Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).
Description

[0001] This invention relates to coaxial connectors and in particular providing electrostatic discharge protection to those coaxial.

[0002] There are various communication devices, such as hand-held cellular phones that incorporate electrical connectors along their outer surfaces. These electrical connectors enable the device to be connected to peripheral support devices, such as battery chargers, data communication devices for example, modems and antennas, such as would be incorporated into a cradle in an automobile. While these connectors enable the communication device to be even more useful, they do present some problems. For example, as the communication devices may be carried around with a user, it is possible that the user builds up a static charge. These connectors represent a path into the electronics of the communication device by which it is possible for the static charge on the user, or elsewhere, to enter into the device and damage the electronics. While it is typical for these devices to incorporate electrostatic discharge protection circuitry within the electronics, it is also desirable to incorporate this in the connector in an electro-mechanical form to further protect the electronics therein.

[0003] A coaxial connector according to the preamble of claim 1 is known from FR-A-2733348. In there a switching coaxial connector for surface mounting is disclosed. The coaxial connector includes a miniature housing holding two horizontal protruding electrically conduction strips which connect directly to a printed circuit board. The strips extend horizontally internal to the housing, and have a flexible make/break area. A spring loaded inner conductor has an insulating protruding section, which forces the spring contacts apart forming the switching action.

[0004] From US-A-5490033 a coaxial connector is known comprising an electrostatic discharge protection member in contact with said fixing surface and located relative said inner contact, such that prior to mating with said complementary connector, said inner contact contacts said discharge protection member in response to a resilient biasing of said electrostatic discharge protection member and upon mating with said complementary connector, said electrostatic discharge protection member is displaced such that its contact with said inner contact is interrupted.

[0005] One example of an electrical connector incorporating electrostatic discharge protection is disclosed in WO/96/13926. This is an input/output data style communication connector that would be part of a cradle wherein a hand-held cellular phone is seated. In the disclosed connector, a plurality of contacts having a central resilient spring section are biased against a shorting bar prior to connection with the mating connector. The shorting bar creates a path the ground which prevents any static charge from passing through the exposed contacts of the connector and reaching the circuitry of the base station. Upon mating with the complementary connector, the contacts are pressed away from the shorting bar. The aforesaid provides adequate protection for input/output style connectors. However, there are other connectors incorporated into devices of this type.

[0006] One such connector is a coaxial switching connector, as disclosed in WO/98/31078. While cellular phones typically comprise their own antennas, when they are mounted in a cradle in an automobile, the cellular phone connects to an auxiliary antenna that is part of the automobile. As these connectors also provide an entrance pathway into the electronics of the connector, it would be desirable to provide electrostatic discharge protection therein also.

[0007] It is desired for the electrostatic discharge protection to be provided in a simple and inexpensive manner, as high qualities of these connectors will be used and it is desirable not to increase the price of these products. Furthermore, while it is known to incorporate electrostatic discharge protection in coaxial connectors, it is more difficult to accommodate both electrostatic discharge protection and a functional switching feature, such as may be required in these cellular applications.

[0008] The aforesaid objects are accomplished by providing a coaxial connector for mating with a complementary connector with the features of claim 1. Described is a coaxial connector comprising: an insulative housing having a passageway therethrough and a mounting surface outward therefrom, where the passageway defines a longitudinal axis that corresponds generally to the mating direction of the connectors; an inner contact that is positioned in the passageway and is resiliently biased by a spring member, the inner contact being moveable along the longitudinal axis, the inner contact having a mating end extending outward of the passageway and a connecting end opposite thereto with a shoulder therebetween; an outer contact mounted to the housing upon the mounting surface to be generally concentric to the inner contact, the outer contact having a grounding contact for connection to a ground and a coupling end for mating with the complementary connector, the coupling end including a fixing surface therealong; and, an electrostatic discharge protection member in contact with the fixing surface and located relative the inner contact such that prior to mating with the complementary connector, the shoulder contacts the electrostatic discharge protection member in response to the resilient biasing of the inner contact and upon mating with the supplementary connector, the inner contact is displaced such that the shoulder is moved out of contact with the electrostatic discharge protection member.

[0009] It is an advantage of this invention that electrostatic discharge protection is provided in a simple manner.

[0010] It is yet another advantage of this invention, that by forming the coupling end of the outer contact as a guide cup, the electrostatic discharge protection member may be formed in a disc-like shape with an inner opening
therethrough for inner contact access, and then be press-fit within the coupling end.

[0011] It is yet another advantage of this invention that as the inner contact is displaceable within the passageway, by incorporating a switching contact in line with the connecting end of the inner contact, a switching function may be achieved.

[0012] An example of the invention will now be described with reference to the following drawings wherein:

Figure 1 is a side view of an electrical connector according to the present invention;
Figure 2 is a top view of the electrical connector of figure 1;
Figure 3 is a bottom view of the electrical connector according to figure 1;
Figure 4 is a partially cutaway side view of the electrical connector of figure 1;
Figure 5 is a partially cutaway side view corresponding to figure 4 showing mating with a complementary connector.

[0013] With reference first to figure 1, a coaxial connector according to the present invention is shown generally at 2. In this exemplatory embodiment, the coaxial connector 2 includes a first coaxial connector 4 and a second coaxial connector 6. The first coaxial connector 4, is adapted to the connected with a complementary connector 8 (figure 5) that would be included in a cradle or other type of docking device (not shown). The second coaxial connector 6 could be used for an antenna that would be normally affixed to the device. As will be described below, the antenna that is normally connected to the second connector 6 will need to be disconnected by way of a switching mechanism when the complementary connector 8 of the docking device is connected therewith. In this embodiment, while the connector 2 incorporates both the first coaxial connector 4 and the second coaxial connector 6, both of which will be described below, it is not necessary to incorporate the second connector 6.

[0014] The connector 2 includes an insulative housing 10 that forms part of each of the first and second coaxial connectors 4, 6. The first connector 4 includes an outer contact 12 with a cup-like lead-in section 14 for receiving the complementary connector 8 and a grounding contact 16 for connection to a ground. Additionally, the connector 2 includes a signal contact 18. The second coaxial connector 6 includes a conductive outer shell 20 and dome-shaped inner contact 22. The conductive outer shell 20 includes a grounding tab 24.

[0015] With reference now to figure 2, the first coaxial connector 4 includes an inner contact 26 disposed within the outer contact 12. An electrostatic discharge protection member 28 is seated within the cup-like portion 14 of the outer contact 12. The electrostatic discharge protection member 28 is advantageously formed as disc having an outer surface 20 which is press-fit into the outer contact 12 to be in contact with a fixing surface 32 thereof. The electrostatic discharge protection member 28 further includes an inner hole 34 through which the inner contact 26 extends. Furthermore, the inner contact 26 includes a shoulder 36 which extends beneath the electrostatic discharge protection member 28 beyond the bounding of the inner hole 34 such that the shoulder 36 is in contact with the electrostatic discharge protection member 28, as will be described in more detail below.

[0016] With respect to figure 3, the insulating housing 12, at the first coaxial connector 4, includes a passageway 38 wherein the inner contact 26 is disposed. The first coaxial connector 4 further includes a resiliently biased switching contact 40, which will be described in greater detail below, having the signal contact 18 of the coaxial connector 2. The switching contact 40 also includes a contacting end 42 that is normally resiliently biased against tang 44 of a second switching contact 46 that is associated with the second connector 6. The second switching contact 46 also includes a resiliently biased tab 48 that is normally set against a bottom 50 of the inner contact 22.

[0017] With respect now to figure 4, the electrical connector 2 is shown such that the functions thereof may be more clearly described. As mentioned above, the electrical connector 2 includes a switching function that utilises a first switching contact 40 and a second switching contact 46 such that the connection to the second coaxial connector 6 is normally coupled to the signal contact 18 of the connector 2. This is accomplished by having a resilient tab 48 of the second switching contact normally engaged with the bottom 50 of the inner contact 22 of the second coaxial connector 6 and the resilient tab 42 of the first switching contact 40, which incorporates the signal contact 18, normally engaged with the tang 44 of the second switching contact 46. As can be seen, this completes the circuit between the second connector 6 and the signal contact 18. It is important to note, that while this connector 2 envisions a second coaxial connector 6, the switching function may also result in coupling to internal antenna circuitry or other structure which would not be connected to an external device.

[0018] The electrostatic protection feature is incorporated into the first coaxial connector 4. The insulative housing 10 includes a passageway 52 that defines a longitudinal axis 54 which corresponds generally to the mating direction, shown as Arrow A in figure 5. The inner contact 26 is disposed within the passageway 52 such that a mating end 56 extends outward from an upper surface 58 of the electrostatic discharge protection member. The inner contact further includes a flange 60 having a shoulder 36 thereupon, it is normally biased by a resilient spring member 62 against a bottom surface 64 of the electrostatic discharge protection member. In this case, the resilient member 62 is a coil spring that is located within the passageway 52. It would also be possible to utilise the first switching contact 40 to bias the inner contact 26. The inner contact 26 further includes a connecting end 64. In this embodiment, the resilient member
62 biases the inner contact 26 away from the switching contact 40 so that there is gap 66 therebetween. However, the electrostatic discharge protection member is still needed because for a static charge may jump the gap 66. The outer conductor 12 is mounted upon a mounting surface 68 of the insulative housing 10 so that it is generally concentric with the inner contact 26 in a manner that is well known within the coaxial arts.

[0020] Therefore, advantageously, a coaxial connector provided with electrostatic discharge protection in a simple and effective manner. Furthermore, this electrostatic discharge protection feature may be easily incorporated in a switching coaxial connector.

Claims

1. A coaxial connector (2) for mating with a complementary connector (8), the coaxial connector (2) comprising:

   - an insulative housing (10) having a passageway (38) therethrough and a mounting surface outward therefrom, where the passageway defines a longitudinal axis that corresponds generally to the mating direction of the connectors;
   - an inner contact (26) that is positioned in the passageway and is resiliently biased by a spring member (62), the inner contact being moveable along the longitudinal axis, the inner contact having a mating end (56) extending outward of the passageway and a connecting end (64) opposite thereto with a shoulder (36) therebetween;
   - an outer contact (12) mounted to the housing upon the mounting surface to be generally concentric to the inner contact, the outer contact having a grounding contact for connection to a ground and a coupling end (14) for mating with the complementary connector, the coupling end including a fixing surface (32) therealong;

characterized in that an electrostatic discharge protection member (28) is in contact with the fixing surface and located relative the inner contact such that prior to mating with the complementary connector, the shoulder contacts the electrostatic discharge protection member and that in response to the resilient biasing of the inner contact and upon mating with the complementary connector, the inner contact is displaced such that the shoulder is moved out of contact with the electrostatic discharge protection member.

2. The coaxial connector of claim 1 wherein the electrostatic discharge protection member (28) is a disc having an outer surface (20) that is engaged with the fixing surface (32) of the outer contact (12), the disc having an inner opening (34) through which the inner contact is assessable by the mating connector.

3. The coaxial connector of claim 1 or 2, wherein the disc is press-fit into the outer contact (12) and in engagement with the fixing surface (32).

4. The coaxial connector of any one of the preceding claims, wherein the inner contact (26) includes a spring (62) located in the passageway (38) of the housing (10) to resiliently bias the contact.

5. The coaxial connector of any one of the preceding claims, wherein the connector further includes a first switching contact (40) having a resilient end (42) to engage a mating tang (44) of second switching contact (46) and a signal contact (18), where the inner contact as a result of mating with the complementary connector, deflects the first switching contact out of engagement with the second switching contacts.

6. The coaxial connector of claim 5, wherein the coaxial connector includes a second coaxial connector (6) and the second switching contact (46) is connected to an inner contact (22) thereof.

Patentansprüche

1. Koaxialer Verbinder (2) zum Einstecken in einen komplementären Verbinder (8), umfassend:

   ein isolierendes Gehäuse (10) mit einem durch diesses verlaufenden Durchgang (38) und einer
Koaxialer Verbinder nach einem der vorhergehen-
den Ansprüche, wobei der innere Kontakt (26), der im Durchgang positioniert ist und elastisch durch ein Federelemen-
t voorgespannt ist, der inncher Kontakt entlang der Längsachse verschieblich ist, wobei der innere Kontakt ein aus sich aus dem Durchgang heraus erstreckendes Einsteckende und in diesem gegenübergeliegt werden und daher in der Befestigungsfläche (32) aufweist; einen am Gehäuse auf der Aufbaufläche befe-stigten äußeren Kontakt (12), der allgemein kon-
zentratisch zum inneren Kontakt ist, welcher äußere Kontakt einen Erdungskontakt zum An-

Schluss an Masse und ein Kopplungsende (14) zum Einstecken in den komplementären Verbin-
der aufweist, wobei das Konkluvende eine Befestigungsschicht (32) auf diesem aufweist; dadurch gekennzeichnet, dass ein Schutzele-
ment (28) gegen elektrostatische Entladungen in Kontakt mit der Befestigungsschicht steht und relativ zum inneren Kontakt positioniert ist, darart, dass vor dem Einstecken in den komplementären Verbin-
die Schulter das Schutzelement gegen elektrostati-
sche Entladungen kontaktiert, und dass in Reaction auf die elastische Vorspannung des inneren Kon-
taks und nach Einstecken in den komplementären Verbin-
der der innere Kontakt derart verschoben wird, dass der Kontakt der Schulter mit dem Schut-
selement gegen elektrostatische Entladungen un-
terbrochen wird.

2. Koaxialer Verbinder nach Anspruch 1, wobei das Schutzelement (28) gegen elektrostatische Entla-
dungen eine Scheibe mit einer Außenfläche (20) ist, die in Eingriff in die Befestigungsschicht (32) des äu-
ßeren Kontakts (12) steht, und die Scheibe eine in-
nere Öffnung (34) aufweist, durch welche der innere Kontakt zugänglich für den Einsteckverbinder ist.

3. Koaxialer Verbinder nach Anspruch 1 oder 2, wobei die Scheibe in den äußeren Kontakt (12) eingepresst
und in Eingriff in die Befestigungsschicht (32) ge-
bracht wird.

4. Koaxialer Verbinder nach einem der vorhergehen-
den Ansprüche, wobei der innere Kontakt (26) eine Feder (62) beinhaltet, die im Durchgang (38) des Gehäuses (10) positioniert ist, um den Kontakt elas-
tisch vorzuspannen.

5. Koaxialer Verbinder nach einem der vorhergehen-
den Ansprüche, wobei der Verbinder ferner einen ersten Schaltkontakt (40) mit einem elastischen En-
dadurch seinen Eingriff in den zweiten Schaltkon-
takt unterbricht.

6. Koaxialer Verbinder nach Anspruch 5, wobei der ko-
axiale Verbinder einen zweiten koaxialen Verbinder
(6) beinhaltet und der zweite Schaltkontakt (46) an
den inneren Kontakt (22) desselben angeschlossen ist.

Revendications
1. Connecteur coaxial (2) pour une conjugaison avec
un connecteur complémentaire (8), le connecteur coaxial (2) comprenant:
un boîtier isolant (10) qui comporte un passage
(38) le traversant et une surface de montage vers son extérieur, où le passage définit un axe
longitudinal qui correspond de façon générale à la direction de conjugaison des connecteurs;
un contact interne (26) qui est positionné dans le passage et qui est poussé de façon élastique par un élément de ressort (62), le contact interne pouvant être déplacé suivant l’axe longitudinal, le contact interne comportant une extrémité de
conjugaison (56) s’étendant vers l’extérieur du passage et une extrémité de connexion (64) qui lui est opposée, un épauleau (36) étant situé entre;
un contact externe (12) monté sur le boîtier sur la surface de montage de manière à ce qu’il soit généralement concentrique au contact interne, le contact externe comportant un contact de mi-
se à la masse pour une connexion à une masse et une extrémité de couplage (14) pour une con-
jugaison avec le connecteur complémentaire, l’extrémité de couplage incluant une surface de
fixation (32) le long d’elle-même,
caractérisé en ce qu’un élément de protection con-
tre une décharge électrostatique (28) est en contact avec la surface de fixation et est localisé par rapport au contact interne de telle sorte qu’avant une con-
jugaison avec le connecteur complémentaire, l’épauleau entre en contact avec l’élément de pro-	ection contre une décharge électrostatique et de tel-
le sorte que, en réponse à la poussée élastique du contact interne et suite à la conjugaison avec le con-
necteur complémentaire, le contact interne soit dé-
placé de telle sorte que l’épauleau soit amené hors de contact avec l’élément de protection contre une décharge électrostatique.
2. Connecteur coaxial selon la revendication 1, dans lequel l’élément de protection contre une décharge électrostatique (28) est un disque qui comporte une surface externe (20) qui est engagée avec la surface de fixation (32) du contact externe (12), le disque comportant une ouverture interne (34) au travers de laquelle le contact interne peut être évalué par le connecteur de conjugaison.

3. Connecteur coaxial selon la revendication 1 ou 2, dans lequel le disque est ajusté par pression dans le contact externe (12) et est en engagement avec la surface de fixation (32).

4. Connecteur coaxial selon l’une quelconque des revendications précédentes, dans lequel le contact interne (26) inclut un ressort (62) localisé dans le passage (38) du boîtier (10) afin de pousser de manière élastique le contact.

5. Connecteur coaxial selon l’une quelconque des revendications précédentes, dans lequel le connecteur inclut en outre un premier contact de commutation (40) comportant une extrémité élastique (42) pour engager un fourreau de conjugaison (44) d’un second contact de commutation (46) et un contact de signal (18) où le contact interne, en tant que résultat de la conjugaison avec le connecteur complémentaire, dévie le premier contact de commutation hors d’engagement avec le second contact de commutation.

6. Connecteur coaxial selon la revendication 5, dans lequel le connecteur coaxial inclut un second connecteur coaxial (6) et le second contact de commutation (46) est connecté à son contact interne (22).
REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 5490033 A [0004]
- WO 9613926 A [0005]
- WO 9831078 A [0006]