United States Patent [19]

Tucci

[11] **3,896,535**

[45] **July 29, 1975**

[54] **CONTACT TERMINAL EXTRACTION TOOL**

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[21] Appl. No.: **505,809**

[52] **U.S. Cl.** ..... **29/206;** 29/203 H; 29/427

[51] **Int. Cl.** **H01r 43/00**

[58] **Field of Search**.... 29/203 H, 203 HM, 203 HC, 29/206, 270, 427

[56] **References Cited**

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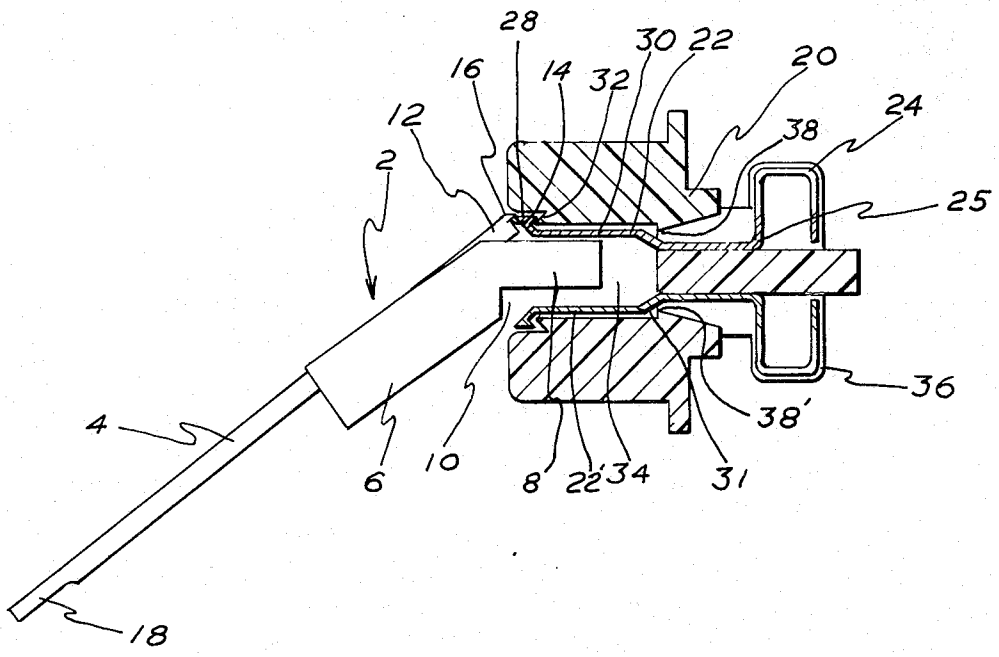
Primary Examiner—Carl E. Hall

Attorney, Agent, or Firm—Frederick W. Raring; Robert W. Pitts; Jay L. Seitchik

[57] **ABSTRACT**

An extraction tool for removing and inserting individual terminals is used with a multi-contact electrical connector. The connector employs mateable connector halves with terminals located in side-by-side relationship. The terminals are held in position in the connector housing because of their inherent spring action against appropriate surfaces of the connector. The extraction tool first engages the end of the terminal and frees the terminal from its secured position. It is then used to partially push the terminal from its normal position in the housing. The terminal can then be completely removed and another inserted. The extraction tool is designed to be used with either half of the mateable connector. It is also designed to prevent damage to other terminals when one terminal is removed.

4 Claims, 5 Drawing Figures



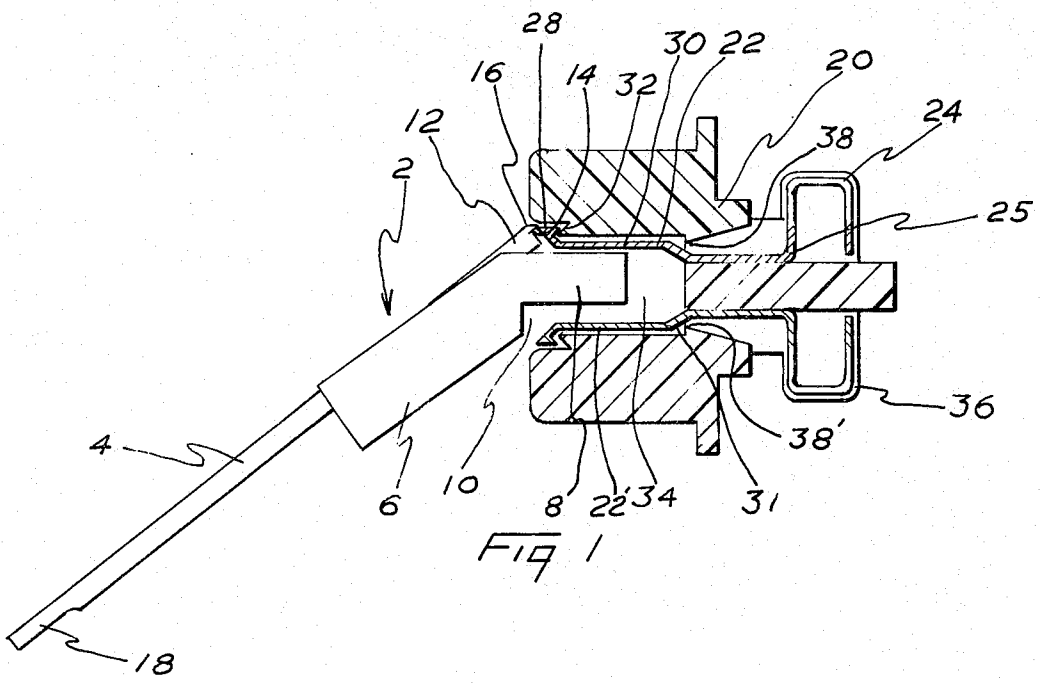

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20
16
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32
12
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38
2
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4
38'
10
6
8
22'
34
31
18

FIG 1

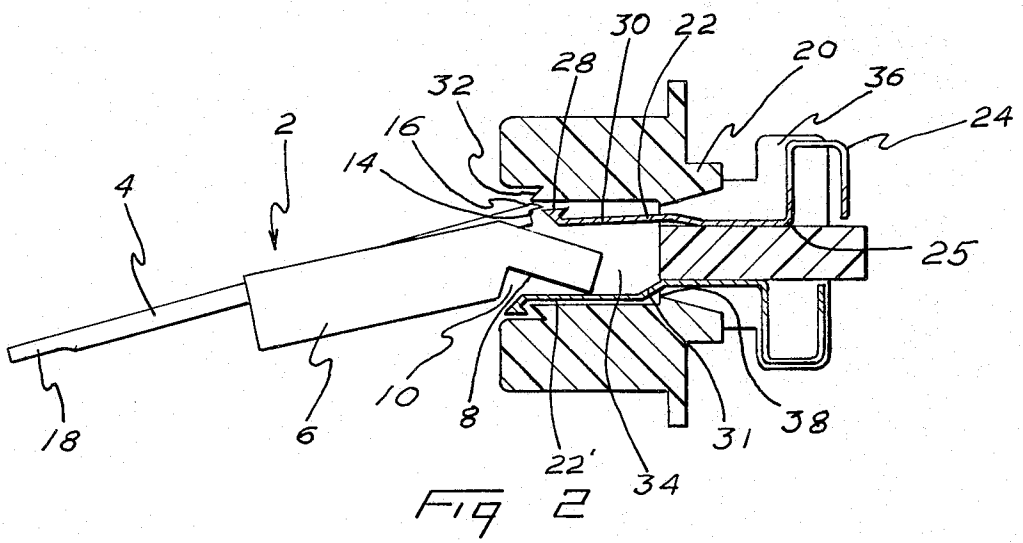

30
22
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22'
34
18

FIG 2

Fig 3

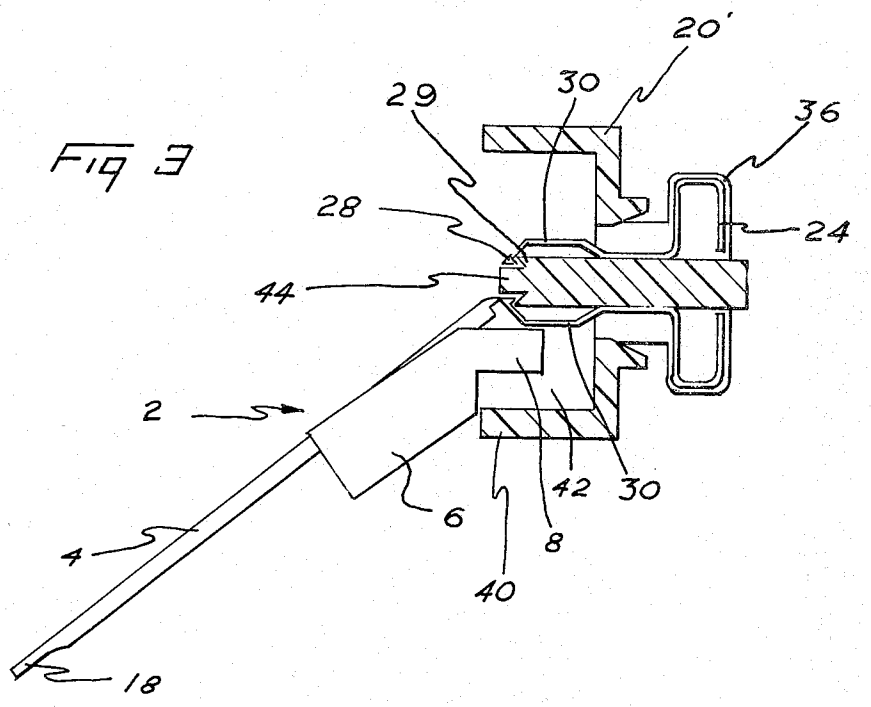


Fig 4

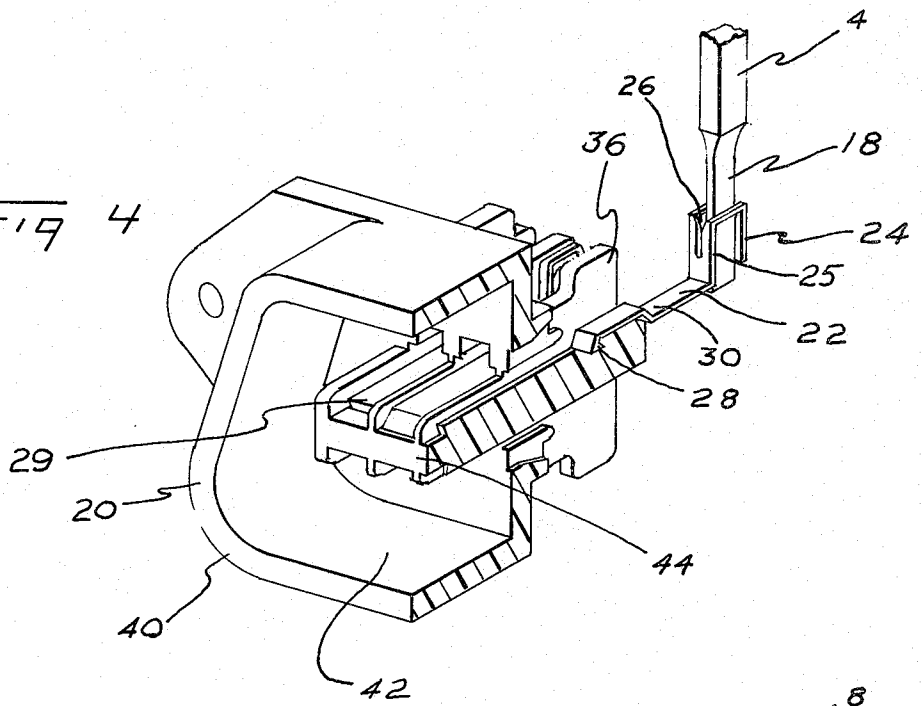
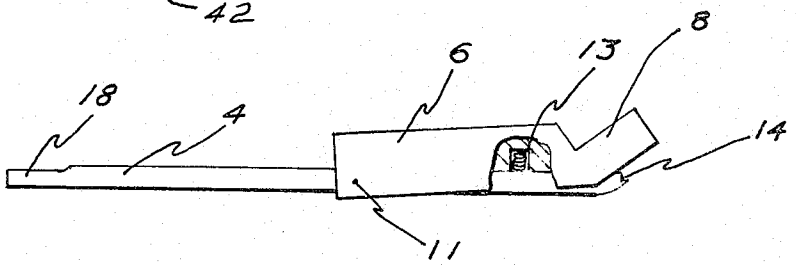


Fig 5



CONTACT TERMINAL EXTRACTION TOOL

BACKGROUND OF THE INVENTION

The instant invention relates to a tool for removing terminals from an electrical connector such as that disclosed in U.S. Pat. No. 3,760,335. The connector disclosed therein houses multiple terminals in mateable connector halves. The terminals are located side-by-side in two parallel opposed rows. One end of each terminal has a structure for retaining a wire while the other end establishes contact with the terminals in the other connector half.

Connectors of this type contain many small, relatively fragile terminals, within a confined space. Fifty terminals might be contained in one connector with an overall length of less than 3 inches. Damage to any one terminal could easily destroy the usefulness of the entire connector assembly. It is clear that replacement of the few damaged terminals, resulting in the salvage of the entire connector, could be of substantial importance when the large volume is considered. A tool for extracting single terminals from a connector would be of use when employed with a housing in which the terminals are held in place by their own resilient spring action rather than being imbedded in the housing. Of course, it would be essential that adjacent terminals not be damaged when a defective terminal is removed. Incorporation of a means of the tool for inserting the new terminal in place of the old would also be desirable. The tool could also be used to inspect individual terminals without damaging them.

The extraction tool disclosed herein can be utilized with both halves of a connector of this type. In use, the extraction tool first frees the contact end of an individual terminal from a suitable stop on the connector housing. Once the terminal has been freed, it may be partially pushed from the connector. The terminal may be completely removed by using the end of a suitable bar or rod which can be integral with the extraction tool. A new terminal may also be inserted for the one which has been removed.

The object of this invention is to provide a tool for removal and insertion of specific terminals from multi-contact electrical connectors without damaging adjacent or opposing terminals. A further object is to provide a tool which may be easily used with both halves of the mateable connector. Another object is to provide a tool which may be used either when the terminals are loaded with wires or when no wires are attached. A still further object is to provide a tool which can be used when the terminals are contained within a relatively small, confined space, without deforming or damaging either the terminal being removed, or the other terminals in the connector.

These and other objects of the invention are achieved in the embodiments thereof which are briefly described in the foregoing abstract, which is described in detail below and which is shown in the accompanying drawing in which:

FIG. 1 shows a sectional view of one connector half with the extraction tool in position to free a terminal.

FIG. 2 is a view similar to FIG. 1 with a terminal partially removed.

FIG. 3 is a view similar to FIG. 1 showing the extraction tool employed with the other mateable connector half.

FIG. 4 is a fragmentary perspective view demonstrating use of the tool for completely removing a terminal.

FIG. 5 is a view of an alternate embodiment of the tool.

The preferred embodiment of the tool 2 is shown in FIG. 1. This tool essentially comprises a bar or rod 4 with a guide or support block 6 attached near one end. The bar 4 acts essentially as a pivoted lever. The guide or support block 6 is basically rectangular in shape in the embodiment shown here. The bar 4 passes across the top of the support block. A guide arm 8 extends at an angle from one end of the support block 6. The guide arm 8 is adjacent to end 12 of the bar and extends at an angle to both the bar 4 and the support block 6. This angle is large enough so that end 12 protrudes above the top of the guide arm. A notch or ledge 14 in end 12 is located just above the top of the guide arm 8. Although not shown, the width of bar 4 at end 12 is substantially equal to the width of any one of the terminals. It can be seen in FIG. 4 that each of the terminals 22 lies in a trough or recess 29. End 12 must be narrow enough to also fit within that recess. It can be seen that in FIG. 1, the guide arm 8 is thinner than the guide or support block 6. This results in the formation of a shoulder 10 at the intersection of the underside of the guide arm and the guide block. The guide arm is rectangular in cross-section so that it will fit in the cavity 34 on the connector shown in FIG. 1.

The connector half 20 shown in FIGS. 1 and 2 contains terminals 22 and 22'. These terminals are contained in rows which face each other across a cavity 34, the cavity 34 extending along the contact or shank portion 30 of the terminals. In use, this cavity would receive two rows of terminals on a mating connector half. A grip or barb 28 on the contact end of terminals 22 engages a surface 32 on the connector housing, thus securely holding the terminals in place. The other end of terminals is adapted to receive a wire. The wire-receiving portion 24 has a U-shaped end 25. A wire receiving slot 26 extends through each branch of the U-shaped terminal end. Approximately midway between the ends, the terminals extend through gaps 38, 38' in the housing 20.

A terminal 22 is shown in FIG. 4 after it has been removed from the housing 20'. On this terminal, the U-shaped conductor receiving portion 24 and the terminal barb 28 are not only on opposite ends of the terminal but are also on opposite sides. The terminal used in connector-half 20 shown in FIGS. 1 and 2 is not the same however. There the U-shaped portion 24 and the barb 28 while still on opposite ends are located on the same side of the terminal. In each case the terminal is shaped so that when inserted into the appropiate housing the terminal itself will act as a spring biasing the terminal against the wall of the housing and thereby insuring that barb 28 engages securing surface 32 when the terminal is in its normal position. The extraction tool must free the terminal by rotating the barb 28 and shank portion 30 against this inherent spring action. The terminal, which may be made of a metal such as beryllium copper, must not be rotated too far against this spring action or the terminal might be permanently deformed and become unusable. The design of the extraction tool guards against the possibility of such deformation. As shown in FIG. 1 and FIG. 3, the notch or ledge 14 is first positioned so as to engage the barbed terminal end 28. The guide arm 8 is thin enough so that it may be inserted into either cavity 34 in FIG. 1 or cav-

ity 42 in FIG. 3. By applying pressure to the extraction tool 2 the barb 28 can be moved away from the securing surface 32. The extraction tool 2 can then be pushed into the cavity 34 in FIG. 2. As the forward end of the tool moves into this cavity the curved top 16 of protruding end 12 will rest against the connector housing in the neighborhood of securing surface 32. This curved top 16 then acts as a fulcrum causing the entire extraction tool to rotate in a clockwise direction as shown in FIG. 2. This rotation continues until the end of guide arm 8 comes to rest against the opposite side of the cavity. The curved top 16 and the guide arm 8 are dimensioned so that, when used with either connector half, excessive deflection of the terminal cannot occur as the terminal is removed in this manner.

FIG. 3 shows that in the other connector half 20', the terminal shank portions 30 no longer face each other across an open cavity. Instead, both rows of terminals are mounted on a ridge 44 which runs along the length of the connector. The outer casing 40 of connector half 20' forms a cavity 42 which completely encircles this ridge and both rows of terminals. In this particular connector, the dimensions of this cavity are on the same order as those of cavity 34 in the first connector half. It can be seen from FIG. 3 that the extraction tool 2 is used in much the same manner with both connector halves. In connector 20', the guide arm 8 is merely positioned against the outer casing 40 as the notch 14 engages the terminal.

The fragmentary perspective view shown in FIG. 4 shows the rows of terminals employed in this connector. One of the terminals, 22, has been partially removed. A knife-edge 18 on one end bar 4 has been inserted into the wire-receiving slot 26. It can be seen that the knife-edge is small enough to be inserted completely into the slot. The terminal 22 may be removed and discarded by simply using this knife-edge of the extraction tool to pull the terminal from the connector. If insertion of a new terminal is desired, one can be pushed into position in much the same manner. It should be noted that when the terminal is pushed into the connector, the force required for insertion will act not upon the U-shaped terminal end 25 but rather upon the terminal shank portion 30. This prevents damage to the wire-receiving end of the newly inserted terminal.

FIG. 5 represents an alternate embodiment of the extraction tool. In this embodiment, bar 4 is not rigidly attached to the guide block 6. Instead, the bar 4 is pivoted about a suitable point 11 on the guide block. A spring 13, attached to the bar 4 and to the guide block 6, is located between the pivot 11 and the guide arm 8. The spring 13 normally biases this end of the bar away from the guide block 6. When the guide arm 8 is positioned against an appropriate surface on one of the connector housings and the notch 14 engages a terminal, the terminal can be dislodged by merely rotating the bar against the action of spring 13. The terminal can then be pushed out as before.

What is claimed is:

1. A tool for extracting and inserting individual terminals from multi-contact connector housings, said tool comprising:

a bar with first and second ends,

guide support means, proximate to said first end and fixed to said bar, said bar extending across one surface of said guide support means, said surface defining the top of said guide support means and the top of said tool,

guide arm means extending from said support means on the end of said guide support means nearest said first end of said bar, said first end protruding slightly above said arm,

notch means on said first end of said bar, whereby upon positioning said guide arm means against an appropriate surface on said connector housing and engaging said notch means against one end of a terminal in said connector, said terminal can first be freed from its normally secured position in the connector and can then be pushed partially from the housing.

2. A tool as set forth in claim 1, said notch means comprising a ledge perpendicular to the axis of said lever, with said first end of said bar having a rounded portion between the top of said bar and said ledge, the width of said first end being substantially equal to the width of one of said terminals.

3. A tool as set forth in claim 1, said bar being pivotally fixed to said guide support block with a spring between said pivot and said first end of said bar, so that said first end may be rotated against the action of said spring toward said guide support means when said tool is used to free said terminal from its normally secured position.

4. A tool for extracting individual terminals with contact ends from mateable multi-contact electrical connector housings in which said terminals are arranged in side-by-side relationship in two parallel rows, said tool comprising:

a lever with first and second ends,

a rectangular guide support block fixed to said lever, proximate to said first end of said lever, said lever extending across one surface of said guide support block, said surface defining the top of said guide support block and the top of said tool,

a rectangular guide arm extending from said guide support block on the end of said block nearest said first end of said lever, said guide arm being thinner than said guide block, said guide arm extending at an angle to said lever with said first end of said lever protruding slightly above said arm,

a notch in said first end of said lever, said notch forming a ledge perpendicular to the axis of said lever, said ledge being above said arm, the width of said first end being substantially equal to the width of one of said terminals,

a curved portion on said first end of said lever,

said curved portion extending from the top of said lever to said ledge,

a knife-edge on said second end of said lever, said knife edge being perpendicular to the axis of said lever, the length of said knife-edge being small enough so that said knife-edge can be inserted into a slot in said terminals, whereby

upon positioning said guide arm against an appropriate surface on either of said mateable connectors and positioning said ledge against the contact end of a single terminal in said connector, said terminal can first be freed from its normally secured position and then pushed practically from its normal position in the housing.

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