March 28, 1950 E. L. MALHIOT 2,501,870

TERMINAL FOR ELECTRICAL CONDUCTORS

Filed Nov. 24, 1945 2 Sheets-Sheet 1

FIG. 1

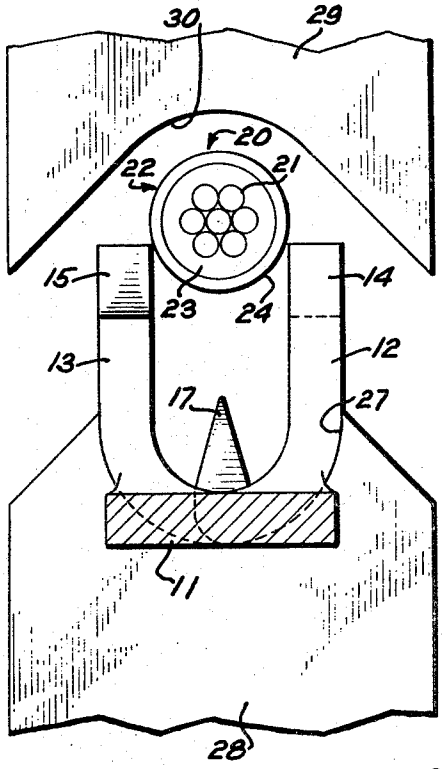


FIG. 2

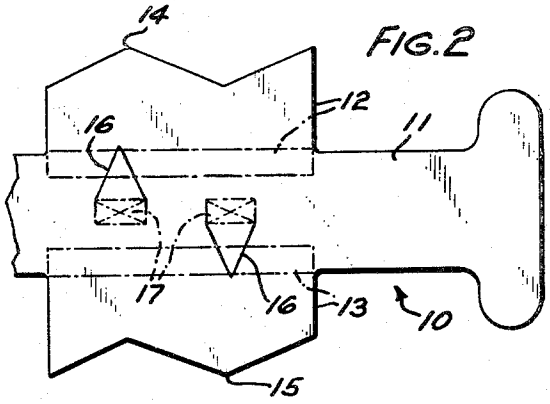


FIG. 3

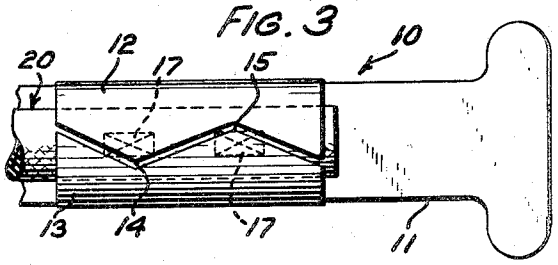


FIG. 4

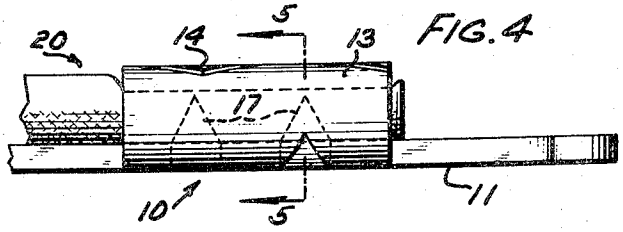
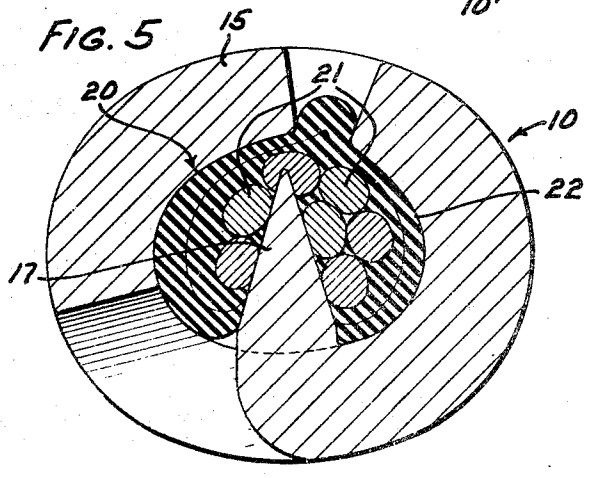


FIG. 5



INVENTOR
E. L. MALHIOT
BY E. A. Kane
ATTORNEY

March 28, 1950 E. L. MALHIOT 2,501,870

TERMINAL FOR ELECTRICAL CONDUCTORS

Filed Nov. 24, 1945 2 Sheets-Sheet 2

FIG. 7

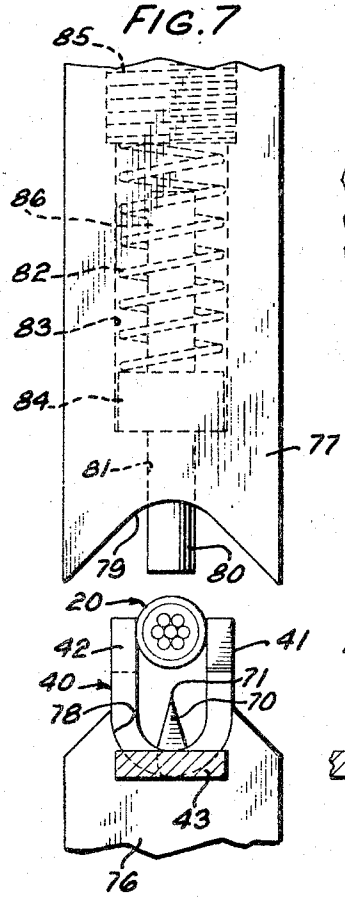


FIG. 6

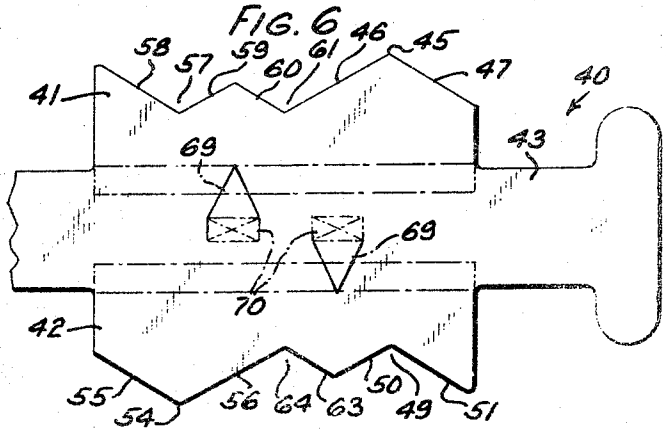


FIG. 8

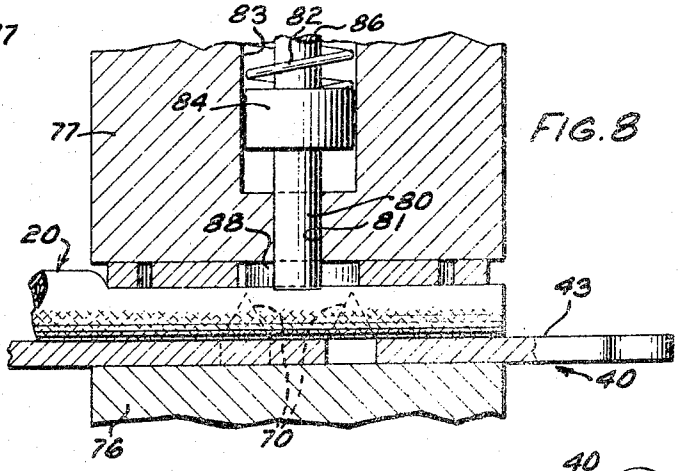


FIG. 9

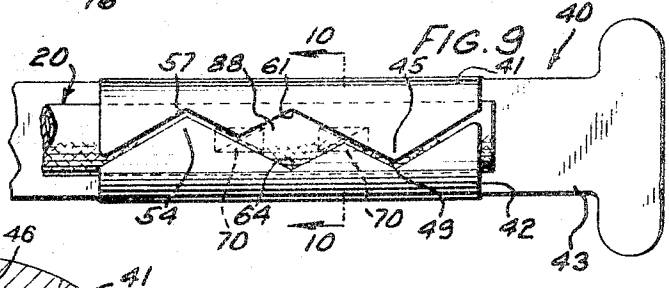
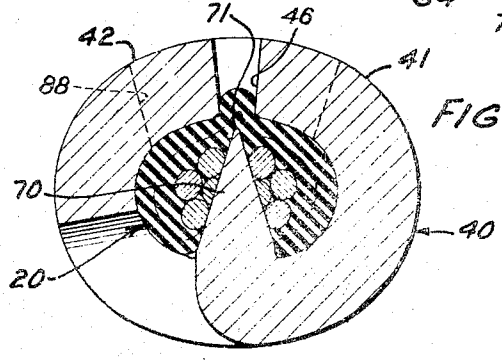


FIG. 10



INVENTOR
E. L. MALHIOT
BY E. F. Kane
ATTORNEY

Patented Mar. 28, 1950 2,501,870

UNITED STATES PATENT OFFICE

2,501,870

TERMINAL FOR ELECTRICAL CONDUCTORS

Eugene L. Malhiot, Maywood, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application November 24, 1945, Serial No. 630,670

4 Claims. (Cl. 173—269)

1

This invention relates to terminals for electrical conductors and the method of making them, and more particularly to a solderless type terminal for and a method of applying them to an insulated conductor having a central multi-strand core.

In one type of solderless terminal for electrical conductor cords similar to that illustrated in Patent No. 1,687,574, granted to A. S. Liss, where the conductor cord is circular in cross section and has a central multi-strand core surrounded by a concentric layer of insulation, a terminal is used which consists in part of a split sheet metal cylindrical sleeve formed around an insulated portion of the conductor cord and has integral prongs piercing the core to make electrical contact with the conductor. It was found that in some of the terminal connections of this type the electrical connections between the terminal and the conductor were defective. In the defective connections, it was found that as a result of the forming of the terminal sleeve into cylindrical shape, the conductor strands were pinched between the sides of the prongs and the side portions of the terminal sleeve and had displaced the insulation between the conductor strands and the terminal sleeve. Some of the conductor strands were severed as a result of this and others made a metal to metal contact with the sleeve which changed in shape with variations in temperature and acted to impair the effectiveness of the electrical connection.

Objects of the present invention are to provide an improved and effective terminal for an insulated conductor providing effective electrical contact with the conductor and to provide a method of forming and attaching terminals to cords.

In accordance with one embodiment of the invention, the terminal is made from a blank having a pair of pointed upwardly directed prongs which, in the practice of the method, pierce the insulation and the stranded metallic core of a conductor cord to which it is connected to make electrical contact therewith. Sleeve forming portions extending from opposite side edges of a central part of the terminal are formed into an elliptically shaped sleeve completely encircling a longitudinal portion of the conductor cord with the major axis of the ellipse disposed transversely

2

of the plane of the prongs to accommodate the divided portions of the conductor cord separated by the prongs. The ends of the sleeve forming portions of the terminal are irregularly shaped to interfit with portions of each other in the completed sleeve and also to form an aperture therein, which aperture permits the use of a yieldable plunger mounted in the upper one of a pair of forming dies, to engage and force the conductor cord onto the upstanding prongs during the clinching operation.

The invention will be more fully understood from the following description taken in connection with the appended drawings, in which

Fig. 1 is an end view of forming dies which may be used to form the improved terminal and shows the terminal and the conductor cord in spaced relation therein;

Fig. 2 is a view of the terminal blank;

Fig. 3 is a plan view of the terminal and conductor cord in assembled relation;

Fig. 4 is a side view of the terminal and conductor cord in assembled relation;

Fig. 5 is an enlarged cross sectional view taken on the lines 5—5 of Fig. 4;

Fig. 6 is a view of the blank of the modified form of the terminal;

Fig. 7 is an end view of forming dies which may be used to form the modified embodiment of the terminal and showing the terminal and conductor cord in position therein:

Fig. 8 is a longitudinal vertical section through the forming dies and the terminal shown in Fig. 7 and showing the forming dies in their closed position at the completion of the forming operation;

Fig. 9 is a plan view of the completed terminal of the modified embodiment; and

Fig. 10 is an enlarged cross-sectional view taken on the line 10—10 of Fig. 9.

Referring to the drawings, Fig. 2 shows a view of a blank from which the completed terminal 10 is formed and which comprises an elongated body portion 11 having laterally extending portions 12 and 13 which are subsequently bent into tubular form to enclose a portion of a conductor. The opposite ends of the laterally extending sleeve forming portions 12 and 13 are irregularly shaped to form staggered serrations 14 and 15, which interfit when the portions 12 and 13 are bent into

tubular form, as indicated in Figs. 3 and 5. The blank is pierced along the V-shaped lines 16 to form a pair of triangular prongs 17. The portions 12 and 13 and the prongs 17 are bent to extend upwardly from the terminal and the prongs are swaged to a pointed and tapering form, as shown in Figs. 1 and 5.

The conductor cord 20 comprises a multiple strand metallic conductor core 21 surrounded by a concentric covering of insulation 22. In the embodiment of the invention illustrated herein, the conductor core 21 consists of seven conductor strands arranged as shown in Fig. 1 and the covering of insulation 22 comprises an inner serving 23 of cellulose acetate and an outer serving of cotton insulation 24.

In practicing the invention, the terminal, having been previously preformed to the shape shown in Fig. 1, is positioned in a recess 27 of a forming die 28 and the conductor cord 20 is positioned in proper relation thereto as shown in Fig. 1. An upper movable forming die having a forming recess 30 therein is adapted to move toward the forming die 28 and in cooperation therewith clinch the terminal portions 12 and 13 around the conductor cord 20 and form them into a split tube or sleeve having an elliptical cross section, as illustrated in Fig. 5. The conductor cord 20 may be forced onto the prongs 17 of the terminal 10 prior to or during the clinching operation by any suitable means cooperating with the movable die. When the conductor cord 20 is forced down over the prongs 17, the prongs pierce the insulation 22 and enter the core 21 and divide the strands, usually into groups of three and four strands on opposite sides of the prong. The division of the conductor cord on opposite sides of a prong is not always uniform and frequently results in an arrangement as shown in Fig. 5, where the prong pierces the core in such a manner that substantially five strands are arranged on one side of the prongs 17 and two on the other. The uneven arrangement of strands occurs especially where the serrated ends of the sleeve portions are disposed relative to the prong to form walls of unequal length on opposite sides of the prongs so that the wall of greater length, during the clinching operation, will force most of the strands to the opposite side of the prong as shown in Fig. 5.

The sleeve portion of the terminal is formed with an elliptical cross section with its minor axis and minor dimension in the plane of the prongs and its major axis and major dimension perpendicular to the plane of the prongs. The major dimension of the elliptical cross section of the sleeve has been substantially increased over that of a similar sleeve formed into circular cross section and provides ample space on each side of the prongs to accommodate the divided portions of the conductor cord which have been separated by the prongs. The increased space between the prong and the walls of the terminal is sufficient to receive the larger of the portions of the cord divided unequally by a prong and may accommodate the increased number of strands in the core, as for example, the five strands shown in Fig. 5 of the drawing, and the insulation surrounding the core without injuring or entirely displacing the insulating between the conductor core and the sleeve of the terminal. This ensures that a layer of resilient insulation will be maintained between the sleeve and the core 21, which acts to urge the strands of the core 21 into tight and positive contact with prongs 17 and to establish a good electrical contact between the terminal and the conductor cord.

A terminal made from sheet metal .0159" thick and having an elliptical sleeve portion, as illustrated in Fig. 5, with a major axis of .080" outside and a minor axis of .065" outside, provides enough space laterally of the prongs to accommodate the divided portions of a conductor cord of .042" diameter having a .020" core without displacing the cushion of insulation between the conductor core and the sleeve and provides an effective electrical connection between the conductor cord and the terminal prongs. Changes in the size and shape of the terminal sleeve due to variation in normal weather temperature changes will not vary the effectiveness of the electrical contact between the terminal prong and the conductor.

In the embodiment illustrated in Figs. 6 to 10, the sleeve forming portions of the terminal are made longer and the ends thereof are shaped to interfit with each other and to form a recess in the completed sleeve, through which a resilient pusher member may pass, to engage the conductor cord and force it downward onto the prongs during the clinching operation. Also, the ends of the sleeve forming members are shaped and disposed relative to each other and to the prongs so that the wall portions of the sleeve on opposite sides of the prongs in planes passing transversely through the prongs are of equal length so that each wall exerts an equal pressure on the conductor cord during the clinching operation and thereby aids in maintaining the conductor cord centrally positioned relative to the prongs.

In the preferred embodiment of the invention as illustrated in Figs. 6 to 10, the terminal member 40 is shown as having sleeve forming portions 41 and 42 extending laterally from the side edges of the central elongated body portion 43. The sleeve forming portions 41 and 42 are longer than in the other embodiment to form an extended sleeve and are provided with irregularly shaped serrated ends. A V-shaped projection 45, having angular edges 46 and 47 on the sleeve portion 41, is disposed opposite a V-shaped notch or recess 49, defined by the edges 50 and 51 of the sleeve portion 42, and a V-shaped projection 54, defined by the angular edges 55 and 56 of the sleeve portion 42, is disposed opposite a V-shaped notch 57, defined by the angular edges 58 and 59 of the sleeve portion 41. The sleeve portion 41 is provided with an edge 60 which, with the edge 46, defines a V-shaped notch 61. Similarly, the sleeve forming portion 42 is provided with an edge 63 which, with the edge 56, defines a V-shaped notch 64, which is disposed directly opposite the V-shaped notch 46. The blank 40 is cut along the V-shaped lines 69 to form a pair of triangular prongs 70. The sleeve forming portions 41 and 42 and the prongs 70 are bent to extend upwardly from the terminal and the prongs are swaged to provide converging sides forming a point 71, as illustrated in Figs. 7 and 10.

In order to assemble the parts, the conductor cord 20 and the preformed terminal member 40 are positioned in the lower one of a pair of relatively movable forming dies 76 and 77, which are provided with forming recesses 78 and 79, respectively, as shown in Fig. 7. The dies 76 and 77 cooperate during the clinching operation to form the sleeve forming portions 41 and 42 of the terminal member 40 into a sleeve having an elliptical cross section with the major axis thereof disposed

transversely to the plane of the prongs to accommodate the divided portions of the cord 20 (Fig. 10). The upper die 77 is provided with a plunger 80 reciprocably mounted in a recess 81 of the die and urged downwardly by a compression spring 82 mounted within a recess 83 and engaging an enlarged portion 84 of the plunger 80. A stop member 85 is mounted within the upper end of the recess 83 at a predetermined distance from the upper end 86 of the plunger 80 to limit the upward movement of the plunger relative to the die 77. The plunger 80 extends downwardly below the recess 79 of the die 77 and is adapted to engage the conductor cord 20 during the downward movement of the die 77 and force the cord over the prongs 70 with sufficient force to insure that the prongs pierce the insulation and the stranded core of the cord 20 and establish a good connection therewith and centrally thereof before the sleeve portions 41 and 42 are clinched therearound. The plunger 80 is located in a central position longitudinally of the die so as to engage a portion of the conductor cord positioned above and between the prongs 70, as seen in Fig. 8.

The relation of the plunger to the prongs and the relation of the prongs to each other is such as to permit the plunger to move that portion of the cord above the prongs down onto the prongs and into firm engagement with the bottom portion of the sleeve. During the clinching operation, the plunger 80 engages the cord 20 and is moved upwardly relative to the die 77 a predetermined distance until it is stopped by the member 85, in which position the lower portion of the plunger 80 projects below the forming surface 79 of the die 77 a distance substantially equal to that of the thickness of the sheet metal of the terminal 40 (Fig. 8). The lower end of the plunger 80 may be engaged by the edges 46 and 60, and 56 and 63 of the sleeve forming portions 41 and 42 during the clinching operation which serves to keep the terminal 40 in position angularly and prevent its turning or rotating on its longitudinal axis while the sleeve portions 41 and 42 are being formed around the cord 20.

In the completed terminal, as viewed in Fig. 9, the V-shaped projections 54 and 45 nest within the V-shaped recesses 57 and 49, respectively, on the opposite sleeve forming portions 41 and 42 and the V-shaped notches 61 and 64 form a diamond shaped opening 88 in the sleeve substantially as wide as the cord and extending from a point substantially above the pointed end of one prong to a point substantially above the pointed end of the other prong. The wall portions of the sleeve, surrounding the cord 20 in a plane extending transversely through the prongs, form a substantially complete enclosure with the end edges thereof juxtaposed and located above the pointed ends of the prongs 70. The cord 20 is thus firmly maintained in engagement with the prongs 70. Also, the terminal blank is shaped so that the wall portions on opposite sides of the prong and in a transverse plane through the prongs are of equal length and act on the conductor cord with equal force during the clinching operation. This equal application of force by the side walls of the sleeve serves to maintain the conductor cord 20 and its stranded core 21 centrally disposed with respect to the prong 70.

I claim:

1. A terminal connector in combination with a multi-strand conductor sheathed in insulation comprising a single metallic member having an inwardly extending prong formed centrally thereof piercing said insulation and said conductor to make electrical contact with said conductor, said member having sleeve forming portions which are wrapped around said insulation and multi-strand conductor to form a split sleeve therearound, and irregularly shaped ends on said sleeve forming portions having oppositely disposed recesses arranged to cooperate with each other to form an aperture in the wall of said sleeve opposite the prong whereby during the assembly of the terminal connector to the insulated conductor the insulated conductor may be engaged in the area defined by said aperture and held against the prong while the sleeve-forming portions are wrapped around the insulated conductor.

2. A terminal connector in combination with a multi-strand conductor encased in insulation comprising a single metallic member having an inwardly extending prong formed centrally thereof piercing said insulation and said conductor to make electrical contact with said conductor, said member having sleeve forming portions which are wrapped around said insulation and multi-strand conductor to form an elliptical split sleeve therearound, said elliptical sleeve having its major axis transverse to the longitudinal plane through the prong to accommodate the divided portions of said conductor and said insulation separated by said prong, said sleeve forming portions having ends arranged to cooperate with each other along spaced portions of the sleeve to form an aperture in said sleeve between said spaced portions whereby during the assembly of the terminal connector to said insulated conductor said insulated conductor may be engaged in the area defined by said aperture and held against the prong while the sleeve-forming portions are being wrapped around the insulated conductor.

3. A terminal connector in combination with a multi-strand conductor encased in insulation comprising a single metallic member having a pair of inwardly projecting prongs formed centrally thereof piercing said insulation and said conductor to make electrical contact with the conductor, said member having sleeve forming portions which are wrapped around said multi-strand conductor and said insulation to form a split sleeve therearound, irregularly shaped ends on said sleeve forming portions having oppositely disposed recesses arranged to cooperate with each other to form an aperture in said sleeve, said aperture being located in the wall portion of the sleeve opposite the prongs and between transverse planes through said prongs whereby during the assembly of the terminal connector to the insulated conductor the insulated conductor may be engaged in the area defined by the aperture and held against the prongs while the sleeve-forming portions are being wrapped around the insulated conductor.

4. A terminal connector in combination with a multi-strand conductor sheathed in insulation comprising a single metallic member having a pair of inwardly projecting prongs formed centrally thereof piercing said insulation and said conductor to make electrical contact with the conductor, said member having sleeve forming portions which are wrapped around said multi-strand conductor and said insulation to form an elliptical split sleeve therearound having its major axis transverse to the longitudinal plane through the prongs to accommodate the divided portions of said conductor and said insulation separated by said prongs, and irregularly shaped ends on said sleeve forming portions arranged

to interfit with each other along spaced portions of the sleeve and to form an aperture in said sleeve, said aperture being located in the wall of the sleeve opposite that in which the prongs are formed and between transverse planes through said prongs whereby during the assembly of the terminal connector to the insulated conductor the insulated conductor may be engaged in the area defined by said aperture and held against the prongs while the sleeve-forming portions are being wrapped around the insulated conductor.

EUGENE L. MALHIOT.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,706,005	Thompson	Mar. 19, 1929
2,302,767	Hackbarth	Nov. 24, 1942
2,379,567	Buchanan	July 3, 1945

FOREIGN PATENTS

Number	Country	Date
617,955	France	1926