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(71) Applicant: **MOLEX INCORPORATED**
2222 Wellington Court
Lisle Illinois 60532 (US)

(72) Inventor: **Case, Arnold A.**
432 Colford
West Chicago Illinois 60185 (US)

DeRoss, Robert
251, Pebblestone Drive
Naperville Illinois 60565 (US)

(74) Representative: **Slight, Geoffrey Charles et al**
Graham Watt & Co. Riverhead
Sevenoaks Kent TN13 2BN (GB)

(54) Connector assembly.

(57) A connector assembly includes a terminated wire (16), a crimp-type terminal (14) and a two-piece housing assembly of interfitting carrier and cover members (18, 20). The terminal (14) is crimped to the wire (16) in a conventional fashion, presenting a portion (34) (see FIG. 3) of reduced cross section at the crimp engagement with the wire (16') proper. The terminated wire is loaded into channels (50) formed in the carrier member (18). The carrier member includes protrusions (74) received in the reduced cross section of the crimp portion (34). After mounting of the terminals (14), the carrier is telescopically inserted in the sleeve-like cover member (20). An excessive crimp height (HT) (see FIG. 4) prevents the complete reception of the terminal within the carrier channel (50), thereby preventing telescopic insertion of the carrier (18) within the cover member (20). Thus, an excessive crimp height (HT) in the crimp portion (34) of the terminal is visually indicated during connector assembly. In a similar fashion, a rotational misalignment of the terminal (14) with respect to the carrier (18) will also prevent insertion of the carrier (18) within the housing (20). Improved terminal retention against pull-out and push-out forces is provided by the projection (74), upon its insertion in the reduced cross sectional crimp portion (34) of the terminal.

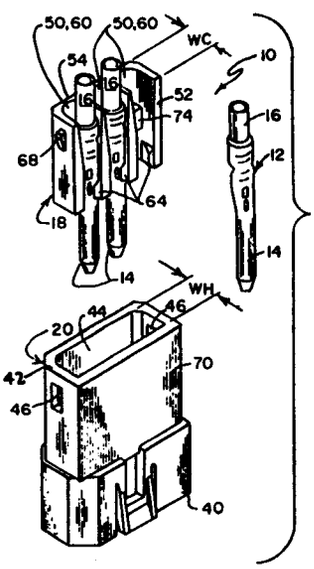

FIG.1

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Description

CONNECTOR ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention pertains to connector assemblies comprising intermating dielectric housing and conductive terminal members. In particular, the present invention pertains to connector assemblies having two-piece housings, and crimp-type terminals.

2. DESCRIPTION OF THE PRIOR ART

Although many improvements have been made generally to electrical connector assemblies, further refinements are still being sought. For example, electrical connectors must have often been made to exhibit a high mating force, for a variety of reasons. For example, in contaminated environments, a high mating force ensures the removal of any oxide coating or the like contamination, which is necessary for a reliable electrical contact, and a gas-type seal at the point of electrical connection. Also, if a significant number of circuits are provided in a given electrical connector, high insertion and withdrawal forces will necessarily tend mating and unmating of two interengaging connector members. Accordingly, an arrangement must be provided to ensure that a terminal is retained within its dielectric housing. This terminal retention feature is often required during mating of an electrical connector pair to prevent terminal push-out, as well as during unmating of an electrical connector pair when a terminal may be pulled out by either the force of unmating, or an operator applying tension to the wires connected to one mating connector part. Some connector applications, for example, those found in moving vehicles, require that terminal retention be assured despite unforeseen circumstances or environmental conditions.

Although electrical terminals having crimp-type wire engaging portions have been known for some time, improvements in crimp-type connectors have been sought. Engagement with a conductive wire in a crimp-type terminal is satisfactory only for a given, rather narrow range of terminal compression about the wire. If the wire engaging crimp portion is insufficiently compressed, the necessary low resistance electrical connection between terminal and wire will not be realized. A ready visual indication of improper height of the crimp portion is desired.

Further, some connector arrangement has terminals with mating portions located off center from the axis of the remaining terminal body. Other terminals have asymmetric cross sectional configuration, such as blade or flag-type terminals. For these arrangements, the relative angular orientation of the terminal with respect to its dielectric housing is crucial for successful connector operation. A ready visual indication of angular terminal orientation is desired.

SUMMARY OF THE INVENTION

The present invention provides an electrical connector assembly of the type including a dielectric housing having a mating end and an opposed open carrier receiving end, a carrier receiving cavity between the ends, and at least one locking window, a crimp-type electrical terminal, a dielectric carrier telescopically insertable in the carrier receiving end of said housing, said carrier including a terminal receiving channel with an open terminal receiving side, means for retaining the terminal in the channel during assembly of said connector, and a locking tab receivable in said locking window to maintain engagement of said carrier with said housing upon insertion therein, whereby said terminal is substantially enclosed by the carrier and housing upon insertion of said carrier within said housing. The improvement comprises a terminal comprising an elongated body having spaced-apart mating and following portions with an intermediate crimp portion therebetween, the crimp portion being recessed with respect to the mating and following portions, and the carrier including a terminal engaging member projecting into the recessed crimp portion to interfere with said mating and the other terminal portions to provide improved longitudinal retention of the terminal in the carrier.

The present invention also provided an electrical connector assembly of the type described above wherein the carrier includes first and second opposed outside surfaces spaced-apart to form a predetermined width of the carrier, the open carrier receiving end having a width substantially equal to the carrier width so as to permit passage of the carrier therethrough, the carrier channel having a predetermined depth extending from the open side at the first surface, a terminal-crimp-portion engaging member having a predetermined height extending into the channel which, when combined with the terminal crimp portion cross sectional height, presents a minimum combined height equal to the depth, to allow insertion of the carrier within the housing open end, whereby a ready visual indication of excessive crimp portion cross sectional height is provided during assembly of the connector, with the terminal interfering with the housing to prevent insertion of the carrier within the housing.

Preferably, the terminal crimp portion cross section has a minimum height only at a predetermined angular orientation to the terminal-crimp-portion-engaging member which, when combined with the terminal engaging member, presents the minimum combined height equal to the depth, whereby other angular orientations of the terminal present an increased combined height which causes the terminal to interfere with the housing during assembly of the connector.

Some ways of carrying out the present invention will now be described in detail by way of example, and not by way of limitation, with reference to drawings which show specific embodiments of the present invention in all of its aspects.

In the drawings, wherein like elements are referenced alike,

FIG. 1 is a perspective view of an electrical connector assembly according to the present invention;

FIG. 2 is a perspective view of an alternative embodiment of a connector assembly according to the present invention;

FIG. 3 is a partial perspective view of the carrier and terminated wire assembly shown just prior to connector assembly;

FIG. 4 is a partial cross sectional view of a completed electrical connector assembly according to the present invention; and

FIG. 5 is a longitudinal sectional view of the completed connector assembly of FIG. 4.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Turning now to FIG. 1, the connector assembly is indicated generally at 10. Assembly 10 includes a terminated wire subassembly 12 comprising a terminal 14 engaging an insulation clad wire 16. Terminal 14 has a crimp-type engaging portion and wire 16 has a leading bared end, suitable for a conventional crimp connection. These features will be described in greater detail herein.

The terminated wire subassembly 12 is mounted in a two-piece housing assembly comprising a carrier member 18 and a cover-like housing 20. The connector assembly shown in FIG. 1 comprises a single planar array of terminated wires, whereas the embodiment of FIG. 2 has a second planar array of wires arranged back to back with the arrangement of FIG. 1. The carrier member 18' of FIG. 2 is conveniently integrally molded to contain both planar arrays but in other features is identical to the arrangement of FIG. 1.

Accordingly, the features of the carrier and housing members of FIG. 2 bear the same numerals as in FIG. 1, but have a prime designation when geometrically different. That is e.g. the numeral 20' is applied to the housing member of FIG. 2 since it differs only in relative size from housing 20 of FIG. 1.

Referring now to FIGS 4 and 5, the terminal 14 of subassembly 12 comprises a forward mating part 30, a rear strain relief portion 32, and an intermediate crimp-type wire engaging portion 34. As shown most clearly in FIG. 5, mating part 30 has a cross-sectional height roughly equal to the sum of the vertical dimensions HT and HP, whereas the wire engaging portion 34 has a reduced cross-sectional height equal to HT alone. The trailing strain relief portion 32 has a cross sectional height substantially greater than that of wire engaging portion 34. In practice, wire engaging portion 34 and strain relief portion 32 are simultaneously formed in a single die to comprise a crimp part of repeatable size and shape.

As is known in the art, wire engaging portion 34 is conveniently applied to a bared leading portion 16' of wire 16, and is inwardly deformed and compressed about that bared portion. As indicated in FIG. 4, wire engaging portion 34 when terminated to wire 16 has an elongated cross section, a feature which is relied upon to provide a ready visual indication of the terminal's angular orientation. As is appreciated by those skilled in the art, the amount of inward deformation or compression of wire engaging portion 34 about wire 16 is crucial to the proper electrical connection between the terminal and wire. Typically, the wire-engaging portion is formed by placing terminal 14 on an anvil-like die, inserting the bared leading end 16' of wire 16, and lowering an opposed crimping die so as to deform wire-engaging portion 34, compressing it so as to establish mechanical and electrical engagement with the conductor portion of wire 16. One problem that may affect connector performance, is the inadequate compression of the wire-engaging crimp portion by the mating die members. Inadequate compression of the wire-engaging crimp portion would result in a "crimp height" HT greater than the desired amount. The connector assembly being described provides a ready visual indication of such improperly enlarged crimp height.

Referring now to the interengagement of the two dielectric members 18, 20, the terminated wire assemblies 12 are mounted to carrier portion 18, which is then inserted in the cover-like housing 20. Housing 20 has a mating end 40, and opposed open carrier receiving end 42, and a carrier receiving cavity 44 extending between those ends. In a present embodiment, carrier receiving cavity 44 has a constant cross-sectional dimension throughout the length of housing 20, although this is not essential. Housing 20 is conveniently provided with a pair of opposed locking windows 46 to maintain the engagement between carrier 18 and housing 20.

Carrier 18 includes a plurality of terminal receiving channels 50 having a depth d (see FIG. 3) extending between opposed outside surfaces 52, 54. Channels 50 have an open side 58 which, open to surface 52. allow transverse loading of terminated subassemblies 12. As will be seen in the figures, the depth of channel 50 is less than the overall width of the carrier WC only by an amount equal to the thickness of the bottom channel wall 60 which opposes the open side 58.

As indicated in FIG. 1, terminated subassemblies 12 are loaded in a transverse direction into terminal receiving channels 50, and are temporarily held therein during connector assembly by resilient finger portions 64. Carrier 18 is thereafter telescopically inserted in the open end 42 of housing 20. Outwardly projecting locking portions 68, formed adjacent the trailing end of carrier 18 are received in locking windows 46, to maintain the engagement between dielectric members 18, 20.

The width of carrier 18, designated WC in FIG. 1, is closely held to the internal width WH of the open end 42 of housing 20 to provide a close tolerance interfitting relationship. Thus, any protrusion of terminal 14 beyond carrier surface 52, will interfere with the side wall 70 of housing 20 preventing a complete insertion of carrier 18 within the housing.

Visible in some of the figures, is a terminal engaging member 74 projecting a predetermined cross-sectional height HP into channel 50. As indicated in FIGS. 4 and 5, the height HP of engaging member 74 is chosen such that when added to the

thickness of bottom wall 60, and the height HT of wire-engaging portion 34, the combined total of these heights equals the width WC of carrier 18. Therefore, if the crimp height HT of wire-engaging portion 34 exceeds its specified value, the overall width of the installed terminal and carrier will exceed WC, preventing insertion of carrier 18 in housing 20. Thus, a ready visual indication of a proper crimp height is provided.

Referring now to FIG. 4, the above-described features of terminal engaging member 74 are advantageously employed to provide a ready visual indication of the angular orientation of terminal 14 relative to carrier 18. As shown in FIG. 4, the cross section of wire-engaging portion 34 is elongated in an amount greater than HT, the maximum crimp height allowed by the complete carrier insertion in housing 20. As can be seen in FIG. 4, any angular displacement of wire-engaging portion 34 (and hence of mating portion 30) will result in a protrusion above carrier surface 52. Therefore, the wire-engaging portion 34 is provided with a unique angular orientation at which the crimp height HT is a minimum.

As indicated in FIG. 5, terminal engaging member 74 closely approximates the gap of reduced terminal width appearing between terminal portions 30, 32. Any axial displacement of terminated subassembly 12 will cause an interference with engaging member 74. Compared to other terminal retention arrangements employed to date, such as locking lances struck out from a terminal wall, the arrangement described offers greatly enhanced retention capability. Terminal retention is ensured in the direction of terminal push-out, as well as terminal pull-out, the terminal being held captive in its engagement with member 74 by the closely fitting housing member 20.

Claims

1. An electrical connector assembly including a dielectric housing (20; 20') having a mating end (40; 40') and an opposed open carrier receiving end (42; 42'), a carrier receiving cavity (44) between the ends, and at least one locking window (46),
an electrical terminal (14) engageable with a wire conductor (16),
a dielectric carrier (18; 18') telescopically insertable in the carrier receiving end of said housing (20; 20'), said carrier including a terminal receiving channel (50) with an open terminal receiving side (52), means (64) for retaining the terminal in the channel during assembly of said connector, and a locking tab (68) receivable in said locking window to maintain engagement of said carrier with said housing upon insertion therein,
whereby said terminal is substantially enclosed by the carrier and housing upon insertion of said carrier within said housing,
characterized in that
said terminal includes an elongated body having a forward mating part (30) and a crimp part, the crimp part having a rear portion (32) an a wire engaging portion (34) intermediate and recessed with respect to said rear portion (32) and said forward mating part (30), said wire engaging portion being formable about a wire conductor (16') for electrical engagement therewith; and in that
said carrier includes a terminal engaging member (74) projecting into the recessed wire engaging portion to interfere with said forward mating part (30) and said rear portion (32).

2. The assembly of claim 1 wherein:
said wire engaging portion (34) has a predetermined cross-sectional height;
said carrier includes first and second opposed outside surfaces (52, 54) spaced-apart to form a predetermined width of said carrier;
said open carrier receiving end having a width (WH) substantially equal to said carrier width so as to permit passage of said carrier therethrough;
said terminal receiving channel having a predetermined depth (d) extending from said open side;
said terminal engaging member having a predetermined height (HP) extending into said channel which, when combined with said wire engaging portion cross-sectional height, presents a minimum combined height equal to said depth, to allow insertion of said carrier within said housing open end,
whereby a ready visual indication of excessive wire-engaging portion cross-sectional height is provided during assembly of said connector, with said terminal projecting beyond said carrier so as to interfere with said housing, preventing insertion of said carrier therewithin.

3. The assembly of claim 2 wherein said wire-engaging portion cross-section has a minimum height only at a predetermined angular orientation to said terminal engaging member which, when combined with said terminal engaging member height, presents said minimum combined height equal to said depth, whereby other angular orientations of said terminal present an increased combined height which causes said terminal to interfere with said housing during assembly of said connector.

4. The assembly of any preceding claim wherein said open housing end and said carrier have complementary rectangular shapes, thereby limiting possible orientations of said carrier within said housing.

5. The assembly of claim 4 wherein said open housing end and said carrier have complementary-shaped-interengaging polarizing means to limit said connector assembly to a single orientation of said carrier within said housing.

6. The assembly of any preceding claim wherein said retaining means (64) comprises resilient terminal engaging tabs formed at a leading end of said carrier when telescopically inserted into said housing.

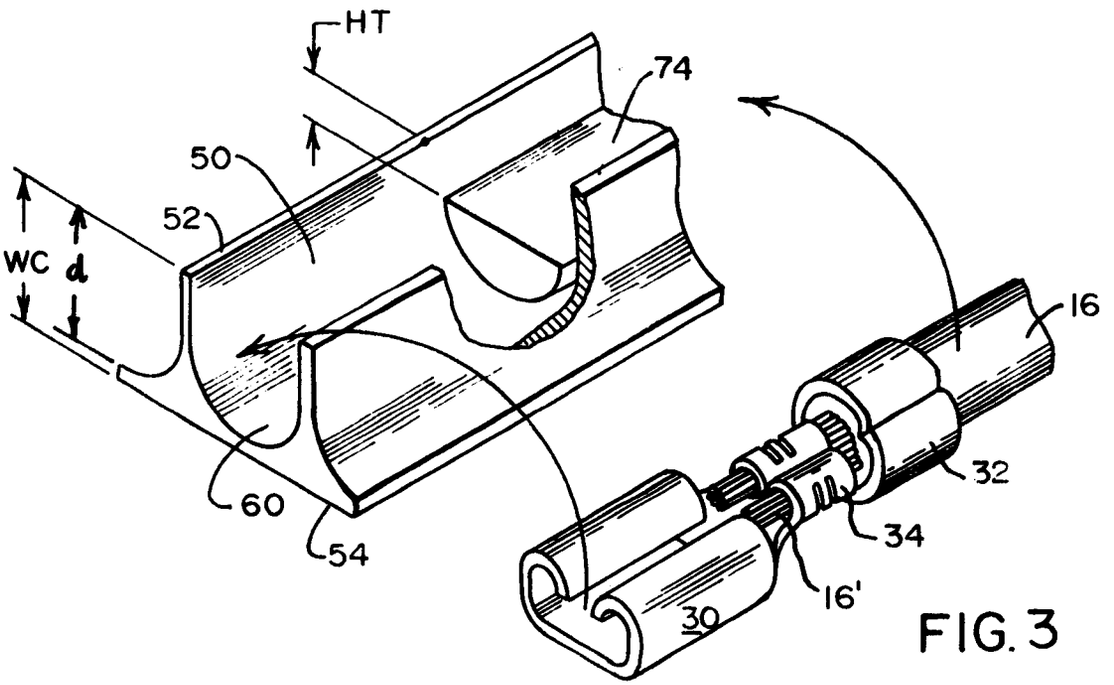


FIG. 3

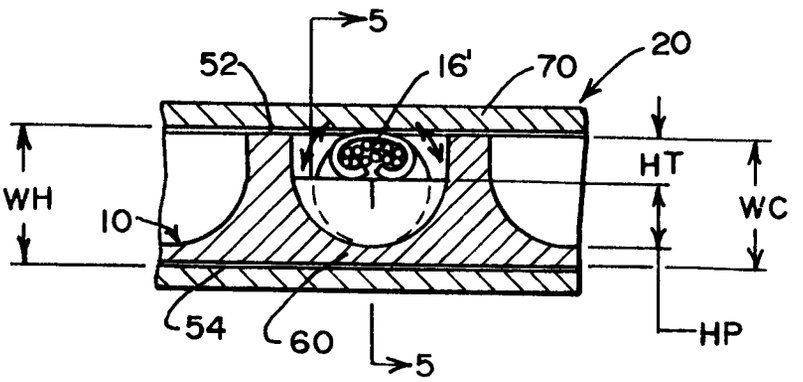


FIG. 4

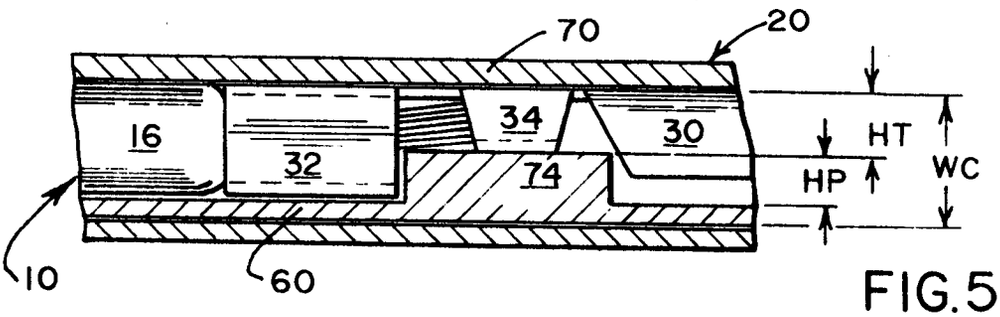


FIG. 5

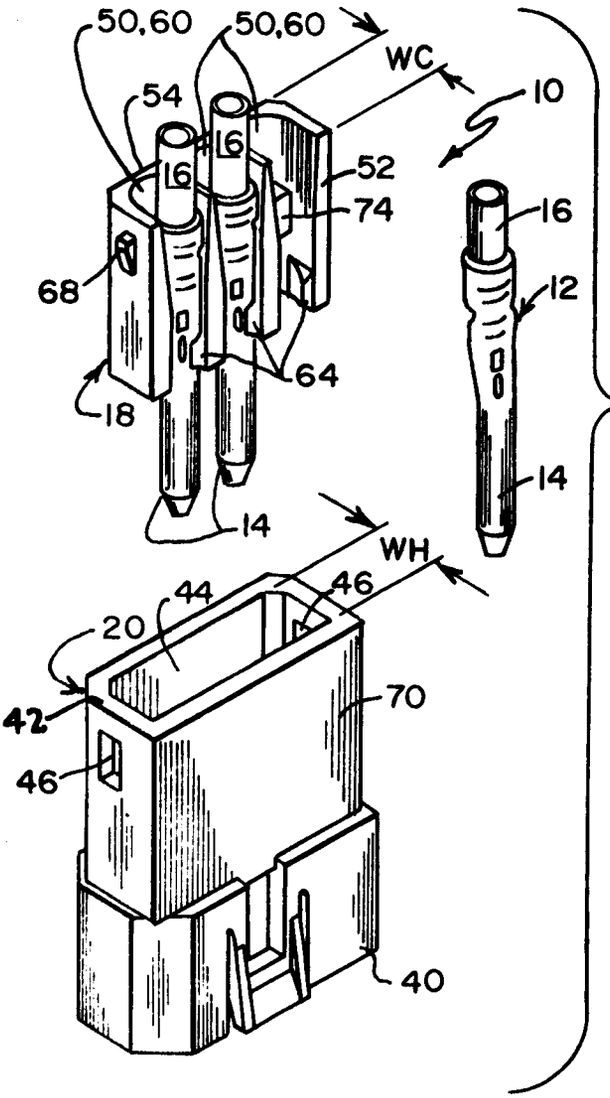
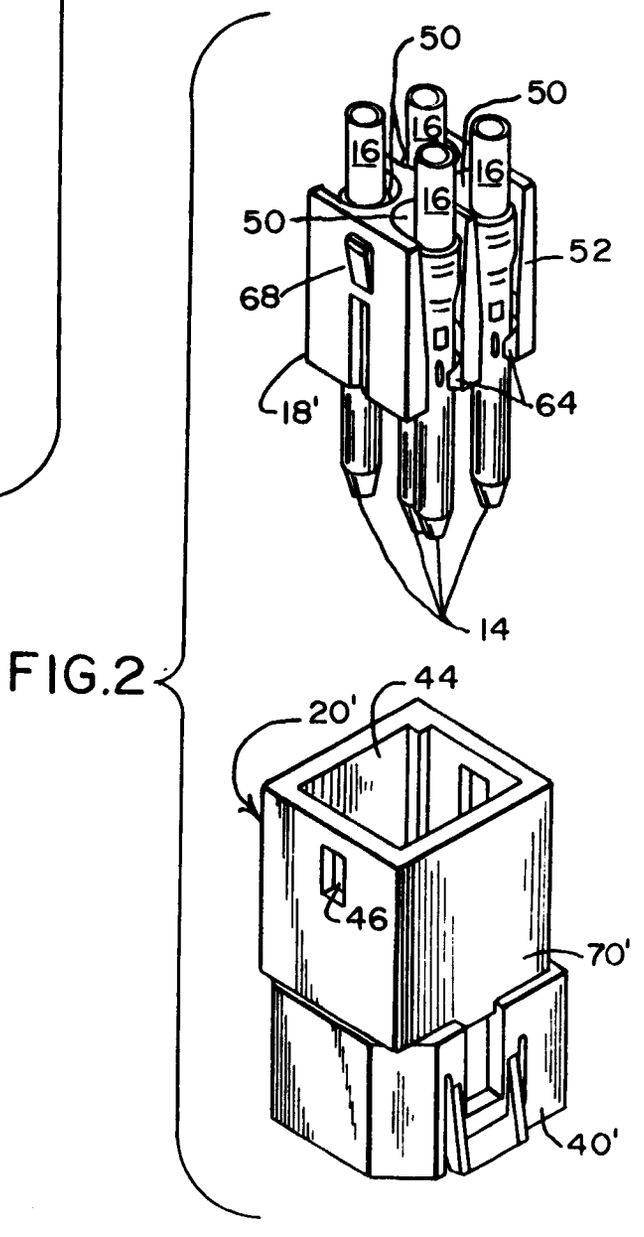

50,60
50,60
WC
10
54
16
16
52
74
68
16
12
64
18
14
14
WH
44
46
20
42
70
46
40

FIG.1


50
50
16
16
16
16
50
52
68
18'
64
14
44
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46
70'
40'

FIG.2