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Eifler et al.

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[54] **REAR RELEASE CONTACT RETENTION ASSEMBLY**

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[52] **U.S. Cl.** ..... **339/59 R**, 339/210 R, 339/217 R

[51] **Int. Cl.** **H01r 9/08**

[58] **Field of Search**.... 339/59 R, 59 L, 59 M, 60 R, 339/60 C, 60 M, 61 R, 61 C, 61 L, 61 M, 198 R, 198 C, 206 R, 206 L, 206 P, 207 R, 207 S, 208, 209, 210 R, 210 M, 210 T, 213 R, 213 S, 213 T, 217 R, 217 S, 217 PS, 219 R, 219 F

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[57] **ABSTRACT**

An electrical connector assembly that includes means for demountably retaining electrical contacts within the connector. The contact retention assembly includes a rearwardly extending tubular contact retention tower that is resiliently and radially expandable so that contacts may be demountably retained within the passage that extends through the contact retention tower. The rearwardly extending contact retention tower is cylindrically shaped with an axial passage therethrough containing a forwardly facing shoulder to provide a rearward stop when an electrical contact is mounted therein. Another insert, having a hole therein, may be mounted around the tubular contact retention tower to prevent radial expansion thereof while the insert is in place.

5 Claims, 4 Drawing Figures

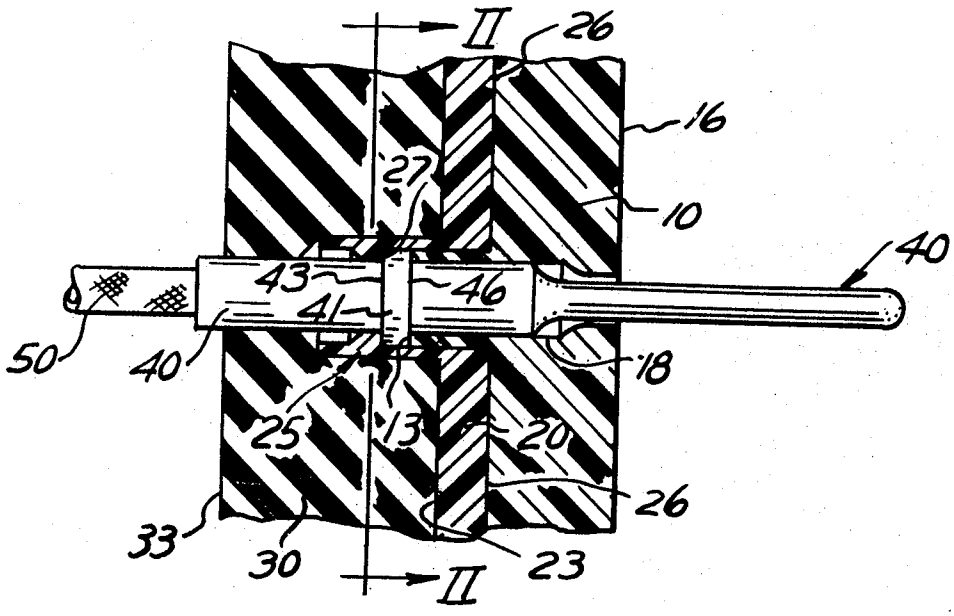
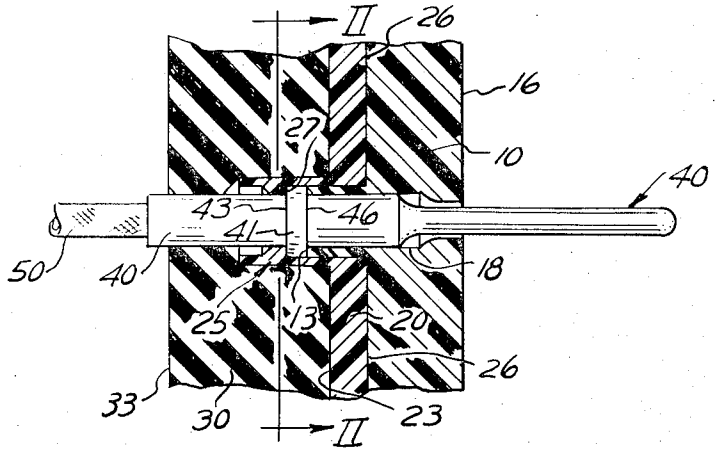


FIG. 1



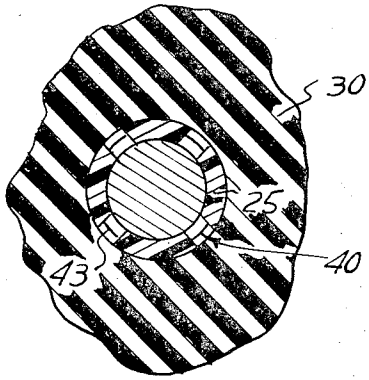
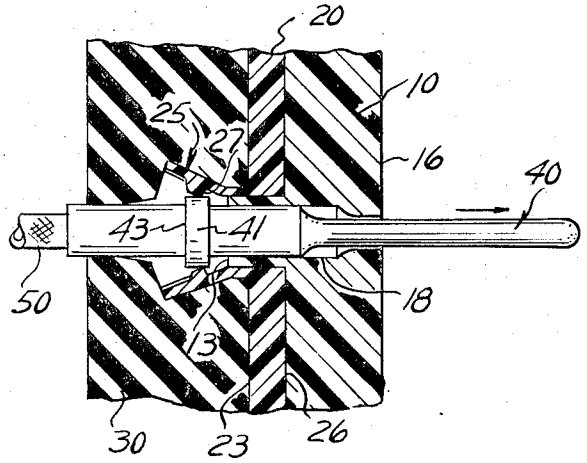


FIG. 2

FIG. 3



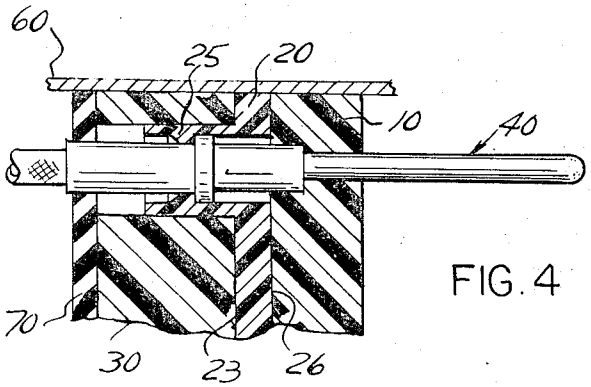


FIG. 4

REAR RELEASE CONTACT RETENTION ASSEMBLY

BACKGROUND OF THE INVENTION

This invention relates to electrical connectors of the type having a plurality of contacts in one connector member which are mateable with a plurality of contacts in another connector member when the members are interengaged. This invention is more particularly related to a retention mechanism in the connector members which permit the contacts to be snapped into their operative position in respective bores in the insulators of the connector members and also permits the contacts to be released for withdrawal from the respective bores by use of a suitable release tool.

Various systems have been employed in the electrical connector art for snap-in retention of the contacts in the insulation bodies of the connector members. Most systems of this general type utilize individual forward extending retention clips which circumscribe the respective contact members and are either mounted on the contacts for engagement against respective shoulders in the insulator bores or mounted in the bores for engagement against respective shoulders on the contacts. One example of this type of contact retention mechanism may be found in U.S. Pat. No. 3,158,424 entitled "Contact Mounting" issued Nov. 24, 1964 to R. Bowen.

In electrical connector assemblies where it is not necessary to have individual contact retention mechanisms, the individual contact retention mechanisms may be assembled into a single assembly which demountably retains a plurality of electrical contacts, each of which is independently released. One example of a single assembly of demountably retained electrical contacts may be found in U.S. Pat. No. 3,165,369 entitled "Retention System for Electrical Contacts" issued Jan. 12, 1965 to J. W. Maston.

Accordingly, the inventor of this invention set out to invent a contact retention mechanism that accomplished the results of the Maston and Bowen patents but by entirely different structures and arrangements.

SUMMARY OF THE INVENTION

This invention provides an alternate approach to retaining the electrical contacts within a connector assembly heretobefore undisclosed. The invention, which is a novel contact retention assembly, provides a means for demountably assembling an electrical contact within a connector assembly which does not require the disassembly of the connector to remove the contacts. Further, it does not require removal of all contacts to replace or remove any one of the contacts.

The invention is an electrical connector assembly characterized by a contact retaining member (**20**) that includes a plurality of tubular contact retention towers (**25**) integral with said retention member (**20**). Each of the tubular contact retention towers (**25**) extend rearwardly from the retention member (**20**) and have on the inside thereof a forward facing shoulder (**27**) for preventing the rearward movement of a contact (**40**) mounted in the retention tower (**25**). Each of the tubular retention towers (**25**) are further characterized by the fact that they are resiliently and radially expandable to allow the enlarged section (**41**) of a contact (**40**) to pass therethrough upon forward insertion of the contact into the axial passage in the tower (**25**).

In one embodiment of the invention the electrical connector unit comprises: a forward member (**10**) having a forward face (**16**), a rearward face and a bore (**18**) extending therethrough from said forward face (**16**) to said rearward face, the bore (**18**) having an enlarged rearward section opening at said rearward face, a smaller forward section and a rearward facing shoulder (**13**); a wafer (**20**), mounted against the rearward face of the insulator member (**10**), having a passage therethrough axially aligned with said insulator bore (**18**), the insulator bore (**18**) and said wafer passage adapted to receive an electrical contact member (**40**) which is insertable in said bore (**18**) and passage from the rear, the electrical contact (**40**) of the type having an enlarged section that includes a rearwardly facing shoulder (**43**) and a forwardly facing shoulder (**46**) thereon with said forwardly facing shoulder (**46**) engageable with said insulator rearwardly facing shoulder (**13**) to limit forward movement of the contact member; and a tubular contact retention tower (**25**) integral with said wafer and coaxial with said wafer passage, said tubular contact retention tower (**25**) extending rearwardly from said wafer to a free end, said tubular contact retention tower (**25**) having a central passage therein that includes a forwardly facing shoulder (**27**), said tubular contact retention tower being resiliently and radially expandable to permit said enlarged contact section (**41**) to pass therethrough upon forward insertion of the contact member (**40**) into the passage and bore (**18**), said tubular contact retention tower contracting behind the rearwardly facing shoulder (**43**) on the contact member (**40**) so that the forwardly facing shoulder (**27**) engages the rearwardly facing shoulder (**43**) on the contact member to limit rearward movement thereof in the passage and bore. Said tubular contact retention tower being substantially rigid in the axial direction when in its contracted position so as to provide a positive stop against rearward movement of the respective contact member. To prevent the radial expansion of the tubular contact retention towers (**25**) or to increase the force necessary to expand the retention tower (**25**), a second insert (**30**) having a tower receiving passage may be removably mounted against the wafer (**20**). As described herein, the electrical contact retention member (**20**) is sandwiched between a forward insert (**10**) and a rear insert (**30**).

Accordingly, it is an object of this invention to provide an alternate approach to prior art contact mounting systems.

It is also an object of this invention to provide a structure that includes a plurality of contact retention towers for retaining contacts within an electrical connector.

It is still another object of this invention to provide a contact mounting mechanism for an electrical connector in which the contact member may be inserted in the bore of an insulation block from the rear face thereof, caused to be locked in the bore against axial movement in either direction, and which is removable by manipulation entirely rearwardly of the insulation block, access to the front of the block or the front of the contact terminal being wholly unnecessary.

It is a further object of this invention to provide a snap-in contact retention member for an electrical connector comprised of a unitary body having a plurality

of resiliently and radially deformable contact retention towers formed therein that releasably retain a plurality of contacts in respective towers in a manner that allows the removal of one electrical contact without the removal of all electrical contacts.

The above and other objects and features of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings and claims that form a part of this specification.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial cross-sectional view of an electrical connector assembly that includes an electrical contact retaining mechanism that embodies the principles of this invention.

FIG. 2 is a partial cross-sectional view taken along lines II—II of FIG. 1.

FIG. 3 is a partial cross-sectional view of the electrical connector assembly shown in FIG. 1, with an electrical contact located in a partially inserted position before the contact retention towers have contracted behind the contact shoulder.

FIG. 4 is an alternate embodiment of the assembly electrical connector shown in FIG. 1 wherein the rear insert is a removably mounted rigid material that prevents the radial deflection of the retention towers.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring now to the drawings, FIG. 1 illustrates a novel contact retention insert (20) sandwiched between a forward insert (10) and a rear insert (30). Forward insert (10) includes a forward face (16), a rearward facing shoulder (13) and a passage (18) extending from the rear face to the front face. Passage (18) in the forward insert (10) is sized to receive the forward portion of electrical contact (40) and to provide a positive stop (13) against further forward movement of the contact (40) and to provide a positive stop (13) against further forward movement of the contact (40) once it is inserted in the passage (18). The rear insert (30), which in this embodiment is comprised of a resiliently deformable material such as rubber, has a rear face (33) and a passage aligned with passage (18) in the forward insert (10). The passage in the rear insert (30) is sized to receive rearwardly extending retention towers (25) which are an integral part of the retention insert (20). The retention insert (20) has a forward face (26), a rearward face (23) and one or more retention towers (25) extending from the rearward face of the retention insert (20). Each of the retention towers (25) includes an internal forwardly facing shoulder (27) that engages the rearwardly facing shoulder (43) of the contact (40) to prevent the rearward movement of the contact (40) once it is inserted into the passage (18). It is the function of the rear insert (30) to provide a fluid-tight seal around the contacts (40) and between adjacent contact retention towers (25). Attached to electrical contact (40) is an incoming lead (50). It is the function of the forward insert (10), which is generally comprised of plastic, to provide the forward stop means (13) and prevent radial movement of the contact (40) once it is inserted in the passage (18).

FIG. 2 is a partial cross-sectional view of the embodiment shown in FIG. 1 taken along lines II—II. This view illustrates how the electrical contact (40) is seated in the retention tower (25). This view also illustrates that the plastic retention towers (25) are radially deflectable because of the splits which extend the length of the tower (25) allowing the sides of the tower to be deflected radially. In this embodiment since the rear insert (30) is made of a resilient material such as rubber, release and removal of the contact terminal (40) may be simply accomplished by merely inserting a suitable tool from the rear so as to deflect the contact retaining shoulders of the retention tower (25) beyond the shoulder (43) of the contact (40), thus clearing a path for rearward withdrawal of the contact (40) out of the bore. One type of tool which is useful for this purpose is a tubular plastic tool which may be slideably engaged over the wire (50) and then over the rear portion of the contact (40).

FIG. 3 illustrates the connector assembly portion shown in FIG. 1 wherein the contact (40) is located in a partially inserted position before the contact retention shoulders (27) have contracted into place behind the rearward facing shoulder (43) of the contact (40) to prevent rearward movement of the contact (40). This figure illustrates how the rearward facing shoulder (13) of the forward insert (10) prevents the contact from moving forward once the forward facing shoulder (46) of the contact (40) engages such rearward facing shoulder (13). The drawing further illustrates how the enlarged portion (41) of the contact (40) radially deflects the contact retention tower (25) before moving into its locked position by the contracting of the forwardly facing shoulder (27) behind the rearwardly facing shoulder (43) of the contact (40). Since the forward insert (10) is made of a fairly rigid material e.g. plastic and the passage (18) is fairly long with respect to the contact (40) body, movement of the contact (40) in a radial direction is prevented by the action of the walls of the passage (18) against the contact (40).

FIG. 4 illustrates a partial cross-sectional view of an electrical connector assembly that embodies alternate features of this invention. In this embodiment, the electrical connector assembly includes a generally tubular metal shell (16) which has mounted therein a forward insert (10), a contact retaining insert (20), a removable locking insert (30), and a removable rubber insert (70) for sealing out moisture. In this embodiment the locking insert (30) is comprised of a rigid material such as plastic which, when mounted into position against the retaining insert (20) and around the contact retaining towers (25), prevents the towers from being radially expanded and the contact (40) from being removed. In this embodiment the inserts (30, 70) are removably mounted within the tubular shell (60) and it is necessary to first remove the inserts before removing one or more of the contacts (40) retained by the contact retaining insert (20) and the forward insert (10). In this embodiment the rearward facing shoulder (13) of the forward insert that prevents further movement of the contact (40) when seated is located within the forward insert instead of extending from the rear as shown in FIGS. 2 and 3.

While a preferred embodiment of the invention has been disclosed, it will become apparent to those skilled in the art that changes may be made to the invention as set forth in the appended claims, and, in some cases, certain features of the invention may be used to advantage without corresponding use of other features. Accordingly, it is intended that the illustrative and de-

scriptive materials herein be used to illustrate the principles of the invention and not to limit the scope thereof.

Having described the invention, what is claimed is:

1. An electrical connector unit comprising:

a body of insulating material having a plurality of passages therethrough from a front face to a rear face, each of said passages adapted to receive respective electrical contacts therein which are insertable from the rear, each of said electrical contacts having an enlarged section defining a rearwardly facing shoulder and a forwardly facing shoulder; and

a plurality of tubular contact retention towers integral with said insulation body and coaxial with respective passages, each tubular retention tower extending rearwardly from the rear face of said insulating body to a rearward free end, each tubular tower having on the inside thereof a forward facing shoulder, the opposite side of said shoulder being tapered radially inwardly from the inside wall of said tubular tower, so that said forwardly facing shoulder and said opposite tapered side form a projection inside said tower that spaces the inside wall of said tower, at said rearward free end, from an electrical contact when an electrical contact is inserted into said tower, each of said tubular towers being resiliently and radially expandable to permit the enlarged section of a respective contact member to pass therethrough upon forward insertion of the contact member into a respective passage, the forward facing shoulder of said tubular tower contracting behind the rearwardly facing shoulder on the contact member to provide a positive stop against rearward movement of the respective contact member.

2. The combination as recited in claim 1 including means for preventing said contact retention towers from being expanded in a radial direction, said means being removably mounted against the rear face of said body.

3. The combination as recited in claim 2 wherein said means for preventing said towers from expanding in a radial direction comprises an insert having a forward face and a rearward face, removably mounted with its forward face against the rearward face of said body, said insert comprised of a rigid material having a plurality of holes therethrough axially aligned with the passages of said body, said holes in said insert sized to receive said rearwardly extending retention towers in a manner that permits the walls defining said holes to contact said retention towers and thereby prevent radial expansion of said latching towers.

4. The combination as recited in claim 1 including an insert having a forward face and a rearward face mounted with its forward face against the rearward face of said body, said insert comprised of a resiliently deformable material having a plurality of holes therethrough, from said front face to said rear face, axially aligned with the passages of said body, said holes in said insert sized to receive said rearwardly extending retention towers in a manner that permits the walls defining said holes to contact said retention towers and the rear portion of said contact, said insert forming a fluid tight seal around each of said contacts and increasing the restoring force of said resiliently expandable retention towers and the force required to radially expand said retention towers.

5. An electrical connector unit comprising:

a forward insulator member having a forward face, a rearward face, and a bore extending therethrough from said forward face to said rearward face, said bore having an enlarged rearward section opening at said rearward face and a conduit axially aligned with said bore and extending from said rear face;

a wafer having a rearward face and a forward face, said forward face mounted against the rearward face of the insulator member, said wafer having a passage therethrough axially aligned with said insulator bore and which receives said insulator conduit, said insulator bore and conduit and said wafer passage adapted to receive an electrical contact member which is insertable in said bore, conduit, and passage from the rear of said wafer, the electrical contact of the type having an enlarged section that includes a rearwardly facing shoulder and a forwardly facing shoulder thereon, said forwardly facing shoulder engageable with the free end of said conduit of said insulator to limit forward movement of the contact member; and

a tubular contact retention tower integral with said wafer and axially aligned with said wafer passage, said tubular contact retention tower extending rearwardly from the rearward face of said wafer to a rear free end, said tubular contact retention tower having a central passage therein that includes a forwardly facing shoulder, said tubular contact retention tower being resiliently and radially expandable to permit said enlarged contact section to pass therethrough upon forward insertion of the contact member into the passage and bore, said tubular contact retention tower contracting behind the rearwardly facing shoulder on the contact member so that the forwardly facing shoulder within the tubular contact retention tower engages the rearwardly facing shoulder on the contact member to limit rearward movement thereof in the passage and bore, said tubular contact retention tower being substantially rigid in the axial direction when in its contracted position so as to provide a positive stop against rearward movement of the respective contact member.

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