

March 22, 1966

L. L. JUGLE

3,242,256

INSULATION PIERCING CONNECTOR

Filed Dec. 13, 1963

FIG. 1

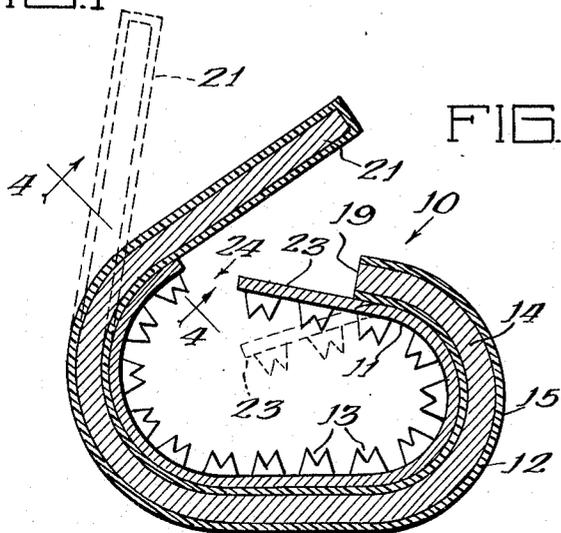


FIG. 7

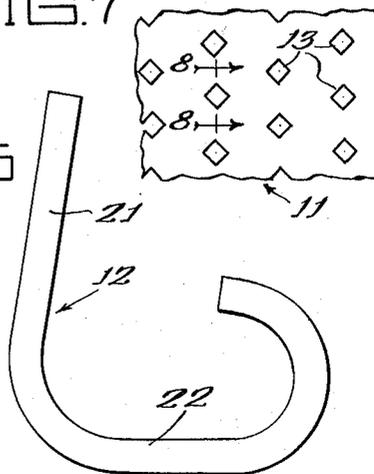


FIG. 5

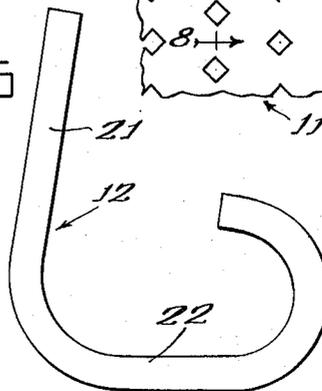


FIG. 6

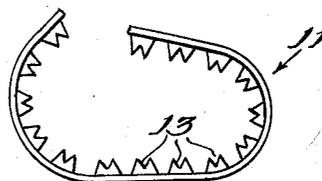


FIG. 2

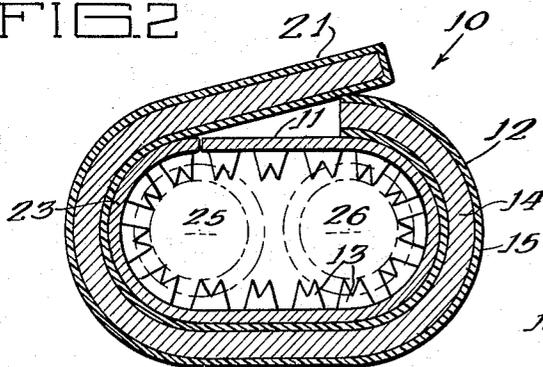


FIG. 4

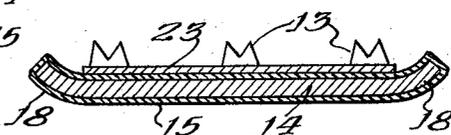


FIG. 3

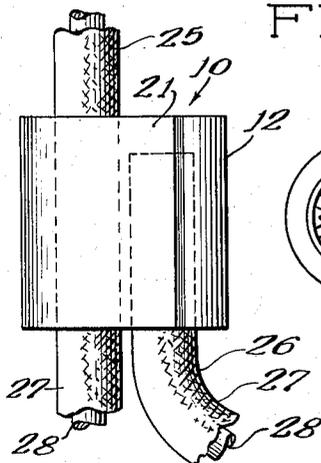


FIG. 10

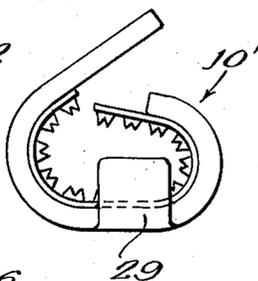


FIG. 9

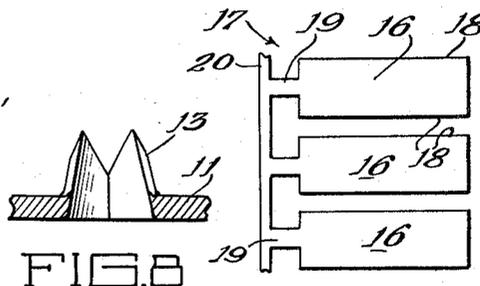


FIG. 8

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INSULATION PIERCING CONNECTOR

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Filed Dec. 13, 1963, Ser. No. 330,369

8 Claims. (Cl. 174-84)

This invention relates to a connector for insulated wires which is of the type having prongs which pierce the insulation of two wires lying side by side so that an electrical connection can be made between the conductors of each.

The insulation piercing connector comprises an insulation piercing element, referred to herein as the "liner," plus a surrounding element of a soft nonresilient metal, referred to herein as the "cover." The liner is formed of resilient stock which is normally biased to an open position so that it will receive two or more wires. However, the cover is sufficiently thick so that when deformed incident to the insulation piercing function, the set assumed by the cover causes the grater to remain in its flexed position.

One of the problems in constructing a low cost connector of this type has been that of insulating the cover against contact with metal parts or with other connectors which may be in the vicinity. It has been proposed to provide a connector in the form of an elongate tube for receiving the ends of two conductors for the reason that the tubular cover may be insulated by inserting the metallic cover-liner assembly within a plastic insulating tube which is heat shrinkable. Such tubular connectors are generally closed at one end.

One disadvantage of the tubular type of connector is that the metallic elements must be inserted within the insulating tube by a manual inserting operation thus contributing to a relatively high cost of manufacture.

According to my invention, I provide an outer element in which the insulation is in the form of a coating, such as a dipped coating. The cost of the dipping step is considerably less than the cost of the manual inserting step of the prior art with the result that the present connector has a decided cost advantage over the prior art connectors.

Another object of my invention is to provide a connector which can be used in making a tap type of connection. The prior art tubular connector cannot be applied to the span portion of a wire; it must be slipped over the end. This is true whether the tubular type is closed at one end, or open at both ends.

Another object of the present invention is to provide a connector which is C-shaped so that it can be applied to the span of a conductor; then the end of the tap wire is inserted and the connector is closed and pressed. Similarly, my improved C-shaped connector can be applied to the spans of two wires.

A further object of my invention is to provide a C-shaped connector which has a snapping action so that when applied to the span of a conductor, it will snap over the conductor and retain itself in place, leaving both hands free for manipulation, such as the fishing out of a tap wire from a cable, and inserting the same endwise into the connector.

According to this aspect of my invention, I provide an uncovered end portion of the liner so that the same may be flexed by the sidewise insertion of the wire span and, being uncovered by the outer element, it can snap back into its open position in which the distance between it and the opposite leg of the connector is less than the diameter of the wire.

A still further object is to provide an improved low

cost method for the fabrication of the insulated cover element of an insulating piercing connector.

Other objects, features and advantages will become apparent as the description proceeds.

With reference now to the drawings in which like reference numerals designate like parts:

FIG. 1 is an elevation showing a preferred embodiment of my invention in its open position, before application;

FIG. 2 is an elevation of the connector of FIG. 1 in its closed position, the conductors being shown in broken lines;

FIG. 3 is a reduced plan view of FIG. 2, as applied to a tap type of connection;

FIG. 4 is a section taken along line 4-4 of FIG. 1;

FIG. 5 is a side elevation of the cover alone;

FIG. 6 is a side elevation of the liner alone;

FIG. 7 is a fragmentary plan view showing the surface of the liner;

FIG. 8 is an enlarged section along line 8-8 of FIG. 7 showing a prong;

FIG. 9 is a plan view of the cover blank assembly before coating; and

FIG. 10 is a view similar to FIG. 1 showing a modification.

With reference now to FIGS. 1 and 4, the connector 10 comprises a liner element 11 and a cover 12. The liner 11 is made of a hard resilient metal such as Phosphor bronze sheet about .006 to .008 inch thick. The material of the liner is first punched by nail punches to form a number of prongs 13, as shown in FIGS. 7 and 8. Then the sheet is cut into a number of rectangular blanks, each of which is bent into a C-shape, as shown in FIG. 6, this being the final shape as shown in FIG. 1.

The cover 12 comprises a body 14 of sheet metal which is relatively soft, compliant, and massive, as compared with the thickness of the stock from which the liner 11 is formed. The body 14 is provided with a coating 15 of suitable insulation material, such as nylon.

The manner in which the cover is formed is illustrated in FIG. 9, which comprises a plurality of blanks 16 which form a part of a main blank assembly 17. Each of the blanks 16 is in the form of a rectangular strip of copper or aluminum having a thickness of substantially .025 inch. The long side edges of the blank are bent up slightly, as at 18 in FIGS. 4 and 9. The various blanks 16 are each provided with a shank 19 which connects with a handling strip 20. The blank assembly 17 is stamped out of copper sheet. Thus, the assembly 17 can be held by the handling strip 20 and dipped into a pot of thermoplastic insulation so as to apply the coating 15. In the alternative, the coating 15 can be applied by the fluidized bed method, in which the blank assembly 17, or the blank portions 16 thereof, are heated by an electrostatic field simultaneously with the dipping thereof into a fluidized bed of powdered insulation material, such as nylon powder.

After the dip coating, the blanks 16 are severed from the shanks 19. It will be noted that all four edges of the blank 16 are coated, except for a relatively small portion of one edge which represents the shear line between the shank 19 and the blank. As will be hereinafter pointed out this uninsulated edge is overlain by the end portion 21 with the result that there is no uninsulated edge portion of the liner, thus avoiding any possibility of short circuits. The width of the liner element 11 is less than the cover 12 (see FIG. 4) with the result that there are no exposed current conducting parts which would be a source of short circuits.

After severing, the blanks are bent into an open C-shape, as shown in FIG. 5, in which the end portion 21

forms an angle of substantially 80° with respect to the central portion 22. When bent into this shape, it is easy to place the liner 11 within the cover 12 as shown in broken lines in FIG. 1. Thereafter, the end portion 21 is bent into the solid line position so that it forms an angle of substantially 34° with respect to the central portion 22.

Thus, the finally assembled connector 10, as shown in FIG. 1, has an uncovered liner portion 23 which is disposed at an angle of about 10° with respect to the central portion 22 of the cover, and hence at an angle of about 44° with respect to end portion 21. This provides a gap 24 between the end of the uncovered portion 23 and the opposite end of the liner. The uncovered portion 23 is resilient and can be flexed downwardly, as shown in dotted lines in FIG. 1 so as to permit the sidewise insertion into the gap 24 of an insulated conductor 25. As will be seen in comparing the diameter of the conductor 25 as shown in FIGS. 2 and 3 with the dimensions of the gap in FIG. 1, the conductor diameter is somewhat larger than the width of the gap 24. This provides a snapping action whereby with only one hand the connector 10 can be applied sidewise to the span of conductor 25 as contrasted with an endwise insertion. Thus, the other hand of the operator is free for the selection and manipulation of an insulated tap wire 26, which may be inserted into the connector 10, either endwise or sidewise.

After both of the conductors have been inserted, the cover portions 21 and 22 are squeezed together by pliers or other tool into the FIG. 2 position, in which the prongs 13 penetrate the insulation 27 of the conductors 25 and 26 and make electrical connection with the copper cores 28 thereof.

The physical characteristics of the material, such as pure copper, from which the body 14 is formed are best summarized by the adjective "dead soft" because the material is lacking in resilience and takes a set without any spring back when deformed, the thickness being sufficient as to overcome the resilience of the liner 11. Thus, when deformed into the FIG. 2 position, the prongs 13 remain in electrical contact with the cores 28 to provide an electrical connection between conductors 25 and 26. Preferably, the material of the coating 15 has sufficient resilience in compression as to provide a slight preload.

FIG. 10 shows a modification 10' in which a side edge of the cover 12 is provided with a bent up flap 29. Thus, in making a tap connection, as shown in FIG. 3, it is not necessary for the operator to visually inspect the connector before crimping in order to make sure that the end of the tap wire does not protrude from the connector.

Of course, in the case of a connection between the ends of two wires as contrasted with a tap connection, the flap may be of greater width so as to provide a stop for both wires, and in the case of across connection, there would be no flap.

Although only preferred embodiments of my invention have been shown and described herein, it will be understood that various modifications and changes may be made in the constructions shown without departing from the spirit of my invention as pointed out in the appended claims.

I claim:

1. An insulation piercing connector comprising a resilient C-shaped insulation piercing liner element having insulation piercing prongs, a C-shaped dead soft cover element, each of said elements having a right end portion and a left end portion, said dead soft cover element being formed of a nonresilient material and having a coating of insulation material overlying its inner and outer surfaces, both side edges, and the end edge of said left hand end portion, said cover element overlying the major portion of said liner element when said connector is in its open posi-

tion with said right end liner portion extending beyond said right end cover portion providing a deformable resilient flap permitting sidewise insertion of a conductor, and with said left end cover portion extending beyond said left and liner portion to provide a deformable nonresilient flap serving as an operating element for closing said liner element to establish electrical connection between two insulated conductors to be encircled thereby, said left end cover portion when in its operated position overlying said right end liner portion and overlapping said right end cover portion.

2. An insulation piercing connector comprising a resilient C-shaped insulation piercing liner element having insulation piercing prongs, a C-shaped dead soft cover element, said dead soft cover element being a bent strip of a compliant sheet metal material and having a coating of insulation material overlying its inner and outer surfaces, both side edges, and at least one end edge, said liner element being disposed within said cover element, said cover element, when closed, overcoming the resilience of said liner element so as to maintain said connector in its closed position about a pair of insulated conductors.

3. An insulation piercing connector as claimed in claim 2 in which an end portion of said liner element extends beyond a corresponding edge of said cover element.

4. An insulation piercing connector as claimed in claim 2 in which said compliant material is copper.

5. An insulation piercing connector as claimed in claim 2 in which said cover element has a first end portion, a second end portion, and a central portion, said first end portion, when said connector is in open position, being disposed at an angle of substantially 34° to said central portion.

6. An insulation piercing connector as claimed in claim 5 in which said liner element has an end portion extending beyond said second end portion of said cover element, said liner end portion being disposed at an angle of substantially 44° to said first end portion of said cover element, and terminating short thereof to provide a gap permitting sidewise insertion of a conductor.

7. An insulation piercing connector as claimed in claim 2 in which said cover element has a flap extending from one side edge, said flap being bent up to form a partial end closure for the space surrounded by said liner element and serving as a positioning stop for the endwise insertion of a conductor.

8. An insulation piercing connector comprising a resilient C-shaped insulation piercing line element having insulation piercing prongs, a C-shaped dead soft cover element having a first end portion and a second end portion, said dead soft cover element being formed if a compliant metal and having a coating of insulation material overlying its inner and outer surfaces, both side edges and the end edge of said first end portion, said liner element being disposed within said cover element, and said first end portion being extended providing an operating element for closing said C-shaped elements about a pair of insulated conductors, said dead soft cover element overcoming the resilience of said liner element so as to maintain said connector in its closed position, and said first end portion of said cover element being of a length sufficient to overlap, when closed, said second end portion of said cover element.

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