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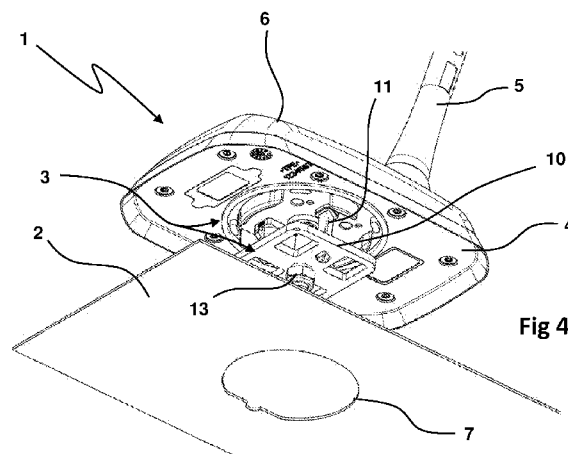
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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(54) **Title:** FASTENING DEVICE, PRIMARILY FOR INSTALLATION OF AN ANTENNA ON A VEHICLE



(57) **Abstract:** The invention relates to a fastening device (3), comprising a base plate (4) for fixation of an antenna rod (5) to a body panel (2), a cover (6) fixed to the base plate (4) from above and a substantially square formed clamping element (10) located below the base plate (4) and connected to the base plate (4) by means of e.g. a screw (13). The invention is achieved by that a first guiding element (15) is arranged as an end stop intended to abut an edge (8a) of a key grip (8) arranged in the mounting hole (7). The first guiding element (15) and the key grip (8) are arranged to automatically orientate the fastening device (3) in a correct rotational/-angular position in the body panel (2). As the first guiding element (15) is arranged inside the circumference of the mounting hole (7,9) makes it possible to install the antenna assembly (1) also in a basic circular hole (9) having no "key grip" (8).



**FASTENING DEVICE, PRIMARILY FOR INSTALLATION OF AN ANTENNA ON  
A VEHICLE**

5 **TECHNICAL FIELD**

The invention relates to a fastening device, preferably  
intended for a roof antenna, or an antenna for installation  
on the side, of a vehicle such as a commercial vehicle like a  
10 truck, a bus or similar, comprising a base plate for fixation  
of the antenna and for accommodating other necessary antenna  
elements which are covered by an cover that is fixed to the  
base plate. An antenna according to the invention is intended  
to be mounted from only one side of a substantially flat  
15 surface of a vehicle body, particularly a vehicle roof.  
Connecting means are embodied in the base plate and a  
clamping element is connected to the base plate and movable  
during installation in relation to the base plate. The  
present application also refers to a vehicle provided with a  
20 fastening device according to the invention.

**BACKGROUND ART**

25 The installation of a roof antenna to the body of a vehicle,  
such as a truck, is usually carried out by an integrally  
threaded pin fixed downwards from the bottom plate of the  
antenna, and which pin is inserted from the outside of the  
vehicle into a hole in a body panel of the vehicle. A nut is  
30 screwed with a tightening torque from the other side onto the  
pin in order to finally fix the antenna assembly to the body  
of the vehicle.

In many applications it is a desire to be able to mount an  
35 antenna from only one side of the vehicle body, e.g. from  
outside of a body panel, as it may be difficult to reach a

screw from behind the body panel. One important advantages of being able to mount the antenna from only one side is that it is faster and more flexible in production, and the service/-aftermarket do not have to dismantle the interior of the vehicle to access the fastening device from inside. It is also a desire that the antenna assembly may be installed only in the correct orientation/direction in the vehicle as well as that a secure electrical contact is obtained between the antenna base plate and the metal in the vehicle body panel. A further desire is that the installation of the antenna assembly should be easy and fast and therefore cost effective.

Many attempts have previously been made to provide a secure, easy and user friendly solution to the problems mentioned and a number of different solutions have been known on the market for a period of time.

**EP1641068** illustrates, for example, an antenna assembly and describes a method for installation of such an antenna on a motor vehicle by means of a clamping device. This antenna assembly is provided with a clamping element connected to the base plate of the antenna assembly by a centrally located screw. The clamping element is axially movable by means of the screw. The antenna assembly is initially mounted by that the clamping element is formed as a bayonet disc comprising six heels. The hole in the vehicle panel is formed in a corresponding way. The clamping element is lowered into the hole and then turned/rotated where after the clamping element is tightened by the screw in such a way that some parts of the clamping device abut the body panel near the hole, from below. A disadvantages of this method, and this device, is that the very special formed hole must be done with special tools and that this solution makes it possible to install the antenna in an incorrect orientation as the antenna is possible to mount in many different angles in relation to the vehicle.

**WO2006/108589** illustrates a similar solution of an antenna assembly. Here the clamping element and the hole are square formed. Also in this solution the clamping element is rotated  
5 in order to secure the antenna assemble to the surface of the body panel. In this solution heals are arranged in the base plate for having the antenna assembly to be oriented in a correct angle in relation to the vehicle.

10 **DE202013010506** describes a further example of an antenna assembly. This solution facilitates that the angle of the installed antenna assembly will be correct. For installation the antenna assembly, and the clamping element, have to be tilted when the clamping element is lowered into a square  
15 formed hole. Thereafter the assembly is moved forwards in such a way that the clamping element is in its entirety lower through the hole. The assembly is fixed from outside to the panel by means of a screw.

20 **EP2276111** describes a still further example of an antenna assembly. This device is mounted, in a square formed hole in the vehicle body panel, by lowering a clamping element downwards in the hole. The clamping element is then rotated  
25 45 degrees and tightened in this position by a screw. In this way the clamping elements four arms abut the edges of the hole from below and are fixed against the body panel.

Other similar solutions, involving various forms of fastening devices with the aim of being able to mount an antenna  
30 assembly from outside a vehicle body panel exists on the market but none of these known systems show an antenna assembly or a fastening device that e.g. will be possible to mount in a basic circular/round hole that do not require special tools to make.

**SUMMARY OF INVENTION**

An object of the invention is thus to solve the above problems and to provide a flexible fastening device that facilitates the installation of an antenna assembly either in a specially formed hole, in which the fastening device easily and automatically may be correctly orientated (a so called poka-yoke-solution), or that the device is possible to install in a basic circular/round hole, that do not require special tools to make, as an aftermarket service.

Another object of the invention is that the fastening device should be easy to install, even in tight spaces.

A further object of the invention is that the fastening device should be able to be manufactured in a cost effective manner.

These and further objects and advantages are achieved by the invention by a fastening device designed in accordance with the features described in the independent claim 1.

The invention concerns a fastening device primarily intended for a roof antenna, or a side mounted antenna, for a vehicle. The fastening device comprises a base plate e.g. for fixation of the antenna and for accommodating necessary antenna elements, and a clamping element. The base plate and the antenna elements are protected by a cover that is fixed to the base plate. The clamping element is attached to the base plate, located below the base plate, by means of a screw. The clamping element is movable downwards or upwards in relation to the base plate. The antenna and its fastening device is intended to be mounted from only one side of a substantially flat surface of e.g. a vehicle like a truck or a bus, particularly on the vehicles roof. Electrically connecting

means are also embodied in the base plate and are reached through holes in the clamping element.

5 The clamping element of the fastening device is designed/  
formed in such a way that it may be installed in different  
formed holes in the vehicle body. In one first application it  
is important that the fastening device may be installed in a  
fast and easy manner but still in a completely correct  
orientated way. This is necessary in the production of the  
10 vehicle where specially formed holes are already punched out,  
or cut by laser, in the body panels. Such holes could easily  
be designed with a "key grip" making it easy, during  
installation, to orientate the antenna assembly in a  
completely correct angle/orientation. These holes require  
15 special tools to make and these are expensive to distribute  
and use in the aftermarket, when antennas are to be installed  
after that the vehicle is manufactured. In the aftermarket it  
is easier and more cost effective to make round holes, using  
standard tools. It is an advantage if the same antenna  
20 assembly could be used both in the production of the vehicle  
as well as in the aftermarket. The antenna according to the  
invention could be installed both in a hole formed with a key  
grip and in a completely circular hole without any key grip.

25 The invention is achieved by that the clamping element is  
substantially square formed and that a first guiding element  
is arranged in the base plate facing downwards. The width of  
the square formed clamping element is substantially equal to,  
or less than, the diameter of the mounting hole in the body  
30 panel. This makes it possible to slide the clamping element  
through the mounting hole, in an angle. The fastening device  
according to the invention could also be mounted in a  
completely circular hole without any key grip, as the first  
guiding element, when located in the mounting hole, is  
35 arranged inside the circumference of the mounting hole.

The first guiding element, arranged on the base plate, is formed as an end stop and is intended to abut the edge of the key grip of the specially formed mounting hole, when installed in the correct position, thereby forcing the antenna assembly to be located in a specific predetermined rotational or angular position in the hole, in relation to the vehicle. The key grip is arranged as a nose or tongue in the mounting hole, having an edge facing inwards the center of the mounting hole.

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Further features and advantages of the invention will appear from the following, more detailed description of the invention and the accompanying drawings and further claims.

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#### **BRIEF DESCRIPTION OF THE DRAWINGS**

The invention is described below in some preferred embodiments referring to the accompanying drawings.

20

**Figure 1** illustrates a perspective view of an antenna assembly mounted on a body panel surface of a vehicle.

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**Figure 2** illustrates a mounting hole with a substantially circular shape but formed with a "key grip".

**Figure 3** illustrates a mounting hole with a simple/basic circular shape.

30

**Figure 4** illustrates a perspective view of an antenna assembly, according to the invention, in a first mounting step with the clamping element loosened to its outermost position.

35

**Figure 5** illustrates a perspective view of an antenna assembly, according to the invention, in a second mounting

position, where the clamping element is partly slid through the hole from above/outside of the vehicle body.

5 **Figure 6** illustrates a perspective view from below of the antenna assembly and its clamping element partly through the mounting hole.

10 **Figure 7** illustrates a perspective view from below of a third mounting position where the antenna assembly and its clamping element is in a position completely through the mounting hole.

15 **Figure 8** illustrates a perspective side view of the antenna assembly in the same position as in figure 7 where the clamping element is located below/inside the body panel.

20 **Figure 9** illustrates a side view of the antenna assembly resting on the outside of the body panel surface and the clamping element still in its loose position.

**Figure 10** illustrates a side view of the antenna assembly in a fourth mounting stage where the clamping element has been fastened by rotating the centrally located screw (indicated).

25 **Figure 11** illustrates a view from below mainly showing the clamping element and the first guiding element and how the clamping element abuts the guiding element.

30 **Figure 12** illustrates a perspective view from an angle below showing the antenna assembly including the clamping element and the first guiding element as well as a second guiding element for guiding the clamping element also in its outermost loosened position, as well as further guiding elements for centralizing the antenna assembly in the hole by  
35 abutting the inner edge of the hole.



**Figure 13** illustrates a view showing the clamping element and its different holes for connectors/cables as well as the recess for the first guiding element and the hole for the second guiding element.

#### DESCRIPTION OF PREFERRED EMBODIMENTS

The invention thus concerns a fastening device intended for fastening of a roof antenna, or similar, onto a vehicle body. The main advantage with the fastening device according to the invention is that the same designed antenna assembly could be used in the production line as well as in the aftermarket, i.e. in an specially formed mounting hole as well as in a hole with a basic circular shape.

**Figure 1** illustrates a perspective view of an antenna assembly 1 mounted on a body panel 2 of a vehicle (not shown). The antenna assembly 1 is fixed to the body panel 2 by a fastening device 3 (see figure 4) comprising a base plate 4 (see figure 4) for supporting the antenna 5 and for accommodating other necessary antenna elements (not shown). The base plate 4 and the antenna elements are protected by a cover 6 that is fixed to the base plate 4.

**Figure 2** illustrates a mounting hole 7, for the antenna assembly 1 and its fastening device 3 (see figure 4), with a substantially circular shape, formed with a "key grip" 8. The key grip 8 is arranged as a nose/tongue in the mounting hole 7, having an straight edge 8a, possibly having a recess 8b, facing inwards the centre of the mounting hole 7. The mounting hole 7 also have an inner circular edge 8c. I.e. the mounting hole 7 has a basic circular shape defined by the inner circular edge 8c and the straight edge 8a forming a chord. It is important that the fastening device 3 may be

installed in a fast and easy manner, especially in the production of the vehicles, but still completely correct oriented in relation to the vehicle. In the production line especially formed holes 7 may be already punched out, or cut  
5 by laser, in the body panels 2 used. These holes 7 may easily be designed with the "key grip" 8, to orientate the antenna assembly 1 in the correct angle/orientation.

**Figure 3** illustrates a mounting hole 9 but with a basic  
10 circular/rounded shape with an inner circular edge 9c. A hole 7 (see figure 2) with a key grip 8 requires special tools that are very expensive to distribute and to use in the aftermarket. In the aftermarket it is therefore easier and more cost effective to make circular/round holes 9 with  
15 standard tools. It is an advantage if the same antenna assembly 1 (see figure 1) could be used both in the initial production of the vehicle, with specially manufactured holes 7, as well as in the aftermarket. This means that only one design/product could be used in different situations giving  
20 higher production volumes and thereby lower costs.

**Figure 4** illustrates a perspective view of an antenna assembly 1, according to the invention, in a first mounting step with the clamping element 10 loosened to its lowest or  
25 outermost position. The clamping element 10 is prevented to rotate in relation to the base plate 4 by means of a guiding pin 11. The antenna assembly 1 and its fastening device 3, the base plate 4 and the clamping element 10 is intended to be mounted from only one side, the outside, of a substantially flat surface of e.g. a vehicle like a truck or a bus,  
30 and particularly on the vehicles roof or its side panel (not shown). Electrically connecting means (not shown) are embodied in the base plate 4 inside the cover 6 and the clamping element 10 is located below the base plate 4 and  
35 connected to the base plate 4 by means of a screw 13. The screw 13 can be rotated from the top of the cover 6, via a

hole 14 (see figure 5). The clamping element 10 is movable downwards or upwards, in relation to the base plate 4, by means of the screw 13.

5 **Figure 5** illustrates a perspective view of an antenna assembly 1, according to the invention, in a second mounting position, where the clamping element 10 is partly slid through the hole 7 from above/outside of the vehicle body panel 2. The antenna assembly 1 is somewhat tilted and moved  
10 sideways in order to slide the clamping element 10 through the mounting hole 7.

**Figure 6** illustrates a perspective view from below of the antenna assembly 1 and its clamping element 10, partly slid  
15 through the mounting hole 7. The movement is stopped as soon as the entire clamping element 10 has passed through the mounting hole 7.

**Figure 7** illustrates a perspective view from below of the antenna assembly 1 (see figure 6) where the clamping element  
20 10 has moved completely through the mounting hole 7 and thereby arrived to a horizontal position below/inside the body panel 2. The antenna assembly 1 is then moved a bit in the opposite direction until the fastening device 2 is  
25 positioned centralized over the mounting hole 7. Figure 7 also disclose a first guiding element 15. The first guiding element 15 is shaped as an elongated flange and is arranged on or attached to the base plate 4, facing downwards. The length in the elongation direction of the flange shaped first  
30 guiding element 15 is substantially the same as the length of the cord shaped straight edge 8a of nose/tongue of the mounting hole 7. The first guiding element 15 has a centrally located substantially circular rod 17 for reinforcing the first guiding element 15, the flange, and to fit in a recess  
35 8b arranged in the nose/tongue 8 of the mounting hole 7 for securing the locking function against the key grip 8 (see

figure 2). The first guiding element 15 is arranged in the base plate 4 so that it protrude from the base plate 4 inside the prolonged circumference, i.e. the prolongation of the inner circular edge 8c of the essentially circular/round mounting hole 7, making it possible to install the fastening device 3 also in a basic circular/round hole 9 having no key grip 8, shown in figure 3 and visualized in figure 7 by the dashed line 9c.

10 **Figure 8** illustrates a perspective side view of the antenna assembly 1 slightly above the body panel 2 and where the clamping element 10 is located below the body panel 2, at a loose position loose from the antenna assembly 1.

15 **Figure 9** illustrates a side view of the antenna assembly 1 pressed/guided through the body panel 2 by further guiding elements 14a-c (see figure 11) and resting on the outside of the body panel 2. The clamping element 10 is here still in its loose position.

20

**Figure 10** illustrates a side view of the antenna assembly 1 where the clamping element 10 has been fastened in a fastened position by rotating the centrally located screw 13 (just indicated inside the cover 6 by dotted lines in the picture).

25

**Figure 11** illustrates a view from below showing the clamping element 10 and the first guiding element 15, flange, and how the clamping element 10 abuts the first guiding element 15 when the clamping element 10 is in the fastened position. A recess 18 in the clamping element 10 is arranged to abut the first guiding element 15. The recess 18 is preferably shaped as being adapted to the elongated flange shape of the first guiding element 15. Said clamping element recess 18 may be provided with an additional inwards facing recess 18a

30 arranged to receive the substantially circular rod 17 of the first guiding element 15, the flange, for securing the

35

locking function. The guiding pin 11 is preventing the clamping element 10 from rotating in relation to the base plate 4. The guiding pin 11 has a length essentially similar to the distance between the base plate 4 and the head of the screw 13 on which the clamping element 10 is resting when in its outermost loosened position. Further guiding elements 14a-c are arranged on the base plate 4, facing downwards, for centralizing the base plate 4 when fitted into the mounting hole 7 (see figure 2). Said further guiding elements 14a-14c have preferably a semi-circular outer edge which is arranged to abut the circular inner edge 8c, 9c of the hole 7 or 9.

**Figure 12** illustrates a perspective view, from an angle below, showing the antenna assembly 1 including the clamping element 10 and the first guiding element 15 as well as the guiding pin 11 for guiding the clamping element 10, keeping it from rotating, also in its outermost loosened position, as well as the further guiding element 14a for centralizing the antenna assembly 1 in the hole 7, 9 by abutting the inner circular edge 8c, 9c of the hole 7, 9 (not shown).

**Figure 13** illustrates a view from below showing the separated clamping element 10 and its different recesses/holes 16a-d intended for connectors/cables (not shown) as well as the hole 17 for the guiding pin 11.

The above description is primarily intended to facilitate the understanding of the invention. However the invention is of course not in any way restricted to only the disclosed embodiments, but many possibilities to modifications would be apparent to a person skilled in the art within the scope of the invention without departing from the basic idea of the invention as defined in the appended claims.

**CLAIMS**

1. Fastening device (3), primarily intended for fastening of  
an antenna assembly (1) in a mounting hole (7, 9) on a  
5 vehicle from only one side of e.g. a substantially flat  
surface like a body panel (2), comprising a base plate (4)  
for fixation of an antenna rod (5), a cover (6) fixed to the  
base plate (4) from above and a substantially square formed  
10 clamping element (10) located below the base plate (4) and  
connected to the base plate (4) by means of e.g. a screw (13)  
which allow the clamping element (10) to be movable downwards  
or upwards in relation to the base plate (4) towards a loose  
or fastened position respectively,

***characterised by***

15 that a first guiding element (15) is arranged in the base  
plate (4) facing downwards as an end stop intended to abut an  
edge (8a) of a key grip (8), when installed into a mounting  
hole (7) which is essentially circular/round but provided  
with a key grip (8),

20 that the first guiding element (15) is arranged to abut the  
clamping element (10) when the clamping element is in the  
fastened position,

that the first guiding element (15) is arranged to  
automatically orientate the fastening device (3) in a correct  
25 angular/rotational position in the body panel (2) by  
interaction with the key grip (8), when installed into the  
mounting hole (7) provided with a key grip (8),

that the first guiding element (15) is arranged to  
automatically lock the fastening device (3) from rotating in  
30 relation to the body panel (2) by interaction with the key  
grip (8), when installed into a mounting hole (7) provided  
with a key grip (8), and

that the first guiding element (15) is arranged in the base  
plate (4) so that it protrude from the base plate (4) inside  
35 the circumference of the mounting hole (7,9), when installed  
into the mounting hole (7), making it possible to install the

fastening device (3) also in a basic circular/round hole (9) having no key grip (8).

2. Fastening device (3) according to claim 1,

5 **characterised by**

that the key grip (8) is arranged as a nose/tongue in the mounting hole (7), having an edge (8a) facing inwards the centre of the mounting hole (7).

10 3. Fastening device (3) according to claim 1 or 2,

**characterised by**

that the first guiding element (15) is arranged as an elongated flange fixed to the base plate (4), facing downwards in relation to the antenna assembly (1).

15

4. Fastening device (3) according to any preceding claims,

**characterised by**

that the first guiding element (15) is arranged to abut the edge (8a) of the nose/tongue in the mounting hole (7).

20

5. Fastening device (3) according to any preceding claims,

**characterised by**

that the first guiding element (15) has a centrally located substantially circular rod (17) for reinforcing the first guiding element (15) and to fit in a recess (8b) arranged in the key grip (8) for securing the locking effect.

25

6. Fastening device (3) according to any preceding claims,

**characterized by**

that a recess (18) arranged in the clamping element (10) is arranged to abut the first guiding element (15).

30

7. Fastening device (3) according to any preceding claims,

**characterised by**

that the clamping element (10) and first guiding element (15) are made of metal.

8. Fastening device (3) according to any preceding claims,

5 **characterised by**

that a screw (13) is arranged to move the clamping element (10) upwards or downwards in relation to the base plate (4) and for final assembly of the antenna assembly (1) to the body panel (2).

10

9. Vehicle **characterized in that** a fastening device (3) of any one of the claims 1 to 8 is used/installed.

15



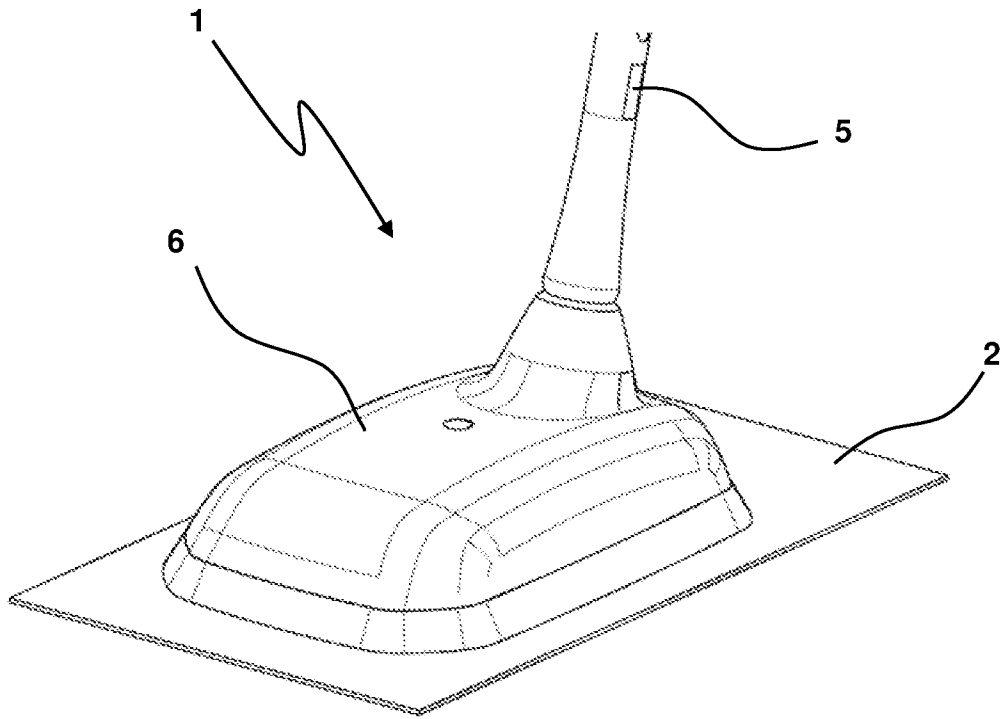


Fig 1

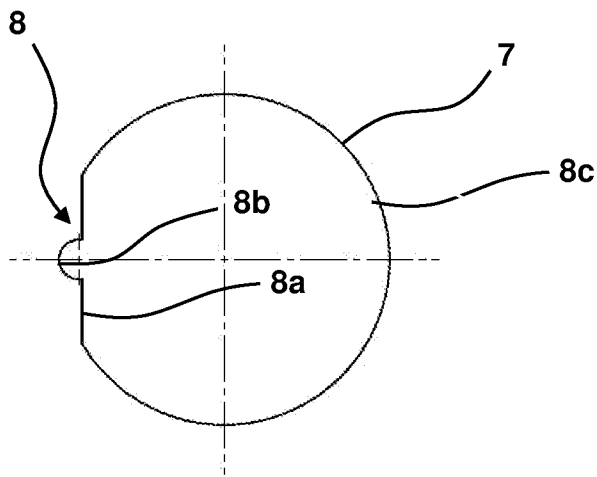


Fig 2

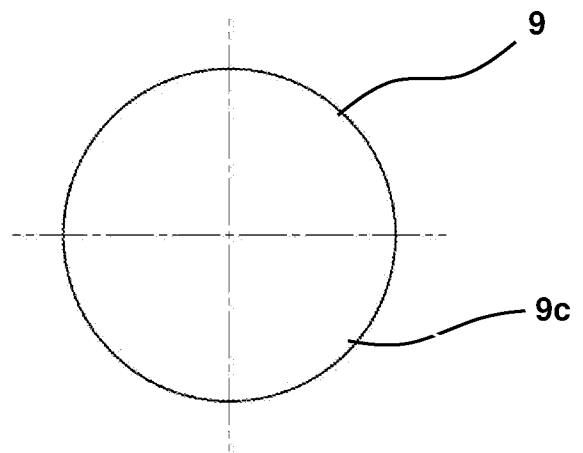
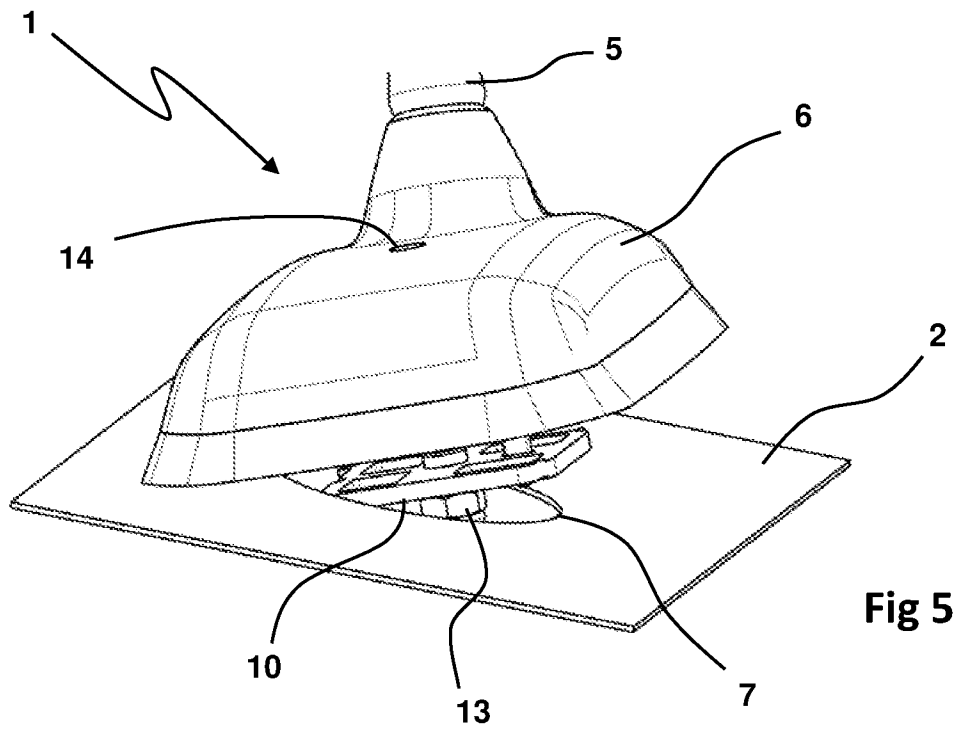
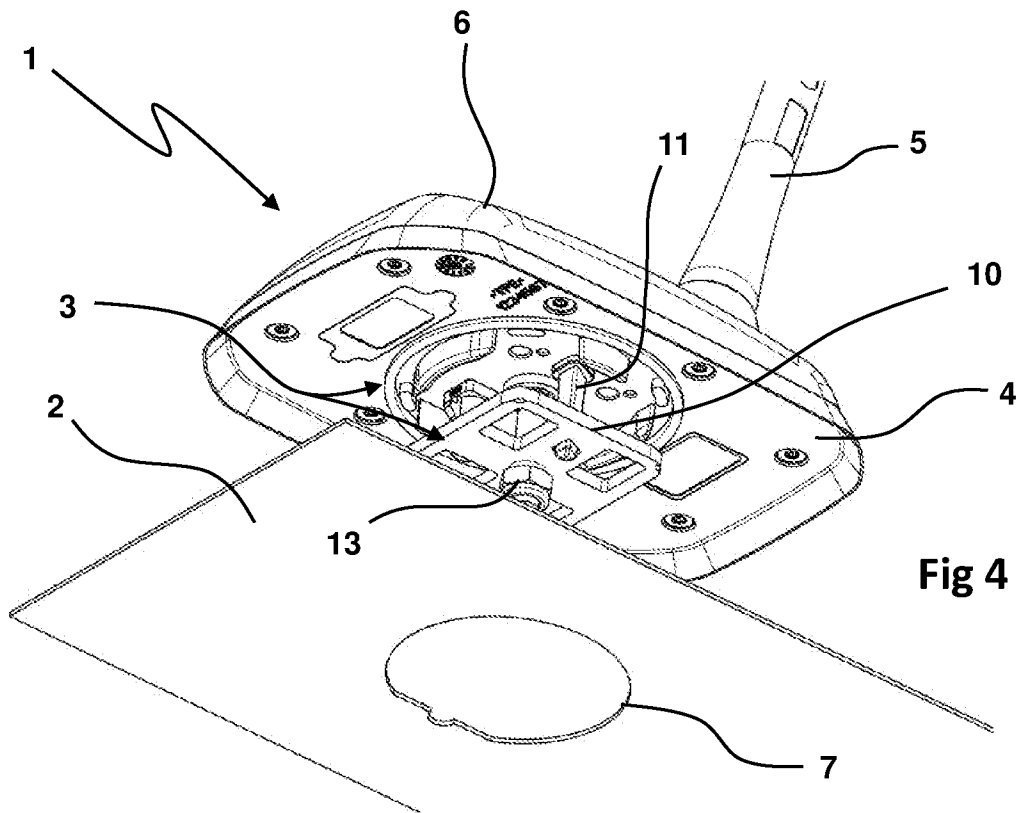


Fig 3



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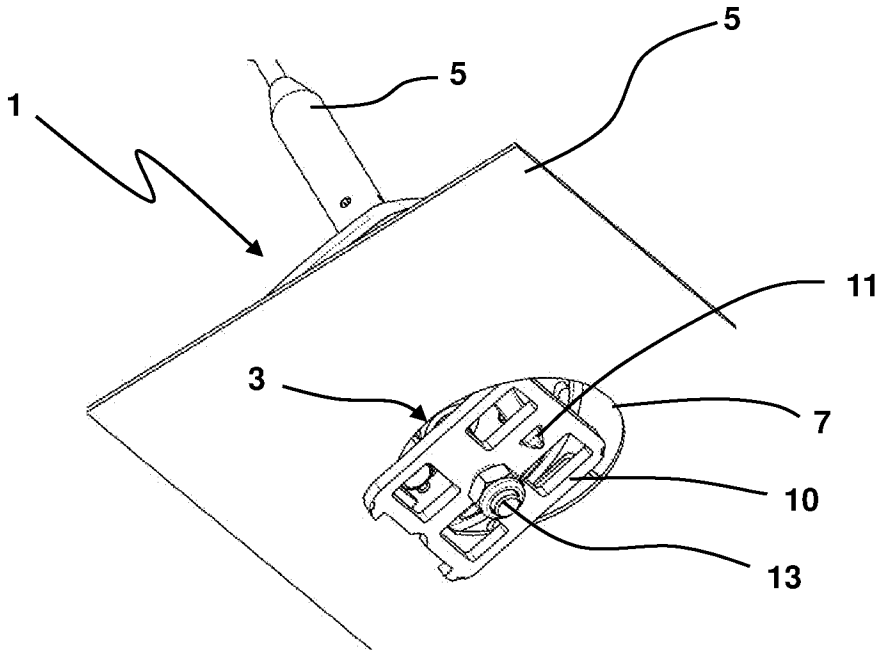


Fig 6

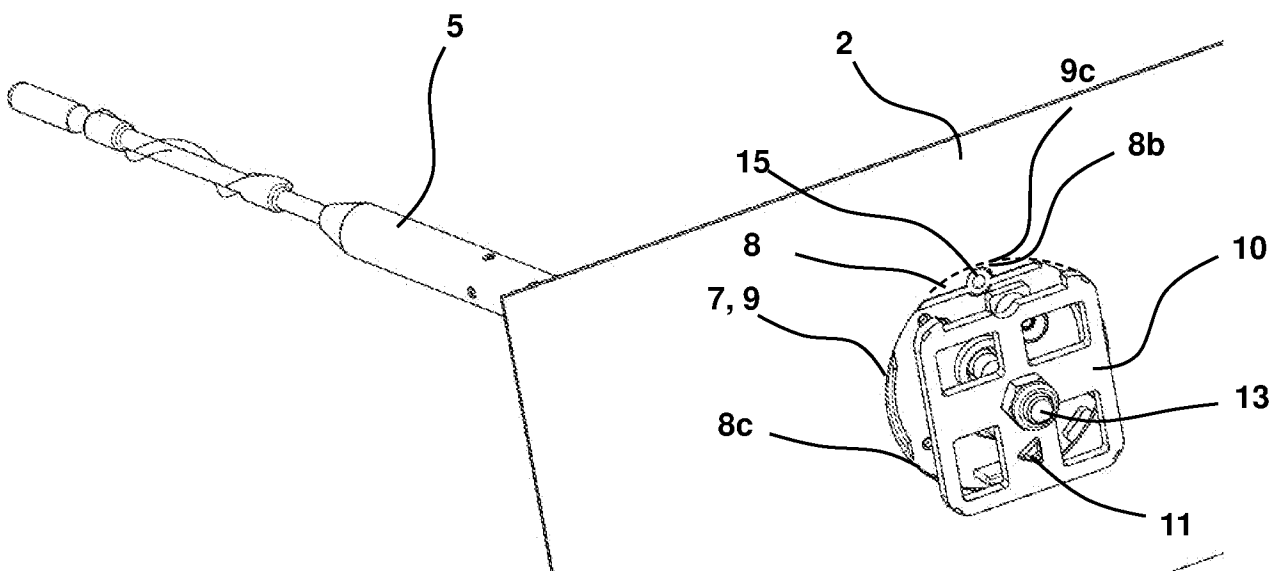
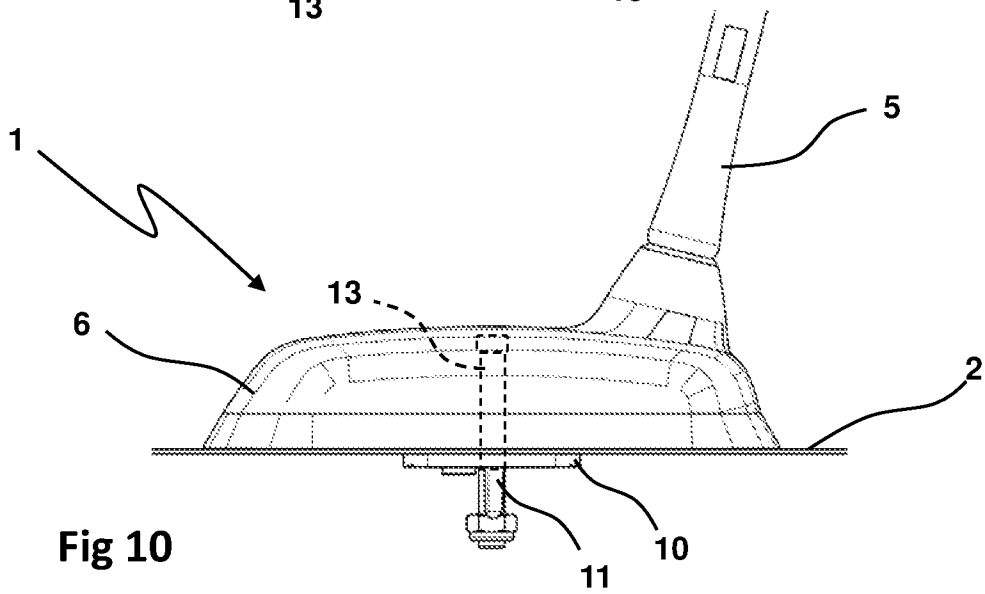
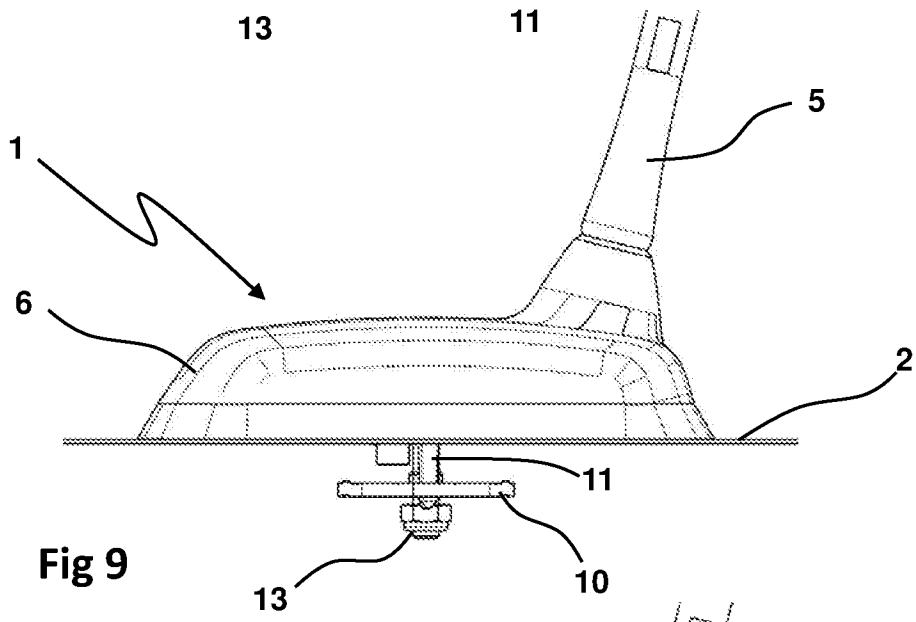
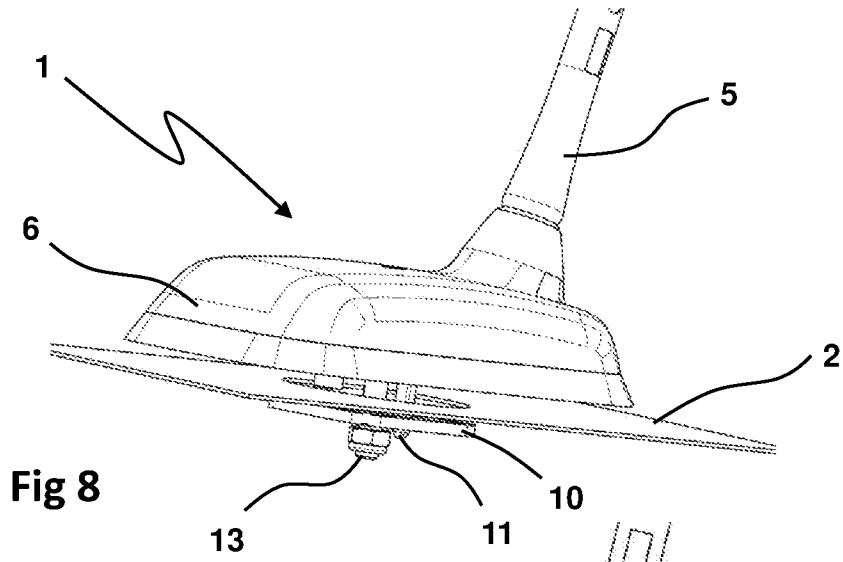


Fig 7



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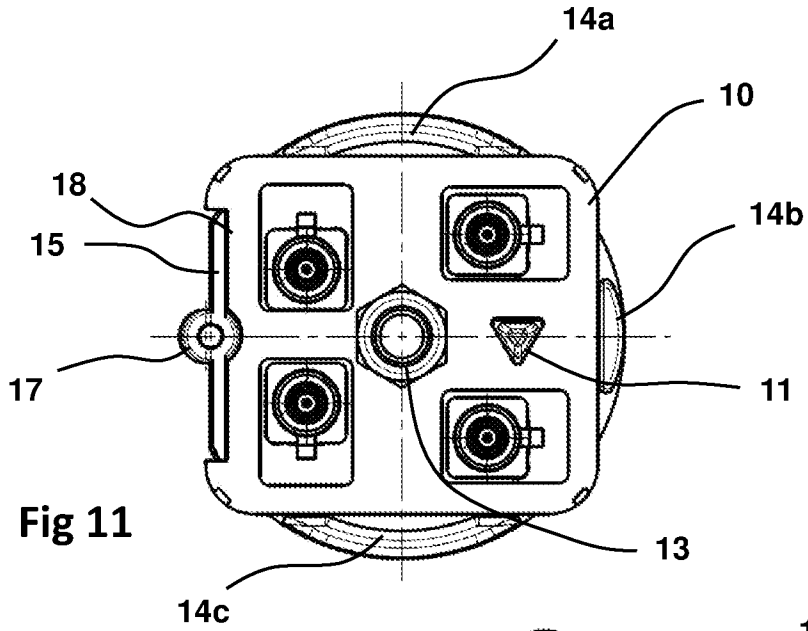


Fig 11

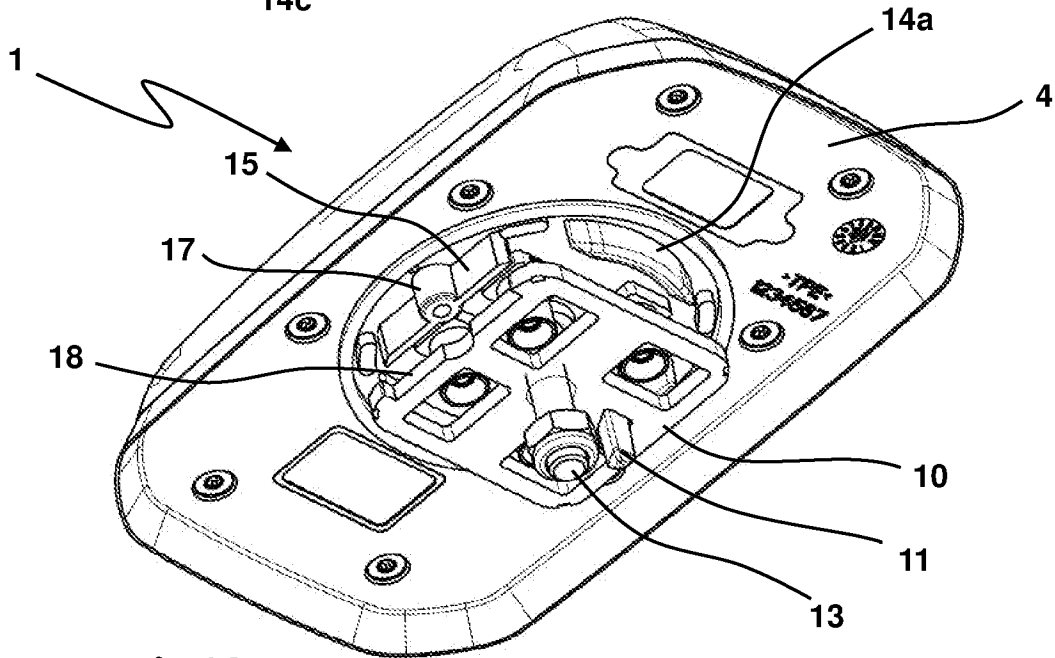


Fig 12

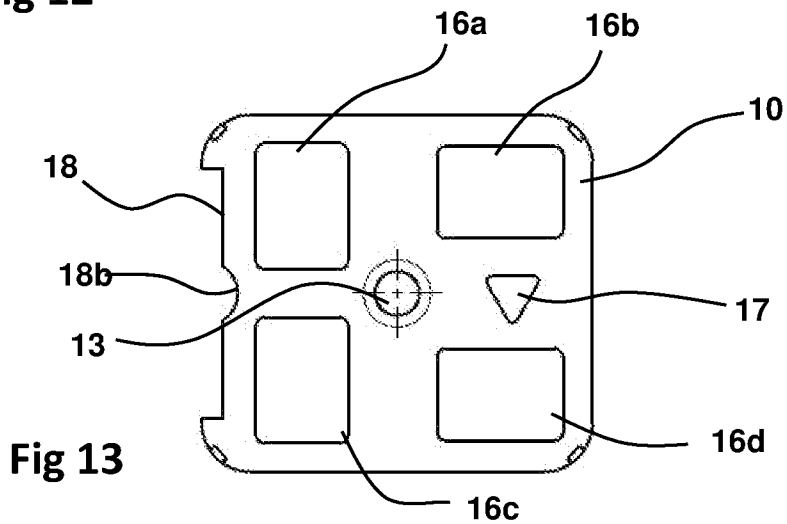


Fig 13

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SE2016/050774

A. CLASSIFICATION OF SUBJECT MATTER		
IPC: see extra sheet		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC: H01Q		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE, DK, FI, NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EPO-Internal, PAJ, WPI data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1760826 A2 (HIRSCHMANN CAR COMM GMBH), 7 March 2007 (2007-03-07); figure 2; claim 1 --	1-9
A	US 20030068198 A1 (KOZLOVSKI A DAVID), 10 April 2003 (2003-04-10); abstract; figures 1-2 --	1-9
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Date of the actual completion of the international search 21-10-2016		Date of mailing of the international search report 21-10-2016
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International application No.  
PCT/SE2016/050774

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**International Patent Classification (IPC)**

**H01Q 1/32** (2006.01)

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