



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.12.2005 Bulletin 2005/52

(51) Int Cl.7: **H01R 9/05**, H01R 13/03,
H01R 13/646

(21) Application number: **05003379.4**

(22) Date of filing: **17.02.2005**

(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 MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR LV MK YU

(72) Inventors:

- **Duquerroy, Patrick Marcel**
63500 Seligenstadt (DE)
- **Decrock, Lieven**
8800 Roeselare (BE)
- **Leeman, Reginald**
8400 Oostende (BE)

(30) Priority: **02.03.2004 EP 04004887**

(71) Applicant: **Tyco Electronics AMP GmbH**
64625 Bensheim (DE)

(74) Representative: **Heinz-Schäfer, Marion**
Tyco Electronics Logistics AG
Ampèrestrasse 3
9323 Steinach (SG) (CH)

(54) **Micro-plug and socket connector**

(57) Disclosed is a micro-plug and socket connector (1) that is suitable for mounting on a printed circuit board and that has a plastic housing (2) comprising a fastening surface with soldering portions (8, 9) for mounting on the surface of the printed circuit board, and comprising a plug receiving opening (3) having an inner contact re-

gion (10) for the receiving and contacting a pin contact, and comprising an outer contact terminal. The inner contact region (10), the outer contact terminal, the soldering portions (8, 9) and the electrically conductive connections provided therebetween are configured in the form of metallized portions of the plastic housing (2).

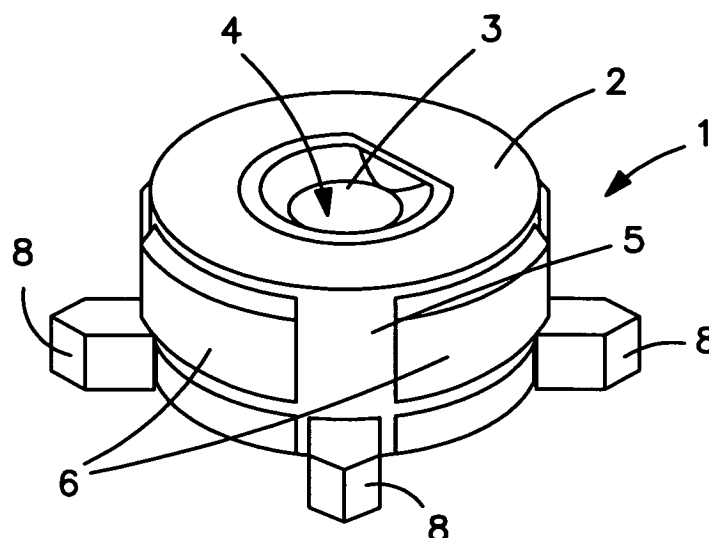


FIG. 1

Description

[0001] The invention relates to a micro-plug and socket connector for mounting on a printed circuit board and for establishing a plug and socket connection with a coaxial plug. The connector comprises an internal conductor configured as a pin contact, a coaxial external conductor, a housing having a fastening surface with soldering portions for mounting on the surface of the printed circuit board, a plug receiving opening with a receiving region connected thereto comprising an inner contact region for receiving and contacting the pin contact, and an outer contact terminal for contacting the coaxial external conductor.

[0002] A micro-plug and socket connector of this type is used in cases in which a coaxial cable is to be connected to a printed circuit board. Because mobile telephones, for example, are constantly becoming smaller, the size of micro-plug and socket connectors of this type must also be reduced accordingly.

[0003] DE 100 51 791 A 1 discloses a connector that is configured for use in mobile telephones and comprises a housing with a contact chamber, which is accessible via an opening for plugging in a plug contact. A U-shaped spring clip, between the arms of which the plug contact that is plugged into the plug receiving opening is fixed, is located in the contact chamber. When the plug contact is not plugged in, the free ends of the two arms about a metallized, and therefore electrically conductive, projection of the housing. When the plug contact is plugged in, the arms of the spring clip are spread sufficiently far apart that the electric contact between the two arms and the conductive projection is separated. The outer contact terminal and the projection of the housing are in the form of metallized plastic material housing parts.

[0004] EP 419 938 A2 discloses a surface mountable coaxial plug and socket connector that has a connector housing, which comprises a substantially cube shaped housing part. Two contacts, an inner contact and an outer contact terminal, punched from a metal sheet, are arranged on the connector housing. Both comprise a terminal lug for soldering to a printed circuit board.

[0005] The present invention provides a micro-plug and socket connector that is particularly easy to produce and may easily be reduced in size.

[0006] A micro-plug and socket connector according to the invention is indicated in claim 1. Advantageous developments of the micro-plug and socket connector according to the invention are indicated in the dependent claims.

[0007] The invention provides a micro-plug and socket connector that is suitable for mounting on a printed circuit board and that has a housing comprising a fastening surface with soldering portions for mounting on the surface of the printed circuit board, and comprising a plug receiving opening having an inner contact region for the receiving and contacting a pin contact, and com-

prising an outer contact terminal. The inner contact region, the outer contact terminal, the soldering portions and the electrically conductive connections provided therebetween are configured in the form of metallized portions of the plastic housing.

[0008] At a side, remote from the plug receiving opening of the chamber, which is connected to the opening for receiving the complementary pin contact, the housing comprises an electrically conductive stop, which is configured for connection to an electric terminal, such as a printed circuit board, for example. The stop is formed as a metallized inner contact region of the housing.

[0009] It is particularly advantageous to configure the inner contact region in inclination toward the plug receiving direction, in order thus to be able to compensate any tolerances in the position of the contact pin.

[0010] The housing is particularly advantageously produced using what is known as the molded interconnect devices (MID) method, wherein, in a housing injected in one piece in two shots, parts of the surface of the housing (corresponding to one of the shots) may be selectively coated in an electrically conductive manner, while the remaining parts of the surface of the housing remain electrically insulative.

[0011] The micro-plug and socket connector is configured as a coaxial connector, in the case of a plug and socket connection to a coaxial plug, which comprises an internal conductor configured as a pin contact and an external conductor coaxial therewith. The housing of the micro-plug and socket connector is provided with an electrically conductive outer region, which is configured such that said region, on the one hand, when the coaxial plug is plugged into the micro-plug and socket connector, contacts the external conductor of the coaxial plug and, on the other hand, when the micro-plug and socket connector is mounted on a printed circuit board, contacts a strip conductor of the printed circuit board. The electrically conductive stop and the electrically conductive outer region of the housing are electrically separated from each other by an insulating zone of the housing.

[0012] In one embodiment of the invention, the outer side of the housing is provided with a latching device for latching with a complementary latching device of a coaxial plug. A stable plug and socket connection may thus be produced between both connector components.

[0013] In practical embodiments, the external height dimension and external side dimensions of the micro-plug and socket connector are approximately 1 to 5 mm. In one practical embodiment, these dimensions are approximately 3 mm.

[0014] The invention will now be explained in greater detail with reference to an embodiment. In the drawings:

Fig. 1 shows a greatly enlarged perspective view of an embodiment of a micro-plug and socket connector according to the invention;

Fig. 2 shows a view from below of the micro-plug and socket connector according to Fig. 1;

Fig.3 shows a view from above of the micro-plug and socket connector according to Fig. 1;

Fig. 4 shows a further greatly enlarged perspective view of the micro-plug and socket connector according to Fig. 1; and

Fig. 5 shows a greatly enlarged sectional view of the micro-plug and socket connector taken along the line A-A in Fig. 3.

[0015] In all of the figures, the micro-plug and socket connector is shown on a greatly enlarged scale (approx. 20:1). In one practical embodiment, the housing of the micro-plug and socket connector is substantially in the shape of a cylinder having a height of less than 2 mm and a diameter of approximately 3 mm.

[0016] Fig. 1 shows an oblique view from above of an embodiment of a micro-plug and socket connector 1 according to the invention comprising a housing 2 that is provided on a ceiling wall, which in Fig. 1 is located at the top, with a plug receiving opening 3 for plugging in a pin contact (not shown in the drawings) of a coaxial plug. A cylindrical receiving region 4 for receiving the contact pin is connected to the plug receiving opening 3. The plug receiving opening 3 is bevelled, in order to facilitate the insertion of a pin contact. The housing 2 is substantially cylindrical. At four paired opposing points, the side wall 5 is provided with latching projections 6, 7, which may cooperate with a complementary latching device of a mating plug, in order to hold the two connectors together in a plug and socket connection with latching.

[0017] On four opposing sides, the housing 2 comprises soldering portions 8 provided for soldering to a substrate.

[0018] The housing 2 is produced using what is known as the molded interconnect devices (MID) method. In other words, the housing 2 is injected from two different plastic materials, which behave differently with respect to the metallization of their surfaces by means of plating. The surface of one of the plastics can be plated in a single plating process, whereas the surface of the other plastic does not accept any metal. Selective plating on the desired surface parts of the housing 2 may thus be achieved in a single plating process.

[0019] Fig. 2 shows a view from below of the micro-plug and socket connector 1. Fig. 2 also contains a view from below of a fifth soldering portion 9, which is arranged below the plug receiving opening 3 and the receiving region 4. Fig. 3 shows a view from above of the micro-plug and socket connector shown in Fig. 1. The stop 10, which is the inner contact region, may be seen through the plug receiving opening 3 in the receiving region 4.

[0020] Fig. 4 shows an oblique view from below of the

embodiment of the micro-plug and socket connector 1 shown in Fig. 1.

[0021] Fig. 5 shows a cross section taken along the line A-A in Fig. 3. The parts of the housing 2 that are constructed using a plastic material 11 that may be metallized by means of plating on its surface are marked with cross hatching, whereas the parts of the housing that are constructed using a plastic material 12 that may not be metallized by means of plating on its surface are marked with hatching running downward from right to left. At the location of the plastic material 11, the surface of the housing 2 is electrically conductive, while at the location of the plastic material 12, the surface of the housing 2 is electrically insulative.

[0022] The housing 2 comprises a receiving region 4, which is accessible via a plug receiving opening 3 for plugging in a pin contact (not shown). The plug receiving opening 3 is bevelled at its periphery, in order to form an insertion funnel 13, which makes the pin contact easier to plug in.

[0023] In one practical application of the micro-plug and socket connector 1 according to the invention, the micro-plug and socket connector cooperates with a coaxial plug contact, which is connected to a coaxial cable. An internal conductor of the coaxial cable is connected to the plug contact, which may be plugged into the receiving region 4. An external conductor of the coaxial cable is connected to an electrically conductive sleeve that coaxially surrounds the plug contact. When the plug contact is completely plugged in, the external conductor abuts an electrically conductive external conductor surface 14, which coaxially surrounds the plug receiving opening 3 on the surface at the top of the housing 2 shown in Fig. 5. The external conductor contact surface 14 is electrically connected to the four soldering portions 8. This connection is produced via electrically conductive metallization of the plastic material 11.

The external conductor contact surface 14 is electrically separated from the electrically conductive stop 9 and the soldering portion 10 by the insulating zone 15, which is formed by a part of the non-metallized plastic material 12.

Claims

1. Micro-plug and socket connector for mounting on a printed circuit board and for establishing a plug and socket connection with a coaxial plug, which comprises an internal conductor configured as a pin contact and a coaxial external conductor, the micro-plug and socket connector (1) comprising a plastic housing (2) having a fastening surface with soldering portions (8, 9) for mounting on the surface of the printed circuit board, a plug receiving opening (3) with a receiving region (4) connected thereto comprising an inner contact region (10), which is connected in a conductive manner to a soldering por-

tion (9), for receiving and contacting the pin contact, and comprising an outer contact terminal, which is connected in a conductive manner to at least one further soldering portion (8), for contacting the coaxial external conductor,

5

characterised in that

the inner contact region, the outer contact terminal, the soldering portions and the respective electrically conductive connections are configured in the form of metallized portions of the plastic material housing.

10

2. Micro-plug and socket connector (1) according to either claim 1 or claim 2, wherein the housing (2) is injected using the MID method in the two shot process, from two plastic materials (11, 12), one of which may be metallized. 15
3. Micro-plug and socket connector (1) according to any one of claims 1 to 3, wherein an outer side of the housing (2) is provided with a latching device (6) for latching with a complementary latching device of the coaxial plug. 20
4. Micro-plug and socket connector (1) according to claim 1, wherein the inner contact region (10) is configured as a plane inclined toward the plug receiving direction. 25
5. Micro-plug and socket connector (1) according to claim 1, wherein the inner contact region (10) is configured as a plane perpendicular to the plug receiving direction. 30
6. Micro-plug and socket connector (1) according to any one of claims 1 to 4, wherein the housing (2) has an external height dimension and external side dimensions of approximately 1 to 5 mm. 35

40

45

50

55

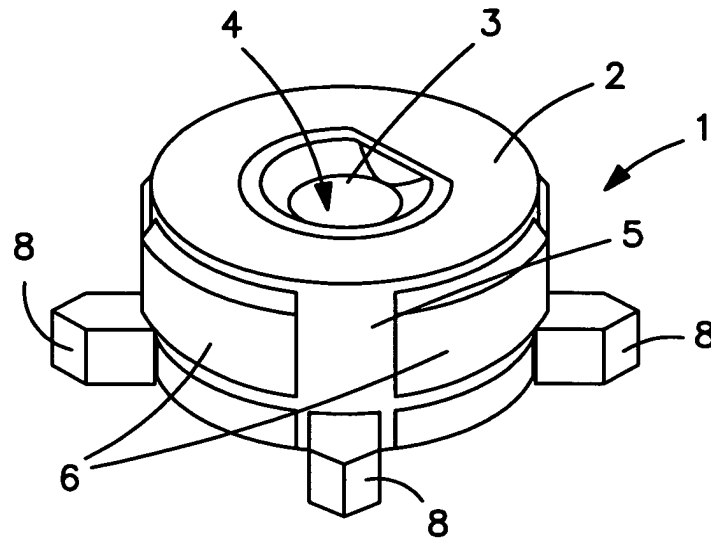


FIG. 1

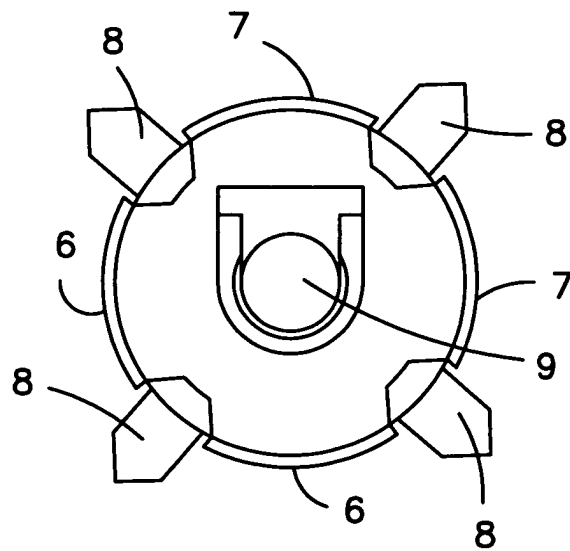


FIG. 2

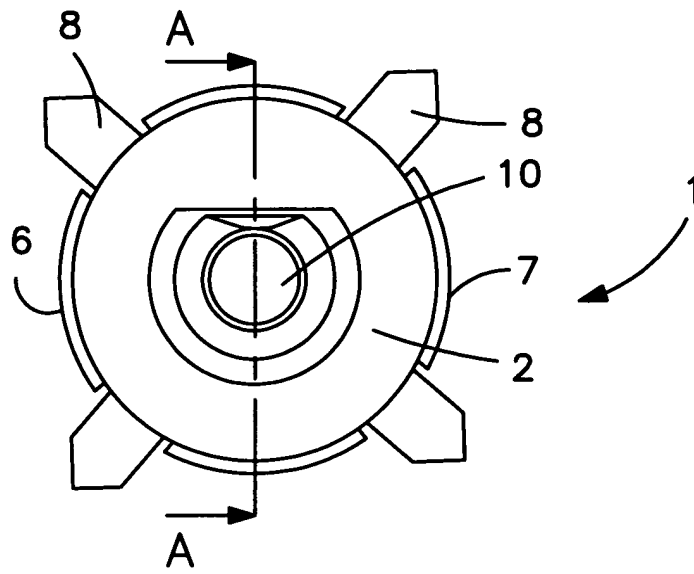


FIG. 3

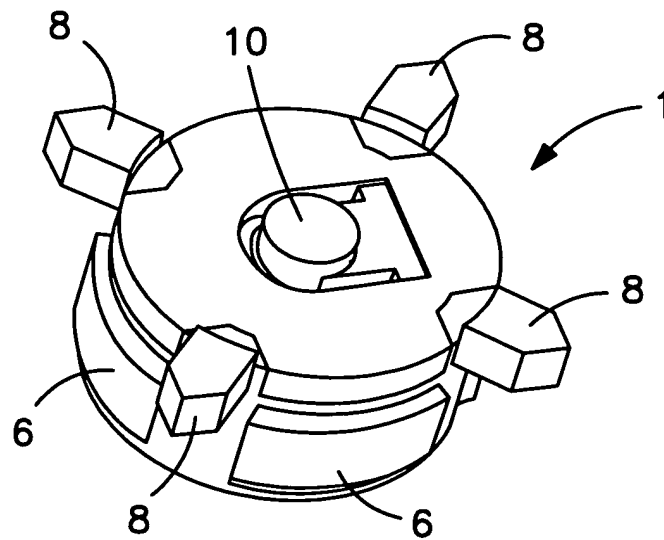


FIG. 4

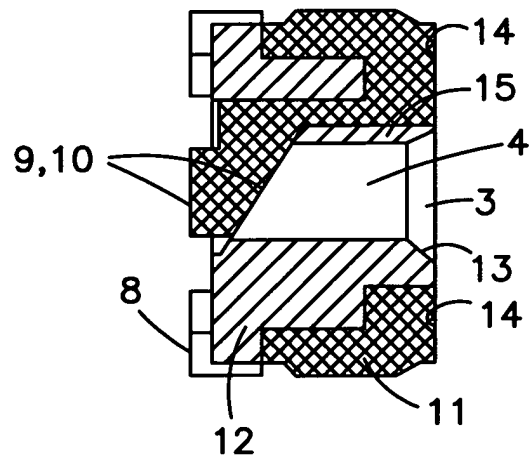


FIG. 5



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 00 3379

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 145 382 A (DICKIRSON ET AL) 8 September 1992 (1992-09-08) * the whole document *	1-3,5	H01R9/05 H01R13/03 H01R13/646
X	EP 0 301 863 A (TEXAS INSTRUMENTS INCORPORATED) 1 February 1989 (1989-02-01) * column 2, line 53 - column 3, line 40 * * column 4, line 10 - line 45 * * figures 1,5-9 *	1,4	
X	US 6 086 383 A (FASANO ET AL) 11 July 2000 (2000-07-11) * column 6, line 36 - column 7, line 5 * * column 7, line 54 - line 65 * * figures 1a-1c,2a-2c,3a-3d *	1,5,6	
A,D	DE 100 51 791 A1 (IMS CONNECTOR SYSTEMS GMBH) 16 May 2002 (2002-05-16) * the whole document *	1-6	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			H01R
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 2 November 2005	Examiner Chelbosu, L
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

2

EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 05 00 3379

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

02-11-2005

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5145382	A	08-09-1992	NONE	
EP 0301863	A	01-02-1989	JP 1035879 A	06-02-1989
			US 4902235 A	20-02-1990
US 6086383	A	11-07-2000	CN 1180932 A	06-05-1998
			JP 3396833 B2	14-04-2003
			JP 10172695 A	26-06-1998
			SG 64445 A1	27-04-1999
			SG 83119 A1	18-09-2001
			US 5791911 A	11-08-1998
			US 5940966 A	24-08-1999
DE 10051791	A1	16-05-2002	AT 302480 T	15-09-2005
			EP 1204178 A2	08-05-2002
			US 2002090863 A1	11-07-2002