Nov. 18, 1969 F. B. STARK ET AL 3,479,635

ELECTRICAL CONNECTORS

Filed Feb. 23, 1968

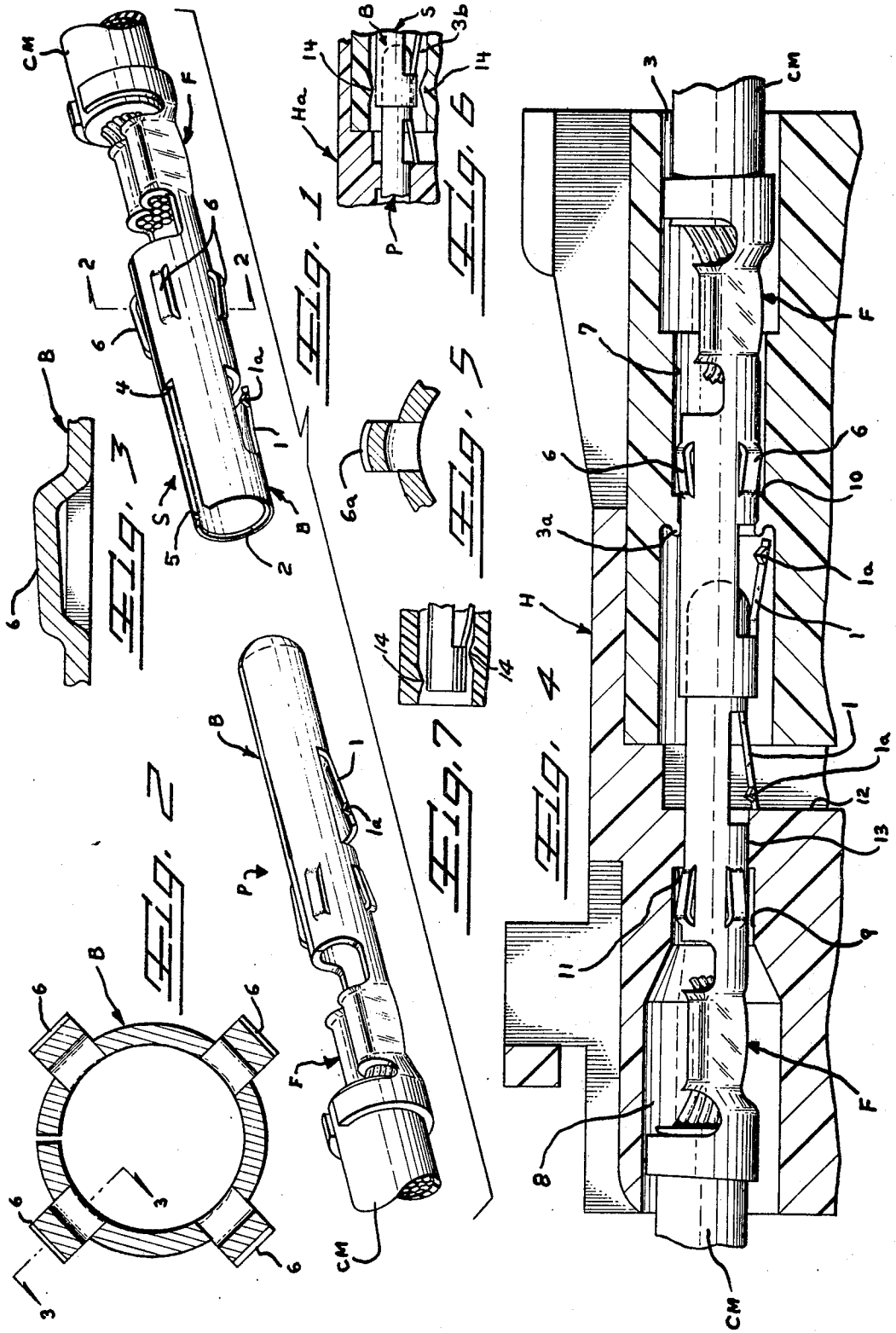


FIG. 1

FIG. 6

FIG. 3

FIG. 5

FIG. 7

FIG. 2

FIG. 4

United States Patent Office 3,479,635 Patented Nov. 18, 1969

3,479,635

ELECTRICAL CONNECTORS

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Continuation-in-part of application Ser. No. 654,752, July 20, 1967. This application Feb. 23, 1968, Ser. No. 707,572

Int. Cl. H01r 13/04

U.S. Cl. 339—64 6 Claims

ABSTRACT OF THE DISCLOSURE

An electrical connector comprises a dielectric housing having a passageway therethrough, an electrical terminal disposed therein, the electrical terminal including a body portion and a connecting section; the connecting section connected to a conductor member, means on the body portion and in the passageway to prevent the terminal from moving out of the passageway in one direction, and projection means extending outwardly from the body portion and along the body portion in the same direction as an insertion axis of the electrical terminal, the projection means engaging the means in the passageway thereby preventing the terminal from moving out of the passageway in a direction opposite to the one direction and to stabilize the terminal in the passageway. Protrusion means are also disposed along the passageway adjacent the body portion of the terminal to prevent the terminal from being cocked to one side of the insertion axis.

Cross reference to related application

This application is a continuation-in-part application of Ser. No. 654,752, filed July 20, 1967.

This invention relates to electrical connectors and more particularly to pin and socket terminals thereof.

Pin and socket terminals are well known in the electrical field and have been used to provide electrical connections for numerous electrical equipment, appliances, computers, systems, etc. These terminals are generally mounted in mating housing members which provide proper alignment between the corresponding pins and sockets, protection therefor and insulation thereof.

It has been found that when the housing members containing the pins and sockets are mated, the pins do not readily engage the respective sockets due to misalignment caused by manufacturing tolerances in the electrical terminals as well as the housing members, changes of temperature, other environmental conditions and manufacturing design of the connector elements.

It has further been found that the terminals disclosed in U.S. Patent 3,311,866 have been inserted into the passageways of the parts of the housing members with difficulty because the stop means and stabilizing means of the terminals impede the insertion of the connectors in a properly seated position in the passageways as well as damaging the passageways. The reason this occurs is that the stop means and the stabilizing means comprise arcuate projections that are stamped out of the bodies of the terminals and most of these projections extend outwardly from the bodies in a direction normal with respect to the insertion axes of the passageways so that the edges of these projections readily dig into the walls of the passageways during insertion of the terminals thereinto as well as damaging the passageways. The digging into the passageways detracts from the stabilizing feature because the passageways are made uneven as a result of the damage caused by the digging. Moreover, these projections are separate from each other thereby compounding the problems.

It is, therefore, an object of the present invention to

provide electrical terminals of the pin and socket variety each of which have the same outside diameter along its body portion.

Another object of the present invention is to provide stabilizing means on each terminal to stabilize them within the passageways of their respective housing members.

An additional object of the present invention is the provision of a pin and socket terminal assembly which is easy to manufacture and is devoid of complexity.

A further object of the invention is to provide combined stop and stabilizing means on the terminals which does not damage the walls of the passageways.

Still a further object of the invention is the provision of protrusion means along a passageway of a housing in which the terminal is to be disposed, the protrusion means maintaining the terminal in position to facilitate mateable engagement with a complementary terminal.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there is shown and described an illustrative embodiment of the invention; it is to be understood, however, that this embodiment is not intended to be exhaustive nor limiting of the invention but is given for purposes of illustration and principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

In the drawings:

FIGURE 1 is a perspective exploded view of the terminals;

FIGURE 2 is a view taken along lines 2—2 of FIGURE 1;

FIGURE 3 is a view taken along lines 3—3 of FIGURE 2;

FIGURE 4 is a partially sectioned view showing the pin and socket terminals in mated relationship in passageways of their respective housing members which are also in mated relationship;

FIGURE 5 is partial cross-sectional view of an embodiment of the terminal;

FIGURE 6 is a partial cross-sectional view of an embodiment of the housing; and

FIGURE 7 is a view similar to FIGURE 6 of a further embodiment of the housing.

Turning now to the drawings, there is shown a pin terminal P and a socket terminal S. Each terminal is provided with a ferrule portion F in which the conductor portion of a conductor means CM is secured by cold-forging or crimping techniques disclosed in U.S. Patent No. 2,600,012. Ferrule portion F also may include a section to engage the insulation of the conductor means. Of course, the conductor means may be secured to the connector elements in any other well-known manner.

The terminals are preferably formed by shaping a sheet metal blank or strip of suitable, electrically-conductive material, such as brass, bronze or other alloy, the metal being sufficiently hard and resilient in order to provide excellent spring quality thereto as well as being malleable to permit the cold-forging or crimping techniques mentioned above.

Each terminal includes a body portion B which has the same outside diameter therealong and includes a spring latch means 1 such as disclosed in U.S. Patent 3,292,137. Spring latch means 1 includes projections 1*a* to prevent the spring latch means from being bent back within the body portions. While the outside diameter of pin terminal P is the same along its body portion, it is slightly larger than the inside diameter of socket terminal S so that a proper frictional fit therebetween is effected to provide excellent mechanical and electrical connection

in addition to minimum of insertion and extraction forces.

Entrance **2** of body portion B of socket terminal S is slightly inclined on the inner surface to facilitate entry within a passageway **3** of one part of housing H such as disclosed in U.S. Patent No. 3,179,738 and entry of pin terminal P thereinto, respectively.

At the top of body portion B of socket terminal S, the ends of the body portion at **4** are almost in engagement and these ends taper slightly away from each other in a direction toward ferrule portion F. This provides a C-shaped type spring action concentrated at this location.

Extending forward of location **4**, the ends of body portion B are spaced with respect to each other in a substantially parallel manner to define a gap **5** which extends the rest of the length of the body portion. The front section of the body portion, at which the spring latch means begins, also defines a C-shaped type spring action. Gap **5** in the body portion facilitates the insertion of the pin terminal within the socket element due to the fact that less surface area of the socket terminal engages the pin terminal. Gap **5** also lends excellent resiliency to the body portion since the ends are far enough apart to allow sufficient play therebetween. The inner end of gap **5** terminates slightly forward of the free end of the spring latch means and over half the length of the body portion.

As can be discerned, the spring latch means does not provide continuity between the two C-shaped type spring areas; therefore, at location **4** there is provided a forked type spring which abets the forward C-shaped type spring.

The body portions of the terminals include projections **6** which are spaced rearwardly from spring latch means **1** and which are equidistantly spaced around body portions B.

Projections **6** project outwardly from and along body portions B in the same direction as the insertion or longitudinal axes of the terminals and they are tapered with the highest point of the taper occurring at the ends closest to the ferrule portions. Projections **6** project outwardly from body portions B at their highest points a distance which is slightly less than the diameter of sections **7** and **9** of passageways **3** and **8** to permit the terminals to be readily inserted therewithin.

When the socket terminal is disposed within passageway **3** of housing H, spring latch means **1** engages the edge or is disposed under annular lip **3***a* and the leading ends of projections **6** engage annular shoulder **10** of section **7** of passageway **3**. The use of annular lip **3***a* is disclosed in U.S. Patent 3,319,912. Spring latch means **1** and projections **6** serve to lock the socket element within passageway **3** of the housing.

With respect to pin terminal P, the leading ends of projections **6** engage an annular shoulder **11** of section **9** in another part of housing H to limit the inner movement of the pin terminal within passageway **8** while spring latch means **1** engages surface **12** and prevents the pin terminal from being removed from the housing without depressing the spring latch means. An annular lip similar to annular lip **3***a* may be provided in surface **12** surrounding an entrance to passageway **8** for engagement by the spring latch means.

Depending upon tolerances, the leading edges of the projections may extend a little distance into the areas forward of shoulders **10** and **11**.

Projections **6** also define stabilizing means to stabilize the pin and socket terminals in their respective passageways. In the case of the socket terminal, the trailing ends of projections **6** in conjunction with section **7** of passageway **3** and the engagement of annular lip **3***a* with body portion B permit limited freedom of movement of the socket terminal in passageway **3** so that it will properly align itself for engagement with pin terminal P. With respect to the pin terminal, the trailing ends of projections **6** in conjunction with section **9** of passageway **8** and the snug engagement of section **13** of passageway **8** with the body portion of the pin terminal stabilizes the pin terminal in position in the passageway.

As can be discerned, projections **6** define a combination of stop means and stabilizing means with each projection performing the dual function of stopping and stabilizing. Since projections **6** extend along the body portions of the terminals in the same direction as the insertion axes thereof, this permits ease of insertion of the terminals in the passageways of the housing with a minimum of effort as well as the preclusion of any damage thereto.

Projections **6***a*, as illustrated in FIGURE 5, may be formed so as to have an arcuate configuration in cross section to obviate sharp edges that could dig into the walls of the passageways during rotation of the terminals therewithin.

FIGURE 6 illustrates housing H*a* which is an embodiment of the invention. Passageway **3***b* of the one part of housing H*a* is provided with protrusions **14** which are spaced equidistantly around the passageway. The addition of protrusions or projections **14** along passageway **3***b* maintains the body B of socket terminal S in proper alignment relative to the insertion axis thereof to facilitate the mateable engagement between socket terminal S and pin terminal P and limit sidewise movement of the body of the terminal.

Absence of protrusions **14** would permit the body of socket terminal S to become cocked against the wall of passageway **3***b*, especially when a force in a direction away from the longitudinal axis of the terminal is being exerted on the conductor member connected to the terminal. Such a condition creates an intolerable situation since mateable engagement between the terminals becomes difficult, especially when there are a number of terminals to be mated because excessive misalignment between only one pair of terminals makes it difficult to effect engagement between the other pairs of terminals even if the latter are propery aligned.

Thus, protrusions **14** assure proper alignment of the body of socket terminal S so that facile engagement between terminals S and P is effected. The relationship between protrusions **14** and terminal S is such that sufficient floatability of terminal S is provided to allow for inherent tolerances that do and will occur. If terminal P is to be positioned in a passageway in the manner of terminal S, similar protrusions may be provided in the passageway to maintain the terminal in proper alignment. Of course, sufficient spacing between the protrusions and the terminal will have to be provided for clearance between the terminal and its engagement with socket terminal S. Protrusions for the terminal P would be preferably located close to the insertion entrance.

The combination of projections **6** on the terminals and protrusions **14** along the passageways provides unique and novel stabilization of the terminals in the passageways for effective and facile engagement between the pairs of terminals when the parts of the housing are brought into engagement; however, it is to be understood that sufficient floating is provided so that the terminals can still have limited movement to compensate for any tolerance problems.

The protrusions may be in the same plane normal to the axis of the housing or they may be axially staggered, as illustrated in FIGURE 7, which would increase the stability since the protrusions would engage the terminal at axially spaced locations instead of at the same location.

It should also be pointed out that since the outside diameter of each body portion of the pin and socket terminals are the same therealong, this provides better coaxial relationship with the passageways of the parts of the housing in which the terminals are disposed and decreases the complexity of the parts during manufacture thereof since no parts on the body portions with different diameters are needed.

As can be discerned, there has been disclosed novel pin and socket terminals which are easy to manufacture, easy to insert within passageways of housings and are readily engaged to provide an excellent mechanical and electrical connection.

It will, therefore, be appreciated that the aforementioned and other desirable objects have been achieved; however, it should be emphasized that the particular embodiment of the invention, which is shown and described herein, is intended as merely illustrative and not as restrictive of the invention.

The invention is claimed in accordance with the following:

1. An electrical connector, the combination comprising a dielectric housing and an electrical terminal; said terminal having a conductor-engaging section for connection to a conductor means and a body section provided with forward stop means and rear stop means; said dielectric housing provided with a passageway in which said terminal is disposed, said passageway including a forward stopping surface cooperating with said forward stop means thereby limiting movement of said terminal in one direction and a rear stopping surface cooperating with said rear stop means thereby limiting movement of said terminal in another direction opposite to the one direction; and projection means extending outwardly from said passageway adjacent a front entrance to said passageway and spaced from said forward stopping surface, said projection means being slightly spaced from said body section to permit slight floatability thereof and for stabilizing said body section within said passageway, said forward stopping surface being disposed between said rear stopping surface and said projection means.

2. An electrical connector according to claim **1** wherein said projection means are spaced equidistantly around said passageway in the same plane.

3. An electrical connector according to claim **1** wherein said projection means are spaced equidistantly around said passageway and axially spaced with respect to one another.

4. An electrical connector housing for housing therein electrical terminal means having body means and conductor-engaging means, said housing being of dielectric material and having passageway means provided with spaced forward and rear stopping surface means for engagement with respective stop means on the terminal means to maintain the terminal means in position in said passageway means, and projection means extending outwardly from said passageway means adjacent front entrance means of said passageway means and spaced from said forward stopping surface means, said projection means being shaped to be slightly spaced from the body means and to permit slight floatability thereof and for stabilizing the body means within said passageway means to facilitate mateable engagement with complementary terminal means.

5. An electrical connector housing according to claim **4** wherein said projection means are equidistantly spaced around said passageway means and they are in the same plane normal to the axis of said passageway means.

6. An electrical connector housing according to claim **4** wherein said projection means are equidistantly spaced around said passageway means and they are axially spaced relative to one another.

References Cited

UNITED STATES PATENTS

3,040,287	6/1962	Agron et al.	339—217 X
3,184,705	5/1965	Obert et al.	339—217 X
3,187,297	6/1965	Gluntz	339—176 X
3,311,866	3/1967	Williamson	339—217
3,368,185	2/1968	Dell et al.	339—217

FOREIGN PATENTS

927,954	6/1963	Great Britain.

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