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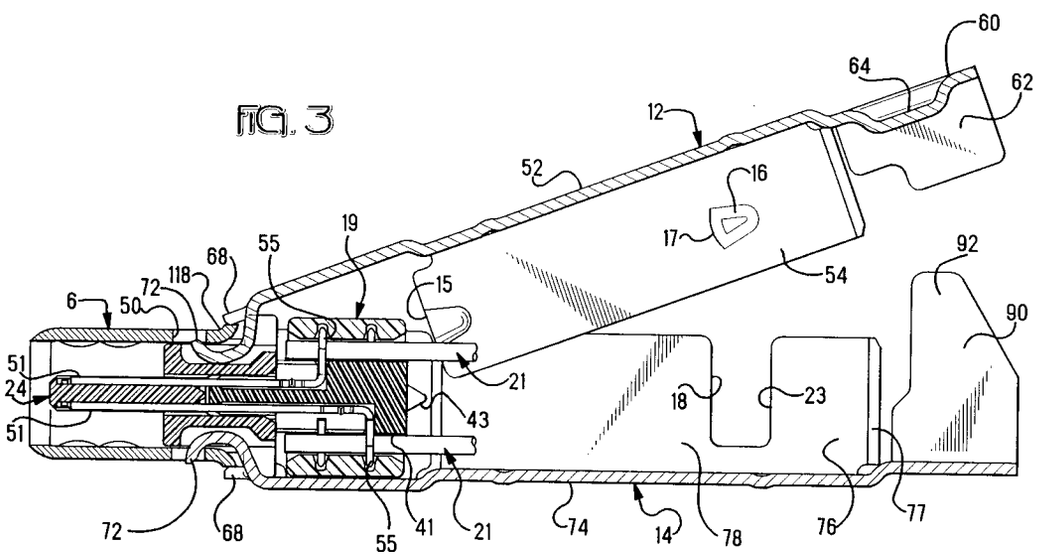
(54) Shielded electrical connector.

(57) A shielded electrical connector comprises a terminal support block (41), contact terminals (51) supported on the block (41) for connection to wires (21), a rear bumper (43) bridging across the block (41) and extending laterally beyond the wires (21), a conductive front shell (6) encircling the block (41), conductive backshells (12, 14) enveloping the block (41), and pushing arms (15) on at least one of the backshells (12, 14) engaging the bumper (43) and urging a mating end of the block (41) to a most forward position relative to a front mating end of the front shell (6), shifting of the block (41) rearwardly being resisted to promote contact wiping during mating connection of the connector (19) with another mating connector.

FIG. 3



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The field of the invention pertains to a shielded electrical connector having a shielding shell according to the preamble of claim 1.

There is disclosed in USA 5,158,481, a shielded electrical connector comprising; a terminal support block, contact terminals supported on the block for connection to wires, and shielding for the connector comprising; a mating end on a front shell encircling a mating end of the terminal support block, and conductive backshells enveloping the block.

The backshells and front shell are assembled by hooks passing through slots in the front shell. Compression beams near the hooks pressed against the front shell to establish electrical continuity between the front shell and the backshells.

The components, for example, the terminal support block and the housing and the front shell are separate components, manufactured with dimensions that vary within a permitted range of dimensional tolerances. These tolerances allow the components to interfit when combined together in a connector. These tolerances accumulate when the components are combined, and allow the components to shift their positions relative to one another in an assembled connector. Shifting of the components is especially detrimental when the connector undergoes mating connection with another, mating electrical connector. Such shifting, which occurs during mating connection, tends to move the terminal support block rearwardly with respect to the mating ends of both the housing and the front shell. The contact terminals supported on the block move rearwardly with the block during mating connection. Rearward movement of the contact terminals is not desired during mating connection, since rearward movement of the contact terminals tends to disconnect the connector from another, mating electrical connector. Furthermore, during mating connection, the contact terminals undergo desired contact wiping to dislodge nonconductive oxides and other contaminants that would contribute to an undesired voltage drop across the surfaces of the contact terminals. The contact wiping occurs when the contacts of the connector stroke against mating contacts of another, mating electrical connector, as the connectors undergo mating connection. The stroke is reduced when the contact terminals move rearwardly. Consequently, the contact wiping is reduced when the terminals move rearwardly due to shifting of the components.

According to a feature of the invention, to assure electrical continuity between components of a shield, and to provide an effective electrical shield, one of the backshells pushes against the other backshell, and urges the other backshell forwardly into engagement with the front shell to assure electrical continuity between the components.

According to a feature of the invention, components of an electrical connector are assembled in such a manner to resist shifting of the components when the electrical connector undergoes mating connection with another, mating electrical connector.

According to another separate feature of the invention, one of the backshells pushes against the terminal block, and urges the terminal block forwardly, such that a mating end of the terminal block is accurately positioned with the mating end of the front shell.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, according to which;

FIGURE 1 is a perspective view of a shielded electrical connector with parts separated from one another;

FIGURE 2 is a perspective view of the connector shown in Figure 1;

FIGURE 3 is a longitudinal section view of the connector as shown in Figure 1 with parts partially assembled; and

FIGURE 4 is a view similar to Figure 3 with the parts assembled together.

FIGURE 5 is a perspective view of a terminal support block and a housing of the connector shown in Figure 1; and

FIGURE 6 is a view partially in section of a portion of the connector shown in Figure 1.

With reference to Figure 1, a shielded plug type connector **19** comprises an insulative cable terminating section **20** for terminating insulated wires **21** of a shielded multiple wire cable **22**, Figure 2, and an insulative plug connector section **24** projecting forwardly for mating with a shielded receptacle type connector, not shown. The plug connector section 24 includes a forwardly protruding terminal support block **41** supporting multiple contact terminals **51** having wire terminating portions **55**, Figures 3 and 4, for connection to the wires 21.

Conductive electrical shielding is provided by a unitary drawn metal front shell **6** and an upper metal backshell **12** and a lower metal backshell **14**. The shell 6 defines a cavity encircled by an upper wall **46** and a lower wall **48** and sidewalls **40** that are angled toward each other. Laterally extending slots **50** are provided in the walls 46 and 48 adjacent to a back lip providing a strip shaped bearing member **118** bridging across the back of the slots 50.

The backshell 12 is of unitary construction stamped and formed from sheet metal. The backshell 12 comprises an upper wall **52** and depending sidewalls **54** providing an inverted channel. At a rear of the backshell 12, projecting from a rear wall **58**, is an anchoring member **56** for the lower back-

shell 14. The anchoring member 56 comprises, an upper wall **60** and depending side walls **62** defining an inverted channel. A recess **64** is formed as a deep depression in the upper wall 60. A plate **66** is offset from the plane of the wall 52 and extends forwardly. A pair of forward extending tabs **68** project from a front edge **70** of the plate 66. A curved, pivot hook **72** projects from the forward edge 70 between the tabs 68.

The backshell 14 is of unitary construction stamped and formed from sheet metal. The backshell 14 comprises a lower wall **74** and upstanding sidewall sections **76**, **78** defining a channel. Laterally outward turned flanges **77** are on front ends of the sidewall sections 76, 78. A plate **80** is offset from the plane of the wall 74 and extends forwardly. From a rear edge **84** of the backshell 14 projects a cable strain relief member **86** comprising a lower wall **88** and upstanding anchoring flanges **90** the tips of which are tapering portions **92**. Forward of a front edge 94 project tabs 68 and a pivot hook 72, similar in construction as described in conjunction with the backshell 12. Further details of the backshell 12 and the backshell 14 are discussed in U.S.A. 5,158,481. Laterally projecting flanges **114** on the backshell 14 engaged behind a laterally projecting flange **42** on the rear of the drawn front shell 6. Further details of the front shell 6 and of the connector 19 are disclosed in USA 955,554, filed October 1, 1992 (15319). With reference to Figure 3, the backshell 14 is hooked and attached to the front shell 6 and envelops the connector 41. The backshell 12 is hooked to the front shell 6 and is pivoted toward the backshell 14 to envelop the connector 19. The anchoring flanges 90 are inwardly bent to wrap over the anchoring member 56 and the cable 22, Figure 2, providing a strain relief for the cable 22, and connecting the backshells 12 and 14.

With reference to Figures 1, 3 and 4, a rear projecting bumper **43** bridges laterally and extends across a rear end of the terminal support block 41. The bumper 43 can be made integral with the support block 41, for example, by molding a dielectric material. The bumper 43 juts outwardly in opposite lateral directions from the wires 21 that extend over the bumper 43. The bumper 43 has a tapered rear edge intersecting a central axis of the terminal support block 41 of the connector 19.

The back shell 12 comprises a set of front pushing arms **15** on front facing edges on respective sidewalls 54. For example, the pushing arms 15 are fabricated by indenting the front facing edges to stiffen them. The pushing arms 15 engage the tapered edge on the rear facing bumper 43, where the bumper 43 juts out laterally beyond the wires 21, urging the connector 19 forwardly with respect to the backshell 12 and with respect to the front shell 6. The pushing forces are exerted axially and through a middle of the connector 19. A high mechanical advantage is achieved when pivoting the backshell 12 by hand about the pivot hook 72, because the length of the backshell 12 to the pivot hook 72 is a multiple of the shorter distance between the pushing arms 15 and the pivot hook 72. Urging the connector 19 forwardly compensates for variations in cumulative tolerances separating the assembled parts, which tolerances tend to space the connector 19 from a desired position with respect to the mating front of the front shell 6. Further, the pushing arms 15 against the bumper 43 resist insertion forces arising from mating connection of the connector 19 with a mating type connector, not shown.

A set of rear pushing arms **16** juts laterally outward from both sidewalls 54. The pushing arms 16 are fabricated by indenting the sidewalls 54 by punching outward the sidewalls 54 to provide sheared front edges **17** facing forwardly and engaging against rearward facing edges **18** of the backshell 14. The edges 18 are formed at the edges of vertical slots **23** having open ends to receive the pushing arms 16 when the backshell 12 is pivoted toward the backshell 14. With reference to Figures 3 and 4, when the backshell 12 is pivoted, the pushing arms 16 enter the slots 23 and impinge against the edges 18, urging the backshell 14 forwardly, such that the flanges 114 are urged forward to engage against a rear of the flange 42. Urging the backshell 14 forwardly compensates for variations in cumulative tolerances that tend to separate the flange 42 on the front shell 6 from the flanges 114 on the backshell 14. Engagement between the front shell 6 and the backshells 14 and 12 assures electrical continuity that is essential to effective electrical shielding. Further, the pushing arms 16 against the edges 18 resist insertion forces arising from mating connection of the connector 19 with a mating type connector, not shown. Following assembly of the backshells 12 and 14, the anchoring flanges 90 are wrapped over the anchoring member 56 and enter the recess 64 to secure together the backshells 12 and 14, and to grip the cable 22 and provide a cable strain relief.

With reference to Figure 5, the terminal support block 41 is a separate component, as are each of the front shell 6 and an insulative housing **61** shaped to be received in, and to be surrounded by, the front shell 6. The housing 61 has a rear facing cavity **71**, Figure 6, to receive a front end of the terminal support block 41. The contact terminals 51 project forwardly from the front end of the terminal support block 41 and are supported against a tongue **75** on the housing 61. Resilient clamping fingers, one being shown at **44**, formed unitary with and on the front of the terminal support block 41

hooks onto undercut recesses **63**, one being shown, in the housing 61 to prevent separation of the terminal support block 41 and the housing 61.

With reference to Figure 6, resilient fingers, one being shown at **65**, on the front shell 6 projects obliquely toward a front mating end **67** of the front shell 6, and registers in undercut recesses, one shown at **69**, in the housing 61 to prevent removal of the front shell 6 from the housing 61. A mating end **73** of the housing 61 is encircled by the mating end 67 of the front shell 6.

The front shell 6, the terminal support block 41 and the housing 61 are manufactured with dimensions that are within a range of permitted dimensional tolerances. These tolerances allow the components to interfit when they are assembled or combined together in a connector. These tolerances become cumulative when the components are combined, and allow the components to shift their positions relative to one another in an assembled connector. For example, with reference to Figure 6, the tolerances permit the fingers 61 to shift, front to rear, in the recesses 63. The tolerances permit the fingers 65 to shift, front to rear, within the recesses 69. Thus, the front shell 6, the housing 61 and the terminal support block 41 are components that tend to shift their positions undesireably relative to one another in an assembled connector 19.

Shifting of the components is especially detrimental when the connector 19 undergoes mating connection with another, mating electrical connector, not shown. Such shifting, which occurs during mating connection, tends to move the terminal support block 41 rearwardly with respect to the mating ends 67 and of both the housing 61 and the front shell 6. The contact terminals 51 supported on the block 41 move rearwardly with the block 41 during mating connection. Rearward movement of the contact terminals 51 is not desired during mating connection, since rearward movement of the contact terminals 51 tends to disconnect the connector 19 from another, mating electrical connector, not shown. Furthermore, during mating connection, the contact terminals 51 undergo desired contact wiping to dislodge nonconductive oxides and other contaminants on the surfaces of the contact terminals 51 that would contribute to an undesired voltage drop across the surfaces of the contact terminals 51. The contact wiping occurs when the contact terminals 51 stroke against mating contacts of another, mating electrical connector, during mating connection. The stroke is reduced when the contact terminals 51 move rearwardly. Consequently, the contact wiping is reduced when the contact terminals 51 move rearwardly due to shifting of the components. According to this feature of the invention, the components of the electrical connector 19 are assembled in such a manner to resist shifting of the components when the electrical connector 19 undergoes mating connection with another, mating electrical connector, not shown.

An advantage of the invention resides in a backshell 12 that urges components of the connector 19 forwardly to resist insertion forces during mating connection with another, mating connector. Another advantage of the invention resides in an electrical connector 19 constructed from separate components that assure mating ends of the components attain predicted positions relative to a mating end of the connector 19.

Claims

1. A shielded electrical connector comprising a terminal support block (41), contact terminals (51) supported on the block for connection to conductors, a rear bumper (43) bridging across the block and extending laterally beyond the wires, and conductive backshells (12,14) enveloping the block, the connector being characterized in that:

pushing arms (15) are provided on at least one of the backshells (12,14) engaging the bumper and urging the block (41) forwardly of the one backshell (12), and urging a front mating end of the block (41) to a most forward position relative to a front mating end of a conductive front shell (6) encircling the block and being connected to the one backshell (12).

2. A shielded electrical connector as recited in claim 1, characterized by a housing (61) encircling the block (41), the block being connected to the housing, and the pushing arms (15) engaging the bumper (43) and urging the block (41) to impinge against the housing (61) and to urge a front mating end of the housing (61) to a most forward position relative to the front mating end of the front shell (6).

3. A shielded electrical connector as recited in claim 1 or 2, characterized in that the pushing arms (15) are provided by indented front facing edges on one of the backshells (12,14).

4. A shielded electrical connector as recited in claim 1, 2 or 3, characterized in that the bumper (43) comprises a portion of the block (41) intersecting a central axis of the block (41).

5. A shielded electrical connector as recited in any one of the preceding claims, characterized in that the bumper (43) has a rear facing tapered edge engaged by the pushing arms (15).

6. A shielded electrical connector as recited in any one of the preceding claims, characterized by

a set of second pushing arms (16) on one of the backshells (12,14) engaged against rear facing edges (18) of a second one of the backshells (12,14), a flange (114) on the second one of the backshells being urged forwardly by the set of pushing arms (16) against a rear of a flange (42) on the conductive front shell (6).

7. A shielded electrical connector as recited in claim 6, characterized by slots (23) on the second backshell (14) having open ends to receive the set of second pushing arms (16) when the first backshell (12) is pivoted toward the second backshell (14).

8. A shielded electrical connector as recited in claim 7, characterized in that rear facing edges of the slots (23) are engaged by the set of second pushing arms (16).

9. A shielded electrical connector as recited in any one of the preceding claims, characterized in that portions of the backshells (12,14) are secured together providing a cable strain relief (56,90) for wires (21) connected to the contact terminals (51).

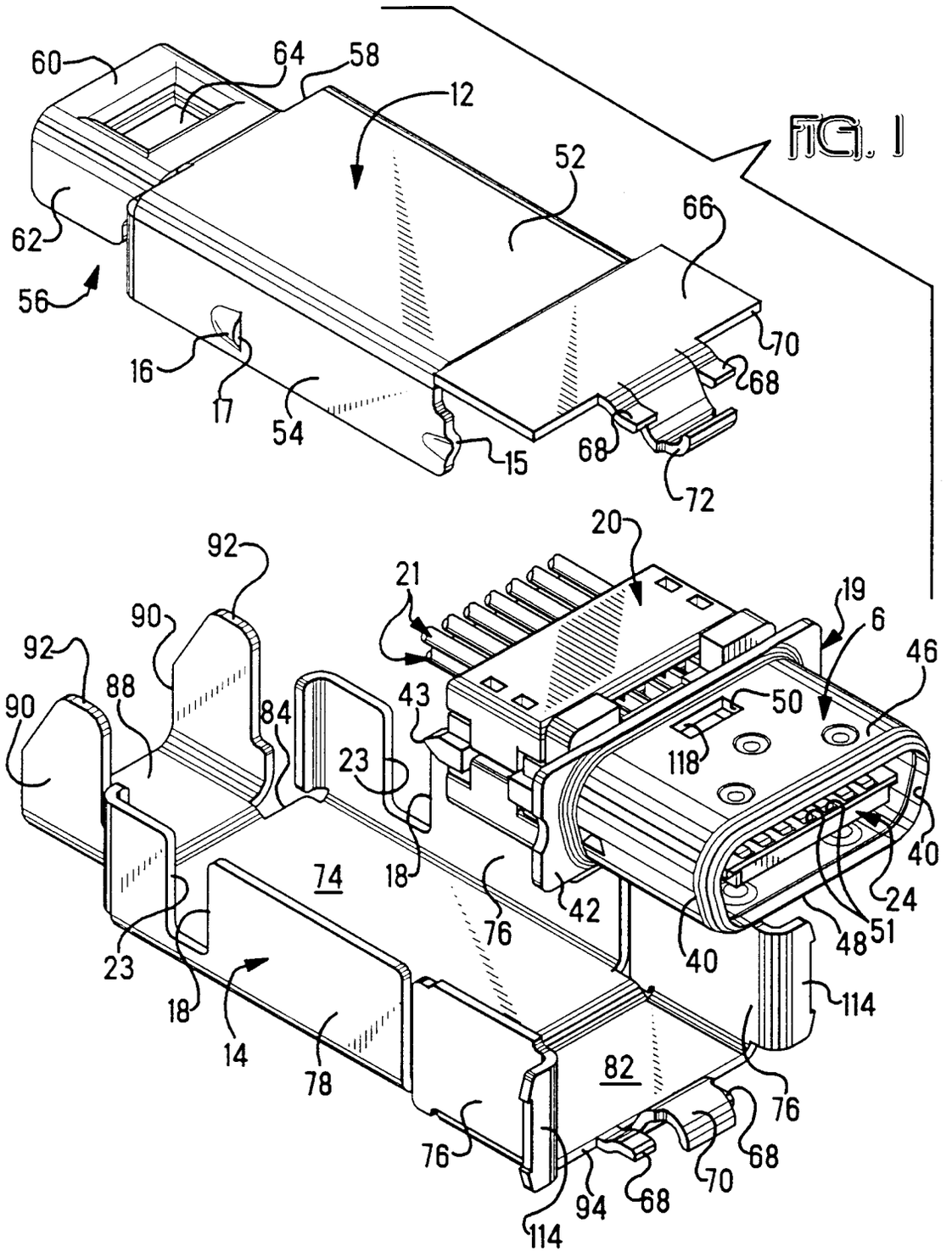
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FIG. 1

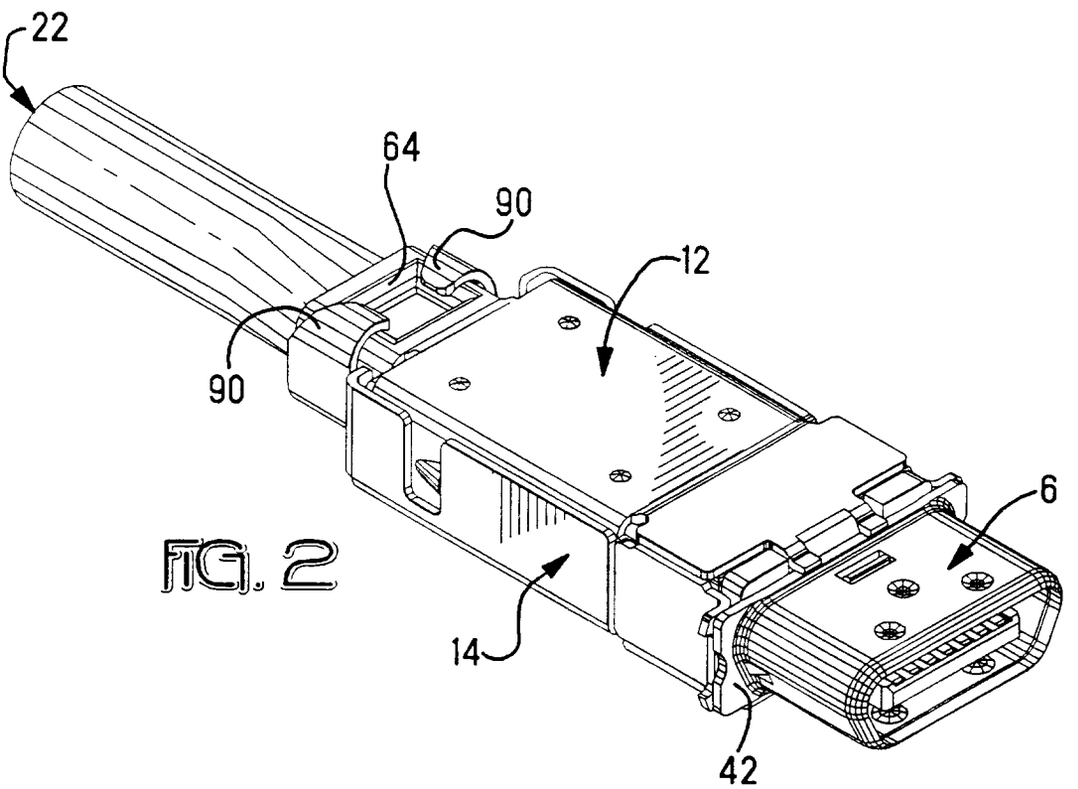

FIG. 2

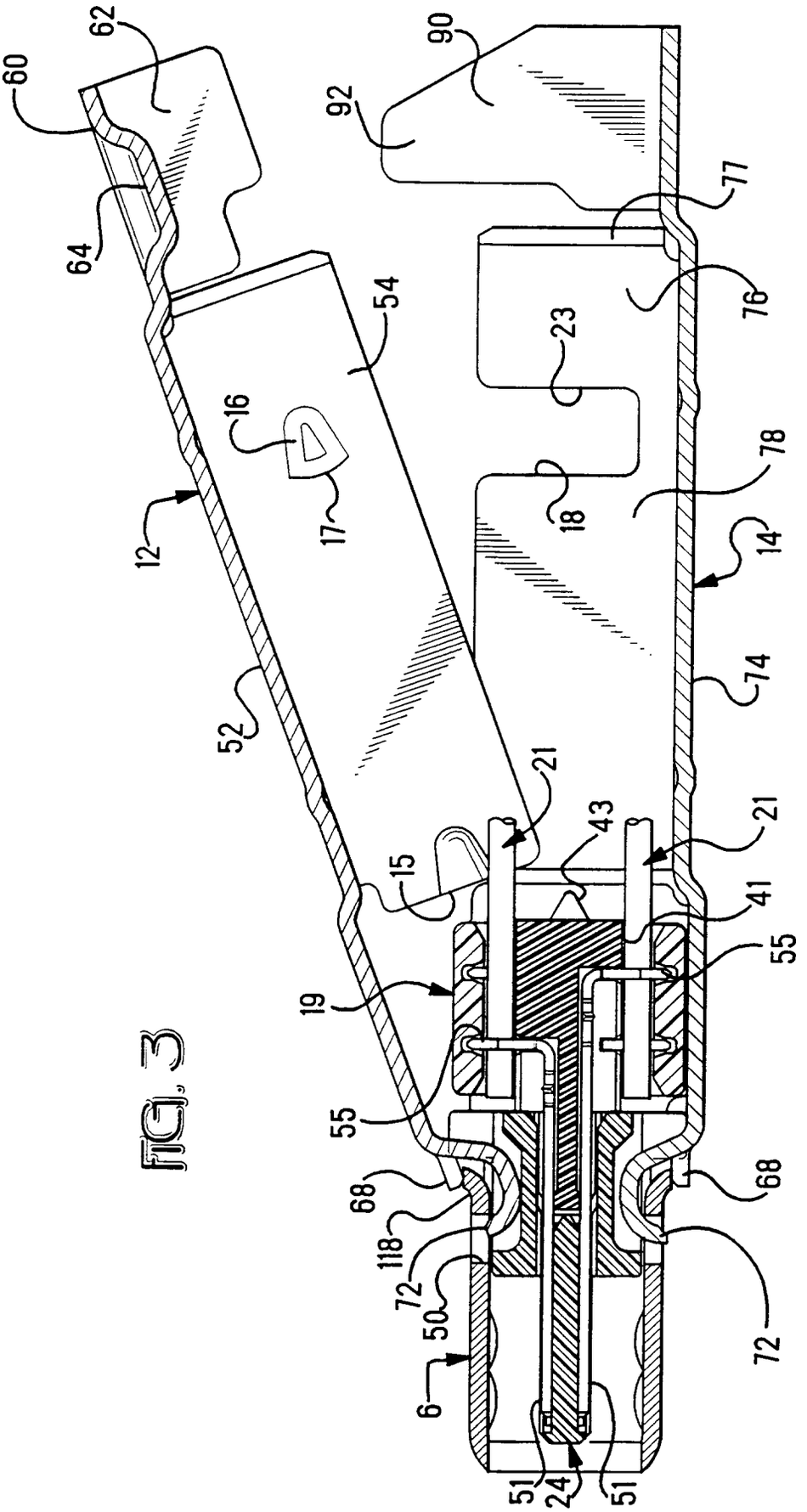
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FIG. 3

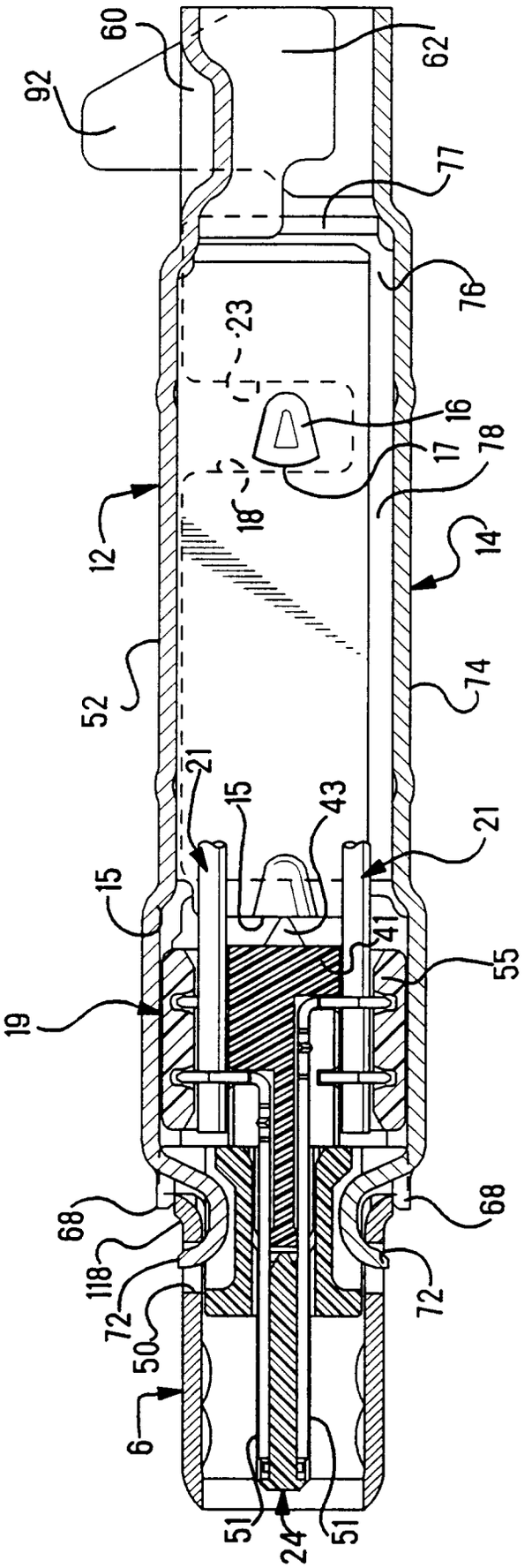
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FIG. 4

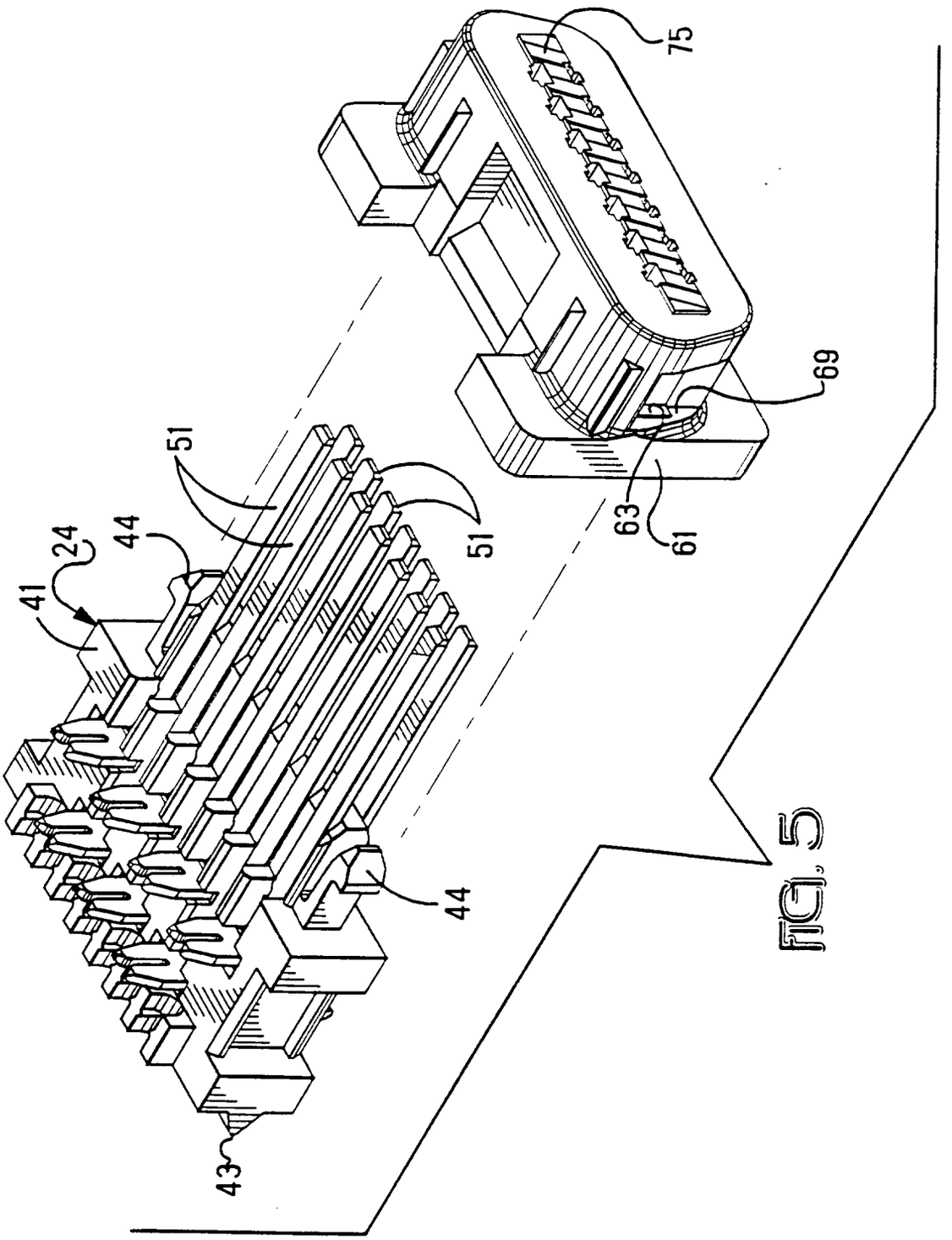

FIG. 5

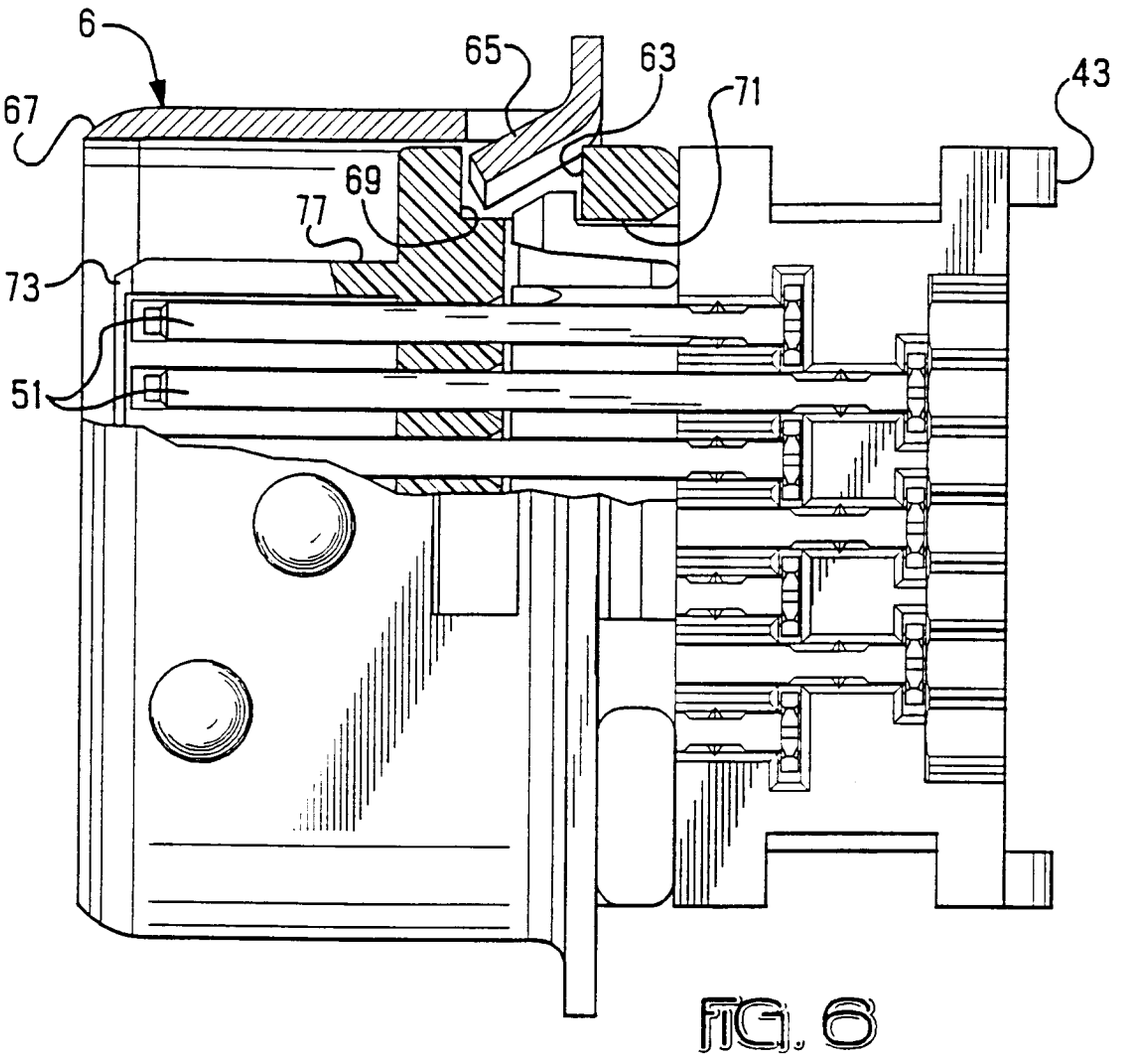

FIG. 6