(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 063 500 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
27.05.2009 Bulletin 2009/22

(51) Int Cl.:
H01R 13/646 *(2006.01)* ***H01R 4/62*** *(2006.01)*

(21) Application number: **07291387.4**

(22) Date of filing: **22.11.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

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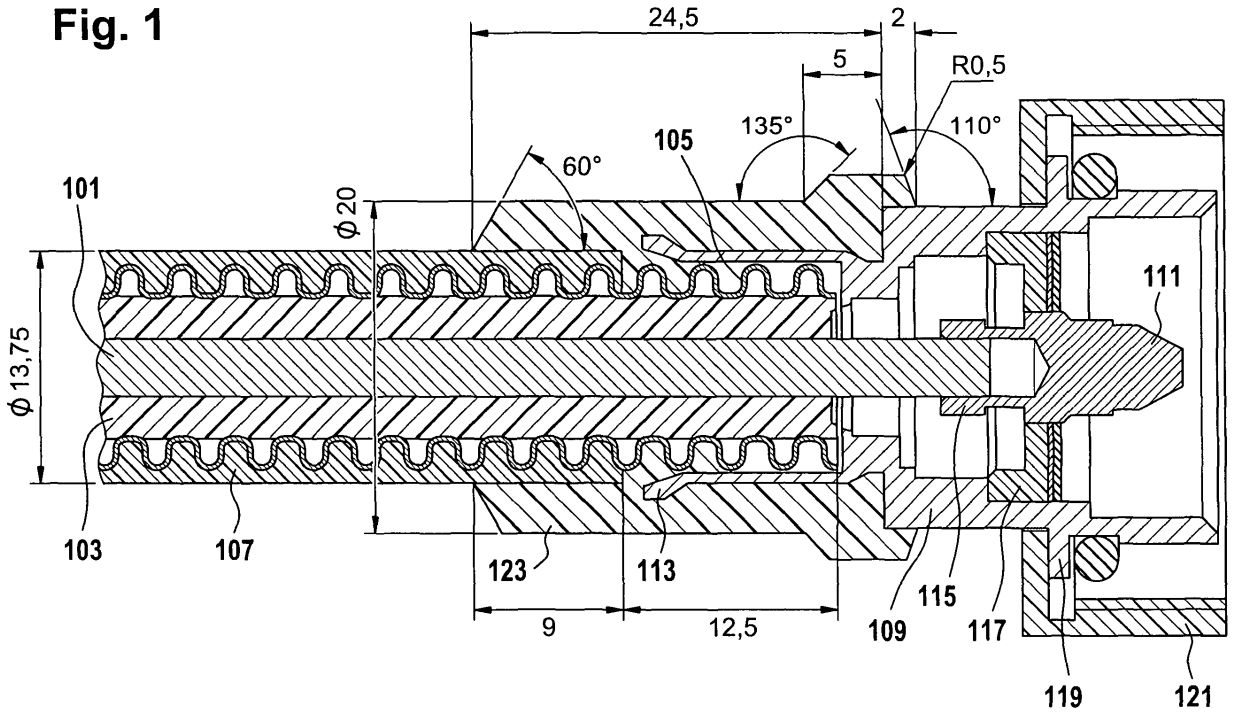
(54) Coaxial cable connector and coaxial cable assembly

(57) The invention relates to a coaxial cable connector for connecting to a coaxial cable, the coaxial cable comprising an inner conductor and an outer conductor. The connector comprises a first connecting element for connecting to the outer conductor, a second connecting element for connecting to the inner conductor, the first connecting element or the second connecting element comprising an alloy of copper, tin and zinc.

Fig. 1



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Description

[0001] The present invention relates to a coaxial cable connector for connecting to a coaxial cable.

[0002] In order to connect e.g. a base station to an antenna or to interconnect electrical devices for high frequency applications, coaxial cables as e.g. described in the US 2004/123999 may be employed. In general, a coaxial cable comprises an inner conductor, an outer conductor and a dielectric material disposed there between. The outer conductor of the coaxial cable may be formed from copper which is, however, expensive and has a high weight. In order to reduce costs and weight, the outer conductor may be formed from aluminum which may further be coated with a thin layer. However, aluminum is difficult to form and to handle. Furthermore, the corrosion resistance of aluminum is less than the corrosion resistance of copper.

[0003] In order to make a coaxial cable connectable to devices, coaxial cable connectors may be employed. A coaxial cable connector may comprise specific connector parts connected to an inner conductor and an outer conductor of a coaxial cable, respectively. However, due to electrochemical voltage between a connector and an outer conductor of the coaxial cable, corrosion may occur. Although the outer conductor may be coated by e.g. a jacket, further corrosion may occur due to possible water ingress between the outer conductor and the jacket. Furthermore, if aluminum is used for the outer conductor, problems of installing the connector may occur due to the softness of aluminum.

[0004] It is the object of the invention to provide a coaxial cable connector or a coaxial cable assembly comprising a coaxial cable connector with improved corrosion resistance.

[0005] This object is achieved by the features of the independent claims.

[0006] The invention is based on the finding that the corrosion resistance may be improved when at least one connecting element of a coaxial cable connector is or comprises an alloy of copper, tin and zinc. Surprisingly, such a connector may be used in particular for connecting to coaxial cables having an outer conductor formed from aluminum since the inventive alloy significantly increases the corrosion resistance. The improvement of corrosion resistance associated with using the inventive alloy of copper, tin and zinc is due to the fact that the electrochemical voltage between e.g. a connector and an outer conductor of a coaxial cable is reduced.

[0007] In order to increase the corrosion resistance of a coaxial cable assembly comprising a coaxial cable and a coaxial cable conductor, the coaxial cable may comprise an inner conductor covered with a dielectric coating, a heat shrink tube disposed around the dielectric coating and an outer conductor made of e.g. aluminum or of the inventive alloy of copper, tin and zinc. Furthermore, at least one connector having e.g. an outer layer for connecting to the outer conductor, the outer layer comprising the alloy of copper, tin and zinc, may be soldered to the outer conductor of the coaxial cable, wherein at least one sealing ring between the outer conductor and the connector may be provided. Furthermore, at least one further sealing ring may be provided between the outer conductor and the heat shrink tube coating the dielectric material and/or the outer conductor. Thus, the combination of the heat shrink tube and the sealing rings along with the alloy of copper, tin and zinc is more resistant with respect to corrosion than coaxial cables assemblies comprising tin metal or tin and lead alloy.

[0008] The invention relates according to an aspect to a coaxial cable connector for connecting to a coaxial cable with an inner conductor and an outer conductor. Preferably, the connector comprises a first connecting element for connecting to the outer conductor and a second connecting element for connecting to the inner conductor, the first connecting element and/or the second connecting element comprising an alloy of copper, tin and zinc.

[0009] The connector comprises according to an embodiment a sealing ring arranged between the first connecting element and the second connecting element. Furthermore, the connector may comprise a further sealing ring surrounding the first connecting element.

[0010] The first connecting element and/or the second connecting element may according to an embodiment further comprise brass.

[0011] The invention relates according to another aspect to a coaxial cable assembly with a coaxial cable with an outer conductor and an inner conductor and the inventive coaxial cable connector, wherein the first connecting element is connectable, e.g. by soldering, to the outer conductor and the second connecting element is connectable, e.g. by soldering, to the inner conductor.

[0012] The coaxial cable assembly comprises according to a further embodiment a sealing ring disposed between the outer conductor and the coaxial cable connector.

[0013] According to an embodiment, the coaxial cable may comprise a heat shrink tube or a molded plastic sleeve coating the outer conductor. Furthermore, the coaxial cable assembly may further comprise a further sealing ring disposed between the outer conductor and the heat shrink tube.

[0014] According to an embodiment, the inner conductor or the outer conductor comprise or consist of aluminum or an alloy of copper, tin and zinc and may additionally comprise brass.

[0015] The invention relates according to a further aspect to a method for making a coaxial cable connector for connecting to a coaxial cable with an inner conductor and an outer conductor. The method comprises forming a first connecting element for connecting to the outer conductor, the first connecting element comprising an alloy of copper, tin and zinc, and forming a second connecting element for connecting to the inner conductor, the second connecting element comprising copper, aluminum or an

alloy of copper, tin and zinc.

[0016] According to an embodiment, the method comprises forming a coaxial cable with an outer conductor and an inner conductor, forming the coaxial cable connector, soldering the outer conductor to the first connecting element and soldering the inner conductor to the second connecting element.

[0017] The invention further relates to a coaxial cable comprising an inner conductor, a dielectric material coating the inner conductor, an outer conductor which may be corrugated and a heat shrink tube coating the outer conductor.

[0018] Further embodiments of the invention will be described with respect to the following figures, in which:

Fig. 1 shows a coaxial cable assembly; and

Fig. 2 shows a coaxial cable.

[0019] The coaxial cable assembly shown in Fig. 1 comprises a coaxial cable with an inner conductor 101 which is coated by a dielectric material 103. Around the dielectric material, an outer conductor 105 is arranged. The outer conductor 105 may be corrugated as depicted in Fig. 1. The dielectric material 103 and the outer conductor 105 are coated by a coating 107 which may be formed by a heat shrink tube or a molded plastic material.

[0020] The coaxial cable assembly shown in Fig. 1 further comprises a coaxial cable connector comprising a first connecting element 109 for connecting to the outer conductor 105. The coaxial cable connector further comprises a second connecting element 111 for connecting to the inner conductor 101. The first and the second connecting elements 109 and 111 may have e.g. a rotation symmetric form for accommodating the respective conductor of the coaxial cable. The first connecting element 109 has an overlap section 113 which, when assembled, overlaps with at least a part of the outer conductor 105. The corresponding overlap section of the outer conductor 105 is free of the coating 107. Correspondingly, the second connecting element 111 comprises an overlap section 115 for overlapping with at least a part of the inner conductor 101.

[0021] The coaxial cable connector further comprises a sealing ring 117 which may have a rotation symmetric form and may be disposed between the first connecting element 109 and the second connecting element 111 so as to seal the connector.

[0022] The first connecting element 109 further comprises a distant section 119 having e.g. a rotation symmetric shape. The distant section 119 is provided for interlocking with a further seal ring 121 disposed around the first connecting section 109 so as to additionally seal the connector.

[0023] The seal rings 117 and 121 as well as the corrugated shape of the outer conductor 105 are optional. Furthermore, the coaxial cable assembly 101 may be e.g. a jumper cable assembly with aluminum outer conductor and soldered connections.

[0024] The coaxial cable assembly further comprises a plastic jacket 123 sealing at least a part of the outer coating 107, the overlap sections 105 and 113 and at least a part of the surface of the first connecting element 109. The jacket 123 and the seal rings 109 and 121 may e.g. be made of polytetrafluoroethylene.

[0025] The first connecting element 109 and/or the second connecting element 111 of the coaxial cable connector may comprise an alloy of copper, zinc and tin and may optionally further comprise brass. The outer conductor 105 of the coaxial cable may be made of aluminum or may comprise the aforementioned alloy. The alloy comprises preferably 50 % copper, 25 % zinc and 25 % tin.

[0026] In Fig. 1, several embodiments of possible diameters, angles and dimensions are indicated. The units are angles and millimeters.

[0027] Fig. 2 depicts a coaxial cable having an inner conductor 201 which is coated by a coating dielectric 203. Around the coated dielectric 203, a corrugated outer conductor 205 is disposed. The outer conductor 205 is sealed by a coating 207 which may be a heat shrink tube. The inner conductor 201 and/or the outer conductor 205 may comprise copper or aluminum or an alloy of copper, tin and zinc.

Claims

1. A coaxial cable connector for connecting to a coaxial cable, the coaxial cable comprising an inner conductor and an outer conductor, the connector comprising:

   - a first connecting element (109) for connecting to the outer conductor;
   - a second connecting element (111) for connecting to the inner conductor;
   - the first connecting element (109) or the second connecting element (111) comprising an alloy of copper, tin and zinc.

2. The coaxial able connector according to claim 1, comprising a sealing ring (117) arranged between the first connecting element (109) and the second connecting element (111).

3. The coaxial cable connector according to claim 1 or 2, further comprising a further sealing ring (121) surrounding the first connecting element (109).

4. The coaxial cable connector according to anyone of the claims 1 to 3, the first connecting element (109) or the second connecting element (111) further comprising brass.

5. A coaxial cable assembly, comprising:

- a coaxial cable with an outer conductor (105) and an inner conductor (101); and
- the coaxial cable connector according to anyone of the claims 1 to 4, the first connecting element (109) being connectable to the outer conductor (105), the second connecting element (111) being connectable to the inner conductor (101).

6. The coaxial cable assembly according to claim 5, further comprising a sealing ring disposed between the outer conductor (105) and the coaxial cable connector.

7. The coaxial cable assembly according to claim 5 or 6, the coaxial cable further comprising a heat shrink tube (107) or a molded plastic sleeve coating the outer conductor (105), the coaxial cable assembly further comprising a further sealing ring disposed between the outer conductor (105) and the heat shrink tube (107).

8. The coaxial cable assembly according to anyone of the claims 6 to 7, the inner conductor (101) or the outer conductor (105) comprising or consisting of aluminum or an alloy of copper, tin and zinc.

9. Method for making a coaxial cable connector for connecting to a coaxial cable, the coaxial cable comprising an inner conductor and an outer conductor, the method comprising:

- forming a first connecting element for connecting to the outer conductor, the first connecting element comprising an alloy of copper, tin and zinc;
- forming a second connecting element for connecting to the inner conductor, the second connecting element comprising copper, aluminum or an alloy of copper, tin and zinc.

10. A method of manufacturing a coaxial cable assembly, the method comprising:

- forming a coaxial cable with an outer conductor and an inner conductor;
- forming the coaxial cable connector according to claim 9;
- soldering the outer conductor to the first connecting element; and
- soldering the inner conductor to the second connecting element.

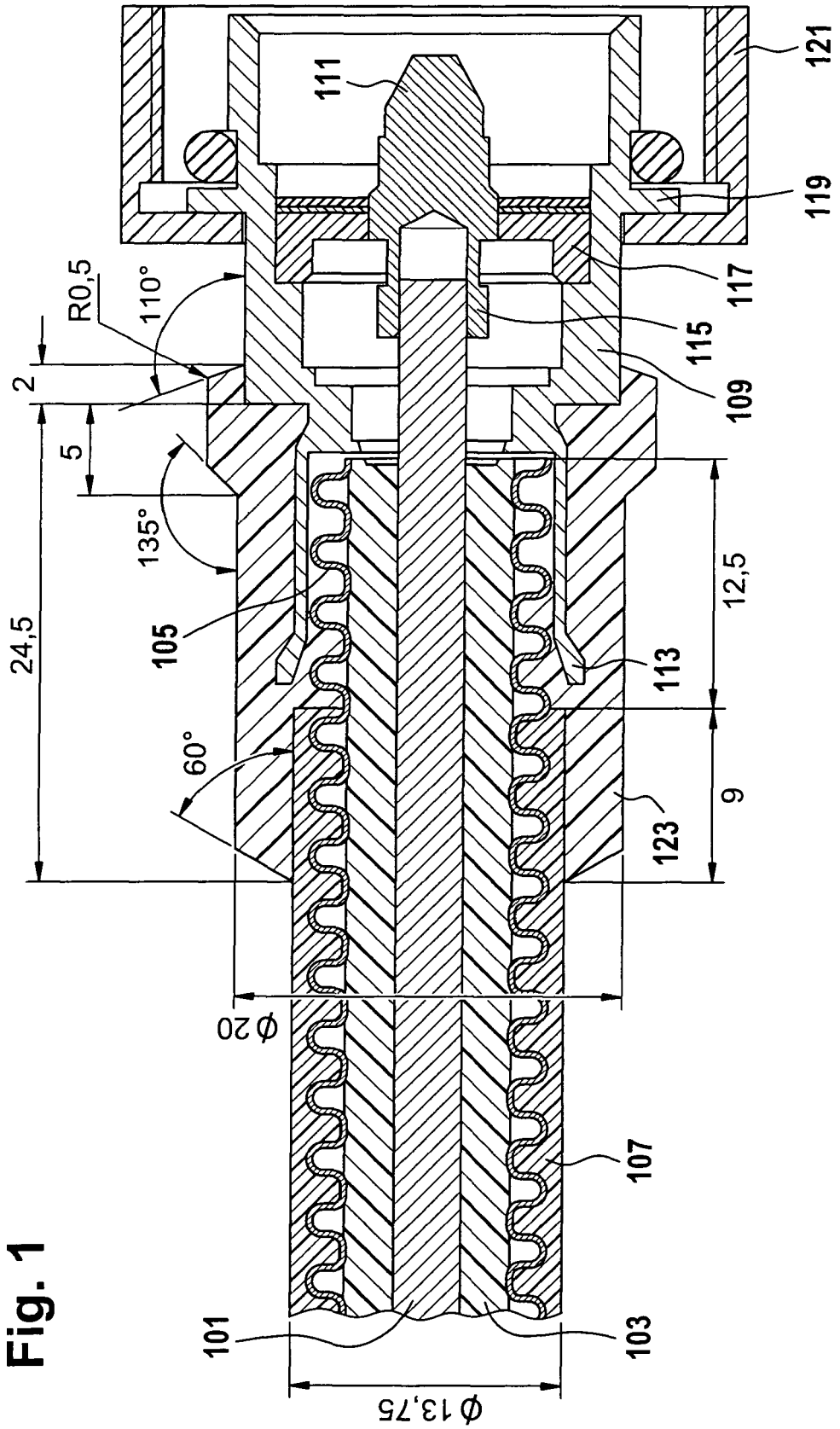
111
121
119
117
115
109
R0,5
110°
2
5
135°
24,5
105
12,5
113
60°
9
123
Ø 20
107
101
103
Ø 13,75

Fig. 1

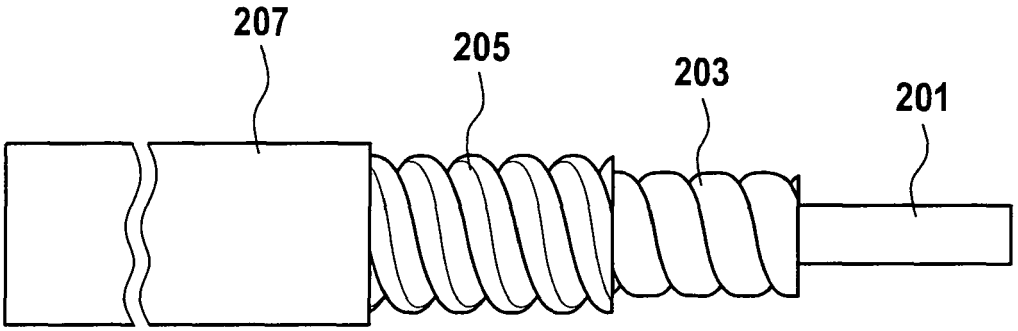

Fig. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 29 1387

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 372 225 A (CANTZ THOMAS [CH]) 17 December 2003 (2003-12-17) * abstract; figures * * paragraph [0001] - paragraph [0014] *	1-10	INV. H01R13/646 H01R4/62
X	US 7 189 114 B1 (BURRIS DONALD ANDREW [US] ET AL) 13 March 2007 (2007-03-13) * abstract; figures 1-3,6,7 * * column 2, line 60 - column 4, line 55 *	1,2,4-6, 8-10	
A	GB 755 272 A (AIRCRAFT MARINE PROD INC) 22 August 1956 (1956-08-22) * abstract; figure 1 * * page 7, line 23 - page 8, line 23 *	1,5,9,10	
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			TECHNICAL FIELDS SEARCHED (IPC) H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 August 2008	Serrano Funcia, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 29 1387

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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