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Eifler

[11] **3,845,452**

[45] **Oct. 29, 1974**

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

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[73] Assignee: **The Bendix Corporation,** Southfield, Mich.

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[21] Appl. No.: **318,343**

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

[51] **Int. Cl.** **H01r 13/42**

[58] **Field of Search** 339/59–61, 339/217

[56] **References Cited**

UNITED STATES PATENTS

3,165,369	1/1965	Maston	339/217 S
3,638,165	1/1972	Anhalt et al.	339/217 S

Primary Examiner—Joseph H. McGlynn

Attorney, Agent, or Firm—Raymond J. Eifler

[57] **ABSTRACT**

An electrical connector assembly that includes means for demountably retaining electrical contacts with the connector. The contact retention assembly includes rearwardly extending latches that are resiliently expandable in a radial direction so that contacts may be demountably retained within a passage surrounded by one or more latches. An additional insert may be used to confine the latches and prevent radial expansion thereof.

8 Claims, 6 Drawing Figures

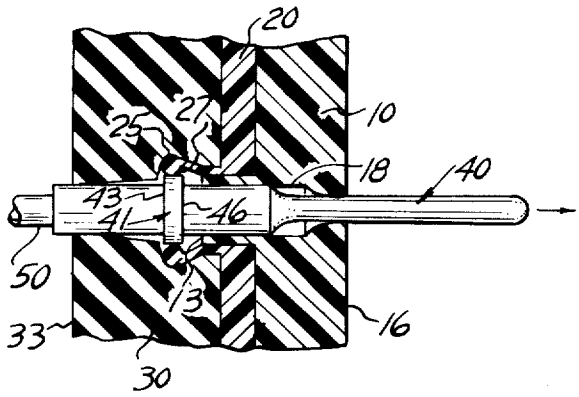


FIG. 1

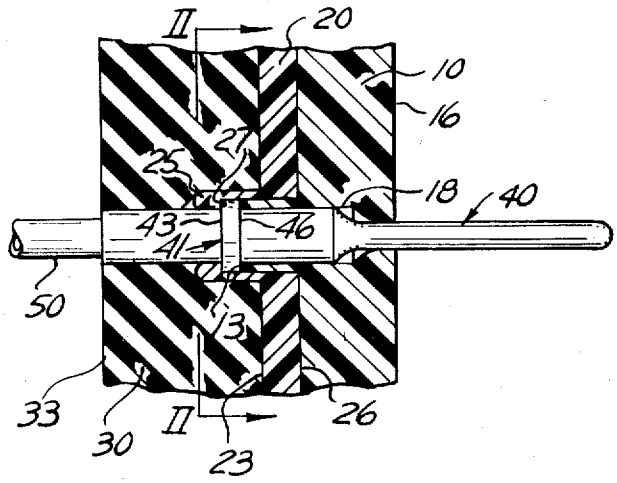


FIG. 2

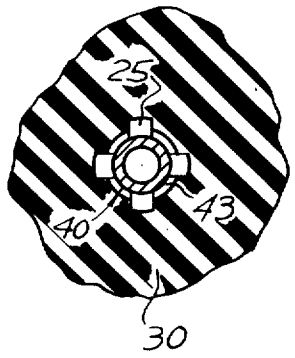


FIG. 4

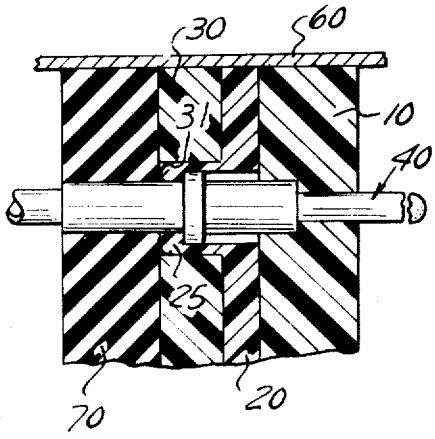


FIG. 3

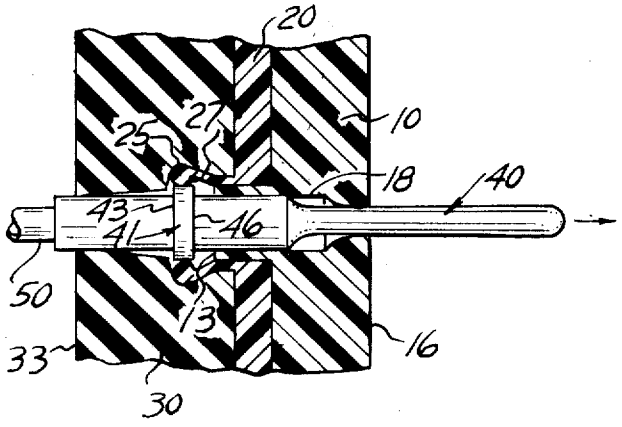


FIG. 6

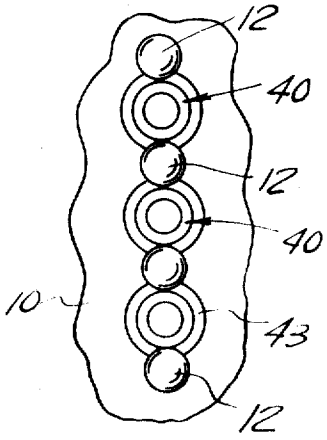
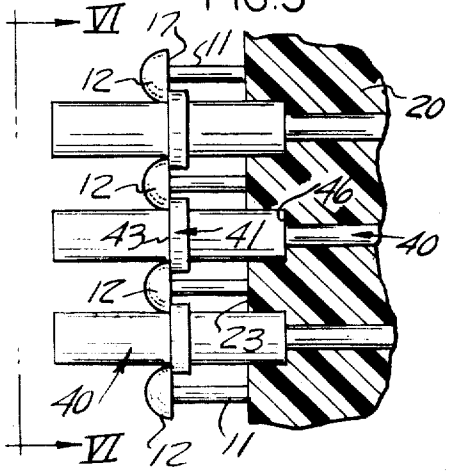


FIG. 5



REAR RELEASE CONTACT RETENTION ASSEMBLY

CROSS REFERENCE TO RELATED APPLICATIONS

This application is related to U.S. Pat. application Ser. No. 318,341 filed concurrently on Dec. 26, 1972 entitled "Rear Release Contact Retention Assembly", inventors — R. J. Eifler and W. F. Hennessey. This application is also related to divisional application Ser. No. 390,625 entitled "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 latches (**25**) integral with said retention member (**20**). Each of the latches (**25**) extends 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 retaining member (**25**). Each of the latches (**25**) is further characterized by the fact that they are resiliently expandable in a radial direction 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 member (**20**).

In one specific embodiment of the invention (FIG. **5**) the electrical connector unit comprises: a body (**20**) having a plurality of passages (**18**) therethrough from a front face to a rear face (**23**), each of the passages adapted to receive respective electrical contacts (**40**) therein which are insertable from the rear and which have an enlarged section (**41**) defining a rearwardly facing shoulder (**43**) and a forwardly facing shoulder (**46**) that engages a portion of said body (**20**) to limit forward movement of said contact; a plurality of mushroom shaped contact retention members (**11, 12**) disposed between adjacent passages of said body (**20**), said mushroom shaped members (**11, 12**) integral with said body and extending generally perpendicular from the rear face (**23**) of said body (**20**), each mushroom shaped retention member including a stem portion (**11**) that terminates in a free end that is cap shaped (**12**), said cap portion defining a forwardly facing shoulder (**17**), each of said mushroom shaped retention members (**11, 12**) being resiliently and radially deflectable to permit the enlarged section (**41**) of a respective contact to pass by the cap (**12**) and stem (**11**) portion of the retention member by deflecting the cap portion upon forward insertion of the contact into a passage, the mushroom shaped contact retention member returning to its undeflected position behind the rearward facing shoulder (**43**) on the contact when the contact forward shoulder (**46**) engages the portion of said body (**20**) that limits forward movement of said contact so that at least a portion of the forward facing shoulder (**17**) of the mushroom shaped retention member engages a portion of the rearward shoulder (**43**) of the contact to limit rearward movement of the contact in said body passage, each of said mushroom shaped retention members being substantially rigid in an axial direction when in its undeflected position so as to provide a positive stop against rearward movement of the respective contact, the forward facing shoulder (**17**) of each of said caps (**12**) between adjacent passages are disposed to engage a portion of the rearwardly facing shoulders (**43**) of at least two adjacent electrical contacts (**40**), inserted into said passages at points on said cap (**12**) that are opposite each other so that said cap (**12**) is engaged at two diametrically opposed points by the rearward facing shoulders (**43**) of said two adjacent contacts whereby said cap is not deflectable in the direction of said diametrically opposed points when a rearward force is applied to either of said two adjacent contacts.

In another specific embodiment (FIGS. **1–4**) the electrical connector comprises: a tubular housing (**60**); a first dielectric insert (**10**) mounted in said housing (**60**), said insert having a front face (**16**), a rear face, and a plurality of bores (**18**) therethrough extending from said front face to said rear face, said insert including means (**13**) for stopping the forward movement of

an electrical contact (40) at a predetermined point when an electrical contact is inserted into one of said bores from the rear face; a second dielectric insert (20) having a forward face (26) and a rearward face mounted with its forward face (26) against the rearward face of said first insert (10), said second insert (20) having a plurality of passages therethrough extending from the front face to the rear face of said second insert and which are axially aligned within said bores (18) of said first insert (10), said bores (18) and said passages each adapted to receive an electrical contact member (40) which is insertable from the rear of said second insert, said second insert (20) including latching means (25) which are resiliently deflectable in a radial direction for latching onto a rearward facing shoulder (43) of an electrical contact (40) inserted into one of said passages to prevent rearward movement of said contact; and a plurality of electrical contacts (40) each disposed in a respective bore and passage, each of said contacts having a forward facing shoulder (46) and a rearward facing shoulder (43), said forward facing shoulder (46) engaging said first insert stop means (13) thereby limiting forward movement of said electrical contacts and said rearward facing shoulder (41) engaging said second insert latching means (25) thereby limiting rearward movement, whereby said contact is retained within said connector housing until said latching means (25) are radially deflected to permit the removal of said contact.

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 latches for removably 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 latches formed integral therewith that releasably retain a plurality of contacts in respective passages 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 electical 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 retaining latches have contracted behind the contact shoulder.

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

FIG. 5 is an alternate embodiment of the invention wherein double acting mushroom shaped retention members replace latches as the retention mechanism.

FIG. 6 is a view taken along lines VI—VI of FIG. 5.

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), preferably comprised of a rigid and electrically nonconducting material, 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 an electrical contact (40) and to provide a positive stop (13) against further forward movement of the contact (40) once it is inserted into the passage (18). The rear insert (30), which, in this embodiment is comprised of a resiliently deformable and electrically nonconducting material, such as rubber, has a rear face (33) and a bore aligned with passage (18) in the forward insert (10). The bore in the rear insert (30) is sized to receive rearwardly extending latches (25) which are an integral part of the retention insert (20). The retention insert (20) has a forward face (26), a rear face (23) and a plurality of latches (25) extending generally perpendicularly from the rear face (23) of the retention insert (20). Each of the latches (25) includes an internal forward facing shoulder (27) that engages the rearward facing shoulder (43) of the contact (40) to prevent the rearward movement of the contact (40) once it is seated in passage (18). It is the function of the rear insert (30) to provide a fluid-tight seal around the contacts (40) and between adjacent contacts (40). 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 the contact (40) is seated 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 the electrical contact (40) seated in the passage (18). This view also illustrates how the latches (25) which are radially deflectable, prevent the contact (40) from moving rearwardly. 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 (27) of the latches (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 latches (25) before moving into its locked position by the contracting of the forwardly facing retention 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 latches (25), prevents the latches (25) 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 these 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 (10) 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.

FIG. 5 illustrates an alternate embodiment of the invention wherein the retention mechanisms are a plurality of mushroom shaped retention members rather than latches. In this embodiment, the retention member (20) includes a plurality of mushroom shaped retention members which are formed by a stem (11) and a cap (12) portion which has a forward facing shoulder (17) thereon. In this embodiment, each of the mushroom shaped retention members extends generally perpendicularly from the rear face (23) of the retention insert (20), and each mushroom shaped retention member is arranged between adjacent passages in the retention insert (20) so that the forward facing shoulder (17) of each cap (12) contacts at least two adjacent electrical contacts (40) disposed in adjacent passages of the retention insert (20).

FIG. 6 is a view taken along lines VI—VI of FIG. 5 to illustrate how the cap portion (12) of the mushroom shaped retention members retains and/or prevents a contact (40) from rearward movement once it is seated in the passage within the retention insert (20). The particular and unique arrangement of the mushroom caps (12) is such that any movement by one contact (40) in a rearward direction will not deflect the mushroom cap because it is maintained in place by another contact (40) that is adjacent the first contact. Therefore, it can be seen from FIGS. 5 and 6 that movement in the rearward direction of a contact (40) will not deflect a mushroom cap (12) because of the unique way in which it is supported at diametrically opposed points. To remove a contact (40) from an electrical connector having an insert of the type shown in FIGS. 5 and 6, it would be necessary to place a tool, as previously described, over the rear portion of the contact and move it forward while rotating it so as to twist the caps (12) away from engagement with the rear facing shoulders (43) of the electrical contacts (40). In other words, it is necessary to have a tool that is able to deflect the mushroom shaped retention members in a direction away from the adjacent contacts between which they lie. Conversely, to mount the contacts (40) in the insert (20), rotational movement applied to a contact (40) as it is being inserted into a passage will cause the retention cap (12) to deflect in a direction that allows the contact to be inserted and retained by the forward facing shoulder (17) of the retaining cap (12).

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. For example, although only two members are retaining a contact in FIG. 6, four contact retaining members could be used per contact. Also, the resiliently deflectable retention members may be comprised of any nonmetal such as a hard rubber-like material or a synthetic resin, with the shape of the retention member further contributing to its axial strength. Accordingly, it is intended that the illustrative and descriptive 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:

an insulator member having a plurality of bores therethrough extending from a forward face to a rearward face;

a body having a forward face and a rearward face mounted with its forward face against the rearward face of the insulator member, said body having a plurality of passages therethrough axially aligned with said bores of said insulator member, said bores and said passages each adapted to receive an electrical contact member which is insertable from the rear of said body and each contact having an enlarged section defining a rearwardly facing shoulder and a forwardly facing shoulder thereon; and

a plurality of hook shaped retention members extending rearwardly from the rear face of said body and disposed in spaced relationship around the periphery of each of said passages, said retention members being integral with said body and having a forwardly facing shoulder that partially blocks the path of a passage in said body and terminates in a rear free end, each of said retention members being resiliently and radially deflectable to permit said enlarged contact sections to pass into said passages upon forward insertion of the contact member into the passage and bore, said hook shaped contact retention members contracting behind the

rearwardly facing shoulder on the contact member to limit rearward movement thereof in the passage and bore of said body and member respectively, said retention members being substantially rigid in the axial direction when in their contracted position so as to provide a positive stop against rearward movement of the respective contact member.

2. An electrical connector unit as recited in claim 1 including an insert comprised of rigid material having a plurality of holes therein that are sized to receive each group of retention members disposed around the periphery of one of said passages, said insert being removably mounted adjacent the rearward face of said body to prevent radial movement of said retention members when said insert is mounted and to permit radial movement of said retention members when said insert is removed.

3. An electrical connector as recited in claim 2 wherein said body and said insert are comprised of a dielectric material.

4. An electrical connector unit as recited in claim 2 wherein said insulator member includes rearward directed means for stopping the forward movement of said contact, said stop means being disposed within the bore of said insulator member.

5. An electrical connector unit as recited in claim 3 wherein said insulator member includes rearward directed means for stopping the forward movement of said contact, said stop means being disposed within the bore of said insulator member.

6. An electrical connector comprising:

a tubular housing;

a first dielectric insert mounted in said housing, said insert having a front face, a rear face, and a plurality of bores therethrough extending from said front face to said rear face, said insert including means for stopping the forward movement of an electrical contact at a predetermined point when an electrical contact is inserted into one of said bores from the rear face;

a second dielectric insert having a forward face and a rearward face mounted with its forward face against the rearward face of said first insert, said second insert having a plurality of passages therethrough extending from the front face to the rear face of said second insert and which are axially aligned within said bores of said first insert, said bores and said passages each adapted to receive an electrical contact member which is insertable from the rear of said second insert, said second insert including a plurality of rearwardly extending hook shaped latching means which are resiliently deflectable in a radial direction and arranged in spaced relationship around each passage in said second dielectric insert for latching onto a rearward facing shoulder of an electrical contact inserted into one of said passages to prevent rearward movement of said contact;

a plurality of electrical contacts each disposed in a respective bore and passage, each of said contacts having a forward facing shoulder and a rearward facing shoulder, said forward facing shoulder engaging said first insert stop means thereby limiting forward movement of said electrical contacts and said rearward facing shoulder engaging said second insert latching means thereby limiting rearward movement, whereby said contact is retained within said connector housing until said latching means are radially deflected to permit the removal of said contact and means for preventing said second insert latching means from being resiliently deflected in a radial direction, said preventing means being removably mounted in said connector housing adjacent the rear face of said second insert and wherein said latching means extends rearwardly from said second insert into a passage in said preventing means.

7. The combination as recited in claim 6 wherein said means for preventing said latching means from being deflected in a radial direction comprises a third insert having a forward face and a rearward face, said third insert removably mounted in said housing with its forward face against the rearward face of said second insert, said third insert comprised of a rigid material having a plurality of holes therethrough axially aligned with the passages of said second insert, said holes in said insert sized to receive said rearwardly extending latching means in a manner that permits the walls defining said holes to contact said rearwardly extending latching means and thereby prevent radial deflection of said latching means.

8. The combination as recited in claim 6 including a third insert having a forward face and a rearward face mounted with its forward face against the rearward face of said second insert, said third 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 second insert, said holes in said third insert sized to receive said rearwardly extending latching means in a manner that permits the walls defining said holes to contact said rearwardly extending latching means and the rear portion of said contact, said third insert forming a fluid-tight seal with said contacts and increasing the restoring force of said latching means, when deflected, and the force required to radially deflect said latching means.

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