APPARATUS FOR INSERTING WIRES INTO TERMINALS IN AN ELECTRICAL CONNECTOR

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ABSTRACT

Apparatus for inserting wires into terminals arranged in two parallel rows in an electrical connector comprises a connector holder, fixed insertion tool means, and movable insertion tool means, the holder being mounted on guide pins between the fixed and movable insertion tool means. The parts are normally resiliently biased apart but the connector holder and the movable insertion tool means are movable towards the fixed tool means. Wires are positioned, by means of integral positioning jigs, between the fixed tool means and the connector holder and between the movable tool means and the connector holder. Upon movement of the movable tool means and the connector holder towards the fixed tool means, the wires are inserted into the wire-receiving portions of the terminals.

10 Claims, 10 Drawing Figures
3,886,641

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BACKGROUND OF THE INVENTION

This invention relates to an improved apparatus for inserting wires into the wire-receiving portions of electrical contact terminals which are contained in a connector or the like having the wire-receiving portions of the terminals arranged in two parallel rows. The herein disclosed embodiment of the invention is specifically intended to insert wires into terminals contained in a connector of the type shown in U.S. Pat. No. 3,760,335, however, it will be apparent that the principles of the invention can be used in tools intended for other types of connectors.

U.S. Pat. No. 3,760,335 discloses and claims an electrical connector containing terminals arranged in two parallel rows, each terminal having an integral wire receiving slot at its rearward end so that upon movement of a wire laterally of its axis and into the slot, the edges of the slot will penetrate the insulation of the wire and establish electrical contact with the conducting core thereof. U.S. Pat. No. 3,758,935 discloses and claims a bench mounted tool which is capable of inserting wires into the wire receiving portions of all of the terminals in a connector of the type shown in the above-identified U.S. Pat. No. 3,760,335 this tool having a centrally located connector holding means and pivoted arms on each side of the connector holding means on which are mounted wire locating jigs and wire inserters for respectively locating wires in alignment with the terminals in a connector mounted in the connector jig and inserting the wires into the wire receiving portions of the terminals.

Connectors and insertion tools of the types disclosed in the above-identified U.S. Pat. Nos. 3,760,335 and 3,758,935 have received wide-spread acceptance and are presently being widely used in the telephone industry and elsewhere. A need was recognized some time ago for a relatively more simple and inexpensive insertion tool for use under circumstances where the volume of work would not justify an insertion tool of the type shown in U.S. Pat. No. 3,758,935 and a relatively simple insertion tool is disclosed and claimed in application Ser. No. 442,958 filed Feb. 15, 1974 by John Tucci. This Tucci apparatus can be used with a conventional bench or arbor press and has also received acceptance in the industry. The insertion apparatus disclosed in application Ser. No. 442,958 inserts wires into only one of the rows of terminals in the connector and in using this apparatus, is therefore necessary to insert wires into the second row in a separate operation.

The instant invention is specifically directed to the achievement of a relatively simple wire insertion apparatus which, like the apparatus disclosed in application Ser. No. 442,958, can be used with a bench or arbor press and which additionally is capable of inserting wires into the terminals in both of the rows of a two-row connector in a single operation. The invention is further directed to the achievement of a simplified apparatus which, with an easily effected modification, can insert either intermediate portions of wires into the terminals or can insert the end portions of the wires into the terminals and simultaneously trim the wire ends.

It is accordingly an object of the invention to provide an improved relatively simple apparatus for inserting wires into the wire receiving portions of the terminals in a two-row electrical connector. A further object is to provide an apparatus which is capable of inserting either an intermediate portion of the wires or the ends of the wires into the terminals in a two-row connector. A still further object is to provide a relatively simple and durable wire insertion apparatus which can be used with a conventional bench or arbor press. A further object is to provide a wire insertion apparatus which can be used successfully by a relatively unskilled technician.

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

FIG. 1 is a perspective view of an insertion apparatus in accordance with the invention, this view showing the positions of the parts immediately prior to insertion of intermediate portions of wires into the wire receiving portions of a two-row electrical connector.

FIG. 2 is a perspective exploded view of the apparatus of FIG. 1.

FIG. 3 is a perspective view illustrating the initial steps of positioning wires in the apparatus for insertion into the lower row of terminals in a connector.

FIG. 3A is a view similar to FIG. 3 but illustrating the step of positioning wires in the apparatus for insertion into the upper rows of terminals.

FIG. 4 is a sectional side view taken along the lines 4—4 of FIG. 1.

FIG. 5 is a view similar to FIG. 4 but showing the positions of the parts after movement of the connector holder and the movable insertion tool means towards the fixed tool means and insertion of the wires into the wire-receiving portions of the terminals.

FIG. 6 is a perspective view of a fixed shearing member which is used in conjunction with the apparatus of FIGS. 1—5 when it is desired to trim the ends of the wires and insert the trimmed ends into the terminals.

FIG. 7 is a perspective view of a spacer which is used in conjunction with the fixed shearing member of FIG. 6 when wires are trimmed at the time of insertion into the terminals.

FIG. 8 is a side view of the apparatus similar to FIG. 4 but showing the use of the fixed shearing member and the spacer for shearing the wires at the time of insertion.

FIG. 9 is a perspective sectional view of the type of two row electrical connector for which the disclosed embodiment of the invention is intended.

Referring first to FIG. 9, the herein disclosed embodiment of the invention is adapted to insert wires 2 into the conductor receiving portions 4 of electrical contact terminals 6 which are contained in a connector 8. The connector comprises an insulating housing 10 having a mating face 12, a rearward face or side 14, and a radially extending flange 32. The contact terminals each comprise a contact portion 20, an intermediate portion 22 and the previously identified conductor receiving portions 4, which comprise a pair of plate-like members 24, 26 which are connected to each other by spaced apart connecting straps 28. The plate-like members 24, 26 have conductor receiving slots 30, the width of these slots being such that when a wire is being moved laterally of its axis into the slots, the edges of the slots will penetrate the insulation of the wire and establish electrical contact with the conducting core thereof.
The connector housing 10 has a central rib 18 extending from its rearward side and contact receiving cavities through the housing from the upper and lower sides of the rib so that the connector has two parallel rows of terminals which are adapted to receive wires in opposite directions. The terminals extend through the cavities 16 and into a trough-like recess 17 on the mating face 12 which is adapted to receive a complementary male connector. The individual contact terminals 6 are separated from each other on the upper and lower sides of the rib 18. The terminals in each row are separated by parallel barriers 34 which are spaced from a rearwardly facing surface 36 of the rearward face. At the ends of each row of barriers 34, a projecting ear 38 is provided which serves to protect the terminals in the row and which is used to position the connector housing in a connector holder which is described below.

Referring now to FIGS. 1 and 2, an insertion apparatus 40 in accordance with the invention comprises a base member 41 in the form of a generally elongated block 42 having a leftwardly facing recess 48, as viewed in FIG. 2, and laterally extending aprons 46 on its lower surface so that it can be supported on the platen of a bench press as will be described below. Guide pins 44, 44' are mounted in the ends of the base block 42 and the connector holder 66 and upper or movable tool holder 100 are slidable mounted on these guide pins. A fixed insertion tool holder 50 (FIG. 4) is secured to the leftwardly facing side of the base block 42 in the recess 48 by suitable fasteners 52. This fixed tool holder has a transversely extending relatively narrow slot 54 extending inwardly from its upwardly facing surface for the full length thereof, this slot being enlarged at its upper end as shown at 56. A narrow plate-like insertion punch block 58 is mounted in the slot 54 by suitable fasteners (not specifically shown) and a plurality of spaced apart insertion punches 60 extend upwardly from this punch block at spaced apart locations. The punches 60 are dimensioned to move relatively into the wire receiving portions of the terminals and between the connecting straps 28. The upwardly extending flanges 62, 64 of the punch block move into surrounding relationship with the terminals and with the barrier plates 34 as shown in FIG. 5 and as will be described in detail below.

The connector holder 66 has enlarged ends in which there are mounted bushings 72 which are slidable on the previously identified guide pins 44, 44'. Coil springs 74 are provided on the pins between the downwardly facing side of the connector holder and the upwardly facing side of the base member 42 so that the connector holder is normally spaced from the base member but can be moved downwardly against the base member with concomitant compression of these springs. Connector holder 66 has rightwardly and leftwardly facing sides 68, 70 as shown in FIG. 4 and a transversely extending rib 78 which has a width which is less than the length of the enlarged ends 76 and which is located below the upper surface of the enlarged ends, ledges 80 which are at each end of the rib 78 and the sides of the enlarged ends 76 provide a nest for the connector 8 and recesses 82 extend in opposite directions from the ledges 80 for the accommodation of the ends of the flanges 32 of the connector housing. As shown best in FIG. 4, when the connector is positioned in this nest, the central rib 18 on the rearward side of the connector housing will project beyond the leftwardly facing side surface 70 of the central rib like portion 78 of the connector holder. As will be apparent from FIGS. 3 and 4, this relationship of the parts permits the fixed tool holder 50 and the movable tool holder 50' (described below) to move against the central rib 18 of the connector housing and insert the wires into the wire-receiving portions of the terminals.

The wires 114 are located in the apparatus in alignment with the wire-receiving portions of the terminals in the connector by means of wire-positioning jigs or combs 88, 90, each of these combs comprising a plate-like member having a plurality of slots 92 extending inwardly from its upper edge 94. These slots are dimensioned freely to receive the wires 114 and are spaced apart by distances corresponding to the spacing between adjacent terminals in the connectors. The comb or wire jig 90 is secured to the ends of the connector holder 66 with the ends of the combs being received within recesses 84 and secured by suitable screws 96. The comb 88 is similarly secured against the rightwardly facing side 68 of the connector holder but screws 98 having enlarged ends are used to secure this comb in place. Advantageously, small aligning pins 99 are provided in the sides 68, 70 of the connector holder which extends into small holes in the combs 88, 90. As will be explained below, it is desirable to be able to readily remove comb 88 during use of the apparatus.

The upper or movable tool holder 100 has enlarged ends 102 in which bushings 104 are mounted to permit sliding movement of this member on the pins 44, 44'. Springs 105 are interposed between the upper tool holder and the connector holder so that the parts will normally be biased to the positions of FIG. 4 with the upper tool holder spaced from the connector holder and the connector holder spaced from the base member. A upper tool holder 50' is secured by fasteners in a recess 108 on the leftwardly facing side of the central transverse portion 106. As shown in FIG. 4, this upper tool holder and the associated insertion punch block 58' and insertion punches 60' are identical to the fixed tool holder 50 and the fixed insertion punch block and need not be described in further detail. The rib or central section 106 of the movable tool holder is advantageously provided with an upwardly facing flat bearing surface 108 against which the ram 112 of the press bears when the device is used.

In use, the upper tool holder is first lifted upwardly on the pins 44, 44' until its righthand end is above the shorter guide pin 44 and it is then swung on the pin 44' so that it will not interfere with the steps of locating wires in the combs. Advantageously a locking collar is provided on the longer pin 44' to prevent removal of the upper tool holder from this pin. Wires 114 which may extend from a cable 116 are then located in the slots in the combs 88, 90 and moved downwardly into the lower portions of the slots. As shown in FIG. 3, intermediate portions of the wires will span the space between the two combs 88-90.

A connector 8 is then positioned in the nest defined by the central rib portion 78 of the connector holder, the ledge 80 and the recess 82 in the connector holder 66 so that the rearwardly projecting rib portion of a connector will extend leftwardly as viewed in FIG. 4 and the lower row of terminals with its downwardly directed wire receiving portions of its terminals will be in alignment with the wires. Additional wires 114' are
then positioned in the slots 92 and these wires will be in alignment with the terminals on the upper side of the rib 18 of the connector housing. The movable tool holder 100 is then swung with respect to the guide pin 44' until its right hand bushing 104 as viewed in FIG. 2 is in alignment with the guide pin 44 and it is then lowered onto the pin 44 until it is supported by the springs 105. The apparatus is then placed on the plate 110 of a bench press with the bearing surface 108 beneath the ram 112 of the base. The press is then operated to drive the upper tool holder downwardly against the biasing force of the springs 105 and 74. Both the connector holder 66 and the upper tool holder are moved downwardly until they occupy the positions of FIG. 5. During such movement of the connector holder and the upper tool holder, the insertion punches 60 of the fixed insertion punch 58 will cause the wires 114 to be moved relatively into the wire receiving portions of the terminals in the lower rows and the insertion punches 60' will similarly move the wires 114' into the wire receiving portions of the terminals in the upper row. The ram 112 is then raised and the parts of the apparatus will return to their normal positions under the influence of the springs 74, 105. The movable tool holder 100 is again raised above the upper end of pin 44 and swung. The comb 88 may be removed by unscrwing the fasteners 98 and the connector having intermediate portions of the wires 114, 114' can be removed from the connector holder.

As previously mentioned, the apparatus of FIGS. 1-5 can be easily and quickly modified to trim wires at the time of insertion and insert the trimmed wires into the terminals. FIGS. 6-8 show this modification. The wires are trimmed by a modified insertion tool holders 138, 138' and a fixed shearing member 118, FIG. 6. This fixed shearing member is carried by the connector holder 66 and is fixed in the sense that it does not move relative to the connector 8 or to the connector holder 66 although it does move with the connector holder towards the base member 41 as will be described below. The fixed shearing member comprises flat plate 120 and two cutter plates 122 which are secured by suitable fasteners as shown to the side edges of the plate 120. The cutter plates are relatively thin and have short flanges 124 on their free ends which extend inwardly over the plate 120 and towards each other. A plurality of spaced apart relatively narrow slots 126 are provided in the cutter plates 122 and extend in the flanges and in the main sections of the cutter plates. The ends of the slots which are in the flanges 124 provide cutting edges 128 which cooperate with the cutting edges of the fixed insertion tool holders 138, 138'. The fixed shearing member 118 is dimensioned to receive a connector 8 with the mating face of the connector against the surface of the plate 120. As shown in FIG. 8, the flanges 124 extend beside the rearwardly facing surfaces 36 of the connector and between these surfaces in the barriers 34. It should be noted that the one side edge of the plate 120 is of reduced width as shown at 130 in order to permit the fixed cutter to be positioned in the apparatus as will be described below.

The spacer, FIG. 7 is in the form of a bar 132 having a rectangular cross-section and having upwardly extending ends 134 which are provided with suitable openings for the screws 98 and for the guide pins which extend into the comb 88. The spacer member is contoured on its upper surface between the ends 134 to receive the plate 120.

When it is desired to modify the apparatus as shown in FIG. 1 so that the wires will be cut in the cut ends inserted into the terminals, the screws 98 are first removed and the comb or wire jig 88 is removed from the connector holder 66. The spacer 132 is then mounted against the rightwardly facing side 68 of the connector holder and the comb 88 is mounted against the spacer as shown in FIG. 8.

The lower wires 114 are then positioned in the slots 92 of the combs 88, 90 and the fixed shearer member 118 is then assembled to the connector by sliding the connector along the surface of the plate 120 and between the shearing members 122 so that the flanges 124 are against the surfaces 36 of the connector housing. The connector and fixed shearer member are then positioned on the connector carrier as shown in FIG. 4 and the additional wires 114' are positioned in the slots 92 above the comb and the fixed shearer.

It is also necessary to replace the fixed insertion tool holders 50, 50' with tool holders 138, 138' which have on the ribs or flanges 62 cutting edges 140 for cooperation with the previously identified cutting edges 128.

The apparatus is then placed in a press as previously described and the ram of the press is lowered to move the upper tool holder and the connector carrier downwardly until they are in positions corresponding to the positions shown in FIG. 4. During movement of the cutting edges 140, 140', relatively past the cutting edges 128, the wires 114, 114' are trimmed and the trimmed ends, which extend from the left in FIG. 4 are inserted into the wire receiving portions of the terminals.

It will be apparent from the foregoing that the invention provides a relatively simple and durable apparatus capable of inserting wires into all of the terminals in the two-row electrical connector shown in FIG. 9. The invention further is extremely versatile in that the wires can be cut or not depending upon the needs of a particular situation. Under some circumstances, it may be desirable or required that wires be inserted into only some of the terminals in the connector and this can be accomplished with an apparatus in accordance with the invention.

A salient feature of the invention which permits the achievement of the advantages discussed above is that only two wire-positioning jigs or combs 88, 90 are used but each slot 92 in each comb serves to locate two of the wires 114, 114'. One of these wires being destined to be inserted into a terminal in the upper row and the other row 114 being destined to be inserted into the terminal in the lower row.

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. Apparatus for moving conductors laterally of their axes in opposite directions towards each other and into the conductor-receiving portions of electrical contact terminals which are contained in a multi-contact electrical connector, said conductor-receiving portions being arranged in two side-by-side parallel rows which are on oppositely facing surfaces of said connector, said apparatus comprising:
fixed and movable insertion tool means, each of said tool means having conductor insertion means for inserting said conductors into said conductor-receiving portions, said insertion tool means being normally spaced apart with said conductor insertion means opposed to each other.

connector holding means normally disposed between said tool means, said holding means being adapted to hold said connector in an orientation with said conductor-receiving portions opposed to said insertion tool means,

guide means extending rectilinearly from said fixed insertion tool means to said movable insertion tool means, said movable insertion tool means and said connector holding means being in guiding engagement with said guide means, and

resilient means interposed between said fixed insertion tool means and said connector holding means and between said connector holding means and said movable insertion tool means whereby, upon locating conductors between said fixed insertion tool means and said connector holding means and between said connector holding means and said movable insertion tool means, and upon moving said movable insertion tool means towards said fixed insertion tool means, said movable insertion tool means moves said connector holding means towards said fixed insertion tool means and said conductor insertion means inserts said conductors into said conductor-receiving portions of said terminals.

2. Apparatus for inserting wires laterally of their axes in opposite directions towards each other and into the wire-receiving portions of electrical contact terminals which are contained in a multi-contact electrical connector, said wire-receiving portions being arranged in two side-by-side parallel rows which are on oppositely facing surfaces of said connector, said apparatus comprising:

fixed and movable tool holders, guide means extending between said tool holders, said movable tool holder being on said guide means and being movable from a remote position to a proximate position, with respect to said fixed tool holder, along a rectilinear path,

a connector holder on said guide means between said fixed and movable tool holders, said connector holder being adapted to hold an electrical connector in an orientation with said rows extending normally of said rectilinear path and with said rows opposed to said tool holders,

wire locating means on said connector holders for locating a plurality of wires in two substantially parallel planes on each side of said connector holder with the axes of said wires extending normally of said rectilinear path and normally of said rows of wire receiving portions and with one wire in alignment with each of said wire-receiving portions,

resilient means between said connector holder and each of said tool holders, said resilient means normally maintaining said connector holder spaced from said fixed tool holder and maintaining said movable tool holder in said remote position,

insertion tool means on said fixed and movable tool holders for inserting wires into said wire-receiving portions upon relative movement of said insertion tool means towards a connector mounted in said connector holding means, and

actuator means for moving said movable tool holder along said path towards said fixed tool holder whereby,

upon locating wires in said wire locating means, mounting a connector in said connector holder and actuating said actuator means, and connector holder and said movable tool holder are moved towards said fixed tool holder, and said wires are inserted into said wire-receiving portions of said terminals by said insertion tool means.

3. Apparatus as set forth in claim 2 said fixed and movable tool holders comprising a pair of elongated tool mounting blocks extending parallel to each other.

4. Apparatus as set forth in claim 3, said guide means comprising a pair of spaced-apart parallel guide rods, said connector holder and said movable tool holder being slidably mounted on said guide rods.

5. Apparatus as set forth in claim 4, said resilient means comprising helical springs surrounding said guide rods.

6. Apparatus as set forth in claim 5 wherein said wire locating means comprises first and second wire locating members disposed against oppositely facing sides of said connector holder, said wire-locating members having aligned slots therein for reception of said wires.

7. Apparatus for inserting wires into the conductor-receiving portions of contact terminals in a multi-contact electrical connector, said wire-receiving portions being arranged in two parallel side-by-side rows and being adapted to receive wires upon movement of said wires laterally of their axes and into said conductor receiving portions, said rows being adapted to receive wires upon movement of said wires laterally of their axes, towards each other, and towards said housing, said apparatus comprising:

a fixed tool holder and a movable tool holder, said fixed and movable tool holders being normally in spaced apart opposed relationship,

guide means extending rectilinearly between said fixed and movable tool holders, said movable tool holder being in engagement with said guide means, connector holding means disposed between said fixed and movable tool holders when said tool holders are spaced apart, said holding means being adapted to receive a connector in an orientation in which said rows of contact receiving portions extend normally of said path and said rows are opposed to said tool holders, said connector holding means being in engagement with said guide means, resilient means interposed between said connector holding means and each of said tool holders, said resilient means normally maintaining said connector holding means spaced from said fixed tool holder and maintaining said movable tool holder spaced from said connector holding means,

actuating means for moving said movable tool holder towards said connector holding means and towards said fixed tool holder means with concomitant compression of said resilient means,

wire locating jig means on said connector holding means for locating wires proximate to said contact receiving portions with the axes of said wires extending normally of said path and normally of said rows and,

wire insertion means on each of said tool holders, said wire insertion means comprising insertion punches directed towards connector holding
means and being effective, upon relative movement thereof towards said connector holding means, to insert wires into said wire-receiving portions, whereby.
upon locating wires in said wire jig means, mounting a connector in said connector holding means and upon moving said movable tool holding means along said path towards said fixed tool holding means, said connector holding means is moved against said fixed tool holding means and said movable tool holding means moves against said connector holding means, and said wires are inserted into said wire receiving portions of said terminals.
8. Apparatus as set forth in claim 7 including shearing means for trimming said conductors during movement of said conductors into said conductor-receiving portions of said contact terminals, said shearing means comprising a movable shearing edge on each of said insertion tool means and a fixed shearing edge extending beside each of said rows in a connector mounted in said connector holding means.
9. Apparatus as set forth in claim 7 including shearing means for trimming said conductors during movement of said conductors into said conductor-receiving portions of said contact terminals, said shearing means comprising a movable shearing edge on each of said insertion tool means and a fixed shearing edge extending beside each of said rows in a connector mounted in said connector holding means, said fixed shearing edge means being on said connector holder.
10. Apparatus as set forth in claim 9, said connector holding means having said fixed shearing means removably mounted thereon.

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