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| [21] | Appl. No. | 66,050 |
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1968, abandoned. |
| [45] | Patented | Dec. 21, 1971 |
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| [56] | References Cited | | |
| | UNITED STATES PATENTS | | |
| 2,853,772 | 9/1958 | Yuter | 29/278 |
| 3,168,750 | 2/1965 | Gattiker | 7/14.1 |

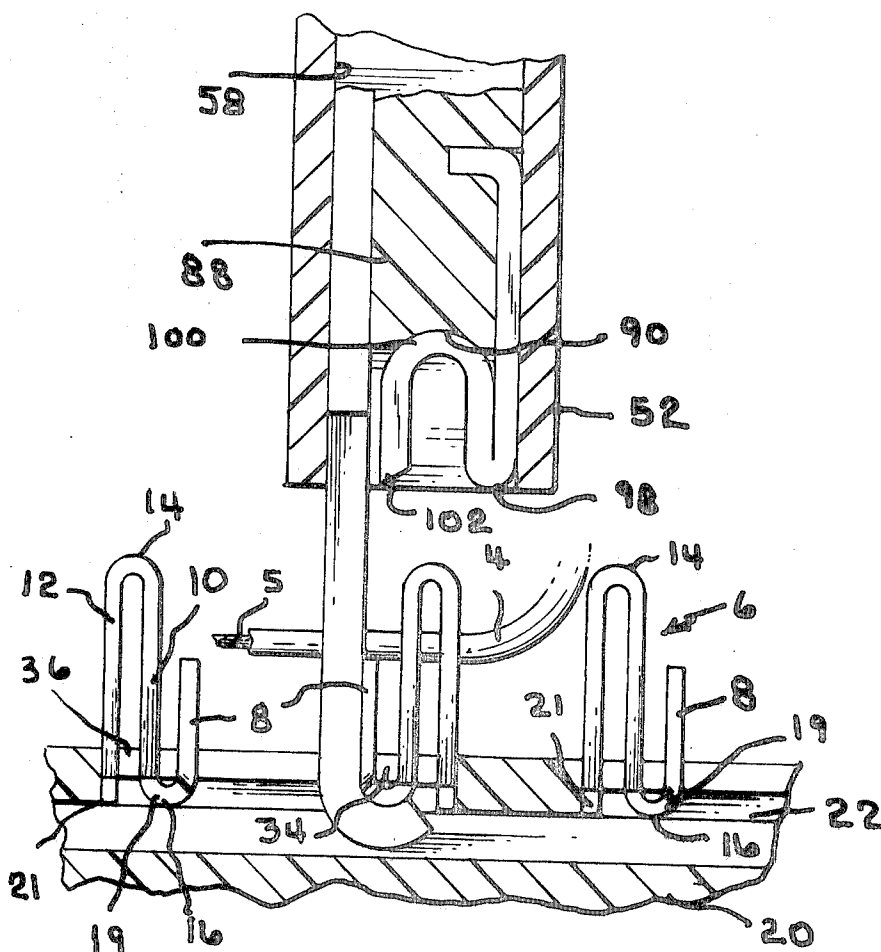
Primary Examiner—Travis S. McGehee

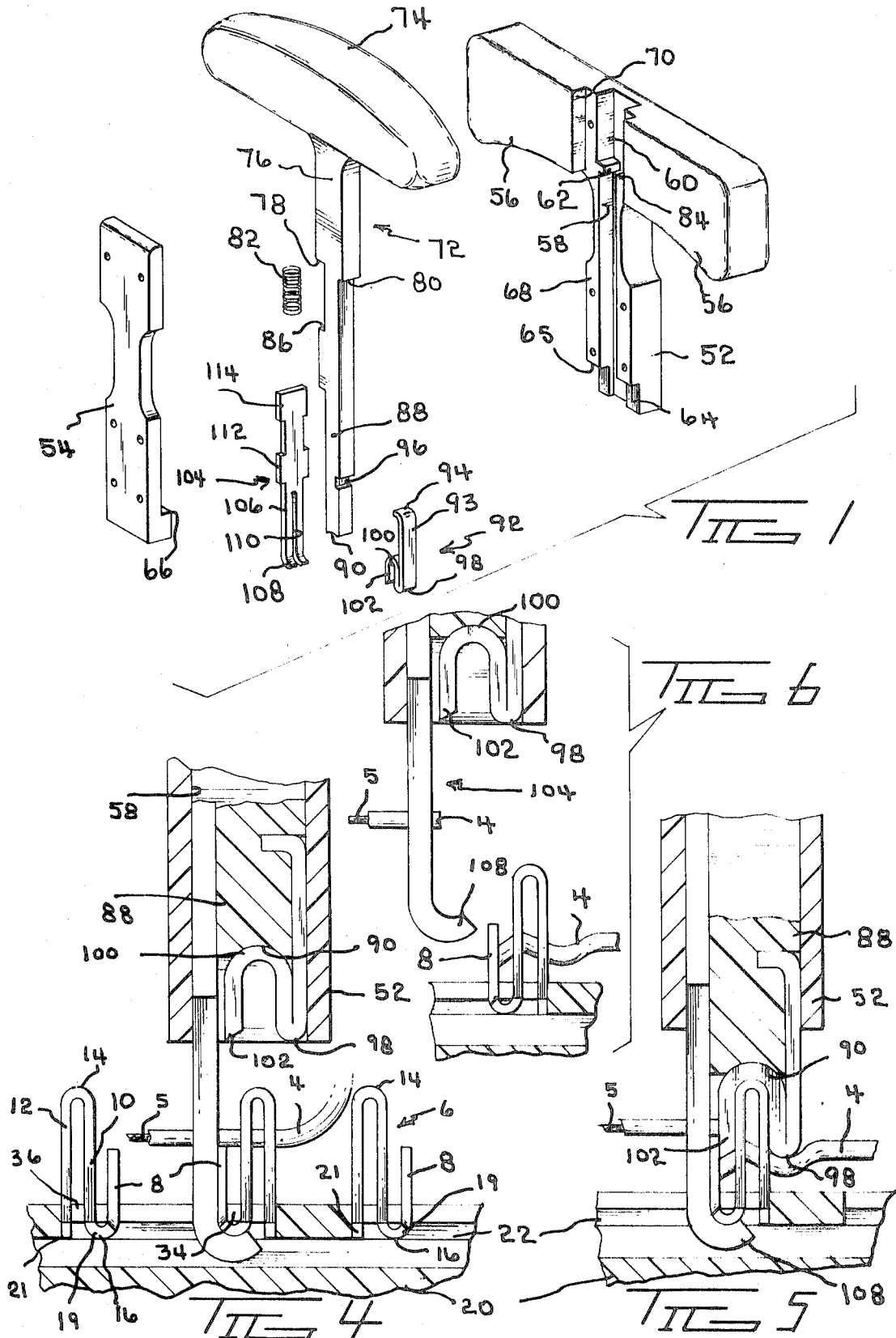
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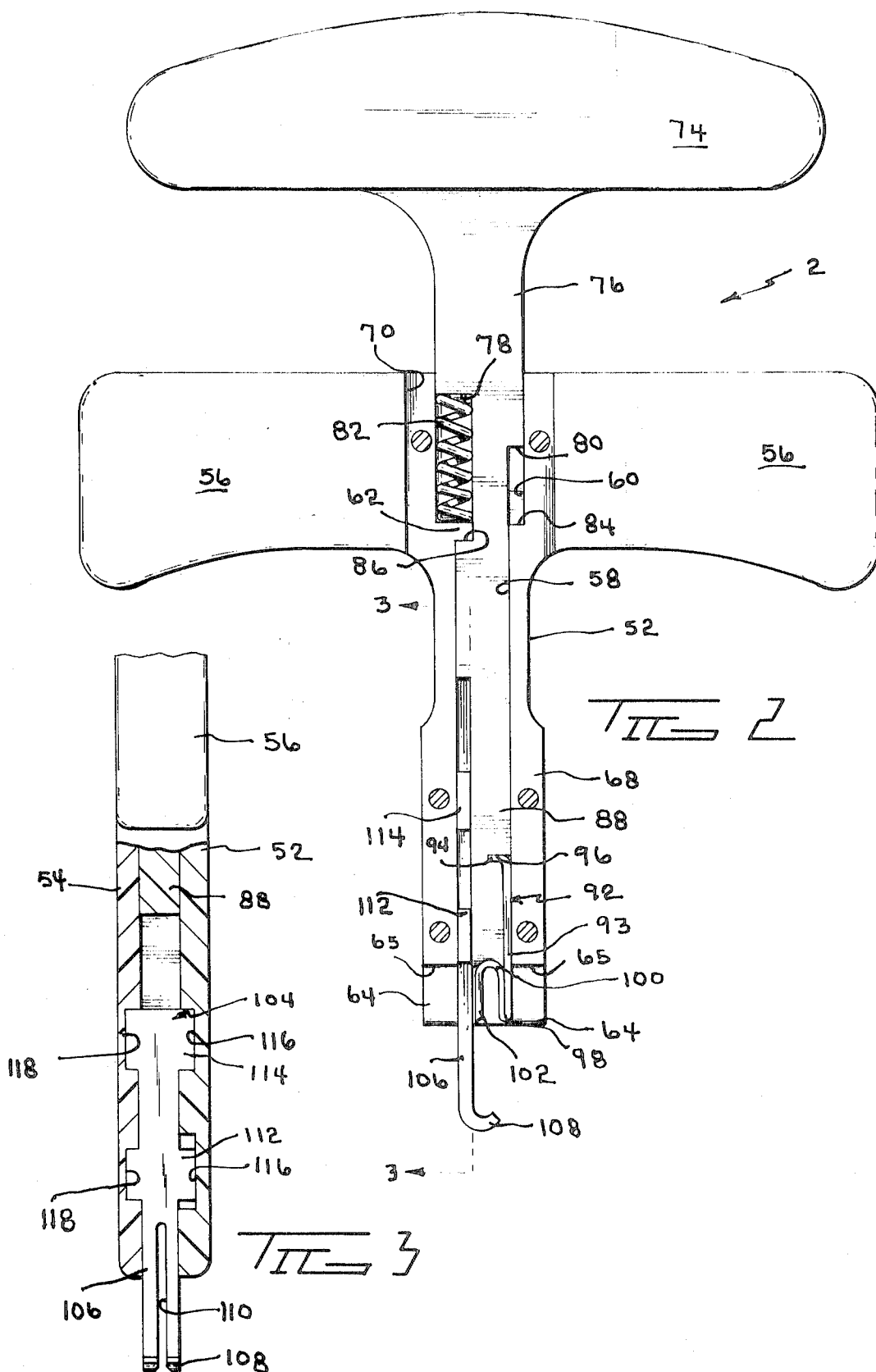
- [54] **TOOL FOR FORMING ELECTRICAL CONNECTIONS**
12 Claims, 8 Drawing Figs.

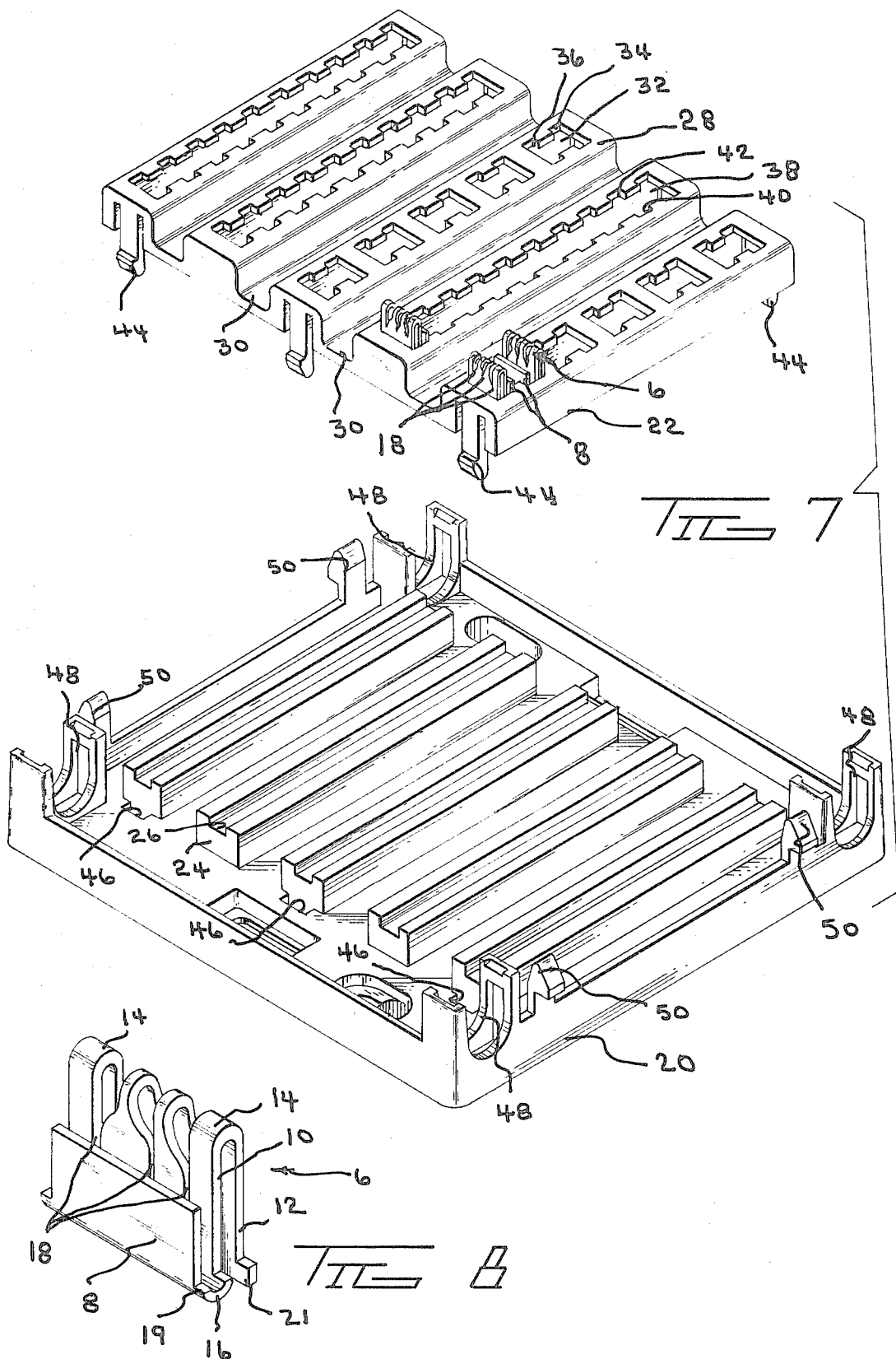
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| [52] | U.S. Cl. | 7/14.1,
29/203, 29/278 |
| [51] | Int. Cl. | B25f 1/04,
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| [50] | Field of Search | 29/278, 203
H, 203 HC, 203 HM; 7/14.1 |

ABSTRACT: Tool for inserting a wire into a slot in a terminal member comprises housing having slidable plunger mounted therein. Terminal support or reaction member extends from the housing and is adapted to support the terminal on its side which is opposite to the side on which the slot is provided. By virtue of this support member, none of the forces applied to the wire and the terminal during insertion of the wire are transmitted to the housing in which the terminal is mounted.









TOOL FOR FORMING ELECTRICAL CONNECTIONS

BACKGROUND OF THE INVENTION

The copending application of George A. Patton Ser. No. 724,346, filed Apr. 26, 1968, discloses and claims an interconnection system for conductors comprising a plurality of platelike terminal members, each terminal member having slots extending inwardly on one side. The terminal members are mounted in, or on, a suitable support or housing which may be of plastic insulating material such as nylon. The slots have a width which is slightly less than the diameter of the conducting cores of the wires so that the wires are pushed into the slots, the edges of the slots penetrate the wire insulation and establish electrical contact with the wire cores.

It has been determined that it would be desirable to avoid the imposition of any stresses on the insulating housing when the wires are inserted into the terminal slots. Under ordinary circumstances, these housings or supports for the terminals need not be extremely strong and need not have the ability to withstand substantial stressing. However, at the time the wires are inserted into the terminals, relatively high forces may be transmitted to the housing from the insertion tool (which pushes the wire into the terminal slot) through the terminal to the support. If the support or housing is designed to withstand these insertion forces, it must be much stronger and heavier than it need be for its ordinary function of merely supporting the terminals and the wires connected to the terminals.

It is an object the present invention to provide an improved tool for inserting wires into slots in terminals. A further object is to provide an insertion tool which avoids the imposition of stresses on the terminal support or housing at the time of insertion. A still further object is to provide a lightweight compact tool which can be used without undue fatigue by the operator. A still further object is to provide a tool which can be used by unskilled or semiskilled personnel to produce a high-quality electrical connection.

These and other objects of the invention are achieved in a preferred embodiment thereof comprising a tool housing having a passageway extending therethrough and a plunger slidably mounted in the passageway. The housing and plunger are of molded plastic material, a wire pushing member of bent metal being mounted on the leading end of the plunger for engagement with the wire. The form of this pushing member is such that it straddles the terminal during the wire-inserting operation and has one arm which cooperates with a portion of the terminal to trim the portion of the wire which extends beyond the terminal at the time of insertion. A fixed reaction member or terminal support is mounted on the housing and extends beyond one end thereof. The end of this reaction member is shaped to grip the terminal during the wire insertion operation and counteract the insertion forces. By virtue of this arrangement, none of the forces imposed on the wire and the terminal during wire insertion are transmitted to the terminal support or housing so that this housing need not be inordinately heavy and bulky.

In the drawing:

FIG. 1 is a perspective exploded view of a tool in accordance with the invention.

FIG. 2 is a front view of a tool with the cover plate removed to reveal the details of the plunger and the terminal support or reaction member.

FIG. 3 is a sectional side view taken along the lines 3—3 of FIG. 2.

FIGS. 4, 5, and 6 are fragmentary sectional side views illustrating the manner in which a wire is inserted in a slot in a terminal by the tool.

FIG. 7 is a perspective exploded view showing one form of support for a plurality of slotted electrical terminals.

FIG. 8 is a perspective view of an individual terminal.

An insertion tool 2 in accordance with the invention is adapted to insert an insulated wire 4 into a slot in a connector 6, the wire 4 having a conducting core 5, the diameter of which is slightly greater than the width of the slot so that the

edges of the slot will penetrate the wire insulation and establish electrical contact with the core. An understanding of the structure and function of the tool requires some knowledge of the structure of the terminal with which it is used and the structure of the support housing on which the terminals of an interconnection wiring system are mounted. Accordingly, a typical slotted terminal and a typical housing therefore will first be described with reference to FIGS. 4-8.

Terminals of the type shown in the above identified application Ser. No. 724,346, comprise parallel plate sections 8, 10, 12 which are connected by an upper bight 14 and a lower bight 16. Terminals of this type are advantageously manufactured from sheet metal by merely punching elongated holes in the metal which form the slots 18 and bending the strip of metal until the three parallel plate sections are formed. The slots 18 are relatively wider at their outer ends, where they intersect the upper bight 14, and have a width at their lower or inner ends which is slightly less than the diameter of the insulating core 5 of the wire as noted above. Lateral extensions 19, 21 are provided on the bottom of the plate section 12 and on the lower bight 16, these lateral extensions functioning to support or lock the terminals in one form of housing shown in FIG. 7.

The type of housing shown comprises a plastic base member 20 and a clamping plate 22, the base member having a plurality of parallel upstanding ribs 24 which have channels or grooves 26 on their upper surfaces. The clamping plate 22 comprises a plurality of ribs 28 which are adapted to fit over the ribs 24 of the base section and which are connected to each other by webs 30. The upper surfaces of the ribs 28 may be provided with H-shaped openings 32 (as illustrated by the center rib and the right-hand rib in FIG. 7). Each H-shaped opening has transversely extending rectangular portions 34, 36 which are connected by an open neck as indicated. Alternately, an elongated opening 38 may be provided which has, at spaced locations along its sides, laterally extending recesses 40, 42.

The terminals 6 are mounted in the H-shaped openings 32 in face-to-face relationship with their plate sections 8 opposed to each other, the lateral extensions 19, 21 projecting laterally beyond the sides of the portions 34 or 36 of these openings. When a housing with an elongated opening such as the opening 38 is employed, the terminals are merely positioned in the opening with their side portions extending into the recesses 40, 42 and again with the lateral extensions 19, 21 extending beyond the undersides of these openings to lock the terminals in place. When an elongated opening is used such as the opening 38, all the terminals can be positioned in the same orientation excepting the terminal at one end of the opening for reasons which will be explained below.

After terminals have been positioned in the openings of the clamping plate member 22, the clamping plate is assembled to the base plate or base member 20 by moving it downwardly as viewed in FIG. 7 until locking arms 44 extend through suitable openings 46 in the floor of the base member. It should be added that a connector housing of the type shown in FIG. 7 conventionally has a cover plate, which is latched to the base member by means of upwardly extending fingers 50 on the base member. Reference is made to the above-identified application Ser. No. 724,346, for details of this cover plate. The corners of the housing are provided with cable clamp means 48 also described in the above-identified application for clamping the incoming wires.

The disclosed form of the invention is adapted to force an individual wire into a slot in one of the terminal members without imposing any stresses on the base member or the clamping plate of the housing. The disclosed embodiment comprises a tool housing generally indicated at 52 having a slot or passageway extending therethrough and having a cover plate 54 which is secured against one side of the housing by suitable fasteners as shown. Laterally extending handles 56 are provided on the upper end of the housing as viewed in the drawing and cooperate with a handle 74 on a plunger to per-

mit the operator to develop the insertion force with one hand as will be described below.

The passageway 58 has an enlarged upper end 60 which merges with a uniform width section extending to the lower end of the tool, a projection 62 being provided at the lower end of this enlarged upper end of the passageway to support a spring 82 described below. The lower end of the housing is cut away or recessed on each side of the passageway as shown at 64 and the cover plate 54 has a pair of rightwardly extending (as viewed in FIG. 1) extending bosses 66, the upper sides of which bear against the shoulder 65 defined by the recesses 64. When the cover plate is assembled to the housing, there remains a laterally extending recess at the low end of the tool which intersects the passageway 58. It will be apparent from FIG. 1 that the cover plate is normally located against the surface 68 of that housing with its upper end in recesses 70 on each side of the enlarged upper end of the passageway. Suitable fasteners such as small rivets may be used to secure the cover plate in position.

The wires are pushed or inserted into the slots in the terminals by means of a plunger generally indicated at 72 and comprising a handle 74 and a relatively enlarged upper section 76 of rectangular cross section which is slidably received in the enlarged upper end 60 of the passageway. The previously identified spring 82 is interposed between a downwardly facing shoulder 78 on this portion of the plunger and the upper surface of the projection 62 and thereby functions to bias the handle upwardly to the normal position shown in FIG. 2. Downward movement of the plunger is limited by a downwardly facing shoulder 80 on the right-hand side of the plunger, as viewed in FIG. 2, and an upwardly facing shoulder 84 formed at the lower end of the enlarged portion 60 of the passageway. Upward movement of the plunger beyond the position shown in FIG. 2 is limited by an upwardly facing shoulder 86 on the left-hand side of the plunger which bears against the underside of the projection 62 when the parts are in their position of FIG. 2.

The lower portion of the plunger is of reduced width as shown at 88, for reasons which will be described below, and the end of the plunger is of arcuate configuration as shown at 90. A metallic insert 92 is mounted against the right-hand side of the plunger at its lower end and comprises an arm 93 having a laterally extending flange 94 at its upper end which extends into a traverse groove 96 in the plunger. The lower portion of the insert 92 is reversely bent at 98 and again at 100 to form a U-shaped wire inserting and wire cutting member on the lower end of the tool. The portions 98, 100, 102 of this insert are dimensioned such that when the plunger is moved downwardly in FIGS. 4 and 5, the plate portion 10, 12 and the bight 14 of the terminal will enter the interior of the U-shaped inserting head. The bent sections 98 of the insert function to push the wire downwardly and the arm 102 cooperates with the plate portion 8 to shear the wire as will be described more fully below.

The terminal into which a wire is being inserted is supported during the insertion operation by a reaction member or support member 104 comprising an elongated shank 106 curved at its lower end 108 to a radius conforming to the radius of the lower bight 16 of the terminal. A slot 110 extends upwardly in the shank portion intermediate the sides thereof to permit the reaction member to be moved downwardly past the wire. The upper portion of the shank has a pair of spaced-apart enlarged sections 112, 114 which extend into recesses 116, and 118 in the housing and cover plate respectively on each side of the passageway, see FIG. 3. It will thus be apparent that all of the parts of the tool are retained in the passageway by the cover plate 54 and that no fasteners are used other than the fasteners which secure the cover plate to the housing.

In use, the wire which is to be connected to a terminal is positioned as shown in FIG. 4 with its axis extending transversely of the slot in the plate portions 12, 10 of the terminal and with its end portion extending across the upper edge of the plate 8. The tool, with the parts in the positions of FIG. 2, is

moved downwardly and the lower end 108 of the reaction member is hooked around the bight 16 of the terminal. The operator then pushes the plunger down by exerting a downward force on the plunger handle 74 while holding the housing by means of the handles 56. As the plunger moves downwardly from the position of FIG. 4 to the position of FIG. 5, the lower end portion 98 of the metal insert moves against the wire adjacent to the plate section 12 and pushes the wire downwardly. At the time, the leg 102 of the metal insert moves against the upper surface of the wire portion which extends between the plate sections 8, 10 and pushes this section of the wire downwardly. The wire is sheared by the cooperative action of the edge of the leg 102 and the edge of the plate portion 8 so that a neat appearing connection is formed with no excess wire extending beyond the terminal itself. After the wire has been fully inserted as shown in FIG. 5, the operator merely releases the pressure imposed on the handle 74 and the tool parts return to their normal positions. He must of course, manipulate the tool slightly to disengage the hooked lower end 108 of the reaction member from the bight portion 16 of the terminal.

It will be apparent from FIGS. 4-6 that some clearance must be provided beneath the terminal for the curved lower end 108 of the reaction member 104. This clearance is provided by virtue of the slots or channels 26 on the ribs 24 of the housing base member 20. The terminals themselves are supported by virtue of their lateral projections 19, 21. These projections rest on the upper surfaces of the ribs on each side of the channels.

Clearance must also be provided in the clamping plate member 22 to permit movement of the reaction member through the clamping plate and location of the end of the reaction member beneath the bight portion 16. Either H-shaped openings as shown in 32 or an elongated opening 38 with lateral recesses 42, 40 may be provided in the cover plate to provide this clearance. As previously noted, where H-shaped openings are used, the terminals must be mounted in face-to-face relationship, that is, two terminals in each H-shaped openings with their plate portions 8 opposed to each other. Where an elongated opening 38 is provided in the clamping plate 22, the terminals (excepting one terminal at the end of the opening) can all be in the same orientation.

It will be understood that alternative housing can be provided for the terminals and that the tool can be used with alternative type of terminals. Since the terminal is fully supported by the tool during the wire insertion and cutting operation, terminals of the type shown can thus be designed as free hanging terminals (unsupported in a housing).

In FIG. 6, it will be noted that the severed section of scrap wire is being carried away from the terminal by the reaction member. In the disclosed embodiment, the slot 110 is of a width such that the wire will be resiliently gripped by the sides of the slot 110. If the slot is made of a width such that it will grip the wire in this manner, the scrap removal problem will be facilitated. Alternatively, the slot can be made relatively wide so that it will easily straddle the wire and the scrap can be removed by other means.

Other changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only.

What is claimed is:

1. A tool for inserting a wire into a slot, said slot extending inwardly on one side of a slotted connector, said tool comprising:

a housing having a passageway extending therethrough, a plunger slidably contained in said passageway, said plunger being movable relative to said housing from a retracted position to an extended position, one end of said plunger being disposed within said passageway when said plunger is in said retracted position and being

disposed exteriorly of said passageway at one end of said housing when said plunger is in said extended position, wire engaging means on said one end of said plunger for engaging a wire positioned in alignment with said slot and moving said wire into said slot when said plunger moves from said retracted position to said extended position, and

plate supporting means on said one end of said housing, said plate supporting means being engageable with the side of said connector which is opposite to said one side thereby to support said plate during movement of said wire into said slot.

2. A tool as set forth in claim 1 wherein said wire engaging means comprises first and second spaced-apart projections on said one end of said plunger, said projections being adapted to engage said wire adjacent to oppositely directed faces of said connector when said wire is pushed into said slot.

3. A tool as set forth in claim 2 wherein said plate supporting means comprises a third projection, said third projection extending axially from said housing beside said plunger and having a slot extending inwardly from its free end for reception of the portion of said wire which extends beyond said connector.

4. A tool as set forth in claim 1 including a laterally extending handle on said housing at the end thereof which is opposite to said one of said housing and a plunger handle on the end of said plunger which is opposite to said one end of said plunger, said handles facilitating pushing of said plunger through said housing with one hand.

5. A tool as set forth in claim 1 including resilient means effective between said plunger and said housing, said resilient means biasing said plunger to said retracted position.

6. A device for inserting a wire into an electrical terminal and concomitantly trimming said wire, said terminal being of the type comprising first and second parallel spaced-apart plate means, said first plate means having a wire-receiving slot extending inwardly from one end thereof, the other end of said first plate means being connected to said second plate means by a connecting section, said second plate means having a height which is less than the height of said plate means and having an edge extending transversely of said slot, said device comprising:

a wire inserting and cutting means and a reaction means, said inserting and cutting means having a generally U-shaped cross section conforming to the cross section of said first plate means, said reaction member extending beside, and beyond said inserting and cutting means and having engaging means on its end for engaging said connecting section, and means for moving said inserting and cutting member towards said end of said reaction member whereby, upon positioning a wire on said one end of said first plate means and in alignment with said slot, engaging said engaging

means of said reaction member with said connecting section, and moving said inserting and cutting member towards said terminal, said inserting and cutting member moves over said first plate means and said wire is forced into said slot, and one side of said inserting and cutting member moves between said first and second plate means and past said edge thereby to trim said wire.

7. A device as set forth in claim 6 wherein said reaction member has a slot extending inwardly therealong from said reaction member.

8. A device as set forth in claim 6 including a housing, said inserting and cutting means being slidably mounted in said housing and said reaction member being mounted on said housing.

9. A device for inserting a wire into an electrical terminal and concomitantly trimming said wire, said terminal being of the type comprising first and second parallel spaced-apart plate means, said first plate means having a wire-receiving slot extending inwardly from one end thereof, the other end of said first plate means being connected to said second plate means by a connecting section, said second plate means having a height which is less than the height of said first plate means and having an edge extending transversely of said slot, said device comprising:

an elongated reaction member having engaging means on one end thereof for engaging said connecting section of said terminal,

an inserting and cutting member disposed beside said reaction member and having a recess in its end which is proximate to said engaging means, said recess conforming to the cross section of said first plate means, and means for moving said inserting and cutting member towards and away from said engaging means whereby:

upon positioning a wire on said one end of said first plate means and in alignment with said slot, and upon engaging said engaging means with said connecting section, and upon movement of said inserting and cutting member towards said engaging member, said inserting and cutting member moves over said first plate member and forces said wire into said slot, and portions of said inserting and cutting member move between said first and second plate means and past said edge to trim said wire.

10. A device as set forth in claim 9 including a housing, said reaction member being mounted on, and extending from, said housing, said inserting and cutting means being slidably contained in said housing.

11. A device as set forth in claim 10 wherein said inserting and cutting means comprises a plunger.

12. A device as set forth in claim 11 wherein said housing has integral laterally extending first hand grip portions, said plunger extending externally of said housing and having second hand grip portions, said plunger being movable manually by second hand grip portions.

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