

**COAXIAL PLUG-IN CONNECTOR COMPRISING A CONTACT MECHANISM
FOR ELECTRICAL CONTACT**

Description

The present invention relates to a coaxial connector, in particular an RF cable micro-connector, for the insertion of a complementary coaxial connector, a switching mechanism having an electrical contact being so arranged and formed in the coaxial connector that the electrical contact is closed when there is not a complementary coaxial connector inserted in the coaxial connector, and the electrical contact is open when there is a complementary coaxial connector inserted in the coaxial connector, as detailed in the preamble to claim 1.

Coaxial connectors containing switches or a switching mechanism are used for example in mobile telephones for switching automatically from an internal aerial belonging to the mobile telephone to an external aerial which is connected to the coaxial connector by means of a coaxial cable, and conversely for switching back from the external aerial to the internal aerial when the coaxial cable which connects up the external aerial is withdrawn from the coaxial connector.

Known from DE 698 05 991 T2 is a coaxial switching connector which has an electrically conductive coaxial centre conductor which extends from a rear part to a front part. Also included in the device is a second coaxial centre conductor. The rear part of the first centre conductor includes an electrically conductive movable part which can be moved between a first position and a second position. The movable part is arranged to be in electrical contact with the second centre conductor and to be electrically isolated from the front part of the first centre conductor when it (the movable part) is in the first position. The movable part is arranged to be in electrical

contact with the front part and to be electrically isolated from the second centre conductor when it (the movable part) is in the second position. An actuator moves the movable part from the first position to the second position when a
5 coaxial cable is fitted to the front part of the first centre conductor.

Known from EO 0 993 080 A2 is a coaxial connector which is fitted with a switch. An insulating body of the coaxial connector is divided into two halves and contains a
10 pair of switching elements of which one is arranged in each of the halves of the insulating body. When the two halves of the insulating body are assembled into a single unit, the two switching elements come into contact with each other. The switching elements, in the form of halves of a
15 sprung fork, are arranged perpendicularly in the coaxial connector, the fork being forced apart by a centre conductor of a male connector which is inserted in the coaxial connector and the electrical contact between the switching elements thus being broken. However, this
20 switching arrangement has the disadvantage that, to allow the requisite resilient travel to be obtained, its structure is very long.

Known from DE 697 05 129 T2 is a coaxial switched connecting arrangement into which a mating coaxial male
25 connector can be inserted and in which the switching contacts are arranged perpendicularly to a coaxial longitudinal axis, one of the contacts being deflected with elastic resilience by a pin-like centre conductor of the mating male connector which is inserted in the switched
30 connecting arrangement, by which means the electrical contact is opened. However, this arrangement has the disadvantage that the position of the pin-like centre conductor of the mating male connector and the switching

spring have to be very precisely matched to one another if the spring is not to be damaged in the insertion process. This system thus becomes expensive and complicated with regard to manufacture and assembly.

5 The object underlying the invention is to improve a coaxial connector of the above kind in respect of its construction and assembly.

 This object is achieved by a coaxial connector of the above kind having the features characterised in claim 1.
10 Advantageous embodiments of the invention are described in the other claims.

 In a coaxial connector of the above kind, provision is made in accordance with the invention for the switching mechanism to have a cylindrical first conductor part which
15 can be expanded and/or compressed radially with elastic resilience, which first conductor part makes electrical contact with a second conductor part of the switching mechanism, the first conductor part being so arranged and formed that a complementary coaxial connector which is
20 inserted in the coaxial connector expands the first conductor part radially or compresses it radially and thus breaks the electrical contact between the first conductor part and the second conductor part.

 This has the advantage that the switching mechanism is
25 a structure requiring very little space and can be manufactured and assembled easily and inexpensively.

 Advantageous coaxial guidance for the complementary coaxial connector when being inserted in the coaxial connector is obtained by arranging the first conductor part
30 coaxially in the coaxial connector.

 In a preferred embodiment, a contact tongue is so arranged and formed on the first conductor part that, when there is not a complementary coaxial connector inserted in

the coaxial connector, the contact tongue makes electrical contact with the second conductor part of the switching mechanism and, when there is a complementary coaxial connector inserted in the coaxial connector, the electrical
5 contact between the first and second conductor parts is broken due to the radial expansion or compression of the first conductor part by the complementary coaxial connector.

In a preferred refinement of the invention, the first
10 conductor part is a sheet of resilient material which is formed into a roll, the coaxial connector being so formed that it holds the first conductor part in the rolled state in opposition to an elastic resilient force from the latter, thus causing the contact tongue of the first
15 conductor part to make contact with the contact area of the second conductor part when there is not a complementary coaxial connector inserted in the coaxial connector.

A reduction in the insertion forces is achieved by forming the first conductor part to be funnel shaped.

20 The first conductor part is usefully slit in the axial direction.

The invention will be explained in detail in what follows by reference to the drawings. In the drawings:

Fig. 1 is a perspective view showing a preferred
25 embodiment of coaxial connector according to the invention.

Fig. 2 is a perspective, partly broken-away, view of the coaxial connector shown in Fig. 1.

Fig. 3 is a plan view (from the insertion end) of the coaxial connector shown in Fig. 1.

30 Fig. 4 is a view from below (from side on which the printed-circuit board is situated) of the coaxial connector shown in Fig. 1.

Fig. 5 shows the coaxial connector shown in Fig. 1 in section on line B-B in Fig. 4, and

Fig. 6 shows the coaxial connector shown in Fig. 1 in section on line C-C in Fig. 5.

5 The preferred embodiment of coaxial connector according to the invention which can be seen in Figs. 1 to 6 comprises an outer-conductor part 10, an insulating part 12 in the form of a dielectric, and a centre-conductor part 14. The centre-conductor part 14 takes the form of a sheet
10 of resilient material which is held in a roll in the insulating part 12 in opposition to a self-restoring spring action. In other words, the centre-conductor part 14 takes the form of a slit, cylindrical sheet of resilient material which is arranged coaxially in the coaxial connector. The
15 centre-conductor part 14 is, in addition, formed to be funnel-shaped, i.e. to taper-in conically from an insertion end 16 of the coaxial connector, as can be seen in particular in Fig. 5.

The rolled centre-conductor part 14 forms a first
20 conductor element of a switch mechanism, having a contact tongue 18 (Fig. 2) which is arranged on the centre-conductor part 14 on a side of the sheet of resilient material 14 remote from the insertion end 16 of the coaxial connector. It is at this point that the conically tapering
25 centre-conductor part 14 is of the smallest diameter. The contact tongue 18 makes electrical contact with a second conductor part 20 (Fig. 6) of the switching mechanism. The second conductor part 20 is laterally arranged at an end of the coaxial connector remote from the insertion end 16 of
30 the coaxial connector.

In the state shown in Figs. 1 to 6, there is not a complementary coaxial connector, which will also be referred to in what follows as a "complementary male

connector", inserted in the coaxial connector according to the invention. The arrangement and form of the centre-conductor part or first conductor element 14, 18 of the switching mechanism are such that in this state the contact
5 tongue 18 makes electrical contact with the second conductor part. For this purpose, the force which is exerted on the sheet of resilient material 14 by the insulating part 12 to hold the sheet of resilient material 14 in the rolled state acts as a contact-making force for
10 the electrical contact between the contact tongue 18 and the second conductor part 20 of the switching mechanism. In addition, suitable areas are provided on the contact tongue 18 and on the second conductor part 20 of the switching mechanism which act as contact areas for the electrical
15 contact between the contact tongue 18 and the second conductor part 20 of the switching mechanism.

This electrical contact between the contact tongue 18 and the second conductor part 20 is used for example to connect in an internal aerial of a device, such as a mobile
20 telephone for example, which has the coaxial connector according to the invention, when there is not a complementary male connector inserted in the coaxial connector. However, as soon as a complementary male connector is inserted in the coaxial connector, the
25 complementary male connector expands the cylindrical centre conductor 14 radially with its centre conductor, which latter engages in the said cylindrical centre conductor 14, the contact tongue 18 thereby being moved mechanically away from the second conductor element 20 of the switching
30 mechanism. This results in the electrical contact between the contact tongue 18 and the second conductor part 20 of the switching mechanism being broken so that, for example, an aerial which is connected to the complementary male

connector via a coaxial cable is connected to the device. As soon as the complementary male connector is withdrawn again from the coaxial connector according to the invention, the contact tongue 18 moves back to the original
5 state where there was not a complementary male connector inserted, due to an elastic resilient force from the centre-conductor part or sheet of resilient material 14, and restores the electrical contact to the second conductor part 20 of the switching mechanism.

10 Insertion forces are reduced by the conical form of the centre-conductor part 14. Because of the production of the first conductive element 14, 18 in the form of a cylindrical, slit part which is elastically resilient radially, the space required for the switching mechanism as
15 a structure is reduced. The centre-conductor part 14 ensures that a centre-conductor pin of the complementary coaxial connector is guided coaxially until, for example, shortly before a printed-circuit board on which the coaxial connector according to the invention is mounted in
20 electrical contact is reached. The structure according to the invention of the switching mechanism is not sensitive to the depth of insertion of the complementary male connector, which means that less exacting tolerances need to be observed when the individual parts of the coaxial
25 connector according to the invention are being manufactured. This reduces costs and simplifies assembly.

Claims

1. Coaxial connector, in particular an RF cable micro-connector, for the insertion of a complementary coaxial connector, a switching mechanism (14, 18, 20) having an electrical contact being so arranged and formed in the coaxial connector that the electrical contact is closed when there is not a complementary coaxial connector inserted in the coaxial connector, and the electrical contact is open when there is a complementary coaxial connector inserted in the coaxial connector, characterised in that the switching mechanism has a cylindrical first conductor part (14) which can be expanded and/or compressed radially with elastic resilience and which makes electrical contact with a second conductor part (20) of the switching mechanism, the first conductor part (14) being so arranged and formed that a complementary coaxial connector which is inserted in the coaxial connector expands the first conductor part (14) radially or compresses it radially and thus breaks the electrical contact between the first conductor part (14) and the second conductor part (20).

2. Coaxial connector according to claim 1, characterised in that the first conductor part (14) is arranged coaxially in the coaxial connector.

3. Coaxial connector according to claim 1 or 2, characterised in that a contact tongue (18) is so arranged and formed on the first conductor part (14) that, when there is not a complementary coaxial connector inserted in the coaxial connector, the contact tongue (18) makes electrical contact with the second conductor part (20) of the switching mechanism and, when there is a complementary coaxial connector inserted in the coaxial connector, the electrical contact between the first and second conductor

parts (14, 20) is broken due to the radial expansion or compression of the first conductor part (14) by the complementary coaxial connector.

4. Coaxial connector according to at least one of the
5 foregoing claims, characterised in that the first conductor part (14) is a sheet of resilient material which is formed into a roll.

5. Coaxial connector according to claims 3 and 4,
characterised in that the coaxial connector is so formed
10 that it holds the first conductor part (14) in the rolled state in opposition to an elastic resilient force from the latter, thus causing the contact tongue (18) of the first conductor part (14) to make contact with the contact area of the second conductor part (20) when there is not a
15 complementary coaxial connector inserted in the coaxial connector.

6. Coaxial connector according to at least one of the foregoing claims, characterised in that the first conductor part (14) is formed to be funnel shaped.

20 7. Coaxial connector according to at least one of the foregoing claims, characterised in that the first conductor part (14) is slit in the axial direction.

8. Coaxial connector according to at least one of the foregoing claims, characterised in that the first conductor
25 part (14) forms a centre-conductor part (14) of the coaxial connector.