insulating covering to take up stresses as before described.

From the foregoing it will be apparent to those skilled in the art that the illustrated embodiment of my invention provides new and improved electrical connection means, readily and conveniently constructed and assembled, and accordingly, accomplishes at least the principal object of my invention. On the other hand, it also will be obvious to those skilled in the art that the illustrated embodiment of my invention may be variously changed and modified, or features thereof, singly or collectively, embodied in other combinations than those illustrated, without departing from the spirit of my invention, or sacrificing all the advantages thereof, and that accordingly, the disclosure herein is illustrative only, and my invention is not limited thereto.

I claim:

1. An electrical connection, comprising: an insulated electrical conductor, the insulation on said conductor terminating short of the end of the conductor, leaving the end portion of the conductor bare; a terminal, for said conductor, including an elongated body having a longitudinal recess closed at one end and open at the other and otherwise imperforate, said recess receiving the bare part of said conductor and the adjacent end portion of the insulation, said terminal and said bare part being swaged into a continuous electrical connection within and about said recess, and said terminal and said insulation being swaged together into a continuous connection sealing the open end of said recess and preventing corrosive substances from reaching said electrical connection, said last-mentioned swage having curved portions conforming substantially to the curvature of the insulation.

2. An electrical connection, comprising: an insulated electrical conductor, the insulation on said conductor terminating short of the end of the conductor, leaving the end portion of the conductor bare; a terminal, for said conductor, including an elongated body having a longitudinal recess closed at one end and open at the other and otherwise imperforate, said recess having a first portion receiving the bare part of said conductor, and having an enlarged entrance portion forming a shoulder between said enlarged portion and said first portion, said enlarged portion receiving the adjacent end portion of the insulation, said terminal and said bare part being swaged at least three places spaced apart circumferentially in a common general plane transverse to said terminal into a continuous electrical connection within and about said recess, and said terminal and said insulation being swaged together into a continuous second connection sealing the open end of said recess and preventing corrosive substances from reaching said electrical connection, said second connection including insulation forced toward said first portion of said recess against said shoulder, the swage at said second connection having spaced apart curved portions defining the outline of a circle, the di-

ameter of which is less than the outside diameter of said insulation.

3. An electrical connection, including members united in swaged relation; said members comprising insulated metallic conductor means and a grooved sleeve having a closed end, and an open end in which a bare end of said conductor means is disposed; a skirt provided on said sleeve receiving the insulation in a manner to provide an annular space between the skirt and the insulation; said conductor means and said sleeve being swaged into a solid-metal cross-section in a predetermined transverse general plane on one side of said groove; said conductor means and said sleeve also being swaged into a continuous solid-metal cross-section in a predetermined transverse general plane on the other side of said groove adjacent the closed end of said sleeve; and said skirt being crimped to bring the sleeve and insulation on the conductor into bearing relation whereby to substantially close said annular space and in conjunction with said closed end substantially seal from the atmosphere at least one of said swaging planes.
4. An electrical connection, including members united in swaged relation; said members comprising insulated metallic conductor means and a grooved sleeve having a closed end, and an open end in which a bare end of said conductor means is disposed; a skirt provided on said sleeve receiving the insulation in a manner to provide an annular space between the skirt and the insulation; said conductor means and said sleeve being swaged into a solid-metal cross-section in a predetermined transverse general plane on one side of said groove between the groove and said skirt; said conductor means and said sleeve also being swaged into a continuous solid-metal cross-section in a predetermined transverse general plane on the other side of said groove; and said skirt being crimped to bring the sleeve and insulation on the conductor into bearing relation whereby to close said annular space and in conjunction with said closed end substantially seal from the atmosphere at least two of said swaging planes.
5. An electrical connection, including members united in swaged relation; said members comprising insulated metallic conductor means and a grooved sleeve having a closed end, and an open end in which a bare end of said conductor means is disposed; a skirt provided on said sleeve receiving the insulation in a manner to provide an annular space between the skirt and the insulation; said conductor means and said sleeve being swaged into a solid-metal cross-section in a predetermined transverse general plane on one side of said groove; said conductor means and said sleeve also being swaged into a continuous solid-metal cross-section in a predetermined transverse general plane on the other side of said groove adjacent the closed end of said sleeve; and said skirt having crimpings bringing the sleeve and insulation on the conductor into bearing relation whereby to substantially close said annular space and in conjunction with said closed end substantially seal from the atmosphere at least one of said swaging planes; said crimpings being located back from the free end of the skirt whereby to permit the conductor under certain conditions to flex slightly within the confines of the skirt.
6. An electrical connection, including members united in swaged relation; said members comprising metallic conductor means and a sleeve in which said conductor means is disposed; said

sleeve having a closed end and at least three swaged indentations spaced circumferentially in a common plane transverse to said sleeve; said sleeve also having at least three swaged indentations spaced circumferentially in a common general plane transverse to said sleeve and in spaced apart relation to said first mentioned plane; and said conductor means and said sleeve having substantially a continuous solid-metal cross-section in said planes.

7. An electrical connection, comprising: an insulated electrical conductor, the insulation on said conductor terminating short of the end of the conductor, leaving the end portion of the conductor bare; a terminal, for said conductor, including an elongated body having a land portion and a skirt portion and a longitudinal recess closed at one end and open at the other and otherwise imperforate, said recess adjacent said land portion receiving the bare part of said conductor, said recess being enlarged at the skirt portion and receiving the adjacent end portion of the insulation, said terminal and said bare part adjacent said land being swaged into a continuous electrical connection within and about said recess, and said terminal and said insulation adjacent said skirt being swaged together into a continuous connection sealing the open end of said recess and assisting to prevent corrosive substances from reaching said electrical connection, said last-mentioned swage having curved portions conforming substantially to the curvature of the insulation.

8. An electrical connection, comprising: an insulated electrical conductor, the insulation on said conductor terminating short of the end of the conductor, leaving the end portion of the conductor bare; a terminal, for said conductor, including an elongated body having a land portion and a skirt portion and a longitudinal recess closed at one end and open at the other and otherwise imperforate, said recess having a first portion substantially within the land for receiving the bare part of said conductor, and having an enlarged entrance portion substantially within the skirt forming a shoulder between said enlarged portion and said first portion, said enlarged portion receiving the adjacent end portion of the insulation, said terminal and said bare part adjacent said land being swaged at least three places spaced apart circumferentially in a common general plane transverse to said terminal into a continuous electrical connection within and about said recess, and said terminal and said insulation adjacent said skirt being swaged together into a continuous second connection substantially sealing the open end of said recess and assisting to prevent corrosive substances from reaching said electrical connection, said second connection including insulation forced toward said first portion of said recess against said shoulder, the swage at said second connection having spaced apart curved portions defining the outline of a circle, the diameter of which is less than the outside diameter of said insulation.

9. An electrical connection, including members united in swaged relation; said members comprising insulated metallic conductor means and a sleeve having an abutment, a closed end, and an open end in which a bare end of said conductor means is disposed; a skirt provided on said sleeve receiving the insulation in a manner to provide an annular space between the skirt and the insulation; said conductor means

and said sleeve being swaged into a solid-metal cross-section in a predetermined transverse general plane on one side of said abutment; said conductor means and said sleeve also being
5 swaged into a continuous solid-metal cross-section in a predetermined transverse general plane on the other side of said abutment; and said skirt being crimped to bring the sleeve and insulation on the conductor into bearing relation
10 whereby to substantially close said annular space and in conjunction with said closed end substantially seal from the atmosphere at least one of said swaging planes.

10. An electrical connection, including members united in swaged relation; said members comprising insulated metallic conductor means and a sleeve having an abutment, a closed end, and an open end in which a bare end of said conductor means is disposed; a skirt provided on
15 said sleeve receiving the insulation in a manner to provide an annular space between the skirt and the insulation; said conductor means and said sleeve being swaged into a solid-metal cross-section in a predetermined transverse general
20 plane on one side of said abutment; said conductor means and said sleeve also being swaged into a continuous solid-metal cross-section in a predetermined transverse general plane on the other side of said abutment adjacent the closed

end of said sleeve; and said skirt having crimpings bringing the sleeve and insulation on the conductor into bearing relation whereby to substantially close said annular space and in conjunction with said closed end substantially seal
5 from the atmosphere at least one of said swaging planes; said crimpings being located back from the free end of the skirt whereby to permit the conductor under certain conditions to flex slightly within the confines of the skirt. 10

11. An electrical connection, including members united in swaged relation; said members comprising insulated metallic conductor means and a sleeve in which said conductor means is disposed; said sleeve having a closed end and
15 at least three swaged indentations spaced circumferentially in a common plane transverse to said sleeve; said sleeve also having at least three swaged indentations spaced circumferentially in a common general plane transverse to said sleeve
20 and in spaced apart relation to said first mentioned plane, said conductor means and said sleeve having substantially a continuous solid-metal cross-section in said plane; said sleeve further having a portion receiving the insulation
25 on said conductor; and said portion being crimped with respect to said insulation.

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