United States Patent

[11] 3,609,642

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[23] **Division of Ser. No. 563,248, July 6, 1966, Pat. No. 3,417,368.**
[45] Patented **Sept. 28, 1971**

[54] **WIRE TERMINALS**
7 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** ..... **339/95 D, /**
[51] **Int. Cl.** **H01r 9/08**
[50] **Field of Search** ..... 339/95, 241, 242, 248; 24/115, 129 B, 257, 259 RC

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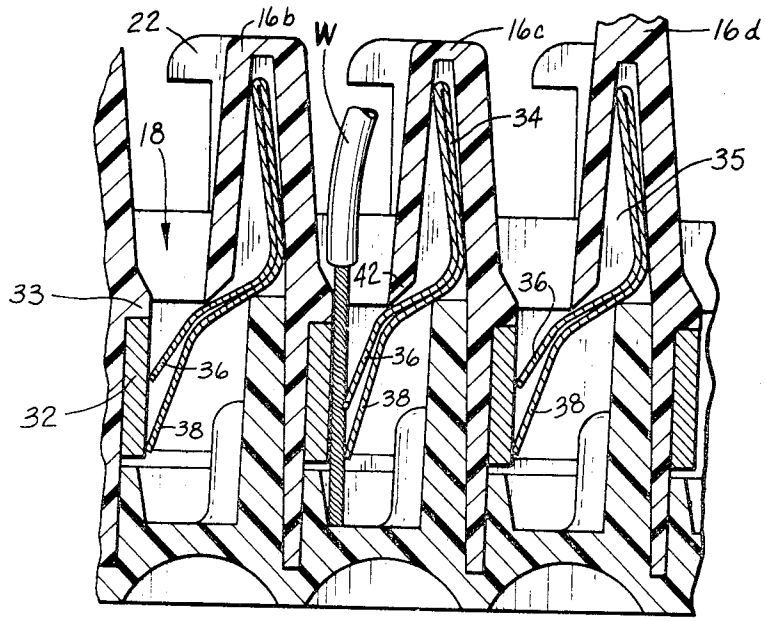
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Primary Examiner—Ian A. Calvert
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ABSTRACT: A terminal block in which there are plural groups of wire-receiving guide passages, each group being for wires to be connected to each other. For each group of passages (three to a group in the example shown) there is an internal metal strip that is relied on primarily for the electrical connection. A leaf spring member has separately resilient portions for biasing inserted wires against the metal strip. Each leaf spring portion inclines toward the wire and extends along the wire in the direction of insertion, forming an acute angle to the wire. The edge of the leaf spring at the end of each wire-engaging portion tends to dig into the wire when resisting pull applied to the wire.



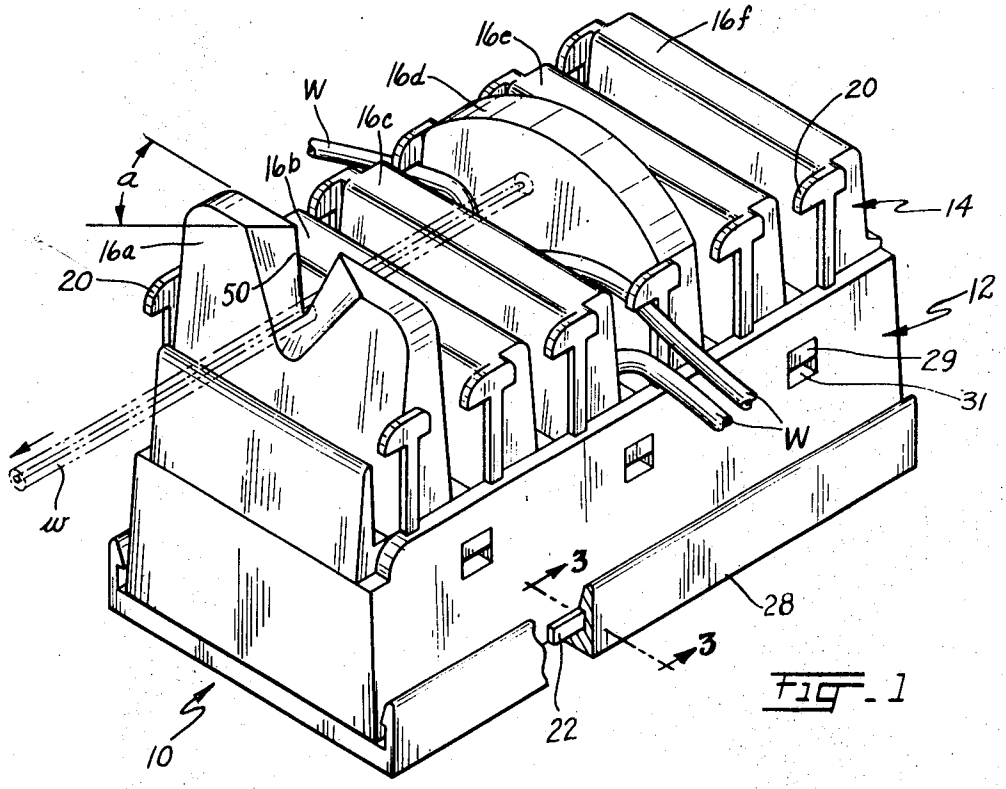


Fig. 1

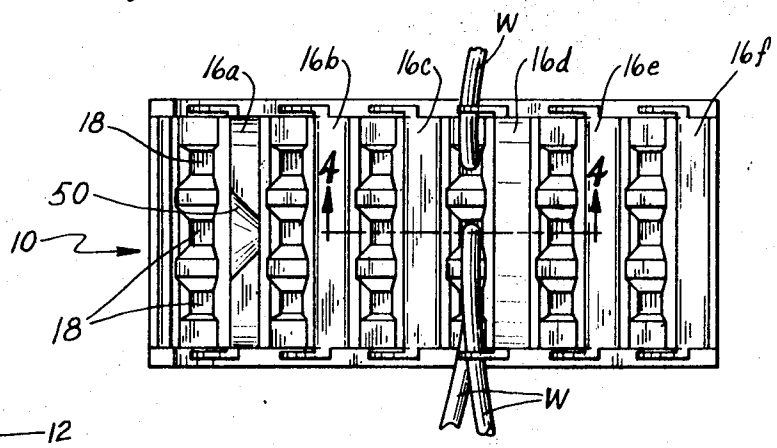


Fig. 2

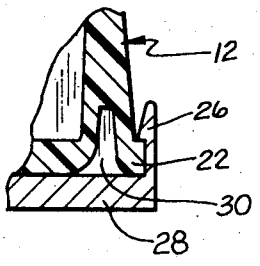


Fig. 3

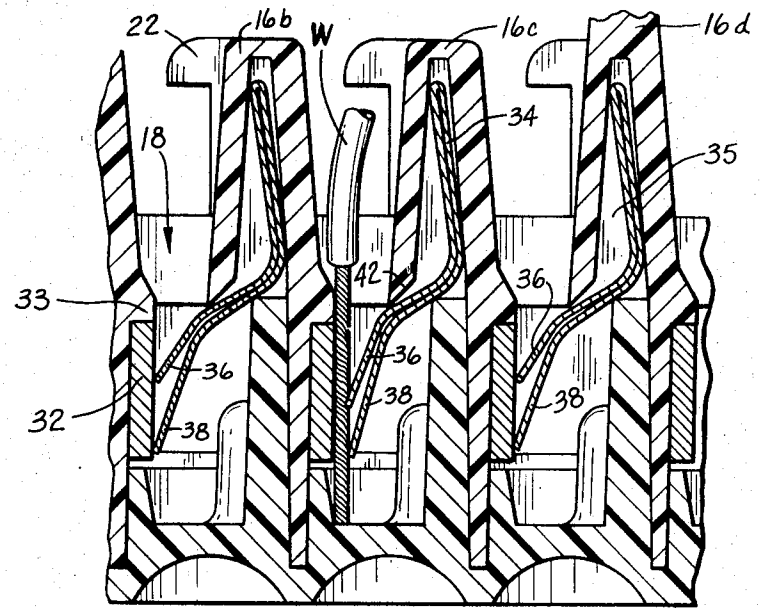


Fig. 4

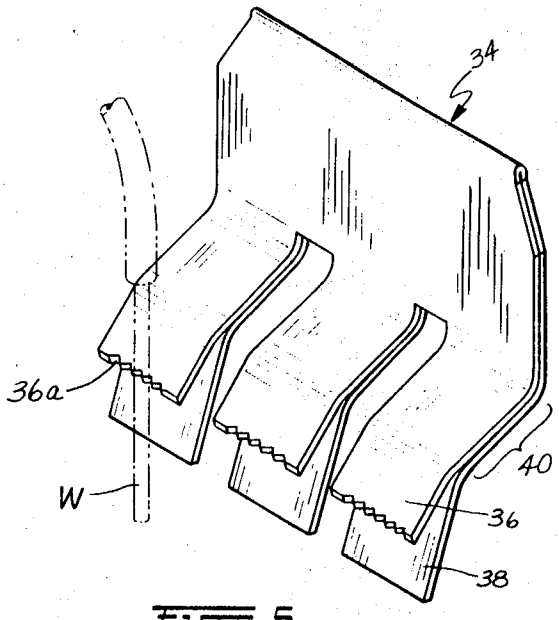


Fig. 5

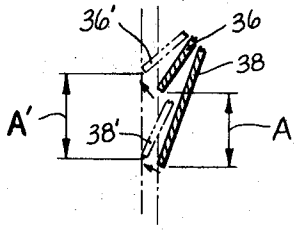


Fig. 6

WIRE TERMINALS

This is a division of my application Ser. No. 563,248, filed July 6, 1966, now U.S. Pat. No. 3,417,368.

Generally, the present invention is concerned with devices for making an electrical connection to the end of a wire, and to strippers for preparing wires for such connection.

A widely used type of wire connection involves no screws, and characteristically depends upon a leaf spring wire-retainer that is disposed at an acute angle to the wire-insertion path. During insertion, the wire is simply pushed into position between the leaf spring and an element opposite the spring. The end edge of the leaf-spring is biased against the wire. In case of pull on the wire, the edge tends to dig into the wire. The spring provides the reaction force resisting removal of the wire. Due to the acute angle of the leaf spring, the reaction force extends essentially along the spring. This arrangement is such that very large pull forces are inherently resisted by the leaf spring.

Wire terminals of this form have proved highly successful where solid wire is used, but they are not well suited to use with stranded wire. Individual strands of a stranded wire tend to bend to one side when an effort is made to insert the wire. In another manner, the bundle of strands at the end of a wire being inserted may not have enough strength to deflect the spring, with the result that the bundle of strands simply collapses, mushrooming as it is being pushed. To overcome this effect, the leaf spring might be made especially soft for accommodating stranded wire. In that case there is danger of the leaf spring being deformed, even buckling, when the wire is subjected to pull which the connection should resist.

An object of the present invention is to provide an improved wire terminal of the foregoing type, that is effective not only with solid wire but also with stranded wire.

A further problem arises with this type of connection. For example, a wire is inserted and a casual pull test is to be made. I have discovered that limited manipulation of a wire preparatory to a test often results in the wire escaping from the terminal block. Such manipulation may involve twisting a wire around one's finger to be sure of a good grip. By like token, there is a certain amount of "working" of wires near a terminal in normal use, which the terminal should resist. Accordingly, a further object of this invention is to improve wire connections of this type, for more effectively resisting a tendency of the wire to be self-releasing when manipulated.

Such arrangements are well-known. I have found that they tend to prevent proper entry of stranded wire and to cut through thin multistrand wire where the leaf spring is firm, or there is a danger of the leaf spring buckling when moderate pull is applied to the wire in the case of softer leaf springs designed to accommodate stranded wire. This is solved in the illustrative terminal block by providing two leaf spring elements that engage each wire at different acute angles at different points along the wire, in an arrangement wherein pull on the wire tends to develop tension between the points of engagement with each wire. This arrangement provides assurance that any pull imposed on the wire is shared between the leaf spring elements. Were two (or more) leaf spring elements used in simple face-to-face parallelism, there would be a tendency for one element to take the whole load of the wire pull, so that such an arrangement would be of doubtful benefit as compared to a single leaf spring element.

Where leaf spring element engage stranded wire, any twisting of the wire (I have found) tends to form a long-pitch helical indentation in the wire and promotes self-release of the wire. By forming fine-pitch serrations in the wire-engaging edge of a leaf spring element, this turning of the wire is actually prevented. The close-spaced teeth find places in the stranded cluster of wires. Such a wire terminal is remarkably immune to the aforementioned self-releasing tendency that characterizes the type of leaf spring terminal connection here involved.

The nature of the invention will be more fully appreciated, and other objects and advantages will be recognized, in the following detailed description of an illustrative embodiment of the invention in its various aspects.

In accompanying drawings:

FIG. 1 is an enlarged perspective view of an embodiment of the invention in its various aspects;

FIG. 2 is a plan view of the embodiment in FIG. 1;

FIG. 3 is a fragmentary cross section of the device in FIGS. 1 and 2 viewed from the plane 3—3 in FIG. 1;

FIG. 4 is a greatly enlarged fragmentary vertical cross section of the device in FIGS. 1–3 as viewed from the plane 4—4 in FIG. 2;

FIG. 5 is greatly enlarged perspective of a leaf spring member forming part of the device in FIG. 4; and

FIG. 6 is a diagram illustrating a feature of the action of the leaf spring elements on a wire when subjected to pull.

In the drawings, FIGS. 1, 2, 4 and 5 show a six-circuit terminal block 10 comprising two parts 12 and 14 of molded insulation. Walls 16*a*, 16*b*...16*f* extending across the top insulating part 14 are barriers that divide the unit into six separate circuits. For each circuit there is a group of three wire-receiving guide passages 18 (FIG. 2). At each end of each wall 16 there is a hook 20 that holds an inserted wire in a right-angled form to "tailor" into a neat arrangement the cluster of wires entering the terminal block.

The lower part 12 has a pair of lateral ribs along its opposite sides, for interlocking retention by in-turned hook formations 26 forming integral parts of a mounting strip 28 as of extruded aluminum. Ribs 22 are on wall portions of insulating part 12, the wall being defined by grove 30. The material of parts 12 and 14 is a relatively firm yet yieldable plastic exemplified by nylon. Thus, when block 12 is pushed against mounting strip 28, ribs 22 snap under hook formations 26 for secure retention. Still, when release becomes necessary, rib 22 is easily pried free of hook 26.

Upper part 14 of the two-part insulator assembly has two rows of lateral projections 29 at its opposite sides for entering corresponding holes 31 in lower part 12 for locking those parts together. The lower faces of projections 29 slant upward and outward. When parts 12 and 14 are to be assembled, they are forced together, the sidewalls of part 12 spreading outward until parts 29 are aligned with holes 31 whereupon the sidewalls snap together to retain projections 29 in holes 31.

As best shown in FIG. 4, each wall portion 16 has a shoulder 33 that holds a metal connector strip 32 as of copper in place below a row of guide passages 18. A leaf spring member 34 is captive in a pocket 35 in each wall 16, and provides three pairs of wire-engaging elements 36 and 38. These pairs of elements are spring biased laterally against respective portions of a companion connector strip 32. The wire-engaging edge of each element 36 is serrated, having several close-spaced teeth 36*a* for locking into fine-stranded wire W.

The teeth 36*a* have points that are disposed in a row along the transverse wire-engaging edge of leaf-spring element 36.

As seen in FIG. 4, each pocket 35 locates a member 34 in position despite outward pull on a wire W that is gripped between connector strip 32 and leaf spring elements 36 and 38. Member 34 has an offset portion 40 (FIG. 5), one part of which bears against insulation portion 42 when an inserted wire is pulled. When this occurs, the different acute angles of elements 36 and 38 tend to cause those elements to swing through short arcs shown with exaggeration in FIG. 6 to positions 36′ and 38′. The arc of element 36 involves a longer component of motion along the wire than that of element 38. Consequently, the points of engagement of elements 36 and 38 with the wire which start with separation A tend to spread apart to a larger separation A′ when a wire is being pulled. The greater separation A′ signifies a tendency of stretch to develop in the wire, and signifies pull in the wire imposed by element 38. This is part of the total pull on the wire, and demonstrates sharing of the pull between the leaf spring elements. Each leaf spring element picks up some of the pull and thus contributes to effective wire retention.

As illustrated, three wires W (FIG. 1) can be inserted into the guide passages 18 of a single circuit, to be interconnected by conducting strip 18. To a degree, member 34 also interconnects the wires W. In other devices using one or more pairs of leaf spring elements 36 and 38, the connect established may extend to other apparatus in such devices rather than to establish interconnection to other wires in the form shown. The term "wire terminal" is used to refer not only to terminal blocks but also to others devices having electrical connections.

Wires for the class of the terminal block illustrated and for other electrical devices are commonly covered with a pliable plastic insulation such as polyvinyl chloride. The end portion of such a wire is effectively bared by a stripper forming part of the terminal block, including a gage stop represented by wall 16*d* that is higher than its neighbors, and a V-notched projecting wall 16*a*. This wall presents a flat face toward gage-stop wall 16*d*, and the sharp-edged V-notch 50 is then effective to cut into the plastic insulation on a wire W when forced by hand into the notch. The angle (FIG. 2) is made suitably suitably small for making an incision into plastic insulation but too small an angle would make the edge feathery and weak. After being firmly pressed to the bottom of the V-notch a wire *w* is firmly pulled in the direction of the arrow in FIG. 1, to strip the accurately measured length of insulation between walls 16*a* and 16*d*.

Parts 12 and 14 are of a relatively hard form of nylon, in a preferred application of the invention, nylon having excellent properties as an electrical insulator and being harder than plastics used as insulation on wire so as to cut that insulation for stripping the wire yet not being so hard as to make an incision. Where nylon is the material used as the electrical insulation, an effective hardness of the material at the wire-stripping V-notch is Rockwell Scale R 110 to 118.

The foregoing illustrative embodiment of the invention in its various aspects is readily susceptible to varied application and modification by those skilled in the art, and therefore the invention should be broadly construed, consistent with its full spirit and scope.

What is claimed is:

1. A wire terminal including means for making electrical connection to a wire inserted in a given direction and for retaining the inserted wire securely against pullout effort, said electrical connection and retaining means including lateral support means and including first and second leaf spring elements for biasing an inserted wire against said lateral support means, said leaf spring elements being arranged for endwise engagement individually with an inserted wire at different acute angles to the wire, the sides of each angle converging in the direction of wire insertion, said second leaf spring element engaging an inserted wire closer than said first leaf spring element to the inserted end of the wire and said second leaf spring element having a smaller angle to the wire than said first leaf spring element, any pull on an inserted wire tending to develop an increase in the separation between the points of engagement of said leaf spring elements with the wire, whereby there is an enhanced sharing of the pull between said first and second leaf spring elements.

2. A wire terminal in accordance with claim 1 for electrically interconnecting multiple wires inserted along respective paths, wherein said lateral support means is a metal contact member extending across multiple wire-insertion paths, and said first and second leaf spring elements each including as may separately resilient portions as there are wire-insertion paths.

3. A wire terminal in accordance with claim 1 wherein said leaf spring elements are interconnected portions of a common leaf spring.

4. A wire terminal in accordance with claim 1, wherein one of said leaf spring elements has a serrated wire-engaging edge.

5. A wire terminal in accordance with claim 1, including an insulating enclosure containing said lateral support means and said leaf spring elements and embodying a wire-guide formation for directing wire insertion.

6. A wire terminal in accordance with claim 5, wherein said first leaf spring element has a serrated wire-engaging edge.

7. A wire terminal in accordance with claim 5 wherein said enclosure incorporates guide formations defining a wire-insertion path, said enclosure further including a hook lateral of said path for engaging and retaining an inserted wire when the inserted wire has been bent and pressed under the hook.