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E. C. QUACKENBUSH

2,779,008

ELECTRICAL CONNECTOR HAVING RESILIENT INSERT

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FIG. 1

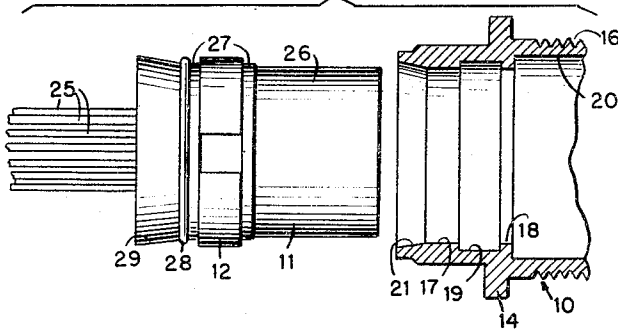


FIG. 2

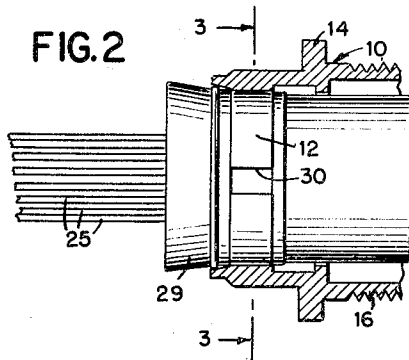


FIG. 3

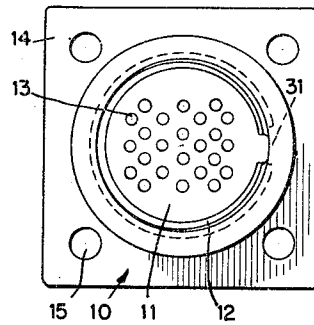


FIG. 4

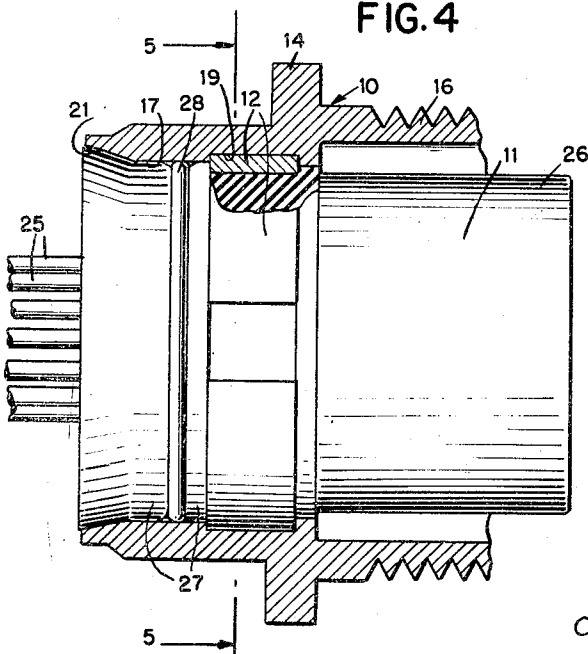
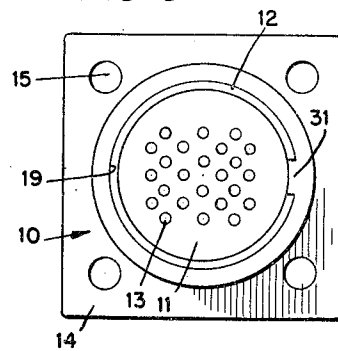


FIG. 5



INVENTOR.

Edward Clarke Quackenbush

BY

Adams, Forward & McLean
ATTORNEYS

1

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ELECTRICAL CONNECTOR HAVING RESILIENT INSERT

Edward Clarke Quackenbush, Hamden, Conn., assignor to Whitney Blake Company, New Haven, Conn., a corporation of Connecticut

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5 Claims. (Cl. 339—59)

My invention relates to the construction of electrical connectors of the axially mating type in which the contacts are embedded in a resilient insert, are exposed at one end of the insert for axial-mating with correspondingly disposed contacts of a complementary connector and are connected to external electrical leads at the opposite end of the insert, and in which the resilient insert is retained within an open-ended rigid shell. More particularly, my invention provides an electrical connector construction having a new and improved manner of retention of the resilient insert within the rigid shell which, while it readily permits insertion of the resilient insert within the shell, assures positive locking of lengthwise position of shell and insert at the proper point and at the same time assures a tight, moisture-proof seal between the resilient insert and its retaining shell.

These and other objects of my invention are essentially obtained by embedding a slotted band of hard material in the resilient insert in such a manner that a portion of the band projects from the surface of the insert. Preferably, the band is bonded to the insert during molding the resilient insert, as is shown in my copending applications Serial No. 413,387 (now abandoned) and Serial No. 458,314, filed March 1, 1954 and September 27, 1954, respectively. A groove is machined or otherwise cut about the inner surface of the rigid shell in a position registering with the projecting portion of the slotted band when the insert is in proper lengthwise position within the retaining shell. Thus the slotted band can be compressed inwardly against the resilient insert and inserted into one end of the shell up to the position in which the band registers with the groove, whereupon the band expands into the groove to lock the insert in position lengthwise within the shell. In general, one complete broad cut through the band will be sufficient to accomplish these purposes. In some instances, particularly with large connectors, it may be preferable to provide several cuts through the band to permit it to compress more readily.

In order to secure the angular position of the insert within the shell, where their engaging surfaces are essentially cylindrical, I have found it convenient to provide a lug or key in the groove in the rigid shell corresponding to each slot in the band, thus utilizing the band's expansion into the groove to secure not only lengthwise position but angular position of the insert within the shell. I have also found it desirable to taper the end of the shell into which the insert is passed sufficiently such that the mere act of passing the insert endwise into the shell through such tapered end accomplishes the necessary compression of the band. Where such a taper is utilized, a similarly disposed taper at the end of the resilient insert which is slightly longer than the taper in the shell assists in obtaining a snug, water-tight fit between insert and shell. Additionally, a bead extending about the resilient shell in the portion of its outer surface between the tapered end and the slotted band can be used to increase the pressure exerted outwardly by the insert against the inner surface of the shell and thus provide additional assistance

2

in obtaining a moisture-proof contact between insert and shell.

For a more complete understanding of the principles of my invention and their practical application to the construction of an electrical connector of the type described, reference is made to the appended drawings in which:

Figure 1 is a partially sectioned view of an electrical connector constructed in accordance with my invention showing insert and shell disassembled;

Figure 2 is a view similar to that shown in Figure 1 but in which the insert has been partially passed into the shell;

Figure 3 is a cross-section taken at line 3—3 in Figure 2;

Figure 4 is a view similar to that shown in Figures 1 and 2 on a somewhat enlarged scale and in which the insert is fully positioned within the shell; and

Figure 5 is a cross-section taken at line 5—5 in Figure 4 and shown in the same scale as Figures 1—3.

Referring to the drawings, the reference numeral 10 indicates a retaining shell for an electrical connector constructed in accordance with my invention. Shell 10 houses a resilient insert 11 which is locked in position in shell 10 by slotted band 12 and which carries embedded contact members 13.

Shell 10 is constructed of aluminum in the illustrated example, although it may be constructed of any suitable rigid material, and is substantially cylindrical in shape, being also provided with a centrally disposed outwardly extending square flange 14 of conventional construction having corner bores 15 for securing the shell to a partition, terminal box or the like. At one end of shell 10 its exterior surface is provided with threads 16 for engagement with the coupling ring of a complementary axially mating connector (not shown). The end of shell 10 carrying threads 16 has an interior cylindrical surface of substantially greater diameter than insert 11 to receive in the annular space between it and insert 11 the cylindrical shell extension of the mating end of the complementary connector with which the connector shown in the drawings is designed to mate. This mating end construction forms no part of my invention and may be suitably varied to meet particular specifications.

The internal surface of shell 10 includes a central cylindrical portion comprising a pair of coaxial, cylindrical surfaces 17 and 18 of substantially the same diameter divided by a coaxially positioned cylindrical surface 19 of a greater diameter, such that surface 19 defines a groove medially positioned within the cylindrical interior of shell 10. The non-mating end of shell 10 is provided with a tapered portion 21 which at its inner end is adjacent to cylindrical surface 17 and extends outwardly to a greater diameter at the end of shell 10 remote from threads 16, such greater diameter being approximately the diameter of cylindrical surface (groove) 19.

Insert 11 is formed of molded rubber in the illustrated case, although suitably it may be formed of any resilient material conventionally utilized in such construction, and is substantially cylindrical in shape. Internally insert 11 carries embedded bar contact members 13 which extend lengthwise through insert 11, each being exposed at one end of insert 11 in the conventional manner for axial-mating with complementary contact members of a mating connector. At their ends remote from their mating ends, each contact member 13 is connected to an electrical conductor 25 which extends externally from insert 11. In the illustrated case the contact members and conductors are preassembled and insert 11 is molded about them in accordance with the process described in my aforementioned applications S. N. 413,387 and 458,314. The construction of my present invention, however, is also applicable

to any conventional manner of assembling contact members within the resilient insert and of connecting the external leads to the contact members.

The exterior cylindrical surface 26 at the mating end of insert 11 is constructed with a diameter sufficiently small to permit it to clear internal cylindrical surfaces 17 and 18 in shell 10. Cylindrical portion 26 lies entirely beneath the threaded, mating end portion of shell 10 as shown most clearly in Figure 4.

The medial portion 27 of the outer surface of resilient insert 11 is also cylindrical and has substantially the same diameter as cylindrical surfaces 17 and 18 of shell 10. Medial cylindrical surface 27 is terminated toward the non-mating end of insert 11 by an integral bead 28 which projects outwardly and extends about the outer surface of insert 11. The outer surface portion 29 of insert 11 at the non-mating end thereof is tapered outwardly to a diameter substantially equal to the internal diameter at the tapered end of shell 10. The tapered portion 29 is longer, however, than the tapered portion 21 of shell 10 such that when insert 11 is positioned within shell 10 with their non-mating ends substantially flush, as shown in Figure 4, cylindrical portion 17 of shell 10 where it merges into tapered portion 21 of shell 10 bites tightly into tapered portion 29. At the same time bead 28 is compressed tightly within cylindrical portion 17.

Brass band 12, which is slotted transversely at 30, is disposed medially about cylindrical surface 27 of insert 11 such that with the non-mating ends of insert 11 and shell 10 substantially flush, as shown in Figure 4, band 12 coincides with and falls in groove 19. Referring particularly to Figure 4, it will be seen that band 12 is not only bonded to insert 11, for example, by molding insert 11 together with band 12, as described in my copending applications S. N. 413,387 and S. N. 458,314, but band 12 is embedded into insert 11 as well as projecting outwardly therefrom.

Cylindrical surface (groove) 19 suitably is provided with a key 31 extending lengthwise in shell 10 and transversely across groove 19 (see Figures 3 and 5). Key 31 is so positioned that when band 12 is positioned within groove 19, the slotted portion 30 of band 12 coincides with key 31 to prevent rotation of band 12 and consequently of insert 11 within shell 10.

As shown in Figure 1, the connector of my invention is assembled by positioning insert 11 with its mating end facing the tapered, non-mating end of shell 10. Insert 11 is then passed into shell 10 with cylindrical surface 26 extending into the opening at tapered portion 21 of shell 10. As band 12 strikes tapered portion 21, it is compressed radially against resilient insert 11 to permit band 12 to slide past cylindrical surface 17 of shell 10 (see Figures 2 and 3). Slotted portion 30 is angularly disposed to coincide with key 31 such that as band 12 passes cylindrical portion 17 and registers with groove 19 of shell 10, it snaps open freely into groove 19 with key 31 fitting in slotted portion 30 (see Figures 4 and 5). Insert 11 is thus locked in both lengthwise and angular position within shell 10 and cannot be removed.

Thereafter, of course, the connector may be assembled with a corresponding complementary connector in the conventional manner.

While I have described my invention with reference to a particular female connector, it will be apparent the advantages of my invention are obtained in the construction of male connectors, and it will be further apparent that the advantages of my invention will also be obtained with connectors of many different designs to meet many specific applications.

This application is a continuation-in-part of my copending applications Serial No. 413,387 (now aban-

doned) and Serial No. 458,314, filed March 1, 1954, and September 27, 1954, respectively.

I claim:

1. In an electrical connector which comprises an open-ended rigid shell, a resilient body disposed within said shell and a contact member embedded lengthwise in said resilient body exposed at one end for axial-mating contact with a correspondingly disposed contact member of a complementary connector, the improvement which comprises a groove medially positioned about the inner surface of said shell, a band embedded in said resilient body projecting out from the surface thereof into said groove whereby said resilient body is locked in lengthwise position within said rigid shell, said band being slotted transversely to permit it to be compressed inwardly to pass said resilient body lengthwise into said rigid shell from one end to a position at which said band registers with said groove whereupon said band expands into said groove an outward taper defined at one end of said rigid shell on the inner surface thereof to produce compression of said band as said resilient body is passed into said rigid shell at said tapered end thereof, and an outwardly tapered portion on the outer surface of said resilient body disposed similarly to said taper in the inner end surface of said rigid shell.

2. In an electrical connector, the improvement according to claim 1 which further comprises a circumferential outwardly extending bead disposed about the outer surface of said resilient body between said band and the tapered end of said body.

3. An electrical connector which comprises an open-ended rigid shell, the interior surface of said shell defining a pair of substantially cylindrical surfaces divided by a medial, coaxially positioned, cylindrical surface of greater diameter than either of said pair of surfaces and an end portion adjacent to one of said pair of cylindrical surfaces tapered to a greater diameter at its outer end than the diameter of said adjacent cylindrical surface, a resilient body having a substantially cylindrical outer surface and having a contact member embedded lengthwise therein exposed at one end for axial-mating contact with a correspondingly disposed contact member of a complementary connector, the diameter of said cylindrical body being approximately equal to the diameter of the pair of cylindrical interior surfaces of said shell, said outer surface of said resilient body being tapered to a greater diameter at the end of said body remote from the exposed ends of said contact members, and a band embedded in said resilient body projecting outwardly therefrom in such a position that the outer cylindrical surface of said body from the tapered end thereof to said band is complementary in size and shape to said tapered end portion, said pair of cylindrical portions and said medial portion of the inner surface of said shell, said band being slotted at least once transversely, and said resilient body being disposed within said shell with said band resting in said medial cylindrical portion and said tapered end of said resilient body tightly compressed within the tapered end of said shell.

4. An electrical connector according to claim 3 which further comprises a circumferential outwardly extending bead disposed about the outer surface of said resilient body between said band and the tapered end of said body.

5. An electrical connector according to claim 3 which further comprises a key disposed in said medial cylindrical portion and received by the slotted portion of said band.

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