

March 10, 1942.

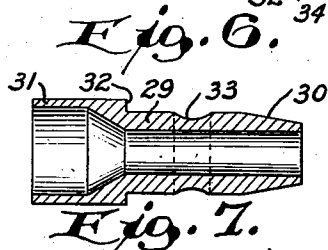
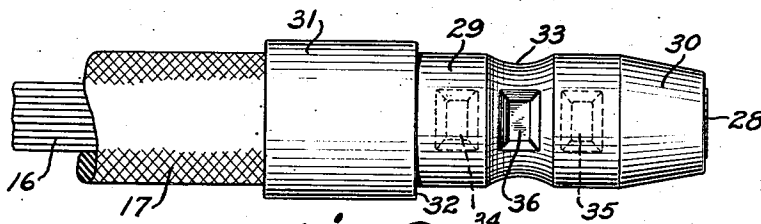
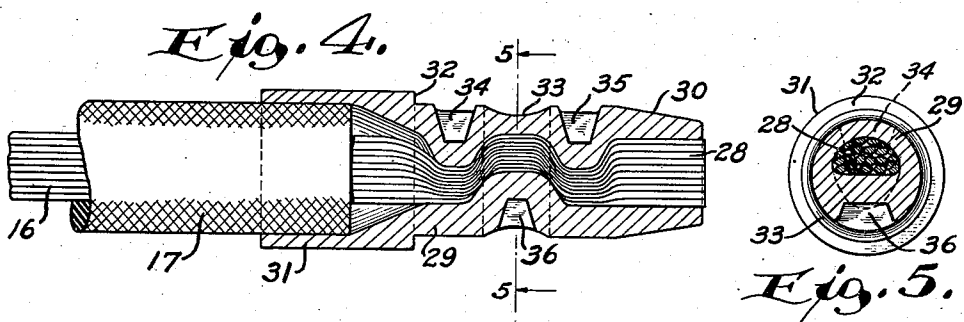
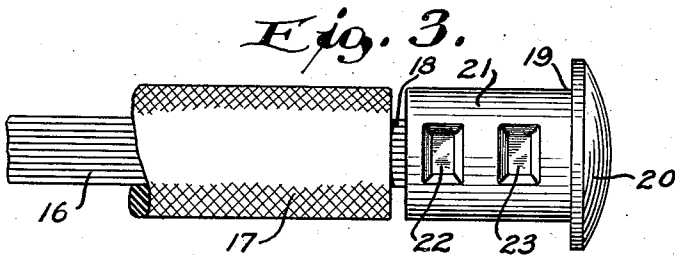
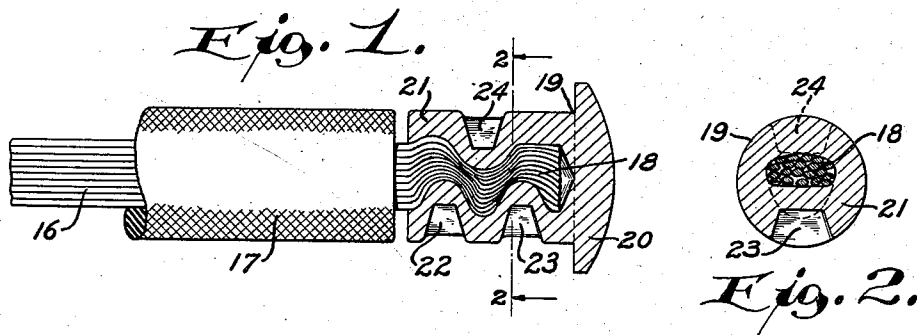
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2,276,140

CONDUCTOR TERMINAL

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2 Sheets-Sheet 1



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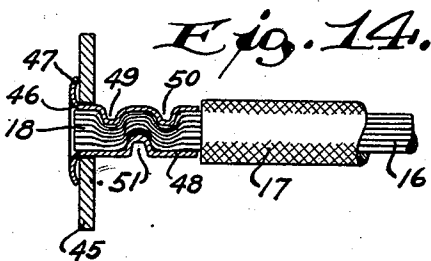
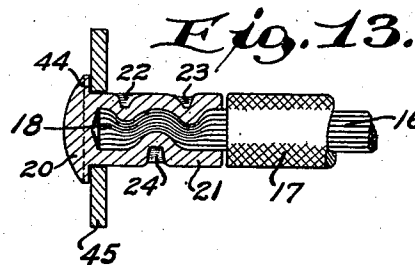
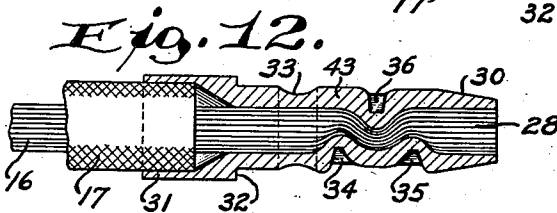
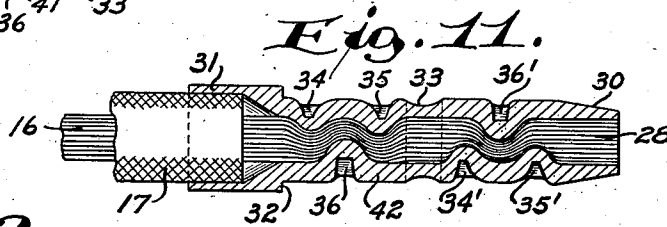
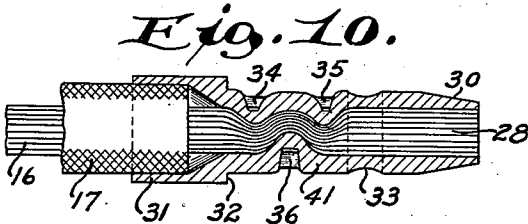
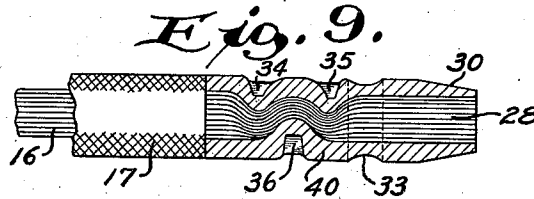
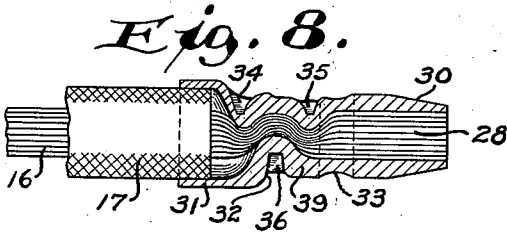
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CONDUCTOR TERMINAL

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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CONDUCTOR TERMINAL

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Application April 18, 1940, Serial No. 330,266

1 Claim. (Cl. 173—269)

Our present invention relates in general to improvements in the art of attaching terminals to the ends of conductors so as to provide a good electrical connection and to prevent ready separation of the attached parts.

An object of the present invention is to provide simple but highly effective means for attaching a tubular terminal to the end of a wire with the aid of simple tools.

Many prior attempts have been made to find some simple, inexpensive and efficient way of attaching a tubular terminal to the bared end of an electrical conductor such as a wire, by distorting the wall of the tube so as to clamp the end of the wire disposed within the terminal. These tubular standard terminals are of two general forms, namely, the plug type comprising an open ended metal tube having a tapered nose portion and an intermediate external peripheral groove, and the ferrule type comprising a tubular metal shank closed at one end by an integral disk shaped head thus forming a deep socket for the reception of the wire end; and both of these types may be formed either of bar stock or of sheet metal in a well known manner. When applying these tubular terminals to the ends of stranded cables or wires composed of a plurality of individual relatively thin strands, it is desirable to distort the tubular portion of each terminal so as to cause the same to laterally bend and clamp the adjacent strands, and it has heretofore been attempted to utilize sharp edged or pointed tools for forming external V-grooves or indentations of sufficient magnitude to actually swage the interior stranded wire section into a solid mass of metal. While this method may produce desirable clamping effect, it is extremely objectionable since the tensile strength of the individual strands is obviously weakened by the swaging and distortion thereof; and the terminal attachment should in fact provide for greatest resistance to separation due to pulling on the terminal longitudinally of the wire axis.

It is therefore a more specific object of our present invention to provide an improved mode of fastening tubular terminals to the bared ends of multiple strand cables or wires so as to firmly clamp the strands while avoiding reduction in the tensile strength of the individual strands.

Another specific object of the present invention is to provide a terminal attachment for tubular terminals of various types, wherein the portion of the elongated conductor which is located within the tube or terminal socket, is distorted into longitudinally corrugated shape and is ef-

fectively clamped both at the crest and trough of each undulation or corrugation without necessarily deforming the transverse cross-section of the wire or strands at the zones of clamping.

A further specific object of the invention is to provide improved means for attaching an externally grooved and tapered plug type terminal to the end of a wire, without destroying the general shape of the terminal at the grooved and tapered portions thereof.

Still another specific object of the invention is to provide an improved fastening for applying tubular terminals to stranded wires or the like, which can be quickly and automatically applied to successive terminals and conductors with relatively simple machinery, and which insures most effective union of the parts.

These and other specific objects and advantages will be apparent from the following detailed description.

A clear conception of the features constituting the present improvement, and of the mode of attaching various types of terminals to insulated stranded wires in accordance with our invention, may be had by referring to the drawings accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is a considerably enlarged side elevation of an end fragment of an insulated and end stripped stranded wire, showing a ferrule terminal in section applied to the bared end of the wire;

Fig. 2 is a likewise enlarged transverse section through the wire end terminal of Fig. 1, taken along the line 2—2;

Fig. 3 is a similarly enlarged bottom view of the assemblage of Fig. 1;

Fig. 4 is another enlarged side elevation of an end fragment of an insulated and end stripped stranded wire, showing a plug terminal in section applied to the bared end of the wire, and also showing attachment effected at the peripheral groove of the plug;

Fig. 5 is a transverse section through the wire end terminal of Fig. 4 taken along the line 5—5;

Fig. 6 is a bottom view of the assemblage shown in Figs. 4 and 5;

Fig. 7 is a somewhat less enlarged longitudinal central section through a plug type terminal of the type utilized in Figs. 4 to 6 inclusive, showing the formation thereof before application to a wire;

Fig. 8 is a somewhat less enlarged side elevation of a fragment of the stripped end of a wire,

showing a plug type terminal in section applied to the wire between the end of the insulation and the peripheral groove of the terminal;

Fig. 9 is a showing of a terminal attachment similar to that of Fig. 8, but having the end of the terminal in abutment with the adjacent end of the wire insulation instead of surrounding this insulation end as in Fig. 8;

Fig. 10 is another modified type of plug terminal attaching means similar to that of Fig. 8 but applied to a terminal having greater distance between the insulation protecting portion and the external groove;

Fig. 11 is still another modified type of plug terminal attaching means wherein attachment is effected on opposite sides of the peripheral groove of the terminal;

Fig. 12 is still another modified form of plug terminal attachment, showing the attachment located between the terminal end taper and the peripheral groove thereof;

Fig. 13 is a view showing an end fragment of an insulated end stripped wire, showing the same applied to a ferrule type terminal similar to that of Fig. 1, but with a fiber washer associated with the terminal; and

Fig. 14 is an elevation of an end fragment of an end stripped insulated wire, showing a ferrule type terminal formed of sheet metal attached to the bared end of the wire.

While my invention has been shown herein as being embodied in various types of terminals which are applied to the stripped ends of insulated multiple strand wires, it is not my desire or intent to thereby unnecessarily limit the scope or restrict the use of the improvement.

Referring to the drawings, and especially to Figs. 1 to 3 inclusive, the headed ferrule type of terminal assemblage illustrated therein, comprises in general, a multiple strand circular section wire 16 having insulation 17 the end of which is stripped from the wire to provide a bared end 18; and a ferrule terminal 19 having a disk shaped end head 20 and a tubular shank 21, the latter of which is closed by the former, and embraces the bared wire end 18. The terminal shank 21 is provided with spaced indentations 22, 23 on one side, and with an intermediate single indentation 24 on its opposite side, these indentations 22, 23, 24 preferably lying in a common plane, and the indentation 24 preferably being located midway between the indentations 22, 23 so as to provide a smooth but rather abrupt corrugation in the wire end 18. The indentations 22, 23, 24 are also preferably formed with relatively blunt nosed tools simultaneously projected into the opposite sides of the terminal shank 21, to an extent sufficient to firmly clamp the wire strands between the successive indentations 22, 23, 24 but insufficient to materially distort and weaken the individual strands. In this manner each individual strand is bent into undulated longitudinal form without impairing its cross-section and hence its tensile strength, and the clamping effected at the ridge and valleys of each corrugation will prevent endwise pulling or stripping of the terminal 19 from the wire 16.

Referring to Figs. 4 to 7 inclusive, the plug type of terminal assemblage shown therein, comprises generally a multiple strand circular section wire 16 having the usual insulation 17 stripped at its end to provide a relatively long bared wire end 28; and a plug terminal 29 having a tapered free end 30, a collared opposite

end 31 providing an abutment 32, and an annular peripheral groove 33 disposed between the end 30 and the abutment 32. The collared end 31 of the terminal 29 embraces the end of the insulation 17, and the bared wire end 28 extends throughout the interior of the terminal 29; and the tubular portion of the terminal 29 which is disposed between the tapered end 30 and the abutment 32, is provided with spaced indentations 34, 35 on one side and with a single intervening indentation 36 on its opposite side, all of which are disposed in a common plane. In this embodiment of the invention, the spaced indentations 34, 35 are preferably disposed equidistant on opposite sides of the peripheral groove 33, while the central indentation 36 may be located centrally of this groove 33, thus again providing a smooth but rather abrupt corrugation extending longitudinally of the wire end 28. The indentations 34, 35, 36 may also be simultaneously formed with relatively blunt tools projected into the opposite sides of the terminal 29, and the depth of these indentations should be sufficient to produce the desired undulation and clamping effect, but insufficient to shear or undesirably weaken the strands of the wire 16. In this manner each individual strand will again be bent into longitudinally corrugated or undulated form without impairing its tensile strength, and will also be firmly clamped between the successive indented portions of the metal tube, thereby effectively resisting endwise removal of the terminal 29 from the wire 16. The taper 30 of this plug terminal 29 facilitates insertion thereof into a conductor bushing, the groove 33 facilitates retention of the plug within such receiving bushing, and the collar 31 protects the end of the insulation 17 while the abutment 32 limits the extent to which the plug terminal 29 can be inserted within a receiving bushing.

In Figs. 8 to 12 inclusive we have illustrated various modified forms of the recessed plug type of terminal, showing primarily variations in the location of the clamping indentations. Referring specifically to Fig. 8, the terminal 39 of this modification is formed from a blank such as shown in Fig. 7, but the indentations 34, 35, 36 are all located in a common longitudinal plane between the annular external recess 33 and the extreme end of the insulation receiving collar 31 of the plug terminal 39. With such an assemblage, distortion of the recess 33 is entirely avoided without lengthening the terminal 39, but the zone of the abutment 32 is somewhat distorted and while good clamping effect is obtained, the appearance is not as neat as in the assemblage of Figs. 4 to 6 inclusive.

Referring to the modified structure of Fig. 9, in this embodiment of the invention, the plug terminal 40 has no collared end for the reception of the end of the insulation 17, but merely abuts this insulation. The indentations 34, 35, 36 of this modification are all located between the peripheral groove 33 and the insulation end of the plug terminal 40, so that the contour of the groove 33 is not marred in any manner, while maximum clamping effect is still obtained. In the modification of Fig. 10, the length of the blank from which each terminal plug 41 is formed, has been lengthened slightly between the external groove 33 and the abutment 32, and the clamping indentations 34, 35, 36 are disposed in a common longitudinal plane but in the lengthened portion of the blank, so that maximum clamping effect is again secured without defac-

ing the groove 33 or the abutment 32. With reference to the modified assemblage of Fig. 11, the plug terminal 42 is formed of a blank similar to that of Fig. 7, but which has been considerably lengthened both between the abutment 32 and the groove 33, and between this groove 33 and the tapered end 30, so as to permit the application of a set of wire clamping indentations at each of these lengthened zones. A set of coacting indentations 34, 35, 36 is provided between the outer recess or groove 33 and the abutment 32, and a reversed set of indentations 34', 35', 36' is likewise provided between the peripheral groove 33 and the tapered end 30, thereby providing a double corrugation and a double set of clamping areas without defacing the taper 30, abutment 32 or groove 33. In the modification of Fig. 12, the plug terminal 43 is of the same length as that of Fig. 10, but the clamping indentations have been placed between the tapered end 30 and the external groove 33, thereby providing an effective fastening without distorting the groove 33 or the tapered end 30.

Referring specifically to Fig. 13, the ferrule type of terminal 44 shown therein, is similar to that of Figs. 1 to 3 inclusive, except that the tubular portion 21 of the terminal has been lengthened for the reception of a fiber washer 45 which may be located adjacent to the head 20. The indentations 22, 23, 24 of this modification are located sufficiently near the end of the insulation 17 so as to provide proper space for the washer 45, and this terminal 44 may be applied to the end 18 of the wire 16 in substantially the same manner as described in connection with Figs. 1 to 3 inclusive, except that the tool for forming these indentations may be formed to provide burrs projecting outwardly beyond the periphery of the tubular shank 21 adjacent the washer 45, to thereby retain the washer in assembled position.

With reference to the modified type of terminal 46 shown in Fig. 14, this terminal 46 may be formed of a tube of sheet metal, with an integral flange 47 and tubular body portion 48. A washer 45 may be provided adjacent the flange 47, and the sleeve portion 48 may be distorted to provide indentations 49, 50, 51 which will corrugate the stranded wire 16 and clamp the strands as previously described. The tool for producing these indentations 49, 50, 51 may extend transversely of the sleeve portion 48 beyond the periphery thereof, so that when the indentations are formed, the metal of the sleeve portion 48 will project outwardly beyond the periphery of the tube sufficiently to form projections for holding the washer 45 in assembled position.

From the foregoing detailed description it will be apparent that the present invention provides an improved fastening for attaching tubular ter-

minals to the bared ends of wires, wherein the strands of the wire are not weakened at the point of attachment, but are firmly clamped against longitudinal displacement. In each of the several modifications illustrated, the wire end is corrugated and clamped by means of a set of three indentations, two of which are spaced apart longitudinally on one side of the tubular terminal, while the third is applied to the diametrically opposite side midway between the two first mentioned indentations. This provides an undulation or corrugation in the wire, and firm clamping of the portions of the wire adjacent to the ends of the corrugation, and it has been found by actual test that many of these wires will break beyond the fastening zone rather than at this zone, when a longitudinal pull tending to longitudinally separate the attached parts is exerted either on the wire or on the attached terminal. Terminals and wires thus united may also be dip soldered in order to enhance the holding effect, but this has been found unnecessary. The important feature of the invention is the provision of transverse indentations lying in a common plane and so applied to the wire that one or more corrugations or undulations extending longitudinally of the wire are produced, and the terminals may be formed to protect the end of the insulation although this is not of importance. The invention has proven highly satisfactory in actual use, and the indentations can be rapidly and effectively applied with relatively simple automatic machinery.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode of attaching the terminals to wires, herein shown and described, for various modifications within the scope of the claim may occur to persons skilled in the art.

We claim:

In a terminal, an insulated multiple strand wire having its extreme end bared, and a tubular metal sleeve snugly embracing said bared end and having two deep and closely adjacent indentations on one side and a third deep indentation on its opposite side between the two adjacent indentations, said indentations being of such depth and so spaced as to compress and abruptly off-set the wire between said third indentation and each of the other two and to thereby produce a short corrugation provided with inclined connecting portions between the successive undulations each having a transverse cross-sectional area which is considerably less than the original cross-section of the wire and is also less than that of the adjacent valleys and ridges of the undulations.

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