United States Patent

[11] 3,605,071

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[54] **TWO WIRE CLIP-TYPE TERMINAL AND TOOL FOR OPERATING SAME**
11 Claims, 5 Drawing Figs.

[52] U.S. Cl. ..... **339/97 P**
[51] Int. Cl. **H01r 9/08**
[50] Field of Search 339/95, 97–99

[56] **References Cited**

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ABSTRACT: A clip terminal is made from resilient strip stock. It has two notches at its upper end which connect with narrow slots which separate the body portion into a center arm and two end arms. The width of each end arm is less than the width of the center arm so that the stiffness of the center arm is more than twice the stiffness of either end arm. The tool for inserting a wire in either slot has a recess which receives all three arms. The insertion of the wire deflects one end arm, but the side of the recess limits the deflection. The surfaces of the recess each have a groove to receive a boss formed on the center arm so that the deflection of either end arm will be limited independently of the other end arm.

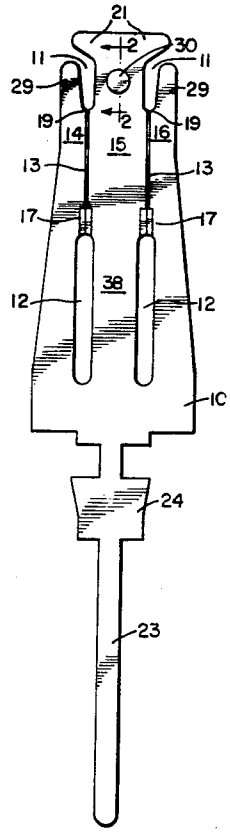

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FIG. 1

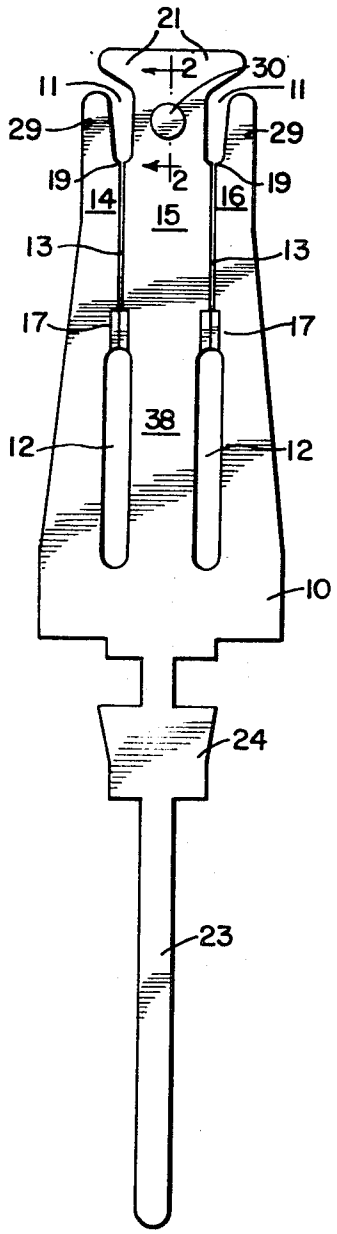


FIG. 3

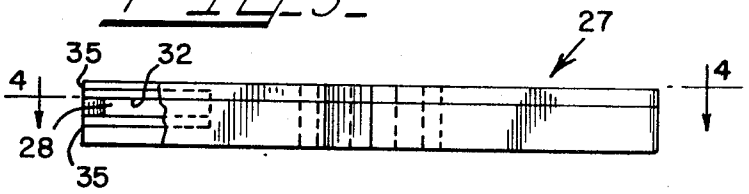


FIG. 4

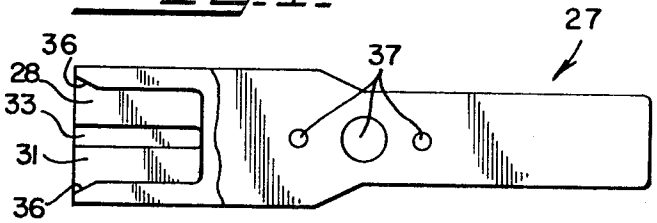


FIG. 5

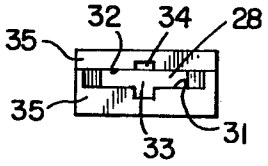
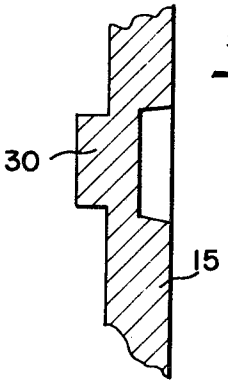


FIG. 2



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TWO WIRE CLIP-TYPE TERMINAL AND TOOL FOR OPERATING SAME

This invention relates to a clip-type terminal which will receive two insulated wires. The clip-type terminal is a flat piece of metal having integrally formed resilient arms providing one or more conductor -receiving slots. The insulated wire is forced into a slot which is of a width considerably less that the diameter of the conductor, that is of the copper. 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.

In previous devices of this type which are adapted to receive more than one conductor, there is a separate pair of arms for each conductor, all of the arm pairs being formed from a single strip of metal.

In the use of multiwire clip terminals, the most common demand is for a two wire clip terminal. Considerable space would be saved if the two wire clip terminal could be made with a total of three arms, providing two slots, the middle arm being common to both slots.

The nature of these clip terminals is such that considerable force is required to insert a wire into its slot, with the result that a special tool has been provided having end surfaces which engage the insulated wire at a point immediately adjacent the side surface of the arms, so that the wire can be forced into the slot, thus spreading the arms. In the single wire clip terminal, both arms flex an equal amount.

The characteristic of a clip-type terminal, whether of the insulation crushing type or insulation stripping type, is that the contact force developed by the clip arms must be sufficient to effect the desired crushing or stripping of the insulation, but at the same time, not so great as to pinch off the conductor or to materially weaken the same by nicking.

It is also desirable to design a clip that will accommodate several sizes of conductor; with the larger sizes there is a greater deflection of the arms, and therefore a greater force is exerted on the conductor. This in itself is not particularly objectionable since the larger diameter conductors are better able to resist the pinching off effect, but there are other factors involved which tend to limit the adaptability or accommodation of the clip to not more than two or three or four even numbered adjacent wire sizes, at least in the range of from 20-gauge down to 28-gauge.

In a two wire clip terminal having a common center arm, both of the end arms react against the insertion of a wire. Thus, the insertion of the second wire would ordinarily require considerably more force than the insertion of the first wire due to the fact that one end arm is already stressed to an extent corresponding to its deformation. Therefore, the force ordinarily exerted by the clip arms on the second wire might be so great as to pinch off the conductor, at least with respect to the larger wire sizes, or even to prevent entry into the slot. In other words, the range of forces encountered would be greater than those encountered in the design for a single clip terminal.

According to my invention, I have found that it is possible to develop a controlled stripping or crushing force even though there is a common center arm. More specifically, I provide a much stiffer center arm, and then design the end arms so that each develops the desired force at about twice the deflection that would occur if both arms were of equal stiffness. Then, when the second wire is inserted, there will be comparatively little movement of the center arm and thus little further deflection of the remote end arm.

In the drawings:

FIG. 1 is an elevation of a preferred embodiment of my invention;

FIG. 2 is a section taken along line 2—2 of FIG. 1;

FIG. 3 is a side view of the tool, partially broken away;

FIG. 4 is a plan view along line 4—4 of FIG. 3; and

FIG. 5 is an end view of FIG. 3. In FIG. 1, the clip comprises a flat body portion **10** of resilient metal having two notches **11** at its upper part and two elongate apertures **12** at its lower part. A slot **13** connects each notch with each aperture, thus providing three arms **14**, **15** and **16**.

The slots **13** are formed by a shearing or slitting operation after which portions are upset or coined at **17** which forces the end arms **14** and **16** away form the middle are **15** to an extent such that the width of each slot immediately adjacent the portion **15** is about 0.002 inches, and the width of the upper end of each slot is 0.009 to 0.012 inches. This slitting operation makes the edges of the slots **13** sharp and square.

The bottom of each notch **11** is preferably rounded providing oppositely disposed sharp corner edges **19** in the manner pointed out in my copending application, Ser. No. 807,336 **filed Mar.** 14, 1969. However, a V-shaped slot entry, instead of a rounded entry, may be provided, as pointed out in U.S. Pat. Nos. 3,112,147 and 3,234,498, dated Nov. 26, 1963 and Feb. 8, 1966, respectively.

The upper notch edges **20** may be either parallel or downwardly converging. A lateral extension **21** on the middle arm **15** cooperates with the rounded top of each of the outer arms **14** and **16** to facilitate entry of an insulated wire where the total wire diameter exceeds the notch width.

The lower end of the body portion **10** is no part of my invention. For instance, it may include a terminal end **23** to permit soldered connections or wire wrapped connections, and a tab **24** for securing the clip to a holder, as by wedging. In the alternative, a plurality of two clip terminals could have a common base portion, as is done with the single clip terminals shown in said U.S. Pat. No. 3,112,147.

The body portion **10** is preferably formed from spring tempered phosphor bronze strip alloy No. A having a thickness of 0.044 inches. 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 metals.

In the example illustrated, which accommodates three wire sizes **22** gauge, **24** gauge and **26** gauge, the end arm length between the corner edge **19** and the bottom of the aperture **12** is 0.670 inches, and the arm width at these two points is 0.070 and 0.097 inches respectively, as contrasted with arm widths of 0.082 and 0.107 inches for the single clip terminal shown in my above mentioned copending application. This reduction in width represents a 40 percent reduction in stiffness. At the same time, the width of the center arm at a point between the two apertures is substantially 0.114 inches, thus making the center arm about three times as stiff as the end arms, insofar as this section is concerned. Actually both the center and end arms are of varying width so that the stiffness ratios are approximate only.

In the round entry type of clip shown, the deflection of the end arm with 26 gauge wire is about 0.004 to 0.007 inches, whereas with 22 gauge wire it is from 0.013 **to** 0.016 inches, or a little less if the deflection of the center arm is taken into account, these deflections being well within the elastic limit of the arms.

As an aid to the insertion of the wire, a tool **27** is provided as shown in FIGS. **3** to **5**, the tool providing a recess **28** to accommodate the upper ends of the arms **14**, **15** and **16**, the outer edges **29** of the arms being substantially parallel in this region. The width of the recess **28** is such that it will accommodate a certain amount of deflection of each end arm **14**, **16**.

In the case of the round slot entry shown, a deflection of up to 0.016 inches is permitted, thus accommodating all wire sizes from 22 gauge down to 26 gauge, but limiting the extent of the flexure so that it will not exceed the elastic limit of the clip material.

In the case of the V-shaped slot entry shown in aforesaid U.S. Pats. Nos. 3,112,147 and 3,234,498, the amount of arm deflection is somewhat more restricted because the reaction of the tool on the arm edges **29** is required in order to develop sufficient force to crush the insulation and at the same time to assure integrity of the contact between the slot edge and the conductor. For instance, with the V-shaped slot entry, only a 0.006 inch deflection would be permitted in a tool accommodating a 24 gauge wire.

With the larger wire sizes, situations may occur in which the deflection of an arm will exceed the elastic limit of the clip material. This is particularly true if the insulation coating is thicker than standard, and the situation will also arise where an attempt is made to insert a wire of a size greater than the maximum size from which the clip terminal is rated. Therefore, the tool is intended to perform a deflection limiting function as above described.

However, when a tool is designed for use with a two wire clip terminal having a common center arm, the deflection permitted for one arm would add to the deflection permitted for the other, so that the maximum deflection for the first wire to be inserted would be twice the permissible limit.

According to my invention, I provide locating means between the center arm **15** and the tool **27** so that the maximum deflection for each end arm will not be cumulative. This locating means thus provides a point of reference by means of which the deflection of either end arm is limited with respect to the center arm, rather that with respect to the other end arm.

The locating means referred to comprises a circular locating boss **30** formed at the upper end of the center arm as shown in FIGS. **1** and **2**. The boss **30** is located along the centerline of the symmetrically designed clip, so that it is half way between the parallel arm edges **29**. Surfaces **31** and **32** of the recess **28** are each provided with a slot **33** and **34** to accommodate the boss **30** in either forwardly or rearwardly facing orientation. The boss diameter and the slot width are formed to sufficiently close tolerances as to avoid appreciable sideplay while still permitting free sliding movement. Thus, when inserting the first wire, which is positioned for example in the notch **11** between the center arm **15** and the end arm **16**, the tool **27** is placed over the upper ends of the three arms **14**, **15** and **16** and pushed downwardly until the wire insulation is urged against the sharp corner edges **19**. The end surfaces **35** of the tool apply pressure to the wire immediately adjacent the side surfaces of the clip so that the amount of force required to cam the sharp corner edges **19** apart can be transmitted to the conductor of the insulated wire. The outer side walls of the recess **28** are chamfered as at **36** to facilitate initail application.

Irrespective of the diameter of either the insulated wire as a whole or of the metallic conductor portion, the deflection of the arm **16** when inserting the first wire is limited, and the same applies with respect to the insertion of the second wire. Furthermore, my invention permits the use of two wires of differing size, one in each slot **13**.

As shown in FIGS. **3** to **5**, the tool is preferably made from two strips of tool steel which are secured to each other by pins **37**.

In the example shown, the elongate apertures **12** define for the lower part of the center arm **15** a section **38** of substantially uniform width, and having a length substantially in excess of the width, preferably from 2½ to 3 times the width dimension. Being located in the lower end of the arm, the width of the section **38** substantially controls the stiffness of the arm as a whole. Thus, the effective width of the arm is substantially equal to the width of this section **38** insofar as stiffness is concerned.

The stiffness of the end arm should be such that the forces developed by a deflection thereof equal to the difference between the diameter of the conductor portion of the largest wire size for which the clip is rated, and the slot width, will be less than the elastic limit of the resilient material of which the arm is made. In the example shown, the effective width of the end arm is from 0.075 to 0.080 inches, making the center arm from three to four times stiffer than an end arm. Where the terminal is rated for one wire size only, a stiffness ratio of two to one would be sufficient. The foregoing corresponds to an effective width ratio of center arm to end arm of from 1.5 to 1.6 for the example given, and of 1.25 for the single wire size rating.

Although the present invention is suitable with either the insulation crushing or insulation stripping type of clip terminal, the latter type which is characterized by a round slot entry as pointed out in my aforesaid copending application, Ser. No. 807,336, is particularly suitable for use in the present invention because the desired stripping force can be determined more definitely that the force required for crushing the insulation.

The operation of the stripping type of clip terminal is pointed out in detail in the aforesaid copending application, and the disclosure of same is incorporated herein by reference, insofar as consistent with the teaching of the present application.

The width of the lower portion of the notch **11** is substantially 0.040 inches, and the notch cooperates with the overall diameter of the insulated wire to regulate the width of the slot **13** to the end that a given clip can be rated to accommodate a range of sizes of insulated wire, as pointed out in the aforesaid copending application. The wire size ratings referred to herein apply to the diameter of the conductor portion of the insulated wire, the over all diameter being from two to three times the conductor diameter.

I claim:

1. A two wire clip terminal comprising an elongate flat body formed from flat resilient metal and having two notches at its upper part, a base portion at its lower part, and a slot communicating with the lower end of each notch, said slots providing a center arm and two end arms extending in the same direction from a common base, the outer ends of said arms being free so as to provide three cantilever beams arranged side by side, the effective width of each end arm being less that the effective width of said center arm to render each end arm more compliant than said center arm when a wire is inserted into one of said slots.

2. A two wire clip terminal as claimed in claim **1** which is rated for the diameter of the conductor portion of an insulated wire, and in which the effective width of each end arm is such that the end arm will be resilient when deflected to an extent equal to the difference between said rated diameter and the slot width, the stiffness of said center arm being in excess of two times the stiffness of either end arm.

3. A tow wire clip terminal as claimed in claim **1** which is rated for a range of wire sizes, each representing the diameter of the conductor portion of an insulated wire, and in which the effective width of each end arm is such that the end arm will be resilient when deflected to an extent equal to the difference between the conductor diameter of the largest wire size rating and the slot width, the stiffness of said center arm being in excess of substantially three times the stiffness of either end arm.

4. A two wire clip terminal as claimed in claim **1** in which the effective width of said end arm is less than 70 percent of the effective width of said center arm.

5. A two wire clip terminal as claimed in claim **1** which is rated for the diameter of the conductor portion of an insulated wire, and in which the bottom of each notch is rounded and has arcuate straight side edges which intersect the edges of said slot to provide substantially 90° sharp corner edges, the width of each said slot at said corner edges being no greater than said rated diameter.

6. A two wire clip terminal as claimed in claim **1** which includes an elongate aperture spaced below each notch, said slot extending between the bottom of each notch and the upper end of said aperture.

7. A two wire clip terminal as claimed in claim **6** in which said elongate apertures define for said center arm, a section having a substantially uniform width, said section being of a length substantially greater than said width so that the effective stiffness of said center arm is determined primarily by the width of said section.

8. A two wire clip terminal as claimed in claim **6** in which the edges of each said slot at a point adjacent to its associated aperture are upset to prestress said end arms and provide a slot width of substantially 0.010 to 0.012 inches at a point adjacent said notch.

9. A combination two wire clip terminal and tool for inserting an insulated wire therein comprising an elongate flat body portion formed from flat resilient metal and having two notches at its upper end, an elongate aperture spaced below each notch, and a slot extending between the bottom of each notch and the upper end of said aperture providing a center arm and two end arms, the effective width of each end arm being less than the effective width of said center arm to render said end arm more compliant than said center arm to render said end arm more compliant than said center arm when a wire is inserted into one of said slots, a tool having a recess for receiving the upper end of said clip terminal and having end surfaces engaging an insulated wire located in said notch to facilitate the insertion of said wire into said slot, the width of said recess being greater than the width of the upper portion of said clip by a predetermined distance, and locating means on said center arm and said tool for centering said tool with respect to said clip terminal so that the deflection of each arm will be limited to substantially one-half of the aforesaid predetermined distance.

10. A combination two wire clip terminal and tool as claimed in claim 9 in which said locating means comprises a boss extending from one surface of said center arm, and a groove in a wall of said recess for receiving said boss in sliding relationship.

11. A two wire clip terminal comprising an elongate flat body portion formed from flat resilient metal and having two notches at its upper end, a slot communicating with the lower end of each notch, said slots providing a center arm and two end arms, the effective width of each end arm being less than the effective width of each said center arm to render each end arm more compliant than said center arm when a wire is inserted into one of said slots, and a locating boss projecting from one surface of said center arm providing a point of reference for limiting the deflection of one end arm with respect to said center arm.

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,605,071
DATED : September 14, 1971
INVENTOR(S) : William S. Sedlacek

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 29, change "that" to -- than --.

Column 4, line 42, change "tow" to -- two --.

Column 4, line 56, delete "straight side"; same line before "edges" (second occurrence) insert -- straight side --.

Signed and Sealed this

Fifteenth Day of *May 1979*

[SEAL]

Attest:

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Attesting Officer

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