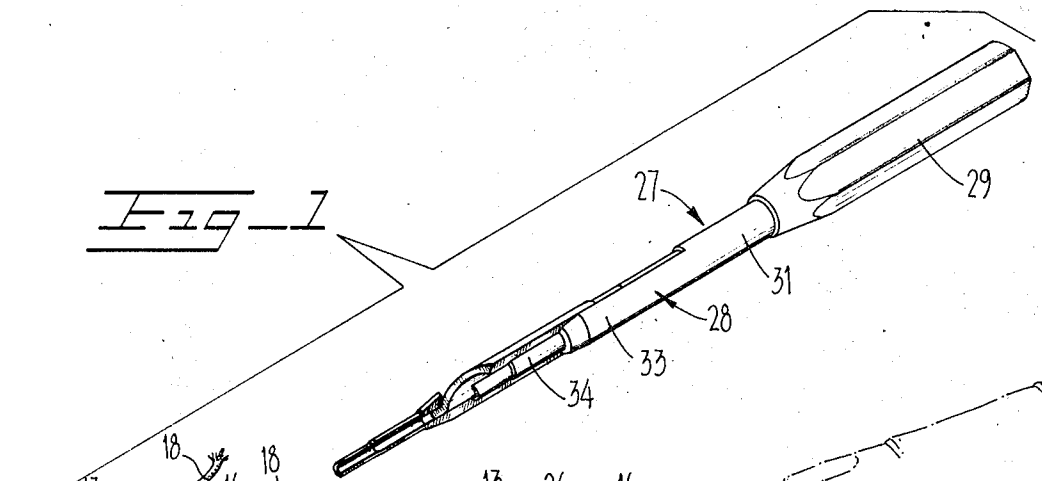
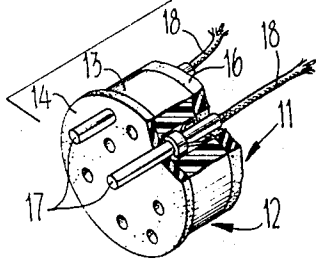
Nov. 10, 1970 R. B. HENDRY ET AL 3,538,585

CONTACT INSERTION-REMOVAL TOOL

Filed Jan. 12, 1968

Fig_1





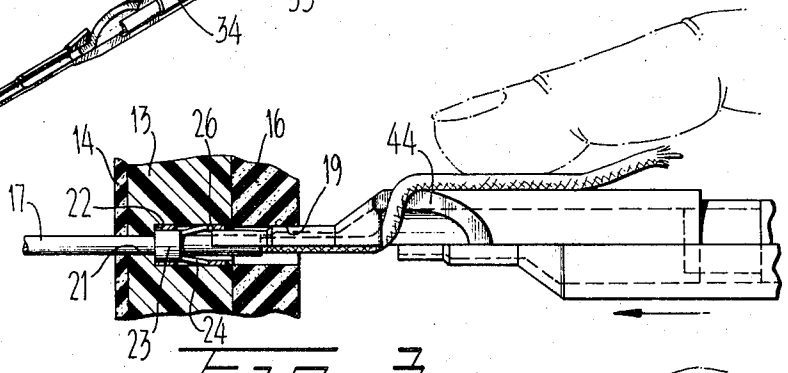


Fig_3

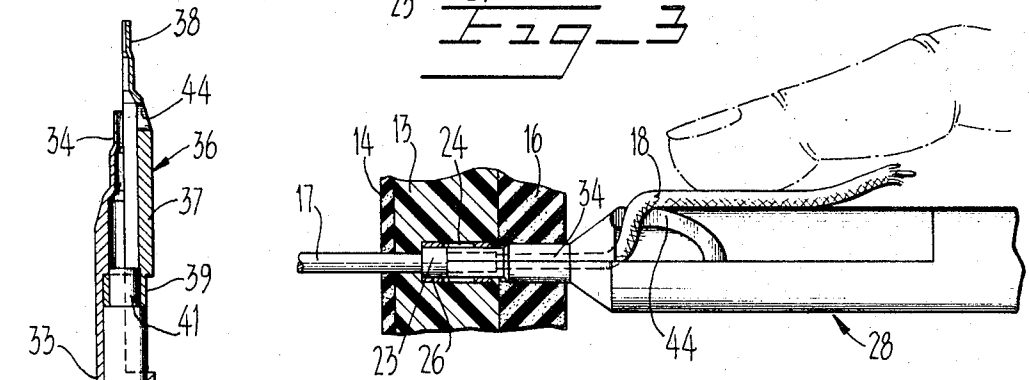


Fig_2

Fig_4

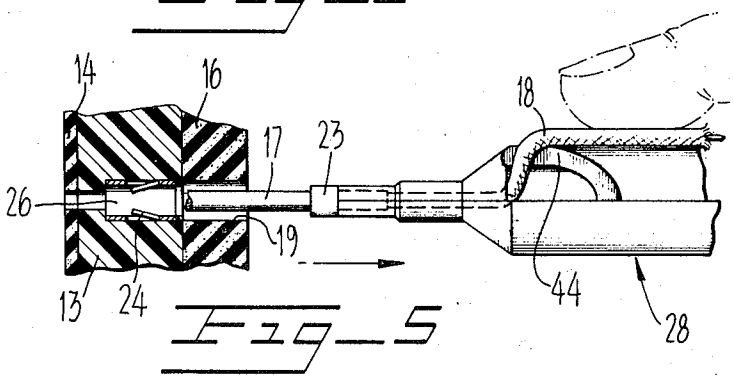


Fig_5

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United States Patent Office 3,538,585 Patented Nov. 10, 1970

3,538,585

CONTACT INSERTION-REMOVAL TOOL

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Filed Jan. 12, 1968, Ser. No. 697,521
Int. Cl. H01r 43/04, 1/00; H05k 13/00
U.S. Cl. 29—203 7 Claims

ABSTRACT OF THE DISCLOSURE

A tool for the ready insertion and removal of electrical contact pins into and from a multiple pin connector. The tool is provided with a nose arranged to releasably grip a pin such that it may be inserted by the nose between contact retention springs of the connector, spreading the springs during the insertion process. The nose may then be released from the pin in such a manner as to partially release the springs and permit them to grip the pin sufficiently to hold same in place. The tool may then be withdrawn, leaving the pin operatively mounted in the connector. Removal of a pin is accomplished in reverse order by inserting the nose of the tool and manipulating same to grip the pin and spread the retention springs, thereby releasing the pin for removal upon withdrawing the tool. The tool is particularly useful in applications involving connectors with many pins as employed in high reliability circuits, it being frequently desirable to replace several defective pins rather than discard the entire connector to restore reliability.

BACKGROUND OF THE INVENTION

In many electrical circuit applications multicontact connectors are utilized to connect certain portions of a circuit to others. Typically, a connector assembly includes interengageable male and female parts, the male connector having a plurality of contact pins projecting from an insulating body and the female connector having a plurality of contact bushings embedded in an insulating body for receiving the pins. When the connector assembly is disconnected for one reason or another, substantial tensile force is exerted on the connectors which tends to render some of the contact pins defective for subsequent use. Particularly in cases of extreme reliability requirements, such as are encountered, for example, in circuits utilized in space research, defective contact pins cannot be tolerated. It is not practical, however, to replace an entire connector because of its relatively high cost. Consequently, it is desirable that only the defective pins be replaced. Heretofore it has been extremely difficult to remove a pin from a connector or insert a pin into a connector without damaging the connector to some extent. In this regard each pin is usually held in place in the connector body by means of internal retention springs acting on one end of a collar of the pin, the other end of which abuts a stop shoulder of the bore in which the pin is disposed. It is thus necessary to depress the springs to permit movement of the pin out of or into the bore. By virtue of their internal location it is difficult to depress the springs while moving a pin with the aid of existing implements without damaging the springs or walls of the bore.

SUMMARY OF THE INVENTION

The present invention relates to a tool for inserting contact pins into, or removing them from the bores of the insulating body of a multiple pin connector. The tool facilitates such manipulation of the pins in an extremely ready, damage free manner.

In the accomplishment of the foregoing, the tool basically comprises a fixed body extending longitudinally from a handle, a movable body translatable longitudinally of the fixed body, and means spring loading the movable body to a normal position wherein its tip is spaced longitudinally forward of the tip of the fixed body. The movable body may be translated against the spring loading to an actuated position wherein the tips of the respective bodies are aligned. The tips of the respective bodies are of elongated semi-annular complementary configuration projecting coaxially forward from enlarged semi-annular portions. When the movable body is in its normal, or open position the interior of its tip is exposed such that it may be engaged with half of the periphery of a contact pin. A notch is provided at the intersection of the tip and enlarged portion of the movable body to define an opening which permits traversal of a wire connected to the pin. When the movable body is in its actuated, or closed position, the tips of the respective bodies define a tubular nose engaging the entire periphery of the pin so as to grip same. The tips are of a length sufficient to engage a pin over a longitudinal extent between the pin end and collar. Thus, with the movable body in closed position and a pin gripped in the nose defined by the tips, the pin may be inserted into a connector bore to operable position while the nose depresses or spreads the contact retention springs. The movable body may be released to its open position, thereby permitting the springs to partially engage the pin and retain same in position. The fixed body may then be withdrawn, leaving the pin in operative position in the bore. To remove a pin, a reverse procedure is employed. The nose defined by the tips when the movable body is in closed position depresses the retention springs to permit withdrawal of the pin.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an exploded perspective view of a connector and contact insertion-removal tool in accordance with the present invention, portions being broken-away to illustrate the interior construction of the connector.

FIG. 2 is a sectional view taken at a diametric plane through the tool.

FIG. 3 is a fragmentary side elevational view of the tool and a connector, the connector being shown in section, illustrating initial steps in the use of the tool to remove a contact pin from the connector.

FIG. 4 is a view similar to FIG. 3, but illustrating further steps in the removal of the contact pin.

FIG. 5 is a view similar to FIGS. 3 and 4, but illustrating final steps in the removal of the pin.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIG. 1, a typical multiple pin connector **11** includes a cylindrical body **12** comprising a rigid central portion **13** of insulating material, such as hard plastic, and relatively resilient outer portions **14**, **16** of insulating material, such as rubber, secured to the faces of the central portion. A plurality of contact pins **17** project from the face of one outer portion **14**, and such pins extend through the central portion **13** and other outer portion **16** for the connection thereat of a plurality

of wires 18. More particularly, a plurality of pin receiving bores extend longitudinally through body 12, each of such bores including a relatively large diameter section 19 extending through outer portion 16 and partially through central portion 13 to terminate in a reduced diameter section 21 extending the remainder of the central portion and through outer portion 14. A stop shoulder 22 is thus defined at the transition between bore sections 19, 21 which serve to engage a collar 23 of the pin 17 when the pin is inserted through the enlarged bore section 19 to an operative position. Retention of the pin in operative position is accomplished by means of contact retention springs 24 which project into the enlarged bore section at a position to engage the opposite face of the collar from that engaged by the shoulder. More particularly, the springs are provided as resilient leafs which project inwardly from the periphery of a sleeve 26 contained in the bore section 19 in the direction of the shoulder. Consequently, when the pin is inserted, the springs are depressed by the collar as it is moved into operative position in engagement with the shoulder. The springs then resiliently snap inward into retentive engagement with the opposite face of the collar.

It will be appreciated that with a pin 17 thus retained in operative position to remove the pin, it is necessary to depress the springs 24 while the pin is withdrawn from bore section 19. The present invention provides a tool 27 for readily accomplishing such pin removal operation, as well as pin insertion, in a nondestructive manner. As best shown in FIG. 2, the pin insertion-removal tool includes a fixed body 28 projecting longitudinally from a handle 29. The body is preferably provided with a tubular shank 31 coaxially secured to the handle in communication with an axial bore 32 extending thereinto. Between an intermediate point of the body and its free end a circumferential half of the shank periphery is removed to define a semi-annular portion 33. The portion 33 is tapered to an elongated semi-annular thin walled tip 34.

The tool also includes a movable body 36 which is mounted for translation longitudinally of the fixed body 28. The movable body is formed to be complementary to the fixed body. In this regard the movable body includes a semi-annular portion 37 tapered to an elongated semi-annular thin walled tip 38. The movable body is translatable between a normal, or open position wherein the end of tip 38 is displaced longitudinally forward of the end of tip 34, and an actuated, or closed position wherein the tips 34, 38 are confronting and define a tubular nose. The inside diameter of the tubular nose is selected to be substantially equal to the outside diameter of a pin 17, while the length of the nose is substantially equal the length of the pin from the collar 23 to the end inserted in the enlarged bore section 19. The translatable mounting of the movable body is preferably facilitated by means of a tubular extension 39 of semi-annular portion 37 engaged by a reduced diameter end 41 of a cylindrical guide pin 42 having its opposite end engaged by a helical spring 43 disposed within the bore 32 of handle 29. The extension 39 in conjunction with the guide pin 42 define a cylindrical shank of the movable body 36 which is coaxially slidable within the tubular shank 31 and semi-annular portion 33 of the fixed body 28. The limits of translation of the movable body 36 relative to the fixed body 28 between the open and closed positions are determined by the tubular extension 39 abutting the end of the channel of semi-annular portion 33 at its tapered transition to tip 34, and the end of semi-annular portion 37 abutting the end of tubular shank 31 at its transition to semi-annular portion 33. The spring 43 resiliently urges, or spring loads, the movable body 36 to its normal, or open position wherein the end of tip 38 is displaced forward of the end of tip 34. The movable body may of course be urged against the loading of spring 43 to its closed position wherein the tips 34 and 38 are confronting and define the previously mentioned tubular

nose. It should be further noted that the movable body is provided with a notch 44 at the tapered transition between the semi-annular portion 37 and tip 38 to define a wire opening.

Considering now the use of the tool 27 in the removal of a pin 17 from the connector 12, and referring to FIGS. 3–5, the tip 38 of movable body 36 is first inserted into one of the enlarged bores 19 of the connector to engage about half of the periphery of the corresponding portion of the pin, as shown in FIG. 3. The wire 18 connected to the pin is led through the wire opening defined by notch 44 and held in place by the forefinger. The handle 29 is urged forward to in turn translate the fixed body 28 relative to the movable body 36 to closed position wherein the respective tips 34, 38 are confronting and defining a tubular nose gripping the pin 17, as shown in FIG. 4. At this time the ends of tips 34, 38 engage the collar 23 of the pin and depress the retention springs 24, as shown. With the tool in closed position and gripping the pin, the tool is withdrawn, as shown in FIG. 5, to thereby remove the pin 17 from the connector 12, the tips 34, 38 depressing or spreading to permit bypass of the collar 23.

In order to insert a pin, a reverse procedure is employed. The tool in closed position with the tips 34, 38 gripping the pin is inserted into the bore 19, the tips spreading the springs 24 to permit the collar 23 to be placed in position.

We claim:

1. A tool for use in removing a contact pin from a multiple pin electric connector having a body provided with a plurality of bores extending therethrough each with a contact pin constrained therein by spring structure, comprising a longitudinally extending fixed body equipped adjacent one end thereof with handle means, a movable body carried by said fixed body and being translatable longitudinally relative thereto, said fixed body and movable body having complementary semi-annular portions including elongated thin walled semi-annular tips insertable into such bore to telescopically receive therebetween the contact pin therein, and means spring loading said movable body to a normal open position wherein said tip thereof is disposed longitudinally forwardly of said tip of said fixed body for initial insertion into such bore, said movable body being translatable relative to said fixed body against the loading of the spring means to an activated closed position wherein said tips are in confronting relation to define a tubular nose for engaging such contact pin in circumjacent relation with a portion thereof located within such bore to release the constraining spring structure and enable the engaged contact pin to be withdrawn from its bore.

2. A tool according to claim 1, in which said tubular nose defined by the confronting tips of the fixed and movable bodies has an inner diameter substantially equal to that portion of such contact pin engageable thereby, and said tips having a length substantially equal to that of such contact pin portion.

3. A tool according to claim 1, further defined by said fixed body having a hollow tubular shank, said shank having a portion removed defining said semi-annular portion of said fixed body, said movable body having an extension mounted within said tubular shank and being longitudinally reciprocable relative thereto between the aforesaid open and closed positions, and said spring means including a spring disposed within said tubular shank and acting against said extension.

4. A tool according to claim 3, further defined by said movable body having a notch at the transition between said semi-annular portion and tip thereof to provide a wire access opening accommodating a lead wire connected with such contact pin and extending through the bore associated therewith.

5. A tool according to claim 1, further defined by said movable body having a notch at the transition between said semi-annular portion and tip thereof to provide a

wire access opening accommodating a lead wire connected with such contact pin and extending through the bore associated therewith.

6. A tool according to claim **5**, in which said tubular nose defined by the confronting tips of said fixed and movable bodies has an inner diameter substantially equal to that portion of such contact pin engaged thereby, and said tips having a length substantially equal to that of such contact pin portion.

7. A tool according to claim **6** and further comprising a separate handle constituting the aforesaid handle means and being mounted upon said hollow tubular shank adjacent an end thereof and provided with a longitudinally extending bore in axial alignment with the hollow interior of said shank, said spring being a helical compression spring disposed at least in part within said handle bore.

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U.S. Cl. X.R.

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