Jan. 30, 1968 P. C. CULVER 3,366,921

ELECTRICAL CONNECTOR

Filed May 5, 1966 2 Sheets-Sheet 1

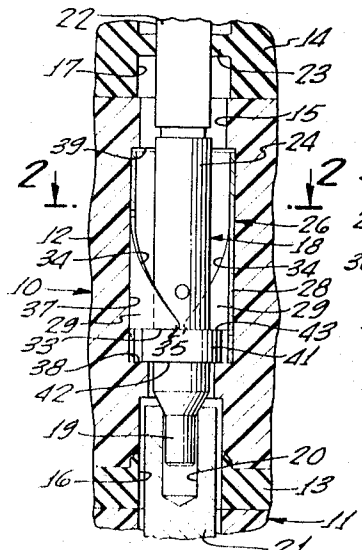


FIG. 1.

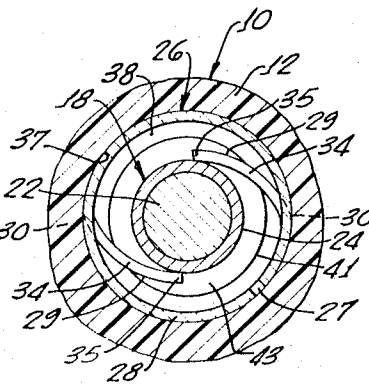


FIG. 2.

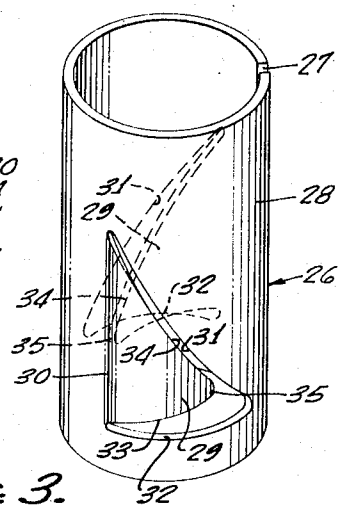
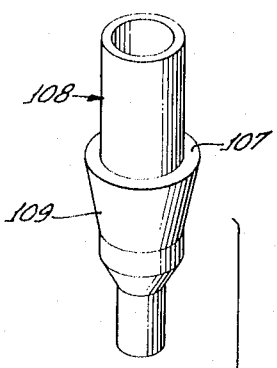


FIG. 3.



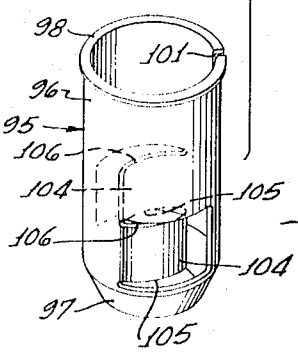


FIG. 9.

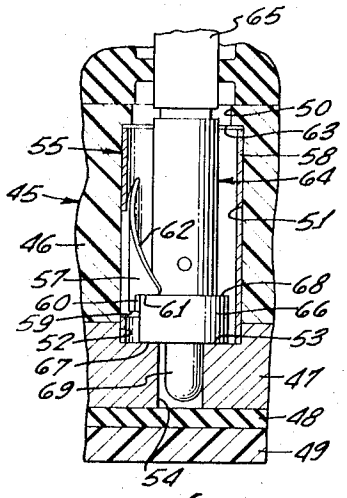


FIG. 4.

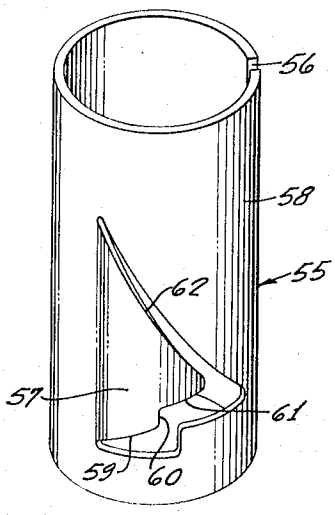


FIG. 5.

INVENTOR.
PERRIN C. CULVER
BY
Jamieson & Carr
ATTORNEYS.

Jan. 30, 1968 P. C. CULVER 3,366,921

ELECTRICAL CONNECTOR

Filed May 5, 1966 2 Sheets-Sheet 2

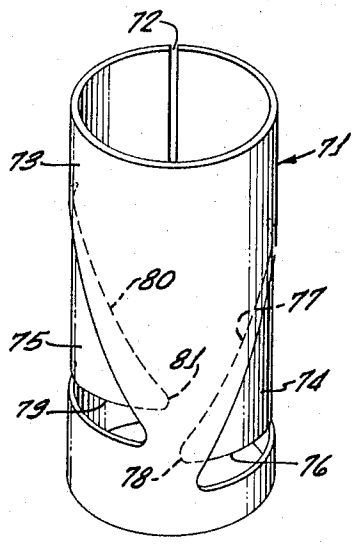


FIG. 6.

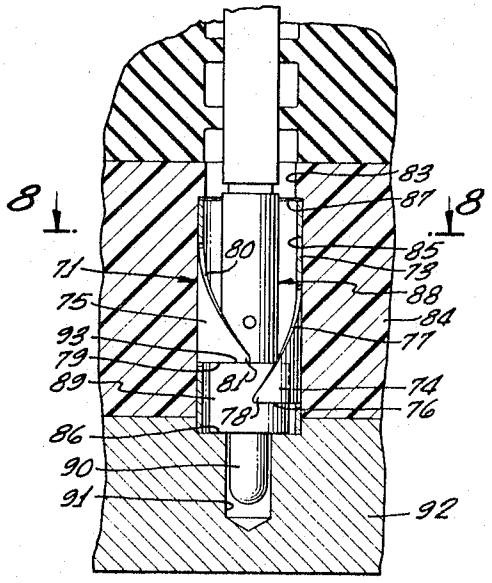


FIG. 7.

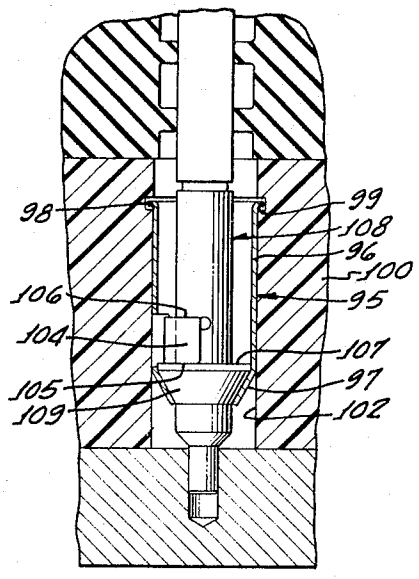


FIG. 10.

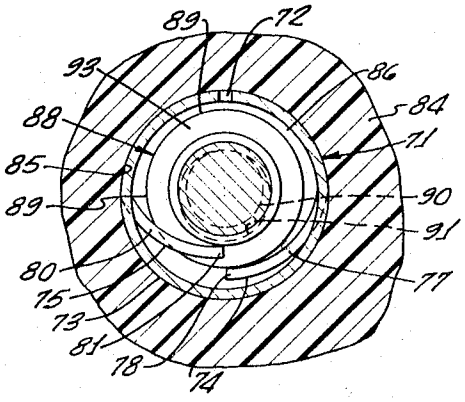


FIG. 8.

INVENTOR.
PERRIN C. CULVER

BY

Jamieson & Carr

ATTORNEYS.

United States Patent Office 3,366,921
Patented Jan. 30, 1968

3,366,921

ELECTRICAL CONNECTOR

Perrin C. Culver, Banning, Calif., assignor to The Deutsch Company Electronic Components Division, Banning, Calif., a corporation of California

Filed May 5, 1966, Ser. No. 547,841
12 Claims. (Cl. 339—217)

ABSTRACT OF THE DISCLOSURE

An electrical connector including a body having a bore, an electrical contact in the bore, and a retaining member in the bore for positioning the contact, the retaining member including a tab extending laterally inwardly from an outward position to an inward position engaging a shoulder on the contact, and including in some instances a means bearing on the side of the contact for producing a lateral force to urge the contact into engagement with a mating contact to produce a good electrical connection.

This invention pertains to electrical connectors and to the retention of electrical contacts in such devices.

For convenience in installing and removing electrical contacts in a connector assembly, the so-called rear-release system has certain important advantages. By such an arrangement, the contact can be removed from the rearward end of the connector section with which it is associated without the necessity for access to the face of the unit. Also, the electrical terminal is installed in the supporting insulation block by insertion from the rearward end. A retaining clip holds the contact within the insulation block, being automatically engaged when the terminal is pushed into place.

In the past it has been proposed to construct a rear-release contact retaining device having a cylindrical sleeve held in the opening in the insulation block. A spring finger inclines forwardly and inwardly from the cylindrical sleeve, and is adapted to fit in back of a shoulder on the contact after the insertion of the contact. This holds the contact against movement to the rear. The spring finger is pushed outwardly in a generally radial direction as the contact is inserted, but when the shoulder of the contact has passed the end of the spring finger it snaps into place to retain the contact. For removal, the spring finger can be pried outwardly by the insertion of a tool from the rearward end so that the contact can be pulled from the opening in the insulation block.

In this type of construction, the forces on the contact tending to push it axially must be absorbed primarily through column loading of the spring finger. At a certain point, this thin flexible element will buckle and the load no longer can be resisted. It is necessary, therefore, to be certain that a material of adequate gauge and tensile strength is used in order to avoid premature buckling of the spring finger, and there is a limit to the force that can be withstood. The retainer clip must be made sufficiently long to permit the spring finger to incline forwardly at a shallow angle so that it will be loaded in column and can resist axial forces on the contact up to the point the spring finger will buckle. If the spring were inclined abruptly inwardly, forces on the contact would be nearly all translated into bending loads on the spring, and the load-carrying capacity of the retainer clip would be even less. Therefore, the retainer clip cannot be made as compact as frequently is desirable.

The present invention provides an electrical connector incorporating an improved rear-release retention clip in which the loads are absorbed in shear, rather than compression, increasing the ability of the clip to resist forces tending to push the contact out of its opening in the insulation block. Also, the clip may be made quite compact in length and, by virtue of its resistance to loads, is satisfactorily made of light gauge metal. Instead of utilizing a forwardly inclined spring finger, the retainer clip includes a tab, which is bent inwardly and to the side in a spiral form from the wall of the cylindrical sleeve of the clip. In other wards, the tab is not inclined forwardly, but instead inclines laterally, being bent from a longitudinally extending connection to the body of the clip. The forward edge of the tab is substantially radial in order to fit back of the annular shoulder of the contact. The tab is made preferably in substantially triangular form, having a rearward edge that converges with the forward edge. The rearward edge is engaged by the shoulder of the contact when it is inserted and allows the contact to pry the tab outwardly as the contact is moved into the bore. The removal tool also engages this inclined rearward edge to force the tab outwardly to release the contact.

The device of this invention may be constructed to act solely as a contact-retaining clip, or to provide the added function of imparting a sideward load on the contact to assure that it makes a good electrical connection with the mating contact to be associated with it. The side load can be imparted by an extension of the tab that fits behind the shoulder, which bears also on the circumference of the shoulder to push the contact to one side. Alternatively, two tabs may be used, one extending laterally inwardly behind these shoulder of the contact, and the second extending inwardly in the opposite direction with its end engaging the circumference of the contact.

An object of this invention is to provide an electrical connector having an improved retention arrangement for an electrical contact.

Another object of this invention is to provide a rear-release type contact retaining system of increased load capacity, lighter weight and greater compactness than conventional designs.

A further object of this invention is to provide a device that will both retain a contact and impart a lateral sideward load on the contact to bias it into a position of electrical engagement with a mating contact.

An additional object of this invention is to provide an improved contact retaining device that can be manufactured at low cost and is easily installed and used.

These and other objects will become apparent from the following detailed description taken in connection with the accompanying drawing in which:

FIGURE 1 is a longitudinal sectional view illustrating an electrical connector in which the contact is retained in accordance with this invention;

FIGURE 2 is an enlarged transverse sectional view taken along line 2—2 of FIGURE 1;

FIGURE 3 is an enlarged perspective view of the retainer clip separated from the other components of the electrical connector;

FIGURE 4 is a longitudinal sectional view of an electrical connector arrangement in which the retainer clip imparts a lateral force on the contact to effect an electrical connection with the mating part, as well as holding the contact axially;

FIGURE 5 is an enlarged perspective view of the retainer clip used in the arrangement of FIGURE 4;

FIGURE 6 is an enlarged perspective view of a different form of retainer clip that both imparts a lateral force to the contact and retains it;

FIGURE 7 is a longitudinal sectional view of an electrical connector utilizing the retainer clip of FIGURE 6;

FIGURE 8 is an enlarged transverse sectional view taken along line 8—8 of FIGURE 7;

FIGURE 9 is an exploded perspective view of a modified connector and retainer clip arrangement; and

FIGURE 10 is a longitudinal sectional view of an electrical connector utilizing the contact and retainer clip of FIGURE 9.

As illustrated in FIGURES 1 and 2, the arrangement-ment of this invention is in the form of a multiple pin-and-socket type electrical connector. This unit includes two mating sections **10** and **11**, which are held together by a suitable clamping arrangement, not shown. The connector section **10** includes a block **12** of rigid dielectric material, having a forward face **13** of softer resilient elastomeric material bonded to it. The latter element engages the forward face of the mating connector section **11**, only a small fragment of which is shown in FIGURE 1. At the rearward end of the rigid block **12** is an additional section **14** of a soft elastomer.

Within the block **12** is a bore **15**, which communicates with similar openings **16** and **17** in the elements **13** and **14**, respectively. An electrical contact **18** is received in the bore **15** of the member **12** and, in the example shown, is a pin-type contact having a forwardly projecting cylindrically shaped section **19** that enters an opening **20** in the mating socket contact **21** carried by the other connector section **11**. A socket contact could be substituted for the pin contact **18** as the invention operates with either type. The engagement of the pin **19** in the socket opening **20** provides an electrical connection between the contacts **18** and **21**. Generally, the connector will include a number of the pin-and-socket combinations.

An insulated wire **22** extends out of the connector section **10** through the opening **17** in the rearward resilient element **14** and connects to an associated item of the electrical circuit. A similar wire (not shown) extends from the socket contact **21**. Annular sealing beads **23** are provided in the opening **17**, engaging the wire **22** and closing the rearward end of the opening into the electrical connector section **12** so as to prevent entry of moisture or other foreign matter. The insulation is removed from the inner end of the wire **22**, which extends into the rearward tubular section **24** of the contact **18**, which is crimpled about the wire end to join the contact to the wire.

The contact **18** is held within the bore **15** of the insulating block **12** by means of a retainer clip **26**. This clip, shown in enlarged detail in FIGURE 3, is of relatively light gauge sheet metal rolled into a tubular form and provided with an axially extending slot **27** that runs for its entire length. Bent inwardly from the circumferential wall **28** of the retainer clip **26** is a pair of tabs **29**. Each tab is inclined laterally inwardly and is of a generally spiral configuration. To form the tabs, the wall **28** of the annular member **26** is given two opposed substantially V-shaped cuts, after which the tabs are bent inwardly. The tabs **29** join the outer wall **28** along a longitudinally extending line **30** that interconnects the ends of the edges **31** and **32** formed on the wall **28** when the cuts for the tabs are made. Each laterally inclined tab **29**, therefore, has a generally triangular shape, with a forward edge **33** in a plane that is radial relative to the tubular member **26**. The rearward edge **34** of each tab **29** is inclined so as to coverge with the forward edge **33**, which it meets at the inner distal end **35** of the tab.

The retainer clip **26** is of resilient material, so that it can be introduced into the enlarged annular recessed portion **37** of the bore **15** in the insulating block **12**. The clip **26**, by virtue of the longitudinal slot **27**, can be contracted in its outside lateral dimension to enable it to pass through the smaller portions of the bore and spring outwardly into the annular section **37**. The radial shoulders **38** and **39** at the forward and rearward ends of the larger portion **37** of the bore in the block **12** are adjacent the forward and rearward ends of the clip **26** and position it axially.

After the retainer clip **26** has been inserted into the recess **37** in the bore **15**, the electrical contact **18** is introduced. The contact **18** with its wire **22** attached is pushed in from the rearward end through the opening **17** in the outer resilient element **14**, past the resilient bead **23**. The contact **18** moves freely into the clip **26**, being smaller in diameter than the diameter of the clip wall **28**. However, as the contact is inserted, the forward end **42** of the annular enlargement **41** of the contact is brought into engagement with the rearward edges **34** of the tabs **29**. Because the rearward edge surfaces **34** are inclined forwardly from their points of attachment with the wall **28**, which points also are radially outward of the contact, the enlarged part **41** of the contact moves beneath the tabs and pries the tabs outwardly as it is advanced. The forward end **42** of the annular enlargement **41** of the contact rides along the rearward edges of the tabs **29** as the axial movement takes place, progressively bending the tabs outwardly. Thus, the annular enlargement **41** of the contact acts as a cam, deflecting the tabs **29** as the contact **18** is inserted.

As soon as the contact has been moved into the block **12** a sufficient distance, the tabs **29** snap inwardly in back of the shoulder **43** at the rearward end of the annular enlargement **41**. The inner distal ends **35** of the tabs **29** then engage the tubular section **24** of the contact immediately behind the shoulder **43**, and are in substantially diametrically-opposed relationship.

The forward radial edges **33** of the tabs **29** extending behind the shoulder **43** prevent the contact **18** from being moved in the rearward direction. Thus, the shoulder **43** and the edge surfaces **33** act as abutments to retain the contact axially. At the same time, the shoulder **38** at the forward end of the annular enlargement **37** of the bore **15** interferes with the forward shoulder **42** of the section **41** of the contact **18**. This provides abutment surfaces that prevent movement of the contact in the forward direction so that it is locked in place within the insulation block and prevented from axial travel.

The contact **18** is held very securely by the retainer clip **26**, which will withstand high loads on the contact that would tend to push it outwardly toward the rear. The tabs **29**, because of their lateral inward inclination and the radial forward edges they present, withstand loads in shear, which enables them to resist strong forces imposed on the contact **18**. This contrasts with prior designs where an elongated deflectable spring inclined forwardly and will tend to be deflected by the loads encountered in service, which are applied directly against the end of the spring element. In the present design, no loads imposed on the contact **18** will cause deflection of the resilient tabs **29**. This not only provides the retainer clip **26** with a greater ability to retain the contact, but also permits it to be made out of very light gauge material, so that a weight and cost reduction is effected. Moreover, the lateral inclination of the tabs permits the retainer clip **26** to be made relatively short and of lesser axial dimension than where forwardly inclined spring elements are provided.

Despite the secure retention of the contact **18**, it is removed readily as the retainer clip **26** is released from it. A tool may be inserted from the rearward end of the opening into the connector to pry the tabs **29** outwardly, so that the edges **33** no longer are engaged with the shoulder **43** and the contact **18** may be pulled from the connector by means of the wire **22**. Particularly suitable in this connection is a tool formed as a split tubular element having an inside dimension that will fit over the tubular section **24** of the contact and an outer diameter slightly greater than that of the annular portion **41**. When such a tool is pushed in from the rearward end of the connector, it will react against the rearward edges **34** of the tabs **29**, deflecting the tabs outwardly so that the forward edges **33** no longer interfere with the rearward shoulder **43** of the enlarged annular portion **41** of the con-

tact 18. This frees the contact so that it may be pulled out from the interior of the bore in the connector.

It has been common practice in electrical connectors to employ some means to assure that a good electrical connection is made between the pin and socket of the mating portions of the connector device. Frequently, this takes the form of a leaf spring within the socket intended to push the pin over to one side so that it engages the opposite socket wall. Such arrangements add the complexities and extra parts of the auxiliary spring, which is an element that is subject to damage, particularly from test probes that are inserted into the socket from time to time. The force exerted by the spring as the contact pin enters also leads to excessive wear. In the arrangement of FIGURES 4 and 5, the retainer clip is constructed to exert a lateral force on the contact, pushing it to one side so that the pin and socket will be forced into engagement that provides a desirable low-resistance electrical connection. This avoids the complications and shortcomings of the extra springs conventionally employed for this purpose.

As illustrated in FIGURE 4, the electrical connector device comprises a terminal junction 45 although the same principles apply to a multiple pin-and-socket or other type of electrical connector. The terminal junction 45 includes a block 46 of rigid dielectric material beneath which is a bus bar 47. A sealing gasket 48 is beneath the bus bar below which is a plate 49 of insulating material. The bus bar 47 may be of any desired size to interconnect various numbers of electrically conductive elements. A bore 50 within the block 46 has an enlarger annular section 51 that extends downwardly to the upper end of the bus bar 47 and connects to an opening 52 of similar size in the bus bar. A radial shoulder 53 interconnects the opening 52 with a smaller end opening 54 in the bus bar 47.

The retainer clip 55 fits within the enlarged annular section 51 of the bore generally the same way as the clip 26 was received in the annular recess 37 in the connector of the previously described embodiment. The retainer clip 55 is of cylindrical form having a longitudinal slot 56 extending from one end to the other. A single tab 57 is bent inwardly from the cylindrical wall 58 of the retainer clip 55. The tab 57 is inclined in the lateral direction and arcuate so as to curve inwardly. The forward end of the tab 57 is notched so as to present two radially extending edge surfaces. The forwardmost edge surface 59 is adjacent the longitudinally extending line of connection between the tab 57 and the wall 58. At the end of the edge 59 is a short longitudinal edge portion 60 beyond which is an additional forward radial edge 61. The rearward edge 62 of the tab 57 is inclined forwardly and meets the forward edge portion 61 at the distal end of the tab.

The clip 55 fits within the enlarged annular portion 51 by first being compressed and introduced through the bore 50 so that it can spring outwardly. The clip 55 then is retained between the shoulder 53 at the bus bar 47 and the other shoulder 63 at the rearward end of the annular enlarged portion 51. The retainer clip 55 is in this manner held within the terminal junction.

With the clip 55 installed, the contact 64, which has been crimped or otherwise attached to a wire 65, is inserted from the rear of the clip. As the contact 64 enters, its enlarged annular portion 66 reacts against the edge 62 of the tab 57, deflecting the tab 57 outwardly so that the annular enlargement 66 can move into the section 51 of the opening. Ultimately, the forward shoulder 67 of the annular enlargement 66 of the contact is brought into engagement with the radial shoulder 53 in the bus bar 47, thereby holding the contact 64 against movement in a forward direction. When the contact 64 assumes this position, the edge 61 of the tab 57 is free to snap inwardly behind the rearward shoulder 68 of the enlarged annular section 66 of the contact. Therefore, the contact is retained between the edge 61 of the tab and the shoulder 53 of the bus bar 47. As before, therefore, the contact is securely held as the tab 57 absorbs in shear loads which would tend to dislodge the contact 64 from the opening in the terminal junction.

When the edge 61 of the tab 57 moves behind the shoulder 68 on the contact, the longitudinal edge 60 of the tab remains in engagement with the circumferential surface of the annular enlargement 66 of the contact. This means that the tab 57 provides a laterally directed force against the contact 64 where the edge 60 of the tab bears against the element 66. This sideward force moves the contact 64 laterally so as to bring the periphery of the pin section 69, forwardly of the annular element 66, into firm engagement with the opposite wall of the opening 54 in the bus bar 47. Therefore, the retainer clip not only holds the contact against axial movement but it also produces the lateral force to effect an electrical connection with the mating portion of the connecting device. As a result, the clip 55 serves a dual function. The need for an extra spring element in the socket to assure the contact between the mating electrical parts is obviated and the unit becomes of maximum simplicity and minimum cost. Any wear effected by the rubbing of the contact where the spring force is imposed upon it is exteriorily of the parts where the electrical circuit is effected, so that any wear produced is unimportant. In other words, wear occurring because of the engagement of the tab edge 60 and the periphery of the section 66 of the contact does not effect the electrical circuit that is completed where the pin 69 engages the opening 54 in the bus bar. This arrangement, therefore, is not only simpler than conventional designs but also is more satisfactory.

The retainer clip 71, as shown in FIGURES 6, 7 and 8, also serves both to retain the contact and to impart a side load on it. Again, the clip 71 is of sheet metal, given a substantially cylindrical shape with a slot 72 in the circumferential wall 73. A forward tab 74 is bent spirally and laterally inwardly from the wall 73, and behind it is a rearward tab 75. The tab 74 is of triangular shape, having a forward edge 76 and an inclined rearward edge 77 that intersects with the forward edge at the distal end 78 of the tab. The rearward tab 75 is of similar configuration, but slightly larger, having a radial forward edge 79 that meets the rearward edge 80 of the tab at the distal end 81.

The clip 71 is compressed to extend through the opening 83 in the insulating element 84 and extend outwardly into the annular portion 85 to be held between shoulders 86 and 87. The contact 88 is pushed inwardly from the rear through the opening 83, whereupon its annular enlargement 89 will engage first the edge 80 of the rearward tab 75 and then the edge 77 of the forward tab 74. The tabs are cammed outwardly by the movement of the contact inwardly, allowing the contact to engage the shoulder 86 at the forward end of the bore that receives it, which limits the forward movement of the contact. The projecting pin portion 90 of the contact then enters the socket opening 91 in the electrically conductive member 92.

As the contact moves within the unit to the position shown in FIGURE 7, the tab 75 is free to snap inwardly in back of the rearward shoulder 93 of the annular enlargement 89 of the contact. Therefore, the forward edge 79 of the tab 75 cooperates with the shoulder 86 to retain the contact 88 against axial movement.

The other tab 74 remains in engagement with the circumferential periphery of the annular enlargement 89. Consequently, the distal end 78 of the forward tab 74 produces a lateral force biasing the contact to one side. Therefore, the projecting pin portion 90 of the contact is brought into firm electrically conductive relationship with the wall of the socket opening 91.

The distal end 81 of the rearward tab 75 engages the tubular section 94 of the contact close to the point where the distal end 78 of the forward tab 74 bears against the annular part 89 of the contact. In other words, both tabs engage the same side of the contact 88. This means that

the tab **75**, which serves to retain the contact axially, assists in producing a lateral force component on the contact to urge the pin element **90** into contact with the wall of the socket opening. In this design, therefore, both tabs work together to effect the important lateral biasing of the contact so that the electrical circuit is completed. With the tabs **74** and **75** extending laterally in opposite directions, it is possible to retain the strength of the spring clip even though the tab ends operate near each other on the surface of the contact in effecting the sideward force.

In the arrangement of FIGURES 9 and 10, the retainer clip is constructed with its forward and rearward edges parallel, rather than convergent as in the previously described arrangements. With this construction, preferably a modified form of contact is used to permit the tabs to be pried outwardly as the contact is inserted into the clip. The retainer clip **95** of this embodiment includes a central cylindrical portion **96** and a forward frustoconical inwardly tapering section **97**. At the rearward end of the clip is a radially outwardly directed flange **98**. The latter element is adapted to fit within an annular groove **99** in the insulating block **100** for holding the clip **95** axially within the electrical connector. A longitudinal slot **101** runs the length of the retainer clip **95**, permitting it to be contracted in diameter so that it can pass through the bore **102** in the insulating block **100** to where the flange **98** can be allowed to spring outwardly into the groove **99**.

The retainer clip **95** includes a pair of laterally inwardly bent spring tabs **104** having parallel forward and rearward edges **105** and **106**, respectively. The edge **105** is adapted to fit behind the radial shoulder **107** on the contact **108**, thereby holding the contact within the retainer clip. The shoulder **107** is at the rearward end of a frustoconical section **109** of the contact, which bears against the forward frustoconical portion **97** of the retainer clip **95**. Thus, while the edges **105** of the tabs **104** prevent rearward movement of the contact **108**, the forward section **97** of the retainer clip prevents the contact from moving in the forward direction. This retains the contact **108** axially within the clip **95**.

When the contact **108** enters the retainer clip **95**, the frustoconical portion **109** of the contact is brought into engagement with the rearward edges **106** of the tabs **104**. This pries the tabs **104** outwardly, permitting the continued forward movement of the contact **108** until it has reached the position where the tabs **104** can spring inwardly back of the shoulder **107**. As before, therefore, the contact is inserted by merely pushing it inwardly from the rear. As in the previously described arrangements, the contact is held securely, with the spring tabs absorbing forces in shear so that high loads can be withstood. The rectangular platform of the tabs resulting from the parallel front and rear edges **105** and **106** means that the tabs are particularly strong in this construction.

For release of the retainer clip **95**, if a tubular releasing tool is utilized, the forward edge should have an inwardly tapered configuration in order to fit between the rearward edge of the tabs **104** and the surface of the contact in order to bias the tabs outwardly. Otherwise, a different type of tool may be used to bend the two tabs outwardly from their position behind the shoulder **107**. Thus, the release of the tabs **104** is not as easily effected as for the tabs with the inclined rearward edge as in the previously described arrangements. In addition, the outwardly projecting flange **98** does not hold the retainer clip in the bore of the insulating block with quite the strength as where the ends of the clip abut radial shoulders formed in the block, although for normal use the flange **98** is more than adequate.

The foregoing detailed description is to be clearly understood as given by way of illustration and example only, the spirit and scope of this invention being limited solely by the appended claims.

I claim:

1. An electrical connector unit comprising

a body having a forward end and a rearward end, said body having a bore extending from said rearward end toward said forward end,

an electrical terminal in said bore, said electrical terminal including an abutment surface facing said rearward end,

a retaining device for holding said electrical terminal against axial movement,

means for axially positioning said retaining device in said bore, said retaining device including a member in said bore outwardly of said electrical terminal in a spaced relationship therewith,

and resilient tab means extending laterally inwardly from said member,

the inner surface of said tab means throughout substantially its entire area being substantially parallel to the longitudinal axis of said bore, said tab means having an abutment adjacent and in opposition to said abutment surface of said electrical terminal for preventing movement of said electrical terminal toward said rearward end,

and means for preventing movement of said electrical terminal toward said forward end.

2. A device as recited in charm **1** in which said electrical terminal is laterally spaced from said body in said bore, said electrical terminal includes a projecting portion for engaging a mating electrical terminal, and in which said tab means includes a portion engaging the periphery of said electrical terminal for imparting a lateral resultant force to said electrical terminal to cause said electrical terminal to make a good electrical connection with a mating electrically conductive device.

3. An electrical connector unit comprising

a body having a forward end and a rearward end, said body having a bore extending from said rearward end toward said forward end,

an electrical contact member in said bore, said contact member including an annular shoulder facing said rearward end,

a retaining device for holding said contact member in said bore, said retaining device including an annular member in said bore around said contact member in a spaced relationship therewith,

and at least one resilient tab connected to and extending laterally inwardly from said annual member, the inner surface of said tab means throughout substantially its entire area being substantially parallel to the longitudinal axis of said bore,

said tab having a first edge portion adjacent said forward end, said first edge portion being adjacent said shoulder of said contact member for preventing movement of said contact member toward said rearward end,

said tab having a second edge portion adjacent said rearward end, said second edge portion extending from a point adjacent the connection of said tab to said annular member to a point remote therefrom for facilitating outward bending of said tab from said rearward end,

and means for preventing movement of said contact member toward said forward end.

4. A device as recited in claim **3** in which said electrical contact member is spaced from said body in said bore, said electrical contact member includes a projecting portion for engaging a mating electrical contact member, and including in addition resilient means integral with said annual member engaging said contact member forwardly of said shoulder for imparting a lateral resultant force on said contact member and causing said contact member to make a good electrical connection with a mating electrically conductive member.

5. An electrical connector unit comprising

a body having a forward end and a rearward end, said body having a bore extending from said rearward end toward said forward end, said bore having an annular enlargement providing

a first shoulder adjacent said forward end, and a second shoulder adjacent said rearward end,

an electrical contact in said bore,

a retaining device for said contact, said retaining device including a tabular member in said annular enlargement of said bore with its ends adjacent said first and second shoulders, whereby said first and second shoulders axially position said tubular member, said tubular member circumscribing said contact in a spaced relationship therewith,

said contact having a portion defining a first shoulder adjacent said forward end and a second shoulder adjacent said rearward end, said first shoulder of said contact being adjacent and opposed to said first shoulder of said body for preventing movement of said contact toward said forward, end

said retaining device further including at least one resilient tab connected to said tubular member along a longitudinally extending line of connection and extending laterally inwardly, the inner surface of said tab means throughout substantially its entire area being substantially parallel to the longitudinal axis of said bore from said line of connection to said contact, said tab having a first edge adjacent said forward end and a second edge adjacent said rearward end, said first edge including a surface substantially radial with respect to said tubular member and adjacent and opposed to said second shoulder of said contact for preventing movement of said contact toward said rearward end, said second edge of said tab including portions extending from said line of contact toward said first edge for facilitating outward bending of said tab from said rearward end of said bore.

6. A device as recited in claim **5** in which there is a pair of said resilient tabs for preventing rearward movement of said contact toward said rearward end, said tabs being in substantially diametrically opposed relationship.

7. A device as recited in claim **5** in which for each of said tabs said first and second edges thereof and said line of connection provide said tab with a substantially triangular configuration.

8. A device as recited in claim **5** in which said contact is spaced from said body in said bore, said contact including a projecting portion for engaging a mating contact and including in addition a second tab,

said second tab having an inner end engaging the periphery of said contact intermediate said shoulders of said contact,

the first-mentioned of said tabs having an inner end engaging the periphery of said contact adjacent said second shoulder of said contact and rearwardly thereof, said ends of said tabs engaging said contact on the same side of said contact, whereby said tabs cooperate to impart a lateral resultant force to said contact.

9. A device as recited in claim **8** in which said second tab extends laterally from said tubular member in the opposite direction in which said first-mentioned tab extends from said tubular member.

10. An electrical connector device comprising

a supporting member having a forward end and a rearward end, and having a bore therein extending from the rearward end of said member toward the forward end thereof,

an electrical terminal in said bore, said terminal having a forward end, a rearward end and an intermediate enlarged portion defining a forward shoulder and a rearward shoulder, said bore having an inwardly extending shoulder engaged by said forward shoulder of said terminal for preventing movement of said terminal in the forward direction,

and a retainer clip in said bore, said retainer clip and supporting member having cooperative means for preventing axial movement of said retainer clip relative to said supporting member, said retainer clip including a tubular member circumscribing said electrical terminal, said tubular member having a longitudinally extending slot for permitting contraction in the lateral dimension of said tubular member said tubular member having a circumferential wall spaced radially outwardly of said electrical terminal, said retainer clip having at least one integral resilient tab extending inwardly from said circumferential wall,

said tab being inclined laterally relative to said circumferential wall from a substantially longitudinally extending line of connection with said circumferential wall, said tab including a substantiall radially directed forward edge in interfering relationship with said rearward shoulder of said electrical terminal for thereby preventing movement of said electrical terminal in the rearward direction,

said tab having a rearward edge extending forwardly from said line of connection with said circumferential wall at a position spaced from said forward edge to converge toward said forward edge for thereby facilitating outward bending of said tab for installation and removal of said electrical terminal.

11. A device as recited in claim **10** in which

said tab includes an additional portion extending forwardly of said forward edge portion,

said additional portion bearing against the periphery of said enlarged portion of said terminal forwardly of said forward shoulder for thereby imparting a lateral resultant force on said terminal for holding said forward end of said electrical terminal in engagement with a mating electrically conductive member.

12. A device as recited in claim **10** including in addition

a second resilient tab extending inwardly from said circumferential wall,

said second tab being bent inward laterally from a substantially longitudinally extending line of connection with said circumferential wall and extending in the opposite direction from the first-mentioned tab so that the distal ends of said tabs are adjacent,

said second tab having inner portions engaging said enlarged portion of said electrical terminal intermediate said shoulders thereof for impairing a laterally directed force on said electrical terminal for causing said forward end of said terminal to make electrical connection with an adjacent electrically conductive member,

said second tab having a rearward edge inclined forwardly from the location of said line of connection to said circumferential wall.

References Cited

UNITED STATES PATENTS

3,112,149	11/1963	Bachman	339—217
3,158,424	11/1964	Bowen	339—217
3,227,993	1/1966	Bentley	339—217
3,229,244	1/1966	Bachman	339—217
3,246,281	4/1966	Cunningham	339—217

MARVIN A. CHAMPION, *Primary Examiner.*

R. S. STROBEL, *Assistant Examiner.*

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,366,921 January 30, 1968

Perrin C. Culver

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 9, for "wards" read -- words --; line 30, for "these" read -- the --; column 3, line 62, for "coverge" read -- converge --; column 6, line 24, for "exteriorily" read -- exteriorly --; line 28, for "effect" read -- affect --; column 8, line 65, for "annual" read -- annular --; column 9, line 5, for "tabular" read -- tubular --; line 16, for "forward, end" read -- forward end, --; line 59, after "direction" insert -- from the direction --; column 10, line 10, for "member" read -- member, --; line 19, for "substantiall" read -- substantially --; line 51, for "impairing" read -- imparting --.

Signed and sealed this 22nd day of April 1969.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents