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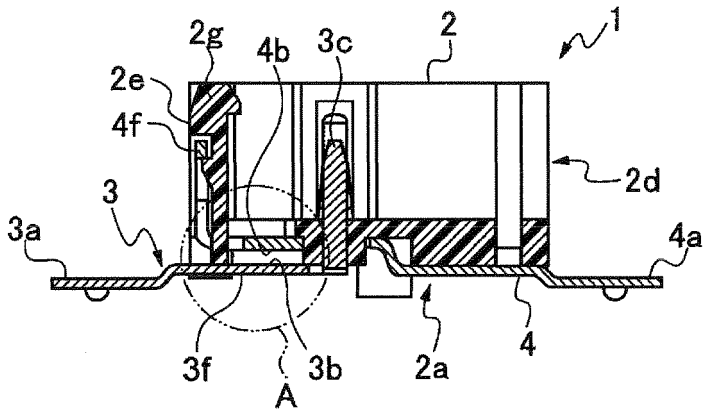
(54) Antenna connector

(57) An antenna connector (1) that is capable of achieving impedance matching easily and reducing a return loss in a high-frequency band so as to improve the high-frequency characteristics is provided. The antenna connector (1) is configured to be fitted to a cable connector (10), and includes a power feeding terminal (3) to be connected to an antenna, a grounding terminal (4) to be used for an earth, and an insulating housing (2) for mounting the power feeding terminal and the grounding terminal. Parts of the power feeding terminal (3) and the grounding terminal (4) are fixed on the substrate surface (15) respectively and the grounding terminal (4) electrically surrounds a connecting terminal of a cable (18) in a fitted state in cooperation with a grounding terminal of the cable connector (10). The grounding terminal (4) and the power feeding terminal (3) of the antenna connector (1) are partly formed with opposing surface portions (3b, 4b) opposing each other at a predetermined distance.

FIG.5



EP 2 475 045 A1

Description

[0001] The present invention relates to an antenna connector configured, for example, to connect a glass antenna provided on a window glass of a vehicle and a coaxial cable wired to a receiver of a TV or the like.

[0002] In the prior art, a glass antenna installed on a window glass is known as a vehicle antenna and, as shown in Figs. 12 to 13B, the glass antenna is configured by arranging a conductor 16 on a substrate surface 15 of a dielectric material such as the window glass, and an electric wave signal therefrom is transmitted to a coaxial cable 18 via an antenna connector 17, and then is transmitted to a receiver 19 such as a digital TV, a digital radio, a GPS, and so on through the coaxial cable 18.

[0003] The antenna connector 17 includes a connector 17a on the receptacle side having an insulating housing 20, a power feeding terminal 21, and a grounding terminal 22 as shown in Figs. 14A to 14C. Then, a terminal mounting portion 21a and a terminal mounting portion 22a are fixed to a glass substrate surface 15 by soldering respectively as shown in Fig. 15.

[0004] As shown in Fig. 15, a plug connector 17b on the cable side includes an insulating housing 23, a signal terminal 24 to be connected to a core wire 18a of the coaxial cable 18, and a grounding terminal 25 connected to a shield braided wire 18b of the coaxial cable 18.

[0005] The plug connector 17b on the cable side is fitted to the connector 17a on the receptacle side, and the electric wave signal received by the conductor 16 of the antenna pattern on the substrate surface 15 is transmitted from the power feeding terminal 21 through a contact 21 b, the signal terminal 24, and the core wire 18a, to the receiver 19. In contrast, the ground is electrically grounded by a connecting terminal 22b of the grounding terminal 22 on the receptacle side and the grounding terminal 25 on the cable side coming into abutment with each other. Such the connector 17 is known (see JP-A-2010-146959).

[0006] The receiver 19, being a digital TV or a GPS, for example, uses high frequencies on the order of hundreds of megahertz to gigahertz, and hence it is necessary to reduce a return loss due to reflection between the antenna to a transmitter such as an amplifier or a tuner in order to transmit the electric wave accurately. In general, an impedance of the connector is determined by an opposing distance and an opposing surface area between the power feeding terminal and the grounding terminal, and the farther the both terminals are located from each other and the smaller the opposing surface area, the higher the impedance of the connector becomes.

[0007] Under such circumstances, in the antenna connector 17 of the prior art, the power feeding terminal 21 and the grounding terminal 22 are branched toward respective mounting portions on a bottom surface of the connector (a portion "A" in Fig. 14A). The power feeding terminal 21 and the grounding terminal 22 do not oppose each other in an area from a branch point to the mounting portion of the power feeding terminal 21, and the impedance is increased and is not matched (the range of a portion B in Fig. 14C). Therefore, in particular, when using the high frequency such as one gigahertz or higher, a reflection loss is increased. Consequently, the antenna connector 17 of the prior art can hardly be used for high frequencies.

[0008] An antenna connector according to the invention is proposed in order to solve the problems as described above.

[0009] In order to solve the problems described above and achieve an object, there is provided an antenna connector to be fitted to a cable connector including: a power feeding terminal to be connected to an antenna; a grounding terminal used for an earth; and an insulating housing for mounting the power feeding terminal and the grounding, the power feeding terminal and the grounding terminal being partly fixed to a substrate surface respectively and the grounding terminal electrically surrounding a connecting terminal of a cable in a fitted state in cooperation with a grounding terminal of the cable connector, wherein the grounding terminal and the power feeding terminal of the antenna connector are partly formed with opposing surface portions opposing each other at a predetermined distance.

[0010] Preferably, the opposing surface portion formed on the grounding terminal engages at a distal end portion thereof with an engaging portion formed on part of the insulating housing, so that the opposing surface portion is maintained at a substantially parallel state so as not to approach an opposing surface of the power feeding terminal.

[0011] Preferably, the opposing surface portion of at least one of the power feeding terminal and the grounding terminal is formed with a hole portion for adjusting impedance.

[0012] Preferably, a hole portion provided on the opposing surface portion formed on the grounding terminal for adjusting impedance forms part of an engaging portion provided on a distal end portion of the opposing surface portion.

[0013] According to the antenna connector of the invention, impedance matching is achieved by disposing the power feeding terminal and the grounding terminal so as to oppose partly each other at a predetermined distance, and hence the return loss is reduced in the transmission characteristics in the high-frequency band, thereby improving the characteristics in the high-frequency band.

[0014] Since the terminal mounting portions of the power feeding terminal and the grounding terminal are the same as those of the prior art respectively, improvement of the high-frequency characteristics is achieved without impairing the mounting performance of the antenna connector of the prior art and without increasing the number of steps of mounting operation. Furthermore, precise tuning is enabled by changing the high-frequency characteristics easily by varying the surface areas of one

or both of the opposing surfaces of the power feeding terminal and the grounding terminal or adjusting the impedance by forming a hole.

Fig. 1 is a front view showing an antenna connector according to the invention;
Fig. 2 is a plan view showing the antenna connector;
Fig. 3 is a left side view showing the antenna connector;
Fig. 4 is a right side view showing the antenna connector;
Fig. 5 is a cross-sectional view taken along the line X-X in Fig. 2;
Fig. 6 is a bottom side of perspective view showing the antenna connector;
Fig. 7 is an exploded perspective view of the antenna connector;
Fig. 8 is a vertical cross-sectional perspective view of the antenna connector taken along the longitudinal direction;
Fig. 9A is a plan view showing a state in which the antenna connector and a cable connector are fitted;
Fig. 9B is a front view showing the state in which the antenna connector and a cable connector are fitted;
Fig. 10 is a vertical cross-sectional view showing the antenna connector according to another embodiment;
Fig. 11 is a graph showing a comparison of characteristics relating to a return loss in a high-frequency area of the antenna connector;
Fig. 12 is a perspective view showing a state of usage of an antenna connector of the prior art;
Fig. 13A is a plan view showing a schematic configuration when the antenna connector of the prior art is in service;
Fig. 13B is a perspective view showing the antenna connector of the prior art in a state of being assembled;
Fig. 14A is a perspective view showing the antenna connector of the prior art;
Fig. 14B is a plan view showing the antenna connector of the prior art;
Fig. 14C is a vertical cross-sectional view showing the antenna connector of the prior art; and
Fig. 15 is a vertical cross-sectional view showing a state of fitting the cable connector to the antenna connector of the prior art.

[0015] In a relation between a power feeding terminal 3 and a grounding terminal 4 arranged so as to oppose each other on a substrate surface on mounting to the substrate surface, an antenna connector 1 according to the invention is configured to achieve matching of an impedance by extending part of the grounding terminal 4 and providing the extended grounding terminal 4 and the power feeding terminal 3 with surfaces opposing each other (opposing surface portions 4b and 3b).

[0016] Figs. 1 to 8 show the antenna connector 1 according to a first embodiment of the invention including the flat panel-shaped power feeding terminal 3 connected to a conductor 16 (see Fig. 12), the flat panel-shaped grounding terminal 4 used as an earth, and an insulating housing 2 configured to mount the both terminals 3 and 4. The antenna connector 1 is fixed to a substrate surface 15 (see Fig. 15) via mounting portions 3a and 4a of both terminals 3 and 4, and a cable connector 10 is fitted to this antenna connector 1 (see Figs 9A and 9B).

[0017] Parts of the power feeding terminal 3 and the grounding terminal 4 are disposed respectively on the bottom side of the housing 2, i.e. a part of the substrate surface 15 where the antenna connector 1 is fixed to (referred as "substrate mounting surface" assigning numeral 2a), and the grounding terminal 4 electrically surrounds a connecting terminal (a core wire 18a, see Fig. 15) of a coaxial cable 18 in a fitted state in cooperation, with a grounding terminal 25 (see Fig. 15) of the cable connector 10.

[0018] Then, as shown in Fig. 5, part of the grounding terminal 4 of the antenna connector 1 is extended to form the opposing surface portions 3b and 4b where the power feeding terminal 3 and the extended grounding terminal 4 are disposed in parallel or in substantially parallel within a range of the insulating housing 2 confronting the substrate mounting surface 2a. In other words, the opposing surface portions 3b and 4b are apart each other, but contain a state of not in parallel thereto.

[0019] As shown in Fig. 6 to Fig. 8, the insulating housing 2 is formed of synthetic resin generally into a box shape, and has a large hollow in the interior thereof, where the cable connector 10 is fitted (a plug connector, see Fig. 9A). Provided respectively on front and rear side surfaces of the insulating housing 2 are engaging portions 2b and 2c which fix the positions of the power feeding terminal 3 and the grounding terminal 4. Also, a right side surface 2d is widely opened to allow entry of the cable 18.

[0020] The power feeding terminal 3 includes a contact portion 3c, which is inserted into a hollow portion in the insulating housing 2, provided to extend upright in a needle shape as shown in Fig. 7, and locking portions 3d and 3e each formed with an engaging hole and bent so as to extend upright from the front and rear sides of a flat body portion 3f. As shown in Fig. 6, the locking portions 3d and 3e are locked and fixed by an engagement of the engaging portions 2c of the insulating housing 2 with the engaging holes thereof at the time of assembly.

[0021] As shown in Fig. 7, the grounding terminal 4 includes a mounting portion 4a extending from a flat body portion 4j, locking portions 4c and 4d each formed with an engaging hole and bent so as to extend upright from the sides, and a contact portion 4e inserted into the hollow portion of the insulating housing 2, brought into sliding contact with the grounding terminal 25 of the cable connector 10, and extended upright.

[0022] The locking portions 4c and 4d are locked by the engaging holes engaged with the engaging portions

2b of the insulating housing 2 as shown in Fig. 6. As shown in Fig. 3 and Fig. 7, the opposing surface portion 4b extended from the grounding terminal 4 of the antenna connector 1 is further extended on its distal end side, and is formed with a hole-shaped engaging portion 4h on a distal end portion 4f bent in the same direction as the contact portion 4e. Part of the insulating housing 2, that is, an engaging portion 2f projecting on a left side surface 2e is configured to engage the hole-shaped engaging portion 4h provided on the distal end portion 4f.

[0023] In this manner, the opposing surface portion 4b is kept fixed so as not to come into contact with the opposing surface portion 3b of the power feeding terminal 3. Also, reference numeral 2g of the insulating housing 2 shown in Figs. 4 and 8 is a locking projection that locks an insulating housing 23 (see Fig. 15) of the cable connector 10.

[0024] An elongated slit-shaped hole portion 4g for adjusting the impedance is provided in the opposing surface portion 4b extending from the grounding terminal 4 of the antenna connector 1 as shown in Figs. 3 and 7. The hole portion 4g for adjusting the impedance forms part of the engaging portion 4h provided on the distal end portion 4f further extending from the opposing surface portion 4b. The elongated hole portion 4g for adjusting the impedance may be provided on the side of the power feeding terminal 3. The hole portion is provided for adjusting the impedance and hence whatever the shape may be, as a matter of course.

[0025] The antenna connector 1 formed in this manner is soldered and fixed to the substrate surface 15 such as the window glass, and the cable connector 10 is fitted to the hollow portion in the antenna connector 1 as shown in Fig. 9A. As shown in a portion "A" in Fig. 5, in the antenna connector 1, the opposing surface portion 3b of the power feeding terminal 3 and the opposing surface portion 4b of the grounding terminal 4 are arranged and held so as to oppose each other at a certain distance. Accordingly, as shown in Fig. 11, a return loss is reduced significantly in comparison with the prior art and the high-frequency characteristics are improved.

[0026] In a relation between the power feeding terminal 3 and the grounding terminal 4, those opposing surface portions 3b and 4b must simply be apart from each other by a certain distance within a range of the insulating housing 2 confronting the substrate mounting surface 2a and, for example, as shown in Fig. 10, a configuration in which the power feeding terminal 3 is bent and the grounding terminal 4 is flat is also applicable. What is essential is just to match the impedance and reduce the return loss by disposing the power feeding terminal and the grounding terminal so as to oppose partly each other at a predetermined distance.

Industrial Applicability

[0027] The antenna connector 1 according to the invention can be used widely in a connector configured to couple a coaxial connector or the like used for the high-frequency band.

Claims

1. An antenna connector to be fitted to a cable connector (10) comprising a power feeding terminal (3) to be connected to an antenna; a grounding terminal (4) used for an earth; and an insulating housing (2) for mounting the power feeding terminal (4) and the grounding terminal (3); the power feeding terminal (3) and the grounding terminal (4) being partly fixed to a substrate surface (15) respectively and the grounding terminal (4) electrically surrounding a connecting terminal of a cable (18) in a fitted state in cooperation with a grounding terminal (25) of the cable connector (10), **characterized in that**:

   the grounding terminal (4) and the power feeding terminal (3) of the antenna connector (1) are partly formed with opposing surface portions (3b, 4b) opposing each other at a predetermined distance.

2. The antenna connector according to claim 1, wherein the opposing surface portion (4b) formed on the grounding terminal (4) engages at a distal end portion (4f) thereof with an engaging portion (2f) formed on part of the insulating housing (2), so that the opposing surface portion (4b) is maintained at a substantially parallel state so as not to approach an opposing surface of the power feeding terminal (3).

3. The antenna connector according to claim 1 or 2, wherein the opposing surface portion (3b, 4b) of at least one of the power feeding terminal (3) and the grounding terminal (4) is formed with a hole portion (4g) for adjusting an impedance.

4. The antenna connector according to claim 2, wherein the hole portion (4g) provided with the opposing surface portion (4b) formed on the grounding terminal (4) for adjusting an impedance forms part of an engaging portion (4h) provided on a distal end portion (4f) of the opposing surface portion.

FIG.1

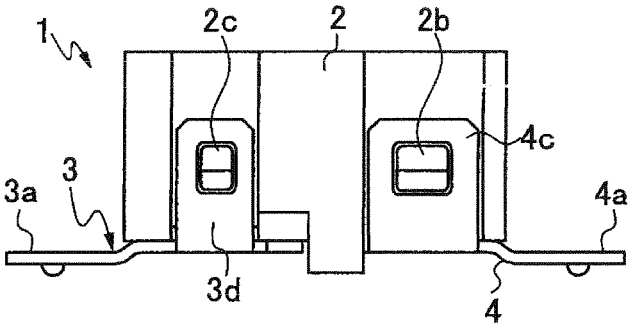


FIG.2

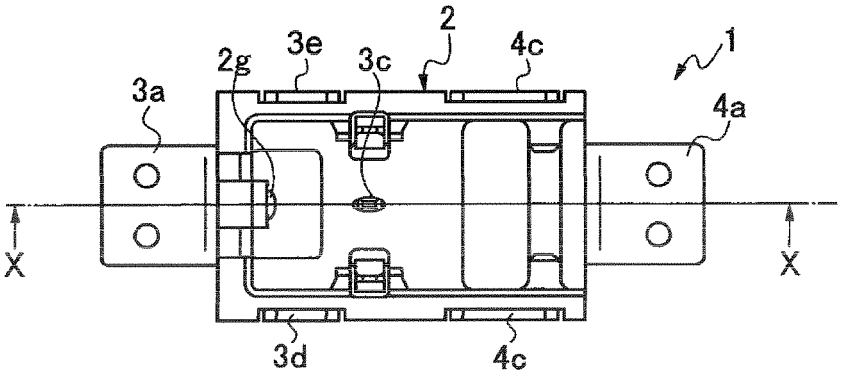


FIG.3

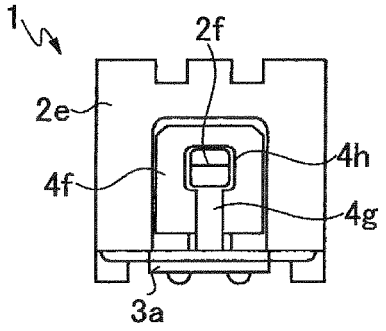


FIG.4

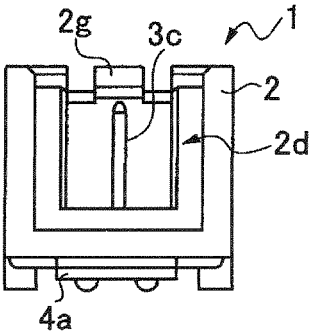


FIG.5

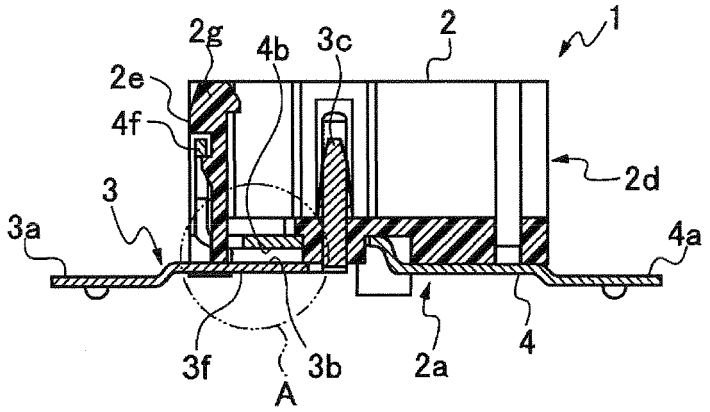


FIG.6

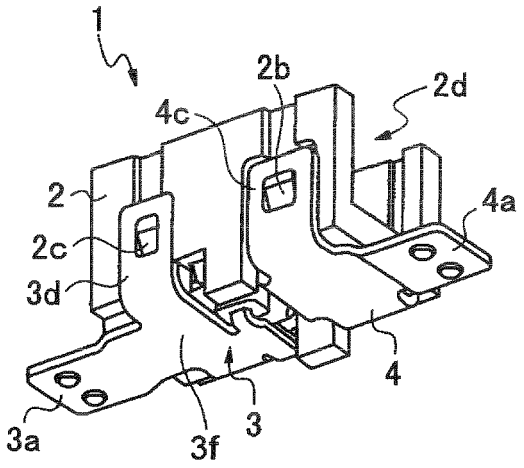


FIG.7

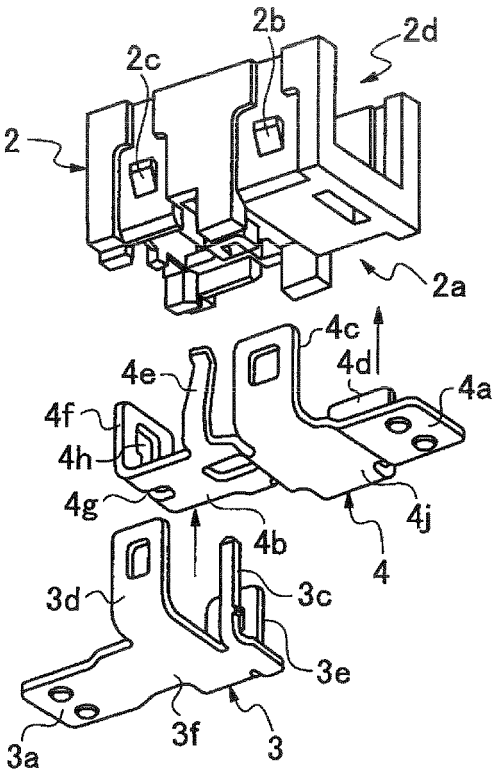


FIG.8

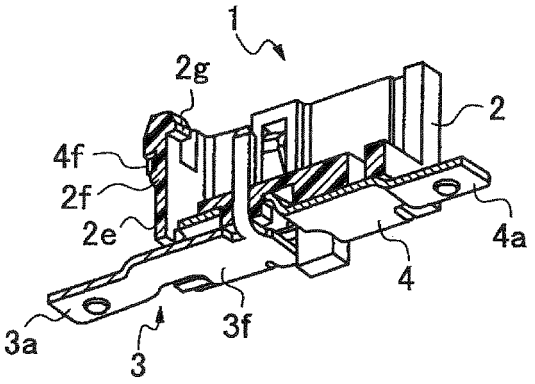


FIG.9A

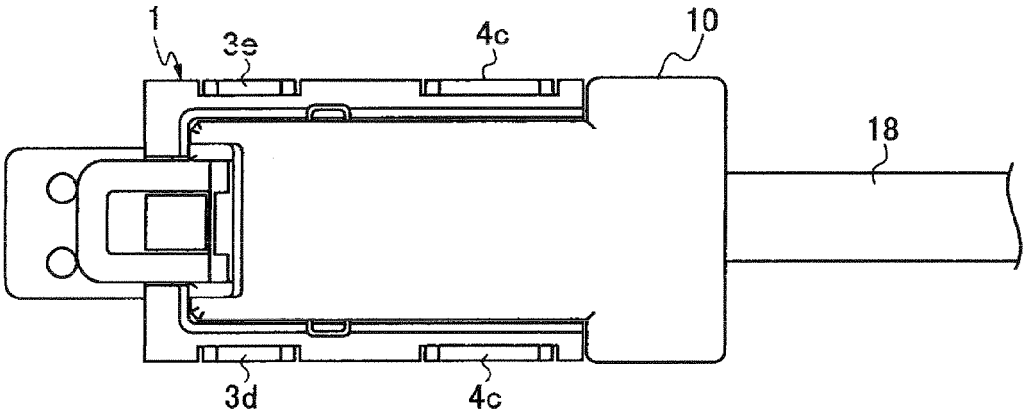


FIG.9B

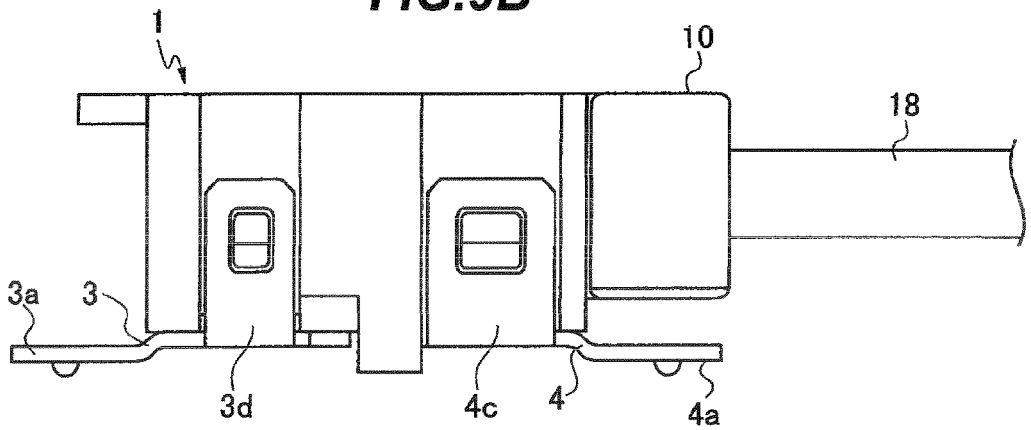


FIG.10

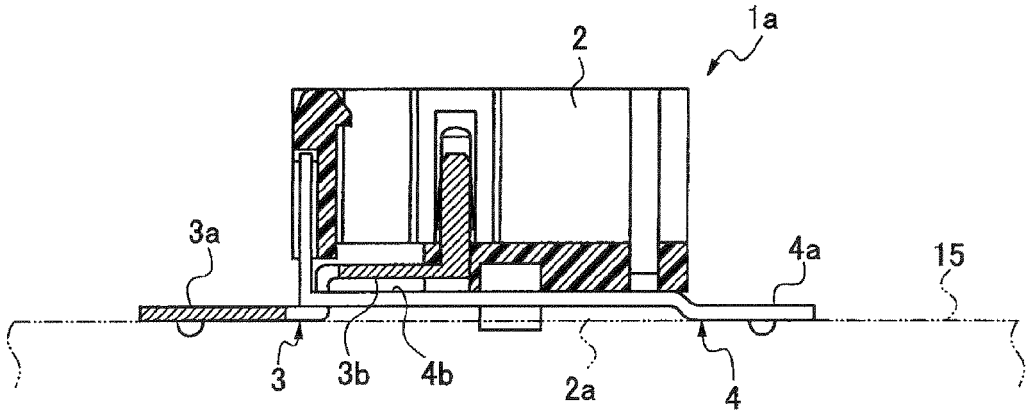


FIG.11

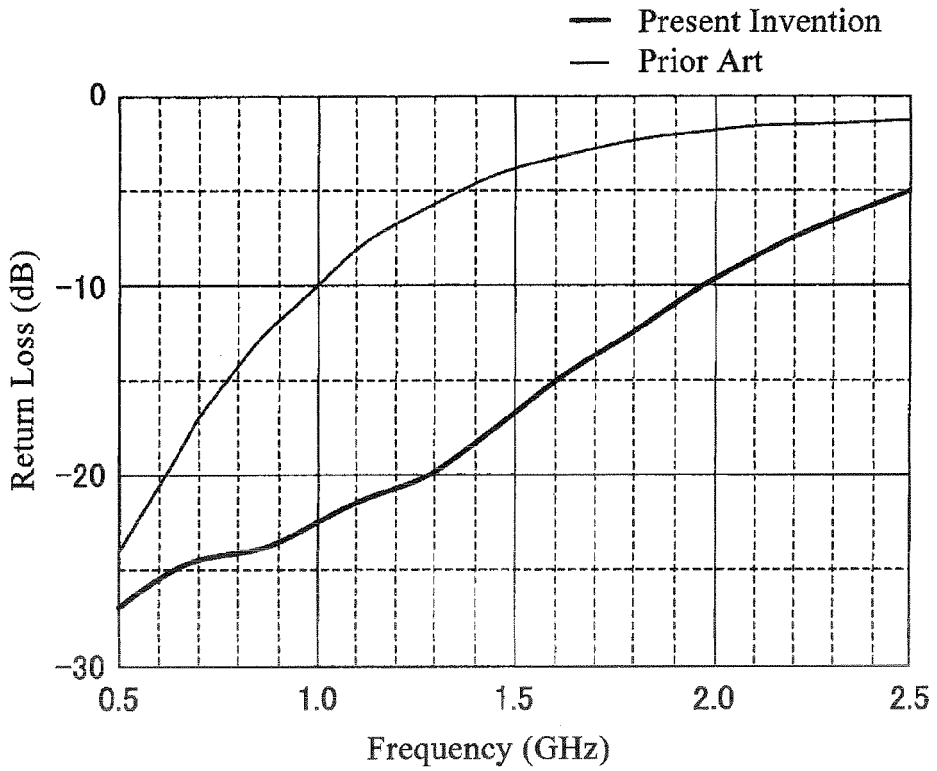

Present Invention
Prior Art
0
-10
-20
-30
Return Loss (dB)
0.5
1.0
1.5
2.0
2.5
Frequency (GHz)

FIG.12

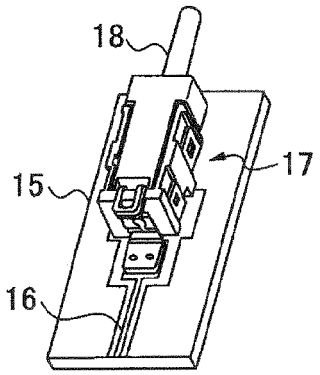

18
17
15
16

FIG.13A

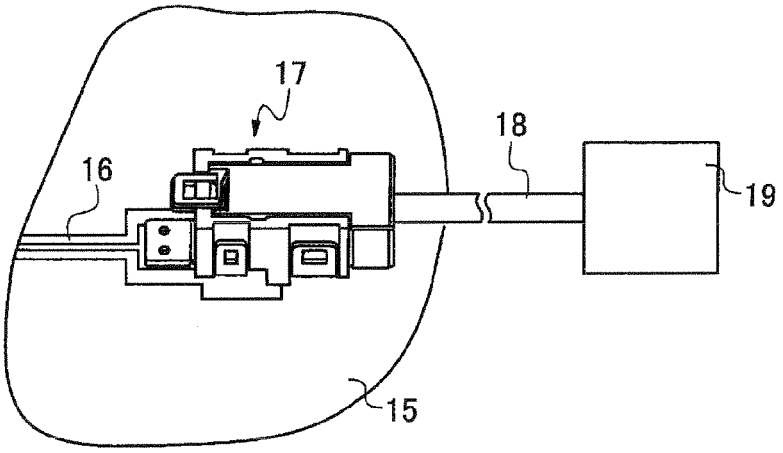


FIG.13B

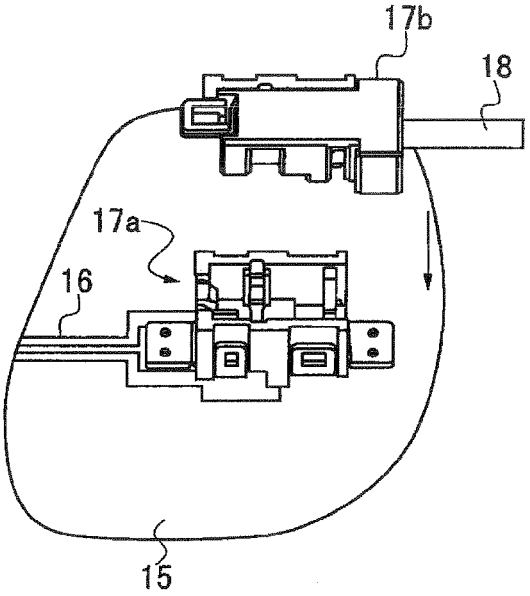


FIG.14A

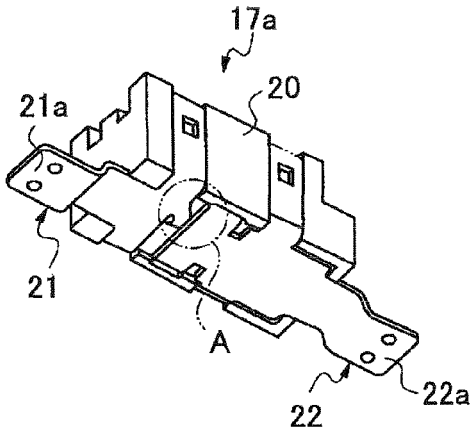


FIG.14B

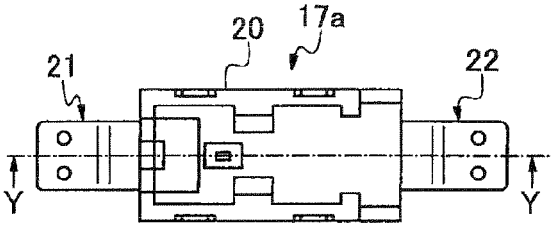


FIG.14C

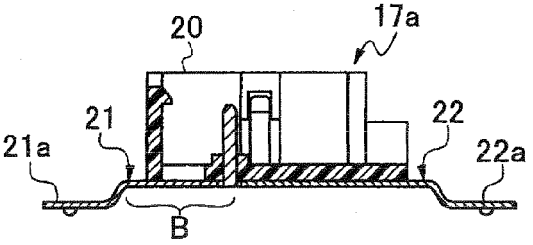
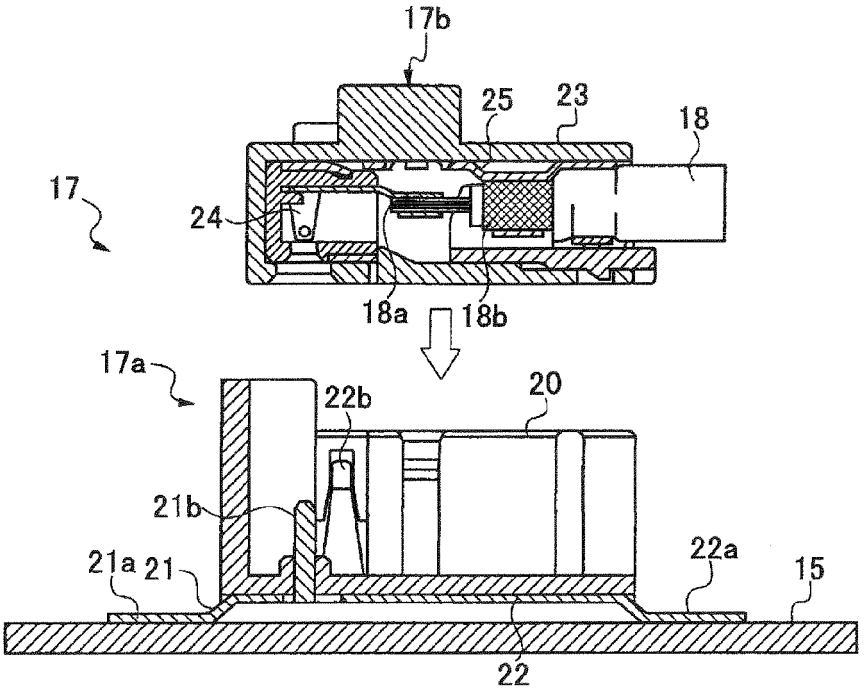


FIG.15



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EUROPEAN SEARCH REPORT

Application Number
EP 11 19 3218

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	EP 2 200 123 A1 (ASAHI GLASS CO LTD [JP]) 23 June 2010 (2010-06-23) * the whole document *	1-4	
A	US 2010/203770 A1 (HIRAI TOMOHARU [JP]) 12 August 2010 (2010-08-12) * the whole document *	1-4	
A	US 5 568 156 A (TERASHIMA FUMITAKA [JP] ET AL) 22 October 1996 (1996-10-22) * the whole document *	1-4	

TECHNICAL FIELDS SEARCHED (IPC)
H01R
H01Q

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	6 March 2012	Pugliese, Sandro

CATEGORY OF CITED DOCUMENTS

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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

1

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 19 3218

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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06-03-2012

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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