MULTICONNECTOR CONNECTOR HAVING
IMPROVED INSERT
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5 1 Claim

ABSTRACT OF THE DISCLOSURE
Multicontact electrical connector part, which is en-

gageable with a complimentary connector part, has a
shell member and an insert in the shell. The insert is axially
movable, to a limited extent, in the shell and is resiliently
biased in the direction of the mating face of the insert.

When the connector part is mated with the complimentary
part, and the mating face of the two connector parts are
pressed against each other, the insert is moved rear-
wardly with concomitant partial compression of the spring
so that the spring functions to bias the insert against
the insert of the mating connector part.

BACKGROUND OF THE INVENTION

A conventional type of multicontact electrical connect-
or comprises a shell member, which is usually of metal,
and an insert of an insulating material in the shell. Con-
tact cavities extend through the insert from the rear-
ward face thereof to the mating face and electrical con-
tact terminals are mounted in the cavities. When a con-
necting part of this type is mated with a complimentary
connector part, the contact terminals in the two

5 connector parts are engaged with each other thereby
to complete the circuits of the wires connected to the con-

nect terminals.

High quality connectors of the type described above,
particularly those intended for use in aircraft or under
other critical circumstances, are usually of the sealed

10 type in which the individual contact terminals in both
connector parts are sealed from the atmosphere. Such
sealing requires that sealing means of some sort be pro-

vided for each of the contact cavities in the inserts at
both ends of the cavity. The rearward ends of the cav-

ities are often sealed by providing constrictions in the

cavities which bear against the wires extending to the

15 terminals mounted in the cavities and prevent the en-
trance of corrosive gases or the like into the cavities.

The forward ends of the cavities, which open into the
mating faces of the inserts, are usually sealed by ensuring

20 that when the connector parts are mated, the two mating faces
will be pressed firmly against each other so that the
resilient material, of which the mating faces are formed,
will be compressed to provide a seal surrounding each of

25 the cavities.

The present invention is directed to the achievement
of an improved sealed connector. It is an object of the
invention to provide an improved multicontact electrical
connector. A further object is to provide a sealed elec-

30 trical connector having means for maintaining the inter-
face seal of the connector notwithstanding exposure to
adverse environmental conditions. A still further object
is to provide a connector having means for offsetting the
deleterious affects of aging of the insert. A still further
object is to provide a connector having means for com-

35 pensating for the affect of compression set in the insert
material. A further object is to provide a connector hav-

ing means for maintaining substantially complete mat-
ing of the contact terminals in the connector parts when
the parts are engaged with each other and for mainatin-

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ing the parallelism of the contact terminals in the con-

nector parts.

These and other objects of the invention are achieved
in a preferred embodiment thereof comprising a con-

45 nector part having a metallic shell member and an in-
sulating insert in the shell. The mating face of the in-
sert is of a compressible material, such as a silicone
rubber, so that when the connector part is mated with a
complimentary connector part, the mating faces of both
parts will be compressed to provide sealing means in sur-

50 rounding relationship to each of the contact terminals in
the connector parts. The insert is resiliently biased in
the direction of its mating face by means of a spring in-
terposed between a shoulder on the insert and a shoulder
on the shell. The strength of this spring is such that when

55 the part is engaged with a complimentary connector part
the mating face of the insert will be compressed and the
insert will move rearwardly in the shell against the bias-
ing force of the spring. During use of the connector, if
the insert material at the mating face thereof should change

60 its physical properties, as a result of aging or tempera-
ture cycling and thereby lose some of its ability to be
compressed against the mating face of the complimentary
connector part, the stored energy of the spring will con-

65 tinue to urge the mating face against the mating face
of the complimentary part thereby maintaining the inter-
facial seal of the connector.

In the drawing:
FIG. 1 is a perspective view of a connector assembly

70 in accordance with the invention showing the two parts of
the connector disengaged from each other and showing
some of the parts exploded from the connector shells
to reveal their structural details.

FIG. 2 is a sectional side view of a connector assembly
in accordance with the invention showing the positions of
the parts prior to engagement of the connector parts
with each other.

FIG. 3 is a fragmentary view similar to FIG. 2, but on
an enlarged scale, showing the parts engaged with each
other.

Referring first to FIGS. 1 and 2 a connector assembly

75 in accordance with the invention comprises a plug part
2 and a receptacle part 4. The plug comprises an upper
shell section 6 and a lower shell section 8, these shell
sections being integral with each other by means of a
web portion 12 and an integral mounting flange 10.

Shells of this type are usually of metal and may con-

siderably manufactured by conventional die casting
techniques. A plurality of keys 14 are mounted in the
web portion 12 of the plug 2 and are adapted to enter
key receiving openings 14' in the web portion 12' of
the receptacle 4. These keys may be individually oriented

85 in any one of several possible orientations so that the two
parts of a connector assembly can be keyed to each other
in a manner such as to prevent mismating of one con-

nector plug with the receptacle of a different connector
assembly. The copending application of Harry E. Barn-

90 hart et al., Ser. No. 669,759, now U.S. Pat. 3,491,330
discloses and claims a preferred method of mounting the
keying means 14, 14' in the web portions in the connector
shells.

The upper shell section 6 is of generally polygonal
cross-section and has an opening extending therethrough
from its rearward end 16 to its forward end 18 for recep-

95 tion of the insert assembly 38 described below. As viewed
in axial cross-section (FIGS. 2 and 3) this opening ex-
extends inwardly with a uniform cross-section 20 from
the rearward end 16 of the shell and is constricted inter-
mediate its ends by a shoulder 22. Adjoining the shoulder

22 is a relatively short section 24 of uniform cross-section,
another rearwardly facing shoulder 26 at the end of the
uniform cross-section portion 24, a further very short
the connector part 4 so that they are always surrounded and protected in accordance with common practice in the connector art.

In the disclosed embodiment, the receptacle connector part is not provided with springs corresponding to the springs 56 of the plug part although the insert assembly in the receptacle part is structurally identical to the insert assembly 38 of the plug. Spacers 66 are, however, provided between the rearwardly facing shoulder defined by the collar 54 of the receptacle insert and the forwardly facing surface of the clamping plate 64 of the receptacle. These spacers effectively prevent any axial movement of the insert assembly 38 in the receptacle while such axial movement is permitted in the plug.

As previously noted, the forward sections 44, 44', of the insert assemblies 38, 38' of are of a suitable rubber-like material such as a silicone rubber. It will also be noted that the mating face 42 of the insert assembly 38 of the plug projects slightly beyond the forward end 18 of the plug 2 when the parts are disengaged while the mating face 42' of the insert assembly 38' projects slightly beyond the shoulder 36 of the receptacle. When the parts are completely mated, these mating faces are compressed to the extent necessary to provide a sealed interface which moisture cannot readily penetrate and the possibility of flash-over between adjacent contact terminals will be minimized or eliminated. When the parts are mated as shown in FIGURE 3, the compressive stresses generated at the interface cause the insert assembly 38 of the plug to be displaced rightwardly as viewed in FIG. 3, by a slight amount with accompanying compression of the springs 56. By virtue of the compression of these springs, the insert assembly 38 in the plug is resiliently urged at all times toward insert assembly 38' in the receptacle.

A particular advantage of the disclosed embodiment of the invention is that the effects of "Compression Set" of the inserts at the mating face or interface are mitigated and the interfacial seal will not be lost if such compression set takes place. "Compression Set" is generally considered to be the loss of elasticity in a rubber-like material which occurs when the material is subjected to a continuous compressive load and/or to an elevated temperature. The distance of compression set in a given material is commonly determined by providing a disc of material one-inch in diameter and one-half inch thick, clamping this disc between two parallel plates, moving the plates towards each other until they are spaced apart by a distance of three-eighths inches, heating the clamped disc to 150°F., and holding the temperature for 24 hours. The specimen is then unloaded, allowed to cool to room temperature, and its thickness is measured. For most rubber-like materials, it will be found that the test specimen will not return to its original dimensions and will have a thickness somewhat less than the one-half-inch.

It will be apparent from the foregoing that if a connector depends entirely upon compression of the interface material for the interfacial sealing, compression set in the insert material at the interface will reduce the effectiveness of the interfacial seal and possibly cause failure. In accordance with the instant invention however, the effects of compression set in the inserts are counteracted by the compressed springs 56 which partially return to their relaxed positions in the event of compression set of the interface of the mated connector parts. It will be apparent that the hardness or resilience of the interfacial material of the springs 56 must be judiciously selected to achieve both compression of the interfacial material and partial loading of the springs 56 when the connector parts are mated with each other. It has been found from experience that the forward section of the insert assembly can advantageously be made of a silicone rubber having a durometer hardness of about A50 to achieve interfacial sealing of the connector. The characteristics of the springs 56 should then be selected...
to provide for retractive movement of the insert assembly 38 by an amount which is about twice the reduction in the length of the insert when the parts are mated. In other words, if the hardness of the portion 44 of the insert is A50, the characteristics of the springs 56 should be such that when the parts are mated the entire insert assembly will move rightwardly as viewed in FIGS. 2 and 3 against the biasing force of the springs by a distance which is twice the reduction in the length of the insert.

In the disclosed embodiment, the springs 56 are provided only in the plug portion of the connector assembly and are replaced by the spacer 66 in the receptacle which effectively prevents any axial movement of the inserts in that member. If desired, springs can be provided in the receptacle insert. It has been found, however, that springs need be provided in only one part of the connector to maintain the interfacial seal under all ordinary conditions.

The insert mounted in the lower shell portion 8 in FIG. 1 differs from the insert 38 in the upper shell portion in that the lower insert is provided with only two cavities 50a having coaxial contact terminals 52a mounted therein. The rearward section 48a of this insert assembly also may be of metal rather than of insulating material since the outer conductors of a coaxial contact terminal are usually grounded to the shell member. The instant invention has an added advantage for coaxial connectors in that the float or relative movement of the insert provided by the springs 56 function to maintain substantially complete engagement of the contact terminals of the plug with the terminals in the receptacle and further to maintain parallelism of the terminals in the plug with those in the receptacle. In the case of coaxial contact terminals, such complete engagement of the terminals is particularly important in order to maintain the electrical characteristics of the terminals when they are engaged with each other.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only.

We claim:

1. In an electrical connector assembly comprising a pair of mateable connector parts, each part comprising an insert and a shell in surrounding relationship to said insert, said insert having a plurality of contact terminals therein and having a mating face and a rearward face, said mating faces of said inserts being in abutting relationship, and the contact terminals being engaged, when said parts are mated, the improvement to said connector assembly comprising:
a radially extending projection on said insert of one of said parts intermediate the ends thereof, said projection defining forwardly and rearwardly facing insert shoulder means.

forwardly and rearwardly facing shell shoulder means in said shell, said forwardly facing shell shoulder means being proximate to the rearward end of said shell and rearwardly facing shell shoulder means being intermediate the ends of said shell, said projection being between said shell shoulders, and resilient means in surrounding relationship to said insert of said one part and interposed between said forwardly facing shell shoulder means and said rearwardly facing insert shoulder means and biasing said forwardly facing insert shoulder means against said rearwardly facing shell shoulder means, said mating face of said insert projecting beyond said leading end of said shell when said forwardly facing insert shoulder means is against said rearwardly facing shell shoulder means whereby upon mating said parts, said insert means of both parts are moved against each other, and said insert means in said one part is moved relatively rearwardly in its shell with concomitant compression of said spring whereby said spring exerts a continuing force on said insert means in said one part urging said insert means in said one part towards said insert means in said other part.

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