United States Patent

Sedlacek

[15] **3,636,500**

[45] **Jan. 18, 1972**

[54] CLIP-TYPE TERMINAL

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[22] Filed: **Mar. 14, 1969**

[21] Appl. No.: **807,336**

[52] **U.S. Cl.** ..... **339/97 R**

[51] **Int. Cl.** **H01r 9/08**

[58] **Field of Search** 339/97–99

[56] **References Cited**

UNITED STATES PATENTS

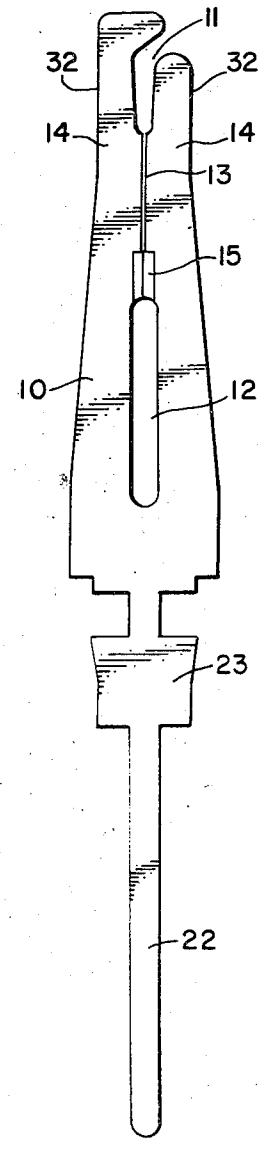
3,167,375	1/1965	Sarazen	339/99
3,234,498	2/1966	Logan	339/97 P
3,521,221	7/1970	Lenaerts et al.	339/97 P

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[57] **ABSTRACT**

A clip terminal is made from resilient strip stock. It has a notch formed at its upper end, an elongate aperture spaced below the notch, and is slitted between the bottom of the notch and top of the aperture to provide a slot which separates the body portion into two arms. The arms are prestressed apart by an upsetting operation. The bottom of the notch is rounded and the notch edges intersect the side edges of the slot to provide substantially 90° sharp corner edges. The width of the slot at the sharp corner edges is somewhat less than the diameter of the solid conductor which is to be forced therebetween. Forcing an insulated wire between the sharp corner edges causes them to cut a notch in the insulation and bare the surface of the conductor. The lower portion of the notch is of a width sufficiently small so that with larger wire sizes, the insulation bearing on the notch edges will flex the arms outwardly to increase the width of the slot.

12 Claims, 9 Drawing Figures



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SHEET 1 OF 2

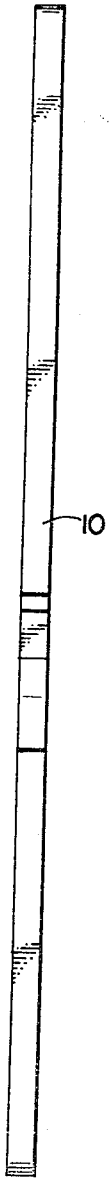


FIG. 2.

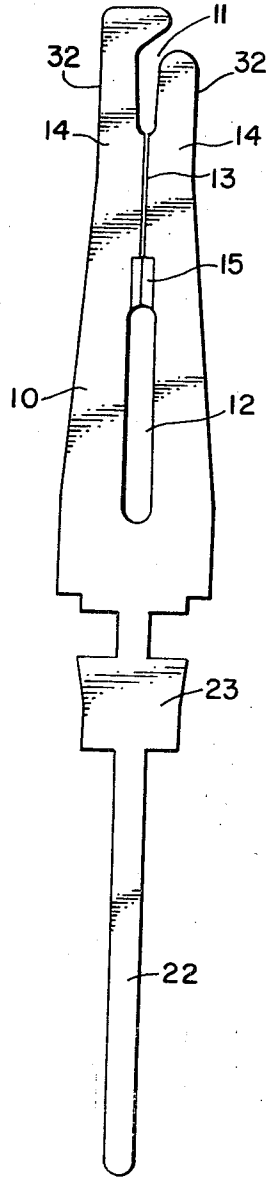


FIG. 1.

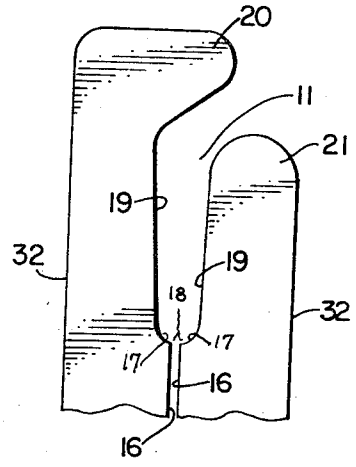


FIG. 3.

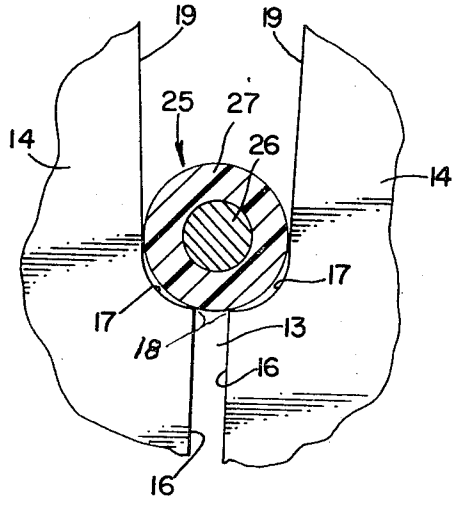


FIG. 4.

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FIG. 7

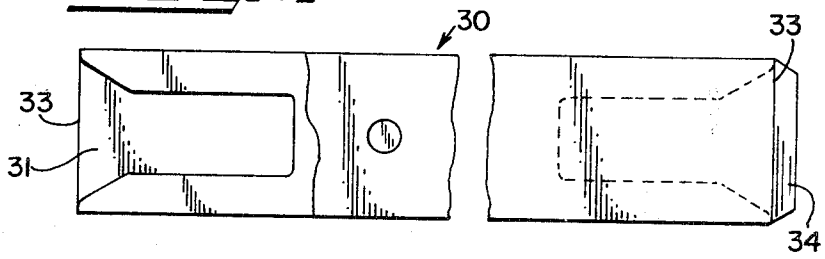
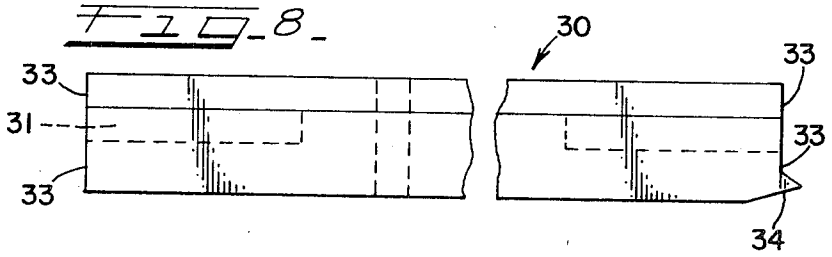


FIG. 8



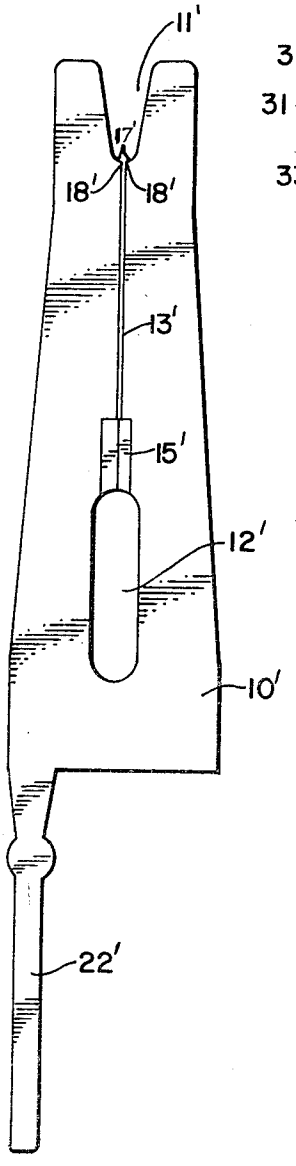


FIG. 9

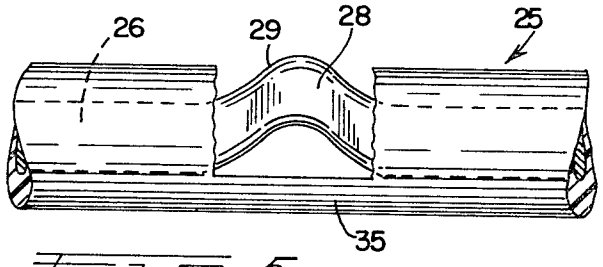


FIG. 5

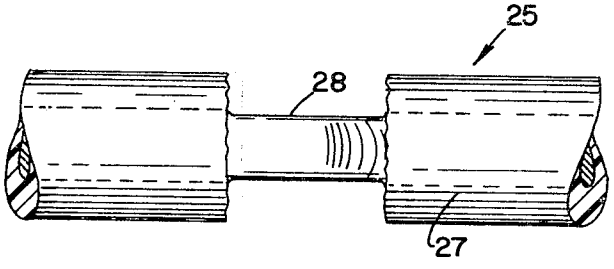


FIG. 6

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CLIP-TYPE TERMINAL

This invention relates to a clip-type terminal, which is a device for engaging a solid conductor insulated wire to make electrical contact therewith. The clip terminal is a flat piece of metal having two integrally formed resilient arms which provide a conductor receiving slot. The insulated wire is forced into the slot which is of a width considerably less than the diameter of the conductor. The process of inserting the conductor into this slot results in a penetration of the insulation so that electrical contact is obtained between the slot edges and the conductor. Wires may be quickly terminated because stripping of the insulation is eliminated.

In previous devices of this type, as shown in U.S. Pat. Nos. 3,112,147 dated Nov. 26, 1963 and 3,234,498 dated Feb. 8, 1966, the penetration of the insulation is a crushing of the same which may be combined with a certain abrasion or tearing of the insulation which results from the relative movement of the conductor with respect to the slot edges. In these prior art devices, the entry to the slot is a smooth V, the insulated wire exerting a camming action which forces the arms apart.

The objection to this prior art device is not that all of the insulation is necessarily removed; in some instances, particularly with smaller diameter insulated wire as **26** gauge, there may be insulation remaining between the conductor surface and the slot edge either in the form of discrete particles or in the form of a thin film, either of which greatly increase the resistance of the connection.

According to my invention I provide an entirely different slot entry which has been found to strip away the insulation cleanly from the surface of the conductor, and make good electrical contact with the conductor. More specifically, I provide at the upper end of the slot opposed corner edges which are arranged parallel to the axis of the conductor. As the wire is forced between the corner edges, they perform a cutting action on the insulation; they cut a square notch in the insulation which is of a width corresponding to the thickness dimension of the arms. The arms at the same time are forced apart by the camming action of the movement of the conductor so that electrical contact is made with the surface of the conductor over a distance which corresponds to the thickness of the slot edges.

A further feature of my invention is that the clip terminal can be made to accommodate a range of wire sizes by providing means for controlling the slot width which becomes operative with the larger wire sizes.

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

In the drawings:

FIG. **1** is an elevation of one embodiment of my invention;

FIG. **2** is an end view thereof;

FIG. **3** is an enlarged elevation of the upper portion of FIG. **1**, with the slot width somewhat exaggerated;

FIG. **4** is a fragmentary further enlargement of a portion of FIG. **3** showing the relationship of an insulated wire to the notch and the slot;

FIG. **5** is a plan view of the insulated wire showing the manner in which the insulation has been removed;

FIG. **6** is a top view of FIG. **5**;

FIG. **7** is a plan view of the inserting tool, with the cover plate partially broken away;

FIG. **8** is a side view of FIG. **7**; and

FIG. **9** is a plan view of another embodiment of my invention.

In FIGS. **1** and **2** the clip comprises a flat body portion **10** of resilient metal having a notch **11** at its upper part and an elongate aperture **12** in its lower part. A slot **13** connects the two thus providing two resilient arms **14**.

The slot **13** is formed by a shearing or a slitting operation after which portions are upset or "coined" at **15** which forces the arms **14** apart from each other to an extent such that the width of the slot immediately adjacent the portion **15** is about 0.002 inch, and the width at the upper end is 0.008 to 0.010 inch. This slitting operation produces sharp square slot edges **16**.

THe bottom of the notch **11** is rounded providing curved edges **17** which intersect the slot edges **16** to provide oppositely disposed sharp corner edges **18** (FIG. **4**). The radius of the curved edges **17** is substantially 0.015 inch, making the width of the bottom of the notch substantially 0.040 inch. The upper notch edges **19** may be parallel, or slightly downwardly converging. A lateral extension **20** on one of the arms cooperates with the rounded top **21** of the other arm to facilitate entry of an insulated wire where the total wire diameter exceeds the notch width.

The base of the clip includes a terminal end **22** to permit soldered connections or wire-wrapped connections and a tab **23** for securing the clip to a holder, as by wedging.

The body portion **10** is preferably formed from spring tempered phosphor bronze strip, alloy No. A, having a thickness of substantially 0.044 inch. After the stamping, slitting and upsetting operations are performed, the clip is heat treated at 450° F. for 1 hour for stress relief. Then the clip is electroplated with tin or other suitable metal.

FIG. **3** is a greatly enlarge view of the parts with the slot width exaggerated, and FIG. **4** is a further enlargement showing an insulated wire **25** located in the notch **11** adjacent the corner edges **18**. The insulated wire comprises a metal conductor portion **26** and an insulating jacket **27**.

As the insulated wire **25** is forced between the corner edges **18**, the edges will cut a square notch (FIGS. **5** and **6**) in the insulation **27**, but when the conductor **26** comes in contact with the corner edges **18**, the arms will yield sufficiently to permit entry of the metallic conductor **26** into the slot **13**, the width of the slot at the corner edges being less than the diameter of the metallic conductor **26**. The operation is such that the corner edges scrape or shear the insulation cleanly from the surface of the metallic portion, thus providing good electrical contact between the metal conductor **26** and each slot edge **16** over a distance of 0.044 inch.

As an aid to insertion of the wire, a tool **30** may be provided as shown in FIGS. **7** and **8**, the tool providing a recess **31** to accommodate the upper ends of the arms **14**, the outer edges **32** of which are substantially parallel in this region. The width of the recess **31** is such that it will accommodate up to 0.010 or 0.011 deflection of each arm **14**, thus accommodating all wire sizes from **20** gauge to **26** gauge, but limiting the extent of the flexure so that it will not exceed the elastic limit of the clip material.

The end surfaces **33** of the tool apply pressure to the wire **25** immediately adjacent to the side surfaces of the clip so that the amount of force required to cam the corner edges **18** apart can be transmitted to the conductor **26**. The outer corners of the end surfaces **33** provide an edge around which the wire can be bent upwardly, thus avoiding a bend at the edge of slot **13**. If preferred, the end surfaces **33** may be notched at the center to provide a forming edge for the wire which is operative in the sideways direction also. The tool may include a sharp blade **34** for cutting off the free end of the wire **25**.

With material of the type specified wherein the arm length between a corner edge **18** and the bottom of aperture **12** is 0.670 inch and the arm width at these two points is 0.082 and 0.107 inch, respectively, a force of 16.2 pounds is required, on the average, to insert a 24-gauge conductor and remove the insulation. The resilience or tension of the arms is preferably such that there is a slight flattening at **28** (FIGS. **5** and **6**) of a **24** gauge conductor, representing an interference of 0.0005 inch. The force of the insertion results in a looping of the conductor as shown at **29** in FIG. **5**, particularly in smaller wire sizes. The leading edge **35** of the insulation **27** remains in its original position, but the trailing edge is generally severed from the remainder.

One advantage of the present invention as compared with the prior art insulation crushing clip is that less insertion force is required in the present invention, and this is in spite of the fact that the prior art invention has a smooth V-shaped entry into the slot **13** as contrasted with the round entry of the present invention which one would ordinarily consider as involving a much less efficient camming action. A comparison of average insertion forces is indicated below:

	Round Entry	V Entry
26 gauge	12.6 lbs.	17.7
24 gauge	16.2 lbs.	24
22 gauge	32.6 lbs.	36.7

The slot **13** width should be considerably smaller than the smallest size conductor to be accommodated. However, with larger size conductors, the thickness of the insulation causes a spreading of the arms as the wire is inserted into the notch **11**. This increases the slot width to an extent such that a camming action will be present. For instance, in FIG. **4** which shows the proportions for a 24-gauge conductor, the slot width is about 50 percent of the conductor diameter with the result that the tangent of the conductor surface at the point of contact with the corner edge **18** is about 30° to the horizontal. For larger conductor sizes, the spreading of the arms by the insulation would tend to provide the same or an even more favorable ratio of slot width to conductor diameter.

Thus, the cooperation of the notch with the total diameter of the insulated wire regulates the slot width insofar as larger wire sizes are concerned, to the end that the present clip will accommodate a range of sizes of insulated wire, such as from 26 gauge to 20 gauge for the example given.

With the small wire sizes here referred to, the regulation provided by the notch width is best obtained when the ratio of notch width right above the arcuate edges **17** is from three to four times the width of the slot **13** at the corner edges **18**.

The prestressing of the arms **14** caused by the upsetting operation at **15** renders the arm resistant to flexure under forces exerted by the relatively soft insulation **27** incident to insertion. The corner edges **18** are not spread by their engagement with the insulation, but remain in their original position until engaged by the conductor. Thus, the sharp corner edges **18** are effective in cutting the notch in the leading edge **35**.

A somewhat greater arm flexibility is desired for 28-gauge wire due to the greater fragility of the conductor.

This can be obtained by reducing the width of the arms, as shown in FIG. **9**, in which the reference numerals primed correspond to the reference numerals of FIG. **1**. The length between the corner edge **18'** and the bottom of aperture **12'** is substantially 0.450 inch, and the arm width at these two points is 0.0625 and 0.075 inch, respectively. The material of the body member **10'** is the same as in FIG. **1**, except that it is 0.031 inch thick. The slot width is 0.008 inch, and the radius of the curved edge **17'** is 0.010 inch. The notch **11'** is tapered, being 0.028 inch wide at the bottom and 0.058 inch wide at the top. The insertion tool used with this clip terminal limits the flexure of each arm to 0.008 inch. This clip terminal is suitable for both 26-gauge and 26-gauge insulated wire. The resilience or arm tension is such that when 26-gauge wire is inserted, there will be a slight flattening of the conductor surface, representing an interference of 0.0005 inch.

The present invention is also applicable to other forms of clip terminals, such as a multiclip terminal wherein a plurality of clip terminals are integrally interconnected by a common base so that a number of parallel terminations can be made.

I claim:

1. In a clip terminal of the type having a flat body portion providing two resilient arms separated by a notch at the upper end and by a slot having substantially parallel edges and communicating with the lower end of said notch, the improvement in which the bottom of said notch is rounded and has curved edges with the radii of curvature lying intermediate the sides of the notch, said curved edges intersecting the edges of said slot to provide substantially 90° corner edges oriented substantially parallel to the axis of an insulated wire received within said notch, the width of said slot at said corner edges being no greater than the diameter of the conductor of said insulated wire so that movement of said insulated wire into said slot will cause said corner edges to cut a notch in the insulation and bare the surface of said conductor, and said arms being resilient to permit the entry therebetween of a conductor which is of a diameter greater than the width of said slot.

2. A clip-type terminal as claimed in claim **1** in which the edges of said notch are substantially parallel for the greater part of their length, the upper ends of said notch edges being outwardly diverging to provide a smooth notch entry.

3. A clip-type terminal as claimed in claim **1** in which the edges of said notch are upwardly diverging.

4. A clip terminal as claimed in claim **1** adapted to accommodate 24 and 26-gauge insulated wire in which the radius of said curved edges is substantially 0.015 inch and in which the width of said slot at said corner edges is from substantially 0.008 to 0.010 inch.

5. A clip terminal as claimed in claim **4** in which the width of the lower part of said notch is from substantially 0.038 to 0.040 inch.

6. A clip terminal as claimed in claim **1** adapted to accommodate 26 and 28-gauge insulated wire in which the radius of said curved edges is substantially 0.010 inch and in which the width of said slot at said corner edges is substantially 0.008 inch.

7. A clip terminal as claimed in claim **6** in which the width of the lower part of said notch is substantially 0.028 inch.

8. A clip terminal as claimed in claim **1** in which the edges of said slot are square with respect to adjacent side surfaces of said body portion so that the notch cut in said insulation will be a square notch, and so that contact with the conductor surface will be made over a distance corresponding to the thickness of said body portion.

9. A clip-type terminal as claimed in claim **1** adapted to accommodate a range of wire sizes in which the width of the lower portion of said notch is less than the total diameter of the larger sizes of said range so that interference between the edges of said lower notch portion and the insulation of said larger sizes will increase the width of said slot sufficiently to permit a camming action between said corner edges and the surface of said conductor.

10. A clip terminal comprising an elongate body portion formed from resilient metal having a notch at its upper end, an elongate aperture spaced below same, and a slot extending between the bottom of said notch and the upper end of said aperture, the bottom of said notch being rounded and having arcuate edges and with the centers of the arcs being intermediate the sides of the notch, each edge extending through substantially 90° of arc which intersect the edges of said slot to provide substantially 90° sharp corner edges, the width of the lower portion of said notch adjacent said arcuate edges being from three to four times the width of said slot at corner edges.

11. A clip terminal as claimed in claim **10** in which said slot edges at a point adjacent to said aperture are upset to prestress the arm portions separated by said slot so that said arm portions will not be further deformed by the entry between said corner edges of the insulation surrounding an insulated wire.

12. A clip terminal as claimed in claim **10** in which said slot edges at a point adjacent to said corner edges are spaced from each other by a distance no greater than the distance between said corner edges.

* * * * *