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(54) ANTENNA FOR A TELEMATIC CONTROL UNIT OF A VEHICLE

(57) The invention relates to an antenna (1) for a vehicle, said antenna (1) comprising a body (10), wherein said antenna (1) further comprises at least one lanced leg (11) that extends from said body (10) and that is configured to bend under a load compression, said at least one lanced leg (11) comprising a z-bender part (110) and a lanced part (111) that extends from the z-bender part (110) and that is configured to come into contact with a conductive portion of an electronic support.

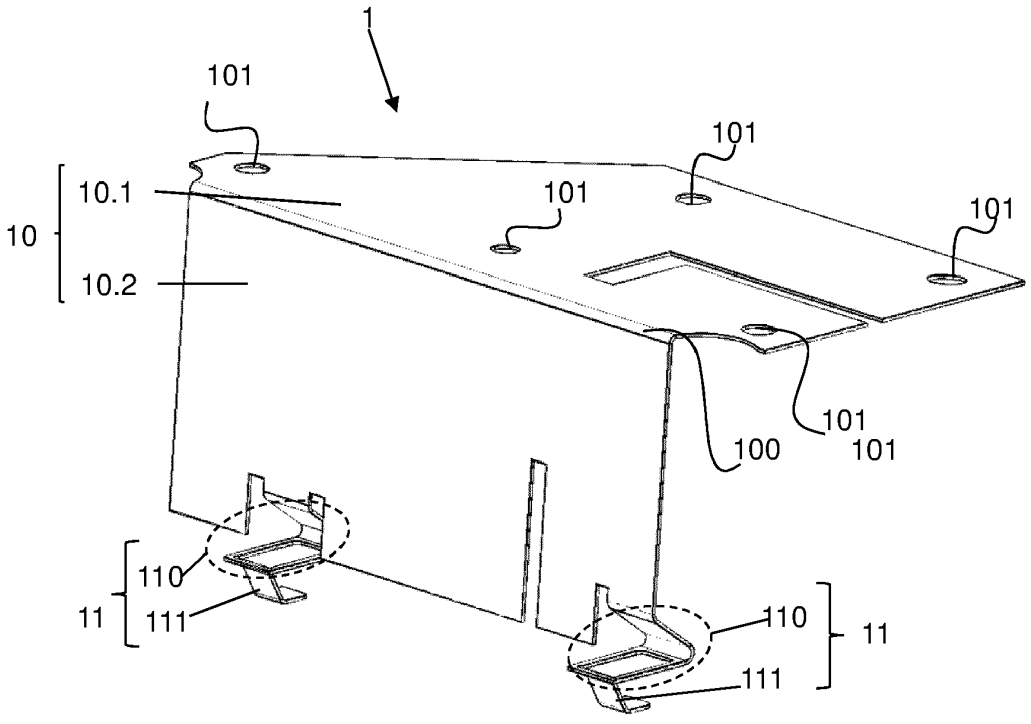

Fig. 1

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Description

[0001] The present invention relates to an antenna for a vehicle. Such an antenna may be used, but not exclusively, in a telematic control unit in the automotive domain.

[0002] In the automotive domain, an antenna, well-known by the man skilled in the art, comprises a body and legs that extends from said body and that are manufactured from a same plate of a conductive material such as a sheet of metal. The antenna is cut around its center so as to form two bending in it to form the legs. The legs constitute contact elements for connecting the body to an electronic support of a module assembly.

[0003] One problem of this prior art is that the legs are rigid and can't accommodate the dimensional variations of the module assembly that integrates the antenna when assembling the antenna to the electronic support, which can reach around +/- 0.3 millimeters (mm) (0.6mm amount in total).

[0004] It is an object of the invention to provide an antenna for a vehicle, which resolves the problem above-stated.

[0005] To this end, it is provided an antenna for a vehicle, said antenna comprising a body, wherein said antenna further comprises at least one lanced leg that extends from said body and that is configured to bend under a load compression, said at least one lanced leg comprising a z-bender part and a lanced part that extends from the z-bender part and that is configured to come into contact with a conductive portion of an electronic support.

[0006] As we will see in further details, the lanced-leg that is integrated within the antenna is flexible and acts as a spring so that it can bend under a load compression and thus adjusts to the dimensional variations (also called manufacturing tolerances, or tolerances) of the module assembly that comprises the antenna. Hence, it compensates tolerances of the module assembly and at the same time exerts a preload between the antenna and the electronic support after all the elements of the module assembly are assembled altogether so that a contact is always maintained between the lanced-leg and the electronic support even when there some vibrations or shocks. Thus, the tolerances can be tuned at a higher range beyond the +/- 0.3 millimeters by using the lanced-leg with better resilience properties.

[0007] According to non-limitative embodiments of the invention, the antenna in accordance with the invention further comprises the following characteristics.

[0008] In a non-limitative embodiment, said antenna comprises a plurality of lanced-legs.

[0009] In a non-variant embodiment, said antenna comprises two lanced-legs.

[0010] In a non-limitative embodiment, said body has a bending that splits the body into two sub-parts.

[0011] In a non-limitative embodiment, said two sub-parts are perpendicular to each other.

[0012] In a non-limitative embodiment, said body comprises a plurality of mounting holes to mount the antenna to an up-casing of a module assembly.

[0013] In a non-limitative embodiment, said at least one lanced leg is configured to bend without permanent deformation under said load compression.

[0014] There is also provided a module assembly for a vehicle, wherein said module assembly comprises :

- an antenna as claimed in any preceding claims,
- an upper-casing where said antenna is to be mounted,
- an electronic support that comprises at least one conductive portion configured to be in contact with the lanced part of said at least one lanced-leg of the antenna,
- a cover that is configured to close the module assembly.

[0015] In a non-limitative embodiment, said upper-casing is made of a conductive material.

[0016] There is also provided a telematic control unit comprising a module assembly as characterized in the previous characteristics.

[0017] In a non-limitative embodiment, the telematic control unit is a telematic control unit of a vehicle.

[0018] Some embodiments of methods and/or apparatus in accordance with embodiments of the present invention are now described, by way of example only, and with reference to the accompanying drawings, in which:

[Fig. 1] illustrates a view in perspective of an antenna, said antenna comprising a body and at least one lanced-leg, according to a non-limitative embodiment of the invention,

[Fig. 2] is a zoom on the lanced-leg of the antenna of figure 1, according to a non-limitative embodiment

[Fig. 3] illustrates an expandible view of a module assembly comprising the antenna of figure 1, said module assembly further comprising an upper-casing, an electronic support and a cover, according to a non-limitative embodiment,

[Fig. 4] illustrates a bottom view of the upper-casing of the module assembly of figure 3, according to a non-limitative embodiment,

[Fig. 5] illustrates the antenna of figure 1 or figure 3 that is mounted into the upper-casing of the module assembly of figure 3, according to a non-limitative embodiment,

[Fig. 6] illustrates the antenna of figure 1 or figure 3 that comes into contact with conductive portions of the electronic support of figure 2 via the at least one lanced-leg, according to a non-limitative embodi-

ment, and

[Fig. 7] illustrates the module assembly of figure 3 when all its elements are assembled altogether and that is closed by the cover of figure 3, according to a non-limitative embodiment.

[0019] In the following description, well-known functions or constructions by the man skilled in the art are not described in detail since they would obscure the invention in unnecessary detail.

[0020] The present invention relates to an antenna 1 for a vehicle, said antenna 1 being described in reference to figures 1 to 7, according to non-limitative embodiments. In a non-limitative embodiment, said vehicle is an automobile vehicle. The automobile vehicle is a motor vehicle or an electrical vehicle. In a non-limitative embodiment, the antenna 1 is a receiving antenna. It is configured to receive/send signals from/to a wireless network.

[0021] The antenna 1 can be configured for use with any kind of technologies such as in non-limitative embodiments, such as Bluetooth™ or Bluetooth Low Energy™, Zigbee™, Ultra-wide Band, Wifi, and the like.

[0022] The antenna 1 is part of a module assembly 4 illustrated in figure 3. In a non-limitative embodiment, the module assembly 4 is part of a telematic control unit 5 of the automobile vehicle.

[0023] As illustrated in figure 1, the antenna 1 comprises :

- a body 10, and
- a at least one lanced leg 11.

[0024] In a non-limitative embodiment, the body 10 has a bending 100 that splits the body 10 into two sub-parts 10.1 and 10.2. In a non-limitative embodiment, the two sub-parts 10.1 and 10.2 are roughly or totally perpendicular to each other.

[0025] In a non-limitative embodiment, the body 10 comprises a plurality of mounting holes 101 to mount the antenna 11 to an upper-casing 41 of a module assembly 4 described in the following. In a non-limitative example illustrated, there are five mounting holes 101.

[0026] The body 10 is made of a conductive material. In a non-limitative embodiment, it is composed of metal. The material is conductive in order to transmit to the electronic support 42 the signals received from the antenna 1 .

[0027] In a non-limitative embodiment, the antenna 1 comprises a plurality of lanced-legs 11. In a non-limitative variant of embodiment illustrated in figure 1, it comprises two lanced-legs 11. This non-limitative variant of embodiment is taken as a non-limitative example in the following.

[0028] As illustrated in figure 1, the lanced-legs 11 extend from the body 10 of the antenna 1. In particular, it extends from the sub-part 10.2 of the body 10. They are made of the same conductive material as the body 10. In a non-limitative embodiment, they are formed from a same sheet of material as the body 10, here a sheet of metal. They are made of a conductive material. In a non-limitative embodiment, it is composed of metal.

[0029] The lanced-legs 11 are configured to bend under a load compression F (illustrated in figure 5). They act as a spring under said load compression F. Under the load compression F, the lanced-legs 11 will deform. The lanced-legs 11 are configured without permanent deformation under the load compression F, so that the deformation is within the elastic limit of the material. In a non-limitative embodiment, the deformation of the lanced-legs 11 is of +/-0.3mm and above. It corresponds to dimensional variations of the module assembly 4. Hence, when the load compression F is released, the lanced-legs 11 are in a preloaded state when all the elements of the module assembly 4 are assembled altogether. They don't come back to their original position. Hence, the antenna 1 permits to accommodate the dimensional variations of the module assembly 4. The antenna 1 permits to always give a preload to the electronic support 42 to ensure the contact by the lanced-legs 11 with it, even if it is vibrated or shocked. Moreover the lanced-legs 11 can operate in an operating temperature range of -40°Celsius to 80°Celsius.

[0030] In a non-limitative embodiment, the lanced-legs 11 are configured to support a load compression F between 2 to 3 Newtons. It is the maximum load that the lanced-legs 11 can stand. It permits to ensure a proper contact between the lanced-legs 11 and the electronic support 42 described in the following.

[0031] As illustrated in figure 2, the lanced-legs 11 comprise a z-bender part 110 and a lanced part 111 that extends from the z-bender part 111. Thanks to this design, the lanced-legs 11 are flexible contrary to classical bending legs that are rigids.

[0032] As illustrated in figure 2, the z-bender part 110 extends from the sub-part 10.2 of the body 10 of the antenna 1. The z-bender part 110 comprises a free space 1100 due to the lancing process where the material is cut and bent to produce a foot 111.1 for contact with a conductive portion 421 of the electronic support 42.

[0033] The lanced part 111 is configured to come into contact with a conductive portion 421 (described later) of an electronic support 42 of the module assembly 4. In particular, the lanced part 111 has a foot 111.1 that is configured to come into contact with the conductive portion 421.

[0034] As illustrated in figure 3, the antenna 1 is part of a module assembly 4.

[0035] The module assembly 4 comprises :

- the antenna 1,
- an upper-casing 41,
- an electronic support 42, and
- a cover 43.

[0036] As illustrated in figure 4, the upper-casing 41 comprises two inner walls 41.1 and 41.2 that are roughly or totally perpendicular to each other.

[0037] The upper-casing 41 is configured to receive the antenna 1. To this end, it comprises a lodgment 410 as illustrated in figure 4. The inner-wall 41.1 is configured to be in contact with the one sub-part 10.1 of the body 10 of the antenna 1, and the other inner wall 41.2 is configured to be in contact with the other sub-part 10.2 of the body 10 of the antenna 1 when the antenna 1 is placed in the lodgment 410.

[0038] The upper-casing 41 is made of a plastic material. In a non-limitative example, the plastic material is PBT (polybutylene terephthalate).

[0039] As illustrated in figure 6, a load compression F can be applied on the upper-casing 41 when the antenna 1 is mounted within the upper-casing 41. This later permits to maintain the lanced-legs 11 into position so that they don't bounce back like a spring into their initial position, that is their relaxed position, where there is no load compression F. The upper-casing 41 holds the antenna 1 into position onto the electronic support 42. The lanced-legs 11 are in the expected preload (2-3 Newtons in the non-limitative example) when the upper-casing 41 holds the antenna 1 into position.

[0040] Depending on the manufacturing process, there are dimensional variations of the module assembly 4 (coming from one or a plurality of elements of said module assembly 4). In a non-limitative embodiment, the dimensional variations are between +- 0.3millimeters (0.6mm in total) and above.

[0041] As illustrated in figure 4, in a non-limitative embodiment, the upper-casing 41 further comprises rivets 411 (illustrated in figure 4) configured to maintain the antenna 1 into contact with said upper-casing 41 and to fix it to said upper-casing 41. In a non-limitative example, there are five rivets 411.

[0042] As illustrated in figure 4, in a non-limitative embodiment, the upper-casing 41 further comprises first fixing holes 413 along its four edges. Said first fixing holes 413 are configured to each receive a screw 5 (illustrated in figures 3 or 7). In a non-limitative example, there are six first fixing holes 413.

[0043] In a non-limitative embodiment, the electronic support 42 is a printed circuit electronic circuit board, referred to as PCBA. The PCBA comprises electronic components 428. To simplify the figures, only one electronic component 428 has been illustrated. The electronic support 42 is configured to provide an electric current (not illustrated) to the antenna 1 via the contact between its conductive portion 421 and the lanced-legs 11 of the antenna 1. The PCBA comprises at least one conductive portion 421, also called a conductive contact 421, configured to be in contact with the lanced part 111 of the at least one lanced-leg 11 of the antenna 1.

[0044] In a non-limitative embodiment, the electronic support 42 comprises a plurality of conductive portions 421. In a non-limitative example illustrated, it comprises two conductive portions 421. The conductive portions 421 are conductive contact 421 for the lanced-legs 11, in particular for their lanced parts 111 that sit on said conductive contacts 421.

[0045] In a non-limitative embodiment, the electronic support 42 further comprises second fixing holes 423 (illustrated in figure 2 and 5) along its perimeter configured to each receive a screw 5. In a non-limitative example, there are six second fixing holes 423. For clarity of the figure 2, only two second fixing holes 423 have been referenced.

[0046] As illustrated in figure 3, in non-limitative embodiments, the electronic support 42 further comprises a plurality of external connectors 424 and 425 to connect the TCU to a vehicle network, and a plurality of antenna connectors 422 for connecting the antenna 1 to the TCU.

[0047] As illustrated in figure 6, the cover 43 is configured to close the module assembly 4. The cover 43 comprises third fixing holes 433 (illustrated in figure 1) along its edges configured to each receive a screw 5. In a non-limitative example, there are six third fixing holes 433.

[0048] The elements 1, 41, 42 and 43 of the module assembly 4 are assembled as follows.

[0049] Firstly, as illustrated in figure 5, the antenna 1 is placed in the lodgment 410 of the upper-casing 41. The rivets 411 of the upper-casing 41 are inserted into the mounting holes 101 of the antenna 1 and the antenna 1 is riveted to the upper-casing 41 so that one sub-part 10.1 of its body 10 is in contact with one inner wall 41.1 of the upper-casing 41 and the other sub-part 10.2 of its body 10 is in contact with the other inner wall 41.2 of the upper-casing 41.

[0050] Secondly, the antenna 1 along the upper-casing 41 is assembled to the electronic support 42. To this end, the lanced-legs 11 of the antenna 1, in particular their lanced parts 111, are put into contact with the conductive portions 421 of the electronic support 42. They sit onto the conductive portions 421.

As illustrated in figure 6, the sub-part 10.1 of the body 10 of the antenna 1 is roughly or totally parallel to the electronic support 42, whereas the sub-part 10.2 of the body 10 is roughly or totally perpendicular to the electronic support 42.

[0051] Then, for the assembly, a load compression F (illustrated in figure 6) is applied onto the upper-casing 41 and antenna 1 assembly. In figure 6, only the antenna 1 with the electronic support 42 has been illustrated. The lanced-legs 11 deform themselves and bend under the load compression F so that the contact with the conductive portions 421 is safely established. The lanced-legs 11 are maintained into this position by any tool. In other words, the lanced-legs 11 of the antenna 1 compress themselves so that a preload is exerted on the electronic support 42 when the lanced-legs 11 are in contact with the conductive portion 421 of the electronic support 42. The lanced-legs 11 are in a preload state (which holds the antenna 1 in its position) so that they don't bounce back.

[0052] Thirdly, as illustrated in figure 7, the cover 43 is assembled to the upper-casing 41 by means of the screws 5 that are inserted into the third fixing holes 431 of the cover 43, the second fixing holes 421 of the electronic support 42 and then the first fixing holes 411 of the upper-casing 41. The screws 5 are screwed into the first fixing holes 411 of the upper-casing 41.

[0053] The module assembly 4 is then assembled. The load compression F can then be suppressed.

[0054] Fourthly, the load compression F is released. When the load compression F is released, the lanced-legs 11 stay in their preload state. Thus, the antenna 1 remains in contact with the electronic support 42 via its lanced-legs 11.

[0055] It is to be understood that the present invention is not limited to the aforementioned embodiments and variations and modifications may be made without departing from the scope of the invention. In this respect, the following remarks are made. All statements herein reciting principles, aspects, and embodiments of the invention, as well as specific examples thereof, are intended to encompass equivalents thereof. In a non-limitative embodiment, the module assembly 4 can be integrated in an emergency call box. In this case, the antenna 1 is configured to receive a signal from the environment of the automobile vehicle and send it to the TCU.

[0056] Hence, some embodiments of the invention may comprise one or a plurality of the following advantages:

- it permits to absorb the dimensional variation (around 0.6mm total amount) of the upper-casing 41 and antenna 1 assembly towards the electronic support 42, contrary to the prior art with rigids legs,
- as the lanced-legs 11 extend from the body 10 of the antenna 1 and are formed from a peripheral part of the sheet of metal used for the antenna 1, there are no wastage of material, contrary to a process where legs are fabricated from the center of the sheet of metal leading to a free space in the center of the sheet of metal,
- it permits to have an easier manufacturing process for the antenna 1, as the lanced-legs 11 extend from the body 10 of the antenna 1, contrary to some prior arts where the antenna 1 has 2 or 3 parts assemblies that have to be assembled to the body instead of a leg,
- the fact that the body 10 of the antenna 1 is in two sub-parts 10.1 and 10.2 perpendicular to each other permits to gain some space, compared to a solution where the body of the antenna is in one part and flat and entirely parallel to the electronic support,
- it permits to convert the antenna 1 into a kind of spring by the lancing. It permits to replace a solution where the conductive portions of the electronic support are about twenty and made of rubbers that takes the dimensional variation of the assembly, and where the more the dimensional variation is, the more the rubbers compress under the antenna compression. The solution reduces additional process's cost as it doesn't need to attached any contact foams onto the electronic support contrary to the solution with the rubbers,
- the lanced-legs 11 can retain their resilient property even at extreme degrees such as minus 40° Celsius to plus 80° Celsius, contrary to rubbers attached to the electronic support that lose their resilient property as they freeze under minus temperatures and therefore stay rigids and therefore can't be compressed anymore and thereby lose the electrical contact with the conductive portions of an electrical support. The resilient property is the ability to spring back into shape, and this resilient property permits to deform the lanced-legs 11 and exert a preload onto the conductive portions 421 of the electronic support 42,
- the solution with the lanced-legs 11 is more robust than a solution where springs are used and attached by welding to the electronic support and to the body of an antenna.

Claims

1. Antenna (1) for a vehicle (2), said antenna (1) comprising a body (10), wherein said antenna (1) further comprises at least one lanced leg (11) that extends from said body (10) and that is configured to bend under a load compression (F), said at least one lanced leg (11) comprising a z-bender part (110) and a lanced part (111) that extends from the z-bender part (111) and that is configured to come into contact with a conductive portion (421) of an electronic support (42).

2. Antenna (1) according to claim 1, wherein said antenna (1) comprises a plurality of lanced-legs (11).

3. Antenna (1) according to any of the preceding claims, wherein said body (10) has a bending (100) that splits the body (10) into two sub-parts (10.1, 10.2).

4. Antenna (1) according to the preceding claim, wherein said two sub-parts (10.1, 10.2) are perpendicular to each other.

5. Antenna (1) according to any of the preceding claims, wherein said body (10) comprises a plurality of mounting holes (101) to mount the antenna (11) to an up-casing (41) of a module assembly (4).

6. Antenna (1) according to any of the preceding claims, wherein said at least one lanced leg (11) is configured to bend without permanent deformation under said load compression (F).

7. Antenna (1) according to any of the preceding claims, wherein said load compression (F) is between 2 and 3 Newtons.

8. Module assembly (4) for a vehicle (2), wherein said module assembly (4) comprises :

- an antenna (1) as claimed in any preceding claims,
- an upper-casing (41) where said antenna (1) is to be mounted,
- an electronic support (42) that comprises at least one conductive portion (421) configured to be in contact with the lanced part (111) of said at least one lanced-leg (11) of the antenna (1),
- a cover (43) that is configured to close the module assembly (4).

9. Module assembly (4) according to the preceding claim, wherein said upper-casing (41) is made of a conductive material.

10. Telematic Control Unit (5) comprising a module assembly (4) as claimed in claim 8 or claim 9.

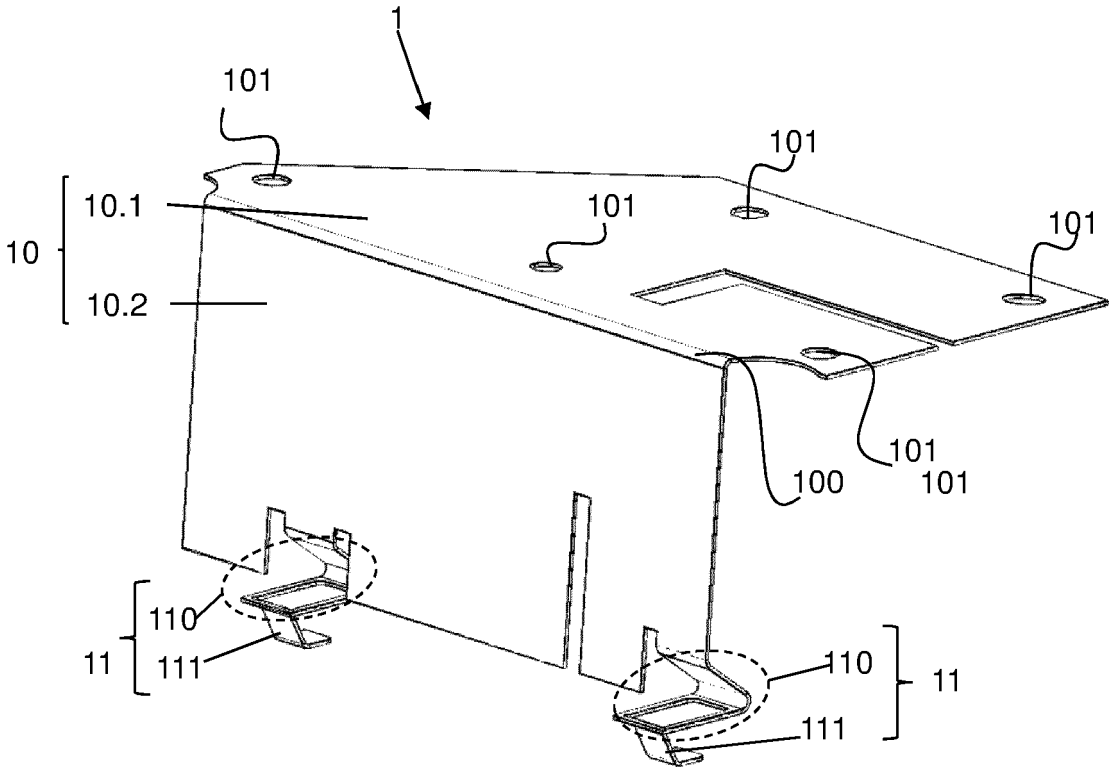
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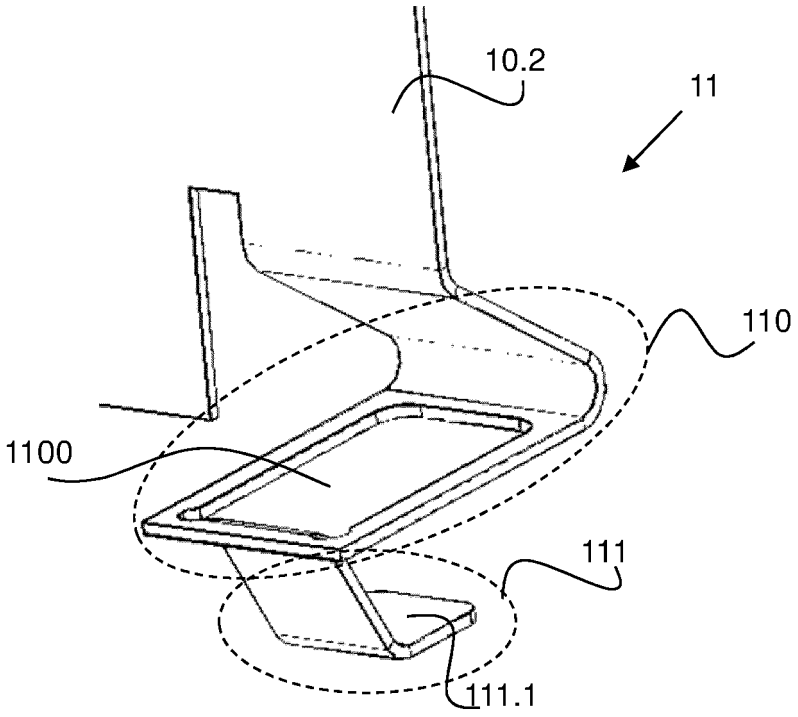
Fig. 1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111.1

Fig. 2

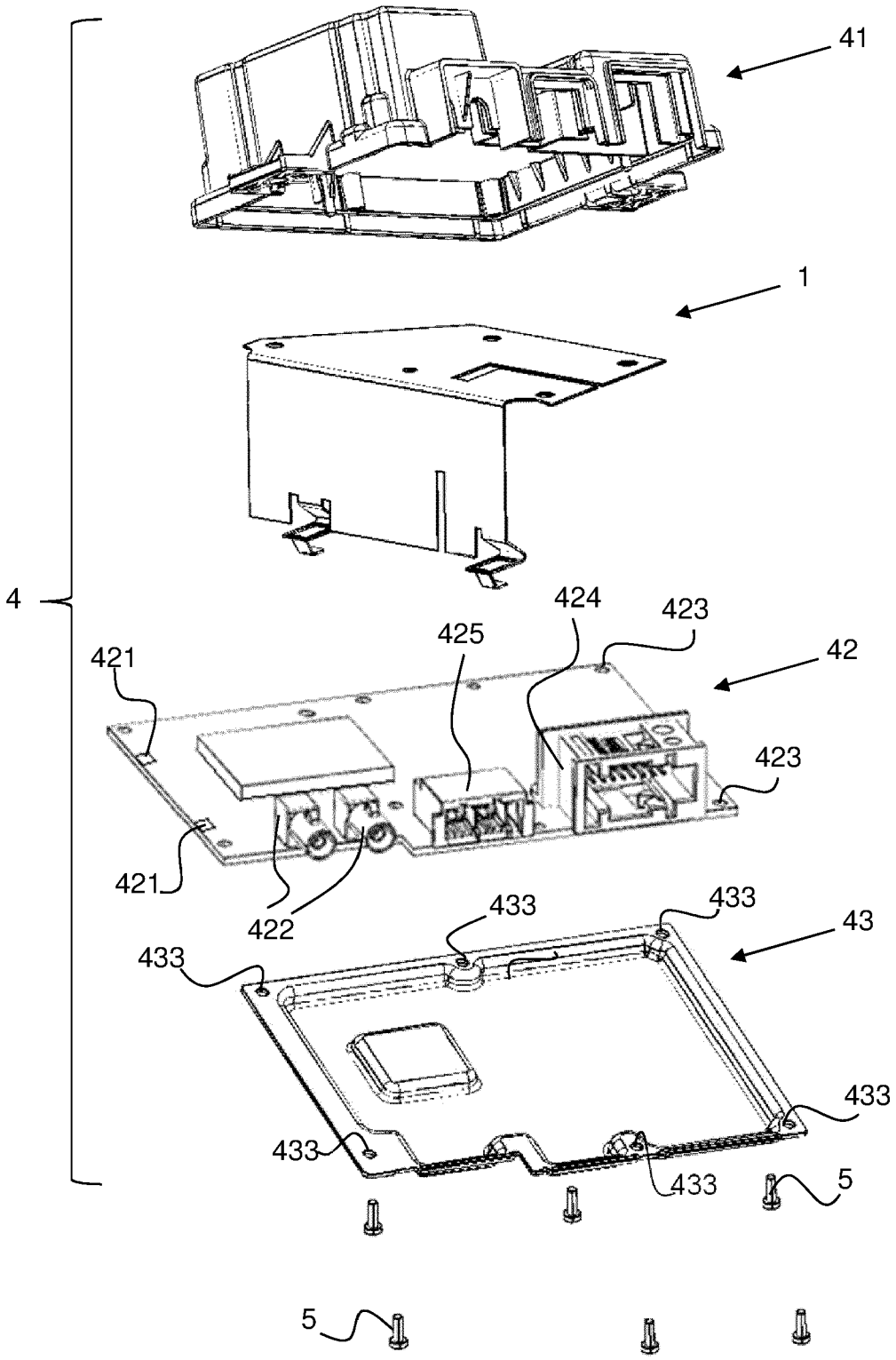


Fig. 3

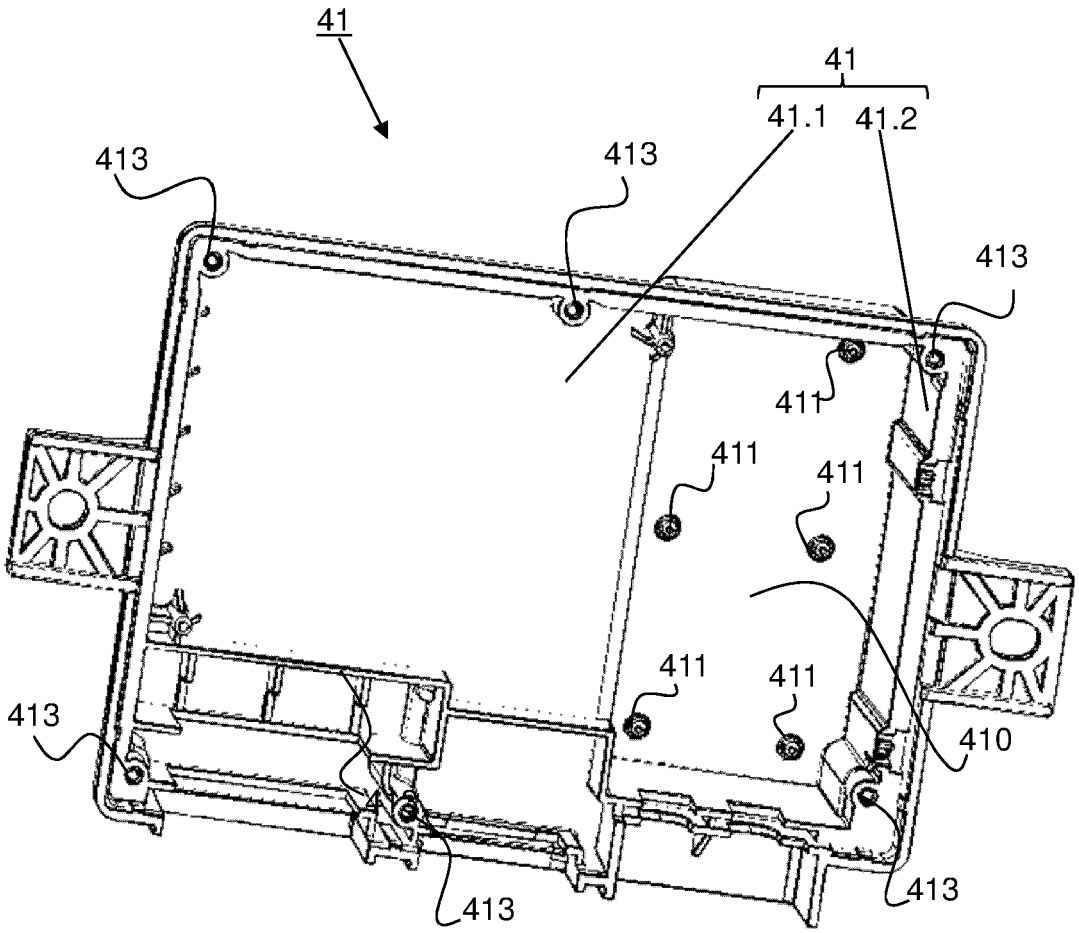
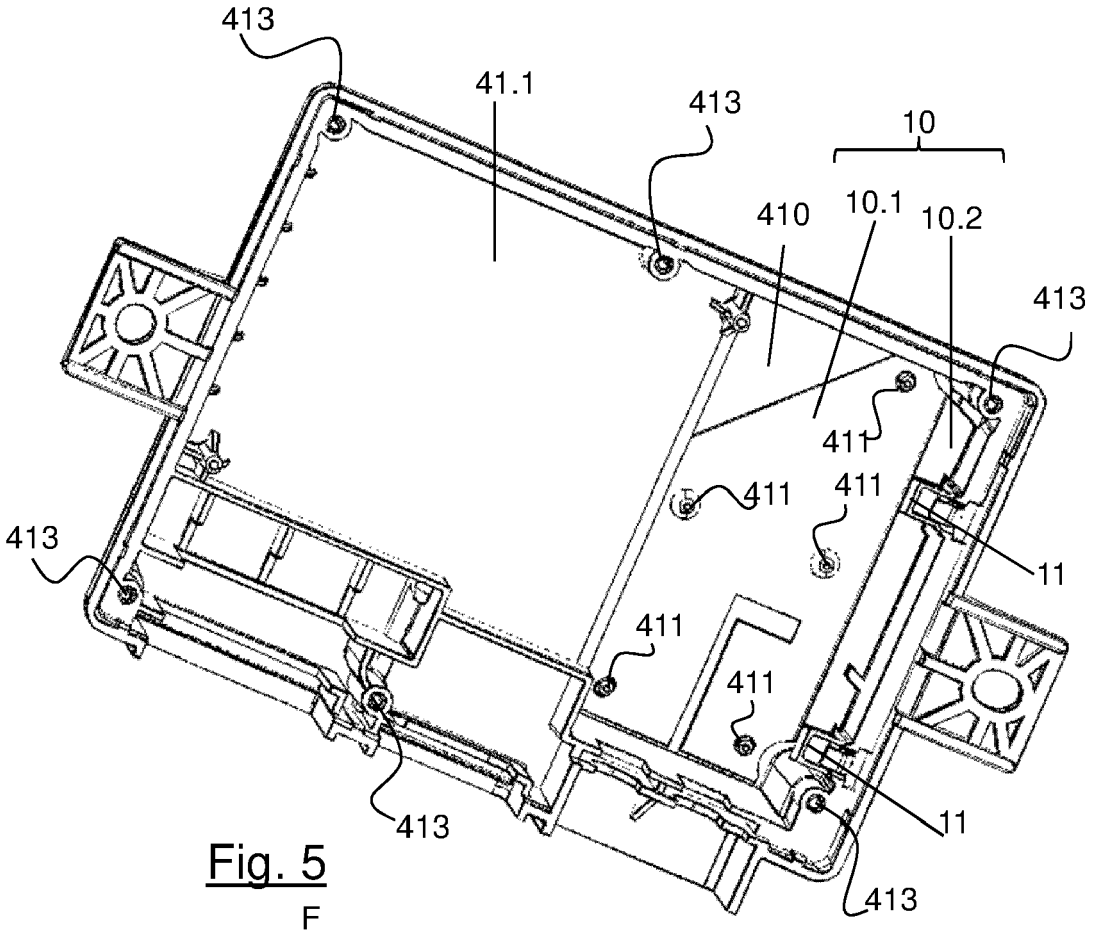


Fig. 4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41.1
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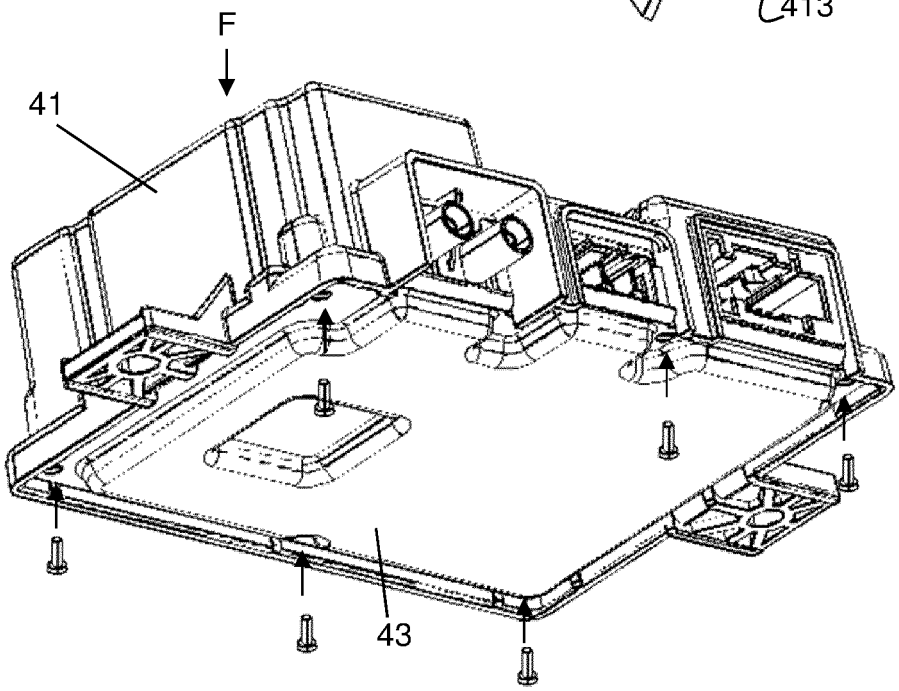
Fig. 5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41
43

Fig. 7

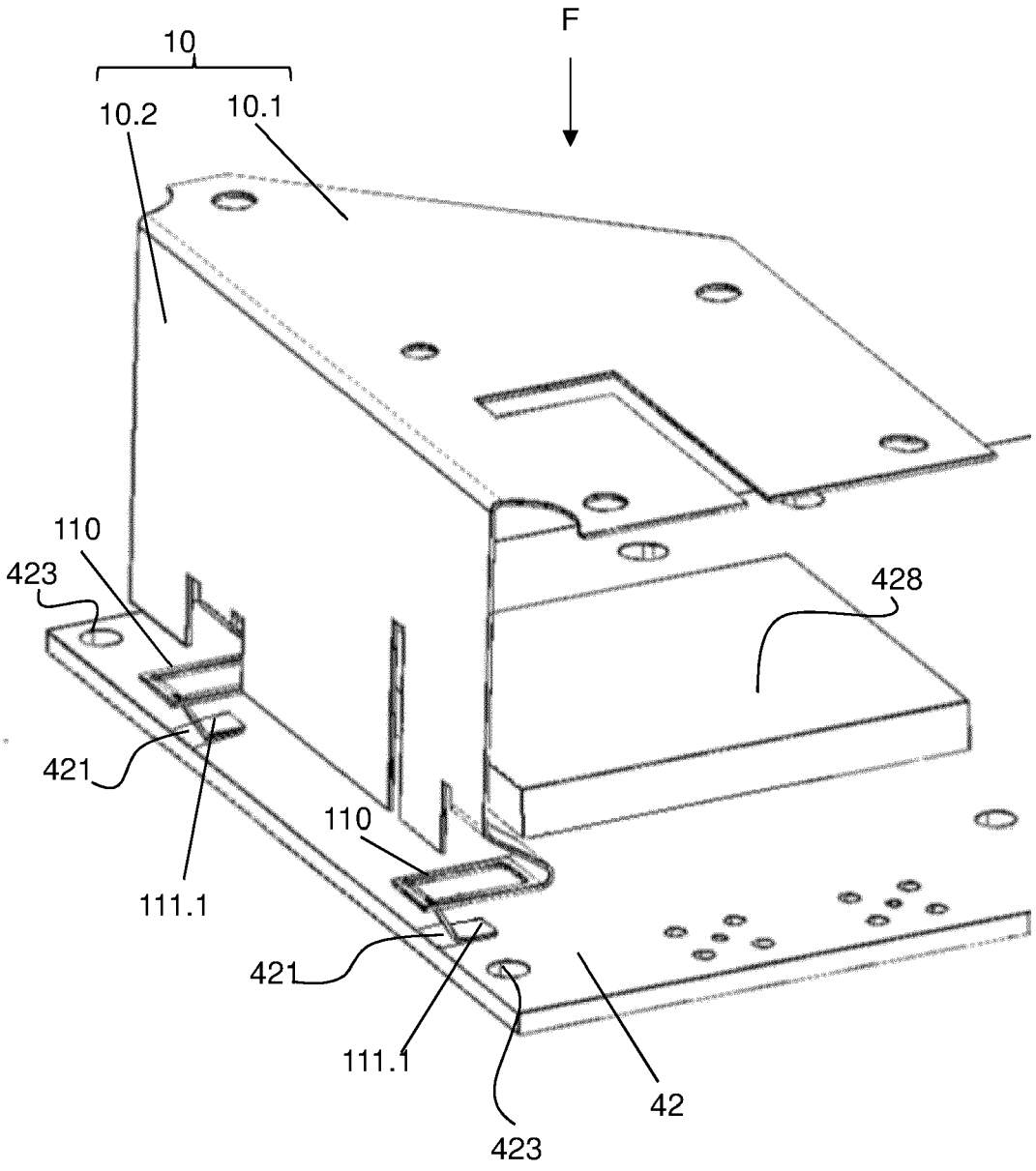

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 22 21 2015

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	CN 203 218 439 U (QINDAO HISENCE MOBILE COMM TECHNOLOGY CO LTD) 25 September 2013 (2013-09-25)	1,2,6-10	INV. H01Q1/20 H01Q1/32
Y	* figures 1-3 *	5	H01Q1/38
X	US 2003/063030 A1 (STOILJKOVIC VLADIMIR [GB] ET AL) 3 April 2003 (2003-04-03) * abstract; figures 1, 6 * * paragraphs [0020] - [0027] *	1-4	
Y	KR 100 701 868 B1 (SKYCROSS KOREA CO LTD [KR]) 3 April 2007 (2007-04-03) * figure 1 *	5	

TECHNICAL FIELDS SEARCHED (IPC)

H01Q

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 May 2023	Hüschelrath, Jens

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 203218439 U	25-09-2013	NONE	
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