

Dec. 17, 1968

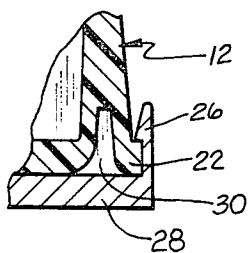
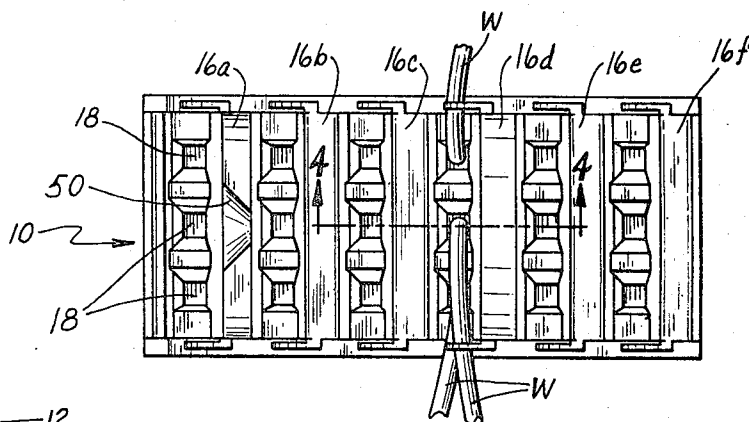
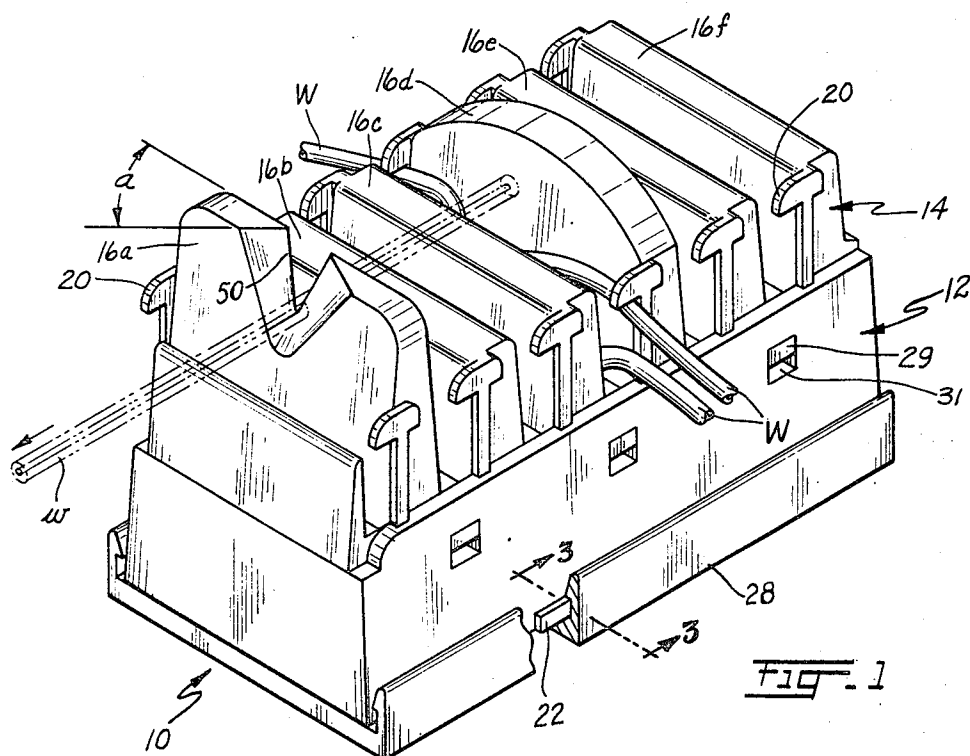
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3,417,368

WIRE TERMINALS

Filed July 6, 1966

2 Sheets-Sheet 1



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WIRE TERMINALS

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2 Sheets-Sheet 2

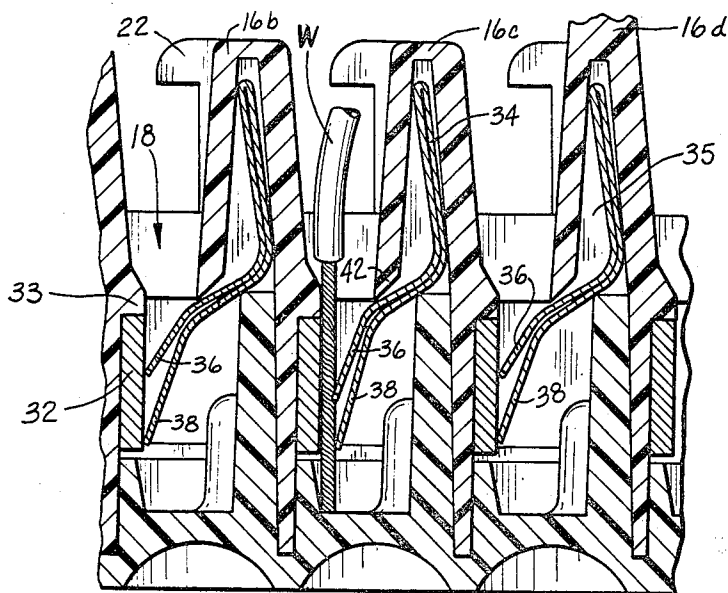


FIG. 4

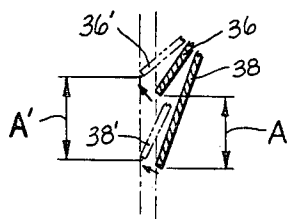


FIG. 6

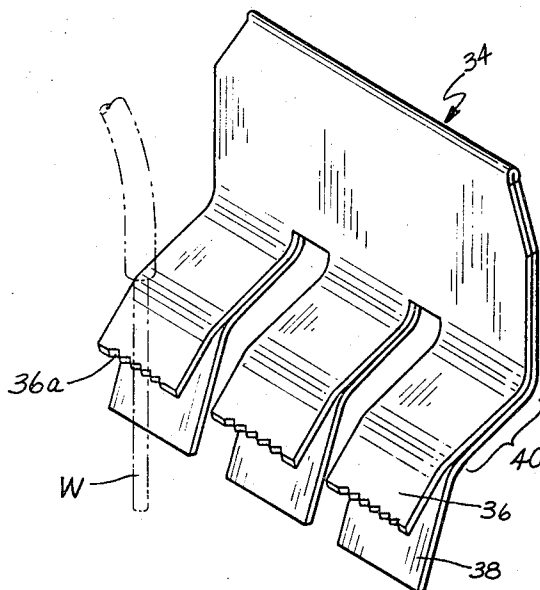


FIG. 5

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WIRE TERMINALS

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ABSTRACT OF THE DISCLOSURE

A wire stripper is provided having cutting edges of a plastic, especially nylon, that is harder than polyvinyl-chloride insulation but softer than wire to avoid making a nick in the wire; and to special advantage the plastic of the wire stripper forms part of the electrical insulation in an electrical device having at least one wire-securing terminal.

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.

A preparatory step in the use of the foregoing type of terminal blocks and other types of terminal blocks is to strip insulation off the end portion of the wire. Wire strippers of conventional form represent a tool that may not be readily available. Furthermore, conventional wire strippers tend to nick the wire. A relatively slight incision into the wire that is often produced by the sharp edge

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of the cutting element in conventional wire strippers can be a serious matter. Particularly when subjected to vibration, such an incision tends to propagate in time and may ultimately cause breaking of the wire.

5 An important feature of the present invention is the provision of a novel improved wire stripper integral with a terminal block and thus one that is always readily available. More generally, a further object of the invention resides in providing a novel wire-stripper for plastic-insulated wire, of a form that entirely eliminates the danger of cutting into a wire incidental to cutting through the insulation.

10 The foregoing objects, and others that will be apparent, are achieved in the illustrative novel terminal block that is shown in the accompanying drawings and described in detail below. In this terminal block 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.

15 Such arrangements are well-known. I have found that they tend to prevent proper entry of stranded wire and to cut through thin multi-strand 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.

20 Where leaf-spring elements 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.

25 Preparatory to each wire insertion, a measured length of the wire should be stripped of insulation. An important feature of the present invention resides in the utilization of the same material that forms the insulating body of the terminal unit not only for its electrical insulating qualities, but also as an insulation stripper having the unique property of eliminating the problem with conventional strippers of nicking the wire incidental to cutting through the insulation. Insulation for the terminal block can readily be selected that is softer than wire yet not so soft as to be rubbery. Such insulation can be formed into a cutting edge for making incisions into vinyl and other common types of plastic wire insulation. The cutter in the illustrative embodiment is a V-notch in an insulating wall, the edges of the V being sharp enough so that when plastic-insulated wire is pressed into the V-notch, the wire

insulation is cut through and yet the wire itself is immune to incision. A pull on the wire at this time strips the insulation from the wire, which is then in condition for use in the terminal block.

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 the accompanying drawings:

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

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

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

FIGURE 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;

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

FIGURE 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 16a, 16b . . . 16f 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 groove 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 side walls of part 12 spreading outward until parts 29 are aligned with holes 31 whereupon the side walls 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 36a for locking into fine-stranded wire W.

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 off-set 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 connection 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 other 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 16d that is higher than its neighbors, and a V-notched projecting wall 16a. This wall presents a flat face toward gage-stop wall 16d, 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 acute angle α (FIG. 2) is made 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 16a and 16d.

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 R110 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 stripper including a pair of opposite portions having cutting edges arranged to penetrate the insulation of plastic-covered copper wire, said opposite portions being of a plastic softer than copper for precluding the formation of an incision in the wire, and a gage stop disposed at a distance from the cutting edges that equals the length of wire to be bared.

2. A wire stripper in accordance with claim 1 wherein the surfaces that merge to form each of said cutting edges have an acute angle therebetween.

3. A wire stripper in accordance with claim 1 for wire having polyvinylchloride insulation wherein said opposite portions are of a plastic harder than polyvinylchloride insulation.

4. A wire stripper in accordance with claim 1 wherein said cutting edges are formed of nylon.

5. A wire stripper in accordance with claim 1 wherein said cutting edges have a Rockwell hardness on Scale R of approximately 110 to 118.

6. A wire stripper in accordance with claim 1 wherein said cutting edges are of nylon and have a Rockwell hardness on Scale R of approximately 110 to 118.

7. A wire stripper in accordance with claim 1 wherein each of said cutting edges has surfaces merging at an acute angle and wherein the plastic has a hardness on Rockwell Scale R of approximately 110 to 118.

8. A wire stripper in accordance with claim 1 wherein said opposite portions are converging parts of a notch formed in a one-piece plastic member.

9. Apparatus in accordance with claim 8, wherein said wire stripper is part of a wire terminal comprising metal wire-securing means and wherein said plastic member is of electrical insulation arranged to support said metal wire-securing means.

10. Apparatus in accordance with claim 8 wherein said wire stripper is an integral part of an electrical terminal block having wire-securing parts electrically insulated by upstanding walls one of which is said one-piece plastic member having said notch therein, another of said walls being a gage stop spaced from said one wall by a distance that equals the length of wire to be bared.

11. Apparatus in accordance with claim 8, wherein said wire stripper is part of a wire terminal comprising metal wire-securing means and wherein said plastic member is of nylon arranged to support said metal wire-securing means.

12. A wire terminal comprising an electrically insulating member, and metal wire-securing means supported by said electrically insulating member, said member including a pair of opposite portions having cutting edges arranged to penetrate the insulation of plastic-covered wire, said member being of a plastic softer than copper for precluding the formation of an incision in the wire.

13. A wire terminal in accordance with claim 12, wherein said member has a Rockwell hardness on Scale R of approximately 110 to 118.

14. A wire stripper in accordance with claim 12 wherein each of said cutting edges has surfaces merging at an acute angle and wherein the plastic has a hardness on Rockwell Scale R of approximately 110 to 118, and further including a gage stop disposed at a distance from the cutting edges that equals the length of the wire to be bared.

15. A wire stripper in accordance with claim 12 wherein each of said cutting edges has surfaces merging at an acute angle and wherein the plastic is nylon.

16. The method of stripping wire having a covering of plastic insulation including the step of making an incision by penetrating the insulation but not cutting into the wire using a tool having a cutting edge of a plastic that is softer than the wire.

17. The method as set forth in claim 16 wherein the wire to be stripped has a cover of polyvinylchloride insulation, and the cutting edge of the tool is harder than the polyvinylchloride insulation of the wire.

18. The method of stripping wire having a covering

of plastic insulation in accordance with claim 16, in which said penetration is effected near an end of the wire, including the further step of pulling the tool along the wire toward the end thereof to remove the insulation from the wire between the incision and the end of the wire.

19. The method in accordance with claim 16 of stripping insulation from wire having polyvinylchloride insulation, wherein the insulation is penetrated at opposite sides of the wire by a tool having opposite cutting edges of a plastic harder than the polyvinylchloride insulation.

20. The method in accordance with claim 16 wherein the material of the cutting edge is nylon having a hardness on Rockwell Scale of R100 to 118, approximately.

21. The method in accordance with claim 16, wherein the tool has a gage stop disposed at a distance from the cutting edge and including the step of butting the end of the wire against the gage stop before making the incision for disposing the cutting edge properly for locating the incision.

22. The method of stripping wire in accordance with claim 16 wherein the tool has a pair of cutting edges disposed to form a V-notch, the surfaces of the tool that form each edge having an acute angle therebetween and the incision being made by pressing the wire transversely into the V-notch.

23. The method in accordance with claim 16, wherein the insulation is penetrated at opposite sides of the wire by a tool having opposite cutting edges converging to form a notch and of a plastic harder than the polyvinylchloride insulation of the wire.

24. The method in accordance with claim 23, in which the incisions are made near an end of the wire, further including the step of pulling the tool along the wire toward the end thereof to remove the insulation from the wire between the incisions and the end of the wire.

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