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(54) **Antenna device, antenna base and antenna unit**

(57) The invention relates to an antenna device for a vehicle, comprising: a first part which is a base which can be mounted on the vehicle and has at least one antenna connector coupled to at least a connection which can be connected to at least one receiver in the vehicle, a second part which is an antenna unit which can be connected to the antenna connector and which is provided

ed with an antenna, coupling means arranged on at least one of the two parts for coupling the antenna unit to the base, wherein one of the parts comprises a base plate provided with a number of projections which protrude from this base plate and which can be received in recesses in the other part, and wherein one of the two parts is provided with at least a clamping means for fixedly clamping the projections received in the recesses.

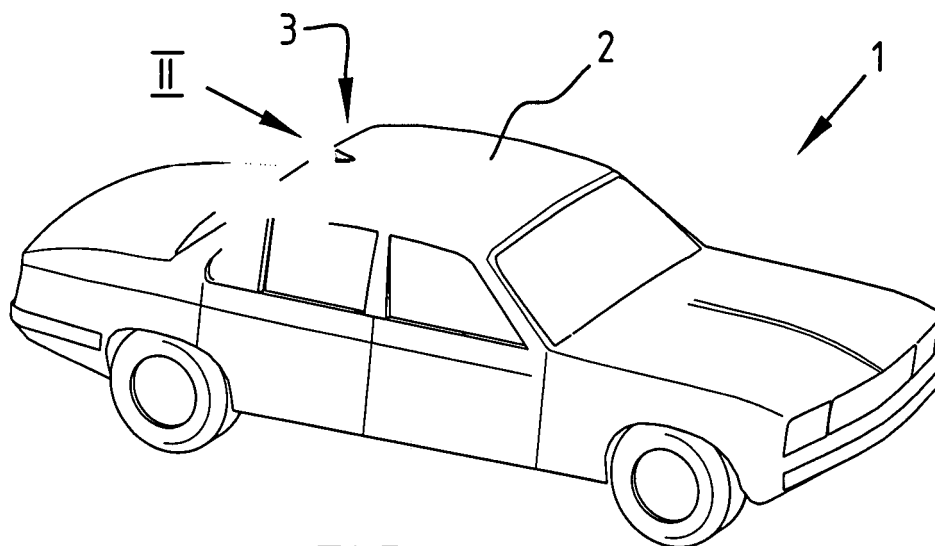


FIG. 1

Description

[0001] The invention relates to an antenna device for a vehicle, comprising a first part which is a base which can be mounted on the vehicle and which is provided with at least one antenna connector, a second part which is an antenna unit which can be connected to the antenna connector and which is provided with an antenna, and coupling means arranged on the two parts for coupling the antenna unit to the base. The invention further relates to a base for an antenna device which can be mounted on a vehicle and to an antenna unit.

[0002] It is known for vehicles to be provided with antennas for receiving diverse signals for different functionalities present on the vehicle. Examples are the AM/FM receiver, GPS, the mobile telephone, traffic information systems and the like. Use is made of different frequencies for the carrier waves for the diverse functionalities, and different antennas with optimal properties are necessary in each case for this purpose.

[0003] Known from DE-A 102.55.549 is an antenna system for a vehicle, wherein the vehicle is provided with a base to which are connected a number of cables which are coupled to receivers with different functions in the vehicle. With the base and the various cables the vehicle is prepared in the factory for the later fitting of these different functional systems. Depending on the functions actually present in the vehicle, an antenna unit equipped for this purpose is placed on the base.

[0004] US 2003/0068198 describes an assembly consisting of a number of parts which is used on vehicles as antenna unit. An antenna part is herein connected to a part arranged on the vehicle. A screw connection on the inner side of the vehicle secures the whole. A mechanic here does not have easy access to the screw connection, which is situated on the inside of a lining of the car. The part mounted on the vehicle is not connected to the electrical conductors which finally make the connection to the antenna.

[0005] EP 1 411 585 also describes an antenna unit consisting of a plurality of separate parts. The second part, the antenna unit, is attached to the first part by means of bolts. The bolts are screwed into the antenna unit from inside the vehicle. The first part is here not connected to the electrical conductors either.

[0006] The prior art coupling between the base and the antenna unit is not robust, can be easily damaged, and the time required in the factory for automated placing of an antenna unit on the base is too long. An object of the invention is to provide an antenna device wherein at least one of the above stated problems is resolved.

[0007] This objective is achieved according to the invention in that one of the parts comprises a base plate provided with a number of projections which protrude from this base plate and which can be received in recesses in the other part, and wherein one of the parts, in particular the part with recesses, is provided with at least a clamping means for fixedly clamping the projections received in the recesses. An installation is hereby obtained in which the projections are embodied on the one hand for the purpose of locking the position of the two parts relative to each other, and on the other as additional guide means when the antenna is placed on the base plate. The same projection is after all engaged by a clamping means which locks the projections protruding through the recess. The base is for instance connected clampingly to the bodywork, in particular the roof of the vehicle, and the projections protrude for instance from the base arranged on the roof. According to this embodiment the projections are also engaged by the antenna unit, whereby the base itself can be embodied in simple manner. In another embodiment the antenna unit is provided with the base plate and the base has recesses for receiving the projections. According to the invention there is provided a first and second antenna part which is provided with engaging means which can be mutually connected and locked wholly outside the car. It is no longer necessary to arrange an additional coupling means on the inside of the car. A considerable advantage in assembly is hereby achieved, wherein not only the cost of opening in each case the inner lining of the roof of the car is saved, but also the assembly time necessary for this purpose.

[0008] The first part is preferably provided with at least one electrical terminal which can be connected to at least one receiver in the vehicle. The first part is thus coupled to electrical conductors. The first part preferably has at least one antenna connector. The antenna connector can be coupled to the antenna unit. By arranging the second part on the first part the prepared antenna connector of the first part is electrically coupled to the antenna unit, and the antenna can function. The antenna connector on the first part is coupled via the connection to for instance receivers in the vehicle. The releasable connection allows rapid replacement. Such a connection also makes it possible to arrange various antenna units if the antenna units are embodied with a standard coupling for connection to the antenna connector provided by the first part.

[0009] In a particular embodiment both the projections and the clamping means are arranged on one of the two parts. From the projections received in the recesses there can for instance protrude a hook which locks and clamps the projection in the recess.

[0010] In contrast to the prior art, during the coupling of the first part to the second part of the antenna device according to the invention it is not only the alignment and positioning of the parts relative to each other which are realized, but the electrical connection of the first and the second parts also takes place, whereby work operations on the inside of a vehicle are made unnecessary. The antenna unit can be replaced easily by uncoupling the mechanical and electrical connection.

[0011] According to a further embodiment the projection is conical. An additional guiding function is achieved due to the conical shape. In a preferred embodiment the outer end is conical and the clamping means engages under this conical outer end. This is in fact the form of a Christmas tree. A locking in two directions is obtained by the engagement of the clamping means under the projection.

[0012] In a preferred embodiment the projection is in the form of a Christmas tree and provided with a foot arranged on the base plate. The foot is an elevation on the base plate. The foot preferably has the same diameter as the inner radius of the recess in the antenna unit, whereby this foot is accommodated in form-fitting manner received in this recess in the coupled situation, while the clamping means is arranged between the foot and the conical outer end.

[0013] The antenna connector is preferably a polygon protruding from the antenna base, and the antenna unit preferably has a recess for the antenna connector. The antenna connector can also be accommodated in a recess in the antenna unit in form-fitting or partially form-fitting manner, whereby an additional blocking is obtained.

[0014] According to a further embodiment, the recesses are arranged in the base plate of the antenna unit. The two base plates are placed on each other in the coupled situation. A large close-fitting surface is hereby obtained. Arranged in the base plate of the antenna unit are recesses into which the projections of the base plate of the antenna base mounted on the vehicle protrude and are accommodated in form-fitting manner. An improved connection is hereby obtained.

[0015] The antenna unit preferably has at least one circuit which is arranged on an elevation on the base plate and which is connected to an antenna arranged in the antenna unit. The circuit, preferably a printed circuit board, is in fact, together with the elevation, a modular component which can be arranged in the antenna. The clamping means and the projections protruding into the antenna unit can moreover be arranged under the elevation. The antenna unit in fact consists of a base plate having a layer thereon for clampingly engaging the projections, and one or a number of elevations which form a layer thereabove for circuits with antennas. This construction, in particular the modular construction, is particularly favourable in respect of the cost of the antenna unit. This construction can also be applied without the projections according to the invention.

[0016] The clamping means preferably consists of an element arranged in the antenna unit close to the recesses. In a preferred embodiment the clamping means is a resilient rod. The clamping means or the resilient rod is arranged in line with the recess on the inside of the antenna unit. When the recess is filled with a projection, the resilient rod is moved outward and the resilient rod will engage in a recess in the projection at right angles to the direction of movement of the projection through the recess.

[0017] In a preferred embodiment the resilient rod is fixedly connected at at least one location to a base plate of the antenna unit, and at least a guide means is arranged for the bar on this base plate. The guide means allows movement of the resilient rod. A limited movement is allowed. This limited movement is particularly useful for unlocking the antenna unit from the base.

[0018] The antenna unit preferably has a recess in which can be placed an external operating member with which the clamping means can be moved from a clamping position to an unlocked position. The antenna unit can hereby be unlocked and released from the base. The external operating member can for instance be a key. Then incorporated in the antenna unit is a lock which can scan the key and which releases the lock if the key "fits".

[0019] In a preferred embodiment the clamping means is arranged in line with the recess. The operating member arranged in the recess can hereby push the clamping means from its position. This pushing will unlock the clamping means.

[0020] In a particular embodiment the clamping means is the resilient rod and this latter is arranged at right angles to the line of the recess. By displacing the resilient rod which is connected at one position to the base plate of the antenna unit and can otherwise move relative to the base plate, the locking engagement of the different projections is unlocked at a plurality of positions in one operation.

[0021] The invention further relates to an antenna base for a vehicle, comprising a base which can be mounted on the vehicle and which has at least a connection which can be connected to at least one receiver arranged in the vehicle and has at least one antenna connector which can be connected to an exchangeable antenna unit. The invention is characterized in that the base comprises a base plate provided with coupling means for coupling to the antenna unit, wherein the coupling means comprise a number of projections which protrude straight from the base plate and which can be received in recesses in the antenna unit. A coupling means is hereby provided which is also a guide means for placing of the antenna unit on the base plate, and the projections can also be engaged by the antenna unit.

[0022] The projection is preferably conical, in a preferred embodiment in the form of a Christmas tree and provided with a foot. The conical shape improves the guiding and placing of the antenna unit on the projections, while a better locking can be obtained with the Christmas tree shape and the foot can form a close fit with the recess in the antenna unit.

[0023] The invention further relates to an exchangeable antenna unit which can be coupled to an antenna base mounted on a vehicle and which comprises an antenna, provided with coupling means for coupling the antenna unit to the base, characterized in that the antenna unit is provided with recesses and with a clamping means for fixedly clamping the parts of the base arranged in the recesses. A snap connection is hereby obtained. Such a connection can be

manufactured at low cost and in automated manner.

[0024] The invention will be further described with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a vehicle provided with the invention,
 Figure 2 shows a detail according to arrow II in figure 1,
 Figures 3a and 3b are top views of the antenna unit, and
 Figure 4 shows two components of the device according to the invention in different embodiments.

[0025] Figure 1 shows a vehicle 1, wherein an antenna device 3 according to the invention is placed on roof 2. The antenna device has the shape of a fin or shoe. The antenna device comprises a shoe-shaped body 4, shown with broken lines in figure 2, which is shaped aerodynamically. Body 4 encloses the antenna and forms part of antenna unit 5. Antenna unit 5 comprises a base plate 6 to which shoe 4 is connected. Arranged on base plate 6 are a number of legs 7,8 which form an elevation formed by plate 9, which is a point plate on which an antenna 10 is arranged for FM/AM reception. Plate 9 is provided with a number of schematically designated connectors 11 which can be connected to connection points on a base 12 mounted on the roof of the car. A second elevation 13 is also shown. This comprises a plate provided with a GPS circuit 14 which is shown schematically.

[0026] Figure 4 shows base plate 12 of the base 15 connected to the roof of the vehicle. Antenna base 15 comprises the base plate and, protruding downward thereon through roof 2 of the vehicle, a channel 16 in which a number of cables are received, in this case cables 17,18,19, respectively for the AM/FM, GPS and GSM receivers/transmitters (transceivers). These latter can be incorporated in the vehicle.

[0027] After mounting of base 15 on roof 2 of vehicle 1, cables 17-19 are permanently coupled to the respective receivers, or can be connected to the receiver. If the vehicle is not provided with a GPS, one of the cables is not functional and it is not connected. The cable is however already available in the vehicle and can be coupled in simple manner to a GPS unit to be added later. The cables run for instance behind the lining of the vehicle to a position behind the dashboard of the car.

[0028] According to the invention the base 15 is factory-mounted on the vehicle provided with at least two, preferably at least three cables 17-19 for at least two or three different functionalities. The invention is not limited to said functionalities, and other non-stated functionalities can be added in accordance with the wishes of the user. Due to pre-assembly of base antenna 15 on the vehicle, the vehicle is prepared to be equipped with any of said functionalities. In a basic embodiment the vehicle can however be embodied with only shoe 20 arranged on the base, whereby a dummy is obtained. The vehicle provided with base 15 and only shoe 20 has no reception possibilities. Through pre-fitting of the different cables 17-19 in the vehicle it is not necessary, when the user wishes extra options to be built into his/her vehicle, to open up the interior of the vehicle in order to place any of said cables between the receiver incorporated in the vehicle and the base/antenna device.

[0029] Cables 17-19 can be connected to receivers in the vehicle. Cables 17-19 thus form an electrical terminal of first part 15 to the receivers in the vehicle.

[0030] Cables 17-19 are connected to antenna connector 40. Antenna connector 40 can take different forms and is shown here as a hexagon. Each of the edges is for instance electrically connected to one or more of cables 17-19. The second part/antenna unit 24 has coupling means which can be coupled to this antenna connector 40. When the second part is placed on base 15, the antenna unit is electrically coupled to the receivers and other units in the vehicle via antenna connector 40 and connections 17-19 coupled thereto. Antenna connector 40 here protrudes from base plate 12 and forms a projection. The antenna connector is also received in a corresponding, here hexagonal, recess 41 in base 25 of antenna unit 5. Antenna connector 40 and recess 41 are form-fitting. Placing of the antenna connector 40 in the corresponding recess has a locking effect and determines the position in which the first part is placed relative to the second part.

[0031] Although not shown in detail in the drawings, it will be apparent to the skilled person how an electrical connection can be made between antenna connector 40 and electrical connecting means arranged on antenna unit 5. Use can be made of spring-mounted, flexible plugs, clamps and the like. The clamps can engage on the edges of the hexagonal antenna connector 40. In another embodiment use is made of a three-core coaxial connector.

[0032] In a particular embodiment use is made of optical cables 17-19 and an optical antenna connector 40. Optical connecting means are arranged in antenna unit 5. In a preferred embodiment use has to be made of only one cable. The one optical cable provides sufficient bandwidth for transmitting signals between antenna unit and receivers incorporated in the vehicle. The receiver(s) is (are) particularly suitable for Digital Audio Broadcasting (DAB). It is hereby possible to receive and/or retrieve sound, text, images, multimedia data for instance for navigation, Internet and the like. The connecting means on antenna unit 5 are formed by a unipolar optical connector.

[0033] In this embodiment base plate 12 is provided with four projections 21 which protrude substantially straight from base plate 12, and protrude straight upward from the vehicle when this base plate 12 is mounted on the roof of the vehicle. Projections 21 are conical at the outer end. Projection 21 has a foot 22 close to the base plate, and there is a

narrowed portion 23 between foot and conical part. The overall shape of projection 21 can be designated as in the form of a Christmas tree provided with a foot.

[0034] The exchangeable antenna unit is a dummy or is provided with at least one antenna functionality. The internal parts of the exchangeable antenna for an AM/FM antenna is designated schematically with 24 in figure 4. Base plate 25 of the antenna unit is provided with four recesses 26, which recesses have a diameter corresponding with the diameter of foot 22 of projections 21. Recesses 26 are arranged in base plate 25 at corresponding locations relative to projections 21 on base plate 12.

[0035] Antenna unit 24 can be placed on projections 21 automatically, for instance by a robot. The conical outer end of projections 21 forms a guide for the placing. Small variations can be compensated for. The conical projection is guided into recess 26 while the base plates move toward each other.

[0036] Figure 4 also shows the internal parts 27 with a comparable base plate. Antenna unit 27 has two functionalities. An antenna 28 and a GPS receiver 29 are shown.

[0037] Figure 3a shows a top view of the antenna unit 27 coupled onto the base. The body 20 is shown cut-away.

[0038] It can be seen that projections 21 protrude through the respective recess and protrude beyond the base plates. The height of foot 22 corresponds with the height of base plate 25. Foot 22 is thus received in recess 26. The narrowed portion 23 is situated just above base plate 25 of the antenna unit. Arranged close to the respective recess 26 is a clamping means in the form of a resilient rod 30. When projections 21 and recesses 26 are arranged, the resilient rod 30 will be moved aside in each case by the conical projections 21. As the antenna unit is moved increasingly further over projections 21, the resilient rod will eventually be received in recess 23, as shown in figure 3a. Resilient rod 30 is fixedly connected at at least one point 31 to base plate 25. In the shown embodiment a guide means 32 is arranged at two locations which limits the freedom of movement of the resilient rod, but allows some movement. The resilient rod is guided along recess 26 from the fixed point. The resilient rod protrudes partly above recesses 26 in line therewith. A snap connection will be formed each time projections 21 are arranged in the recesses.

[0039] With an external operating member in the form of for instance a key, which is shown schematically in figure 3a with reference numeral 33, resilient rod 30 can be moved out of the locking position according to figure 3a. The external operating member 33 is arranged in a recess 34, the receiving chamber 35 of which is visible. The recess has a longitudinal axis 36. Resilient rod 30 is situated in line with the longitudinal axis of the recess.

[0040] The external operating member 33 can be placed in receiving chamber 35 and be rotated through a quarter-turn. Receiving chambers 35 can have a guiding function, for instance in the direction of axis 36, wherein the outer end of the operating member is moved toward resilient rod 30.

[0041] Unlocking is achieved in figure 3b. Operating member 33 is rotated through a quarter-turn. The outer end hereby protrudes beyond the two projections 21 and presses against resilient rod 30. This is moved out of its starting position as shown in figure 3a and is now no longer situated in line above recess 26. Projections 21 can now be moved freely out of the recess. The antenna unit can be uncoupled from the base.

[0042] Using the resilient rod 30 according to the invention a number of projections are locked with one clamping means.

[0043] The coupling means according to the invention are here formed by projections 21 and recess 26 together with clamping means 30. In another embodiment coupling means can be present on only one of the two parts. The locking means for securing the parts relative to each other can also be arranged on one of the two parts, in a particular embodiment on the part with the coupling means.

[0044] Figure 4 shows that AM/FM antenna 24 can be expanded in modular manner with a GPS antenna 29 which can be placed on feet 37 on base plate 25.

[0045] The invention is not limited to the claims according to the invention. A number of the measures stated above can themselves form the basis of an invention, even when the specific advantages of these measures are not stated explicitly in the foregoing. The possibilities of divisional applications provided by this application are explicitly drawn to the attention of the reader here.

Claims

1. Antenna device (3) for a vehicle (1), comprising:

- a first part (15) which is a base which can be mounted on the vehicle (1) and has at least one antenna connector (40) coupled to at least a connection (17-19) which can be connected to at least one receiver in the vehicle (1),
- a second part (5) which is an antenna unit (5) which can be connected to the antenna connector (40) and which is provided with an antenna,
- coupling means (21) arranged on at least one of the two parts for coupling the antenna unit to the base, wherein one of the parts comprises a base plate (12) provided with a number of projections (21) which protrude from this base plate and which can be received in recesses (26) in the other part, and wherein one of the two parts

is provided with at least a clamping means (30) for fixedly clamping the projections (21) received in the recesses (26).

2. Antenna device as claimed in claim 1, **characterized in that** the projection is conical.
3. Antenna device as claimed in claim 1 or 2, **characterized in that** the clamping means engages on the projection under a conical outer end of the projection.
4. Antenna device as claimed in any of the claims 1-3, **characterized in that** the projection is in the form of a Christmas tree and provided with a foot arranged on the base plate.
5. Antenna device as claimed in any of the claims 1-4, **characterized in that** the antenna connector comprises a polygon protruding from the base plate, and that the other part, for instance the antenna unit, comprises a recess for the antenna connector.
6. Antenna device as claimed in any of the claims 1-5, **characterized in that** the recesses are arranged in a base plate of the antenna unit.
7. Antenna device as claimed in claim 6, **characterized in that** the antenna unit comprises at least one circuit which is arranged on an elevation on the base plate and which is connected to an antenna arranged in the antenna unit.
8. Antenna device as claimed in claim 7, **characterized in that** the circuit comprises a printed circuit board which is arranged on the elevation.
9. Antenna device as claimed in any of the foregoing claims, **characterized in that** the clamping means is arranged on the antenna unit.
10. Antenna device as claimed in any of the claims 1-9, **characterized in that** the clamping means consists of an element arranged close to the recesses.
11. Antenna device as claimed in any of the claims 1-10, **characterized in that** the clamping means comprises a resilient rod.
12. Antenna device as claimed in claim 11, **characterized in that** the bar is fixedly connected to a base plate of the antenna unit, and that at least a guide means for the bar is also arranged on this base plate.
13. Antenna device as claimed in any of the claims 1-12, **characterized in that** the antenna unit has a recess for an external operating member with which the clamping means can be moved from the clamping position to an unlocked position.
14. Antenna device as claimed in claim 13, **characterized in that** the clamping means is arranged in line with the recess.
15. Antenna device as claimed in claim 13, **characterized in that** a resilient rod is arranged at right angles to the line of the recess.
16. Antenna device as claimed in claim 15, **characterized in that** the resilient rod is arranged for movement in line with the recess.
17. Antenna base for a vehicle, comprising a base which can be mounted on the vehicle and which has at least a connection which can be connected to at least one receiver arranged in the vehicle and has at least an antenna connector which can be connected to an exchangeable antenna unit, **characterized in that** the base comprises a base plate provided with coupling means for coupling to the antenna unit, wherein the coupling means comprise a number of projections which protrude straight from the base plate and which can be received in recesses in the antenna unit.
18. Antenna base as claimed in claim 17, **characterized in that** the projection is conical.
19. Antenna base as claimed in claim 17 or 18, **characterized in that** the projection is in the form of a Christmas tree

and provided with a foot arranged on the base plate.

20. Antenna base as claimed in any of the claims 17-19, **characterized in that** the antenna connector comprises a polygon protruding from the base plate, and that the antenna unit comprises a recess for the antenna connector.

21. Exchangeable antenna unit which can be coupled to a base mounted on a vehicle and comprises an antenna, provided with coupling means for coupling the antenna unit to the base, **characterized in that** the antenna unit is provided with recesses and with a clamping means for fixedly clamping the parts of the base arranged in the recesses.

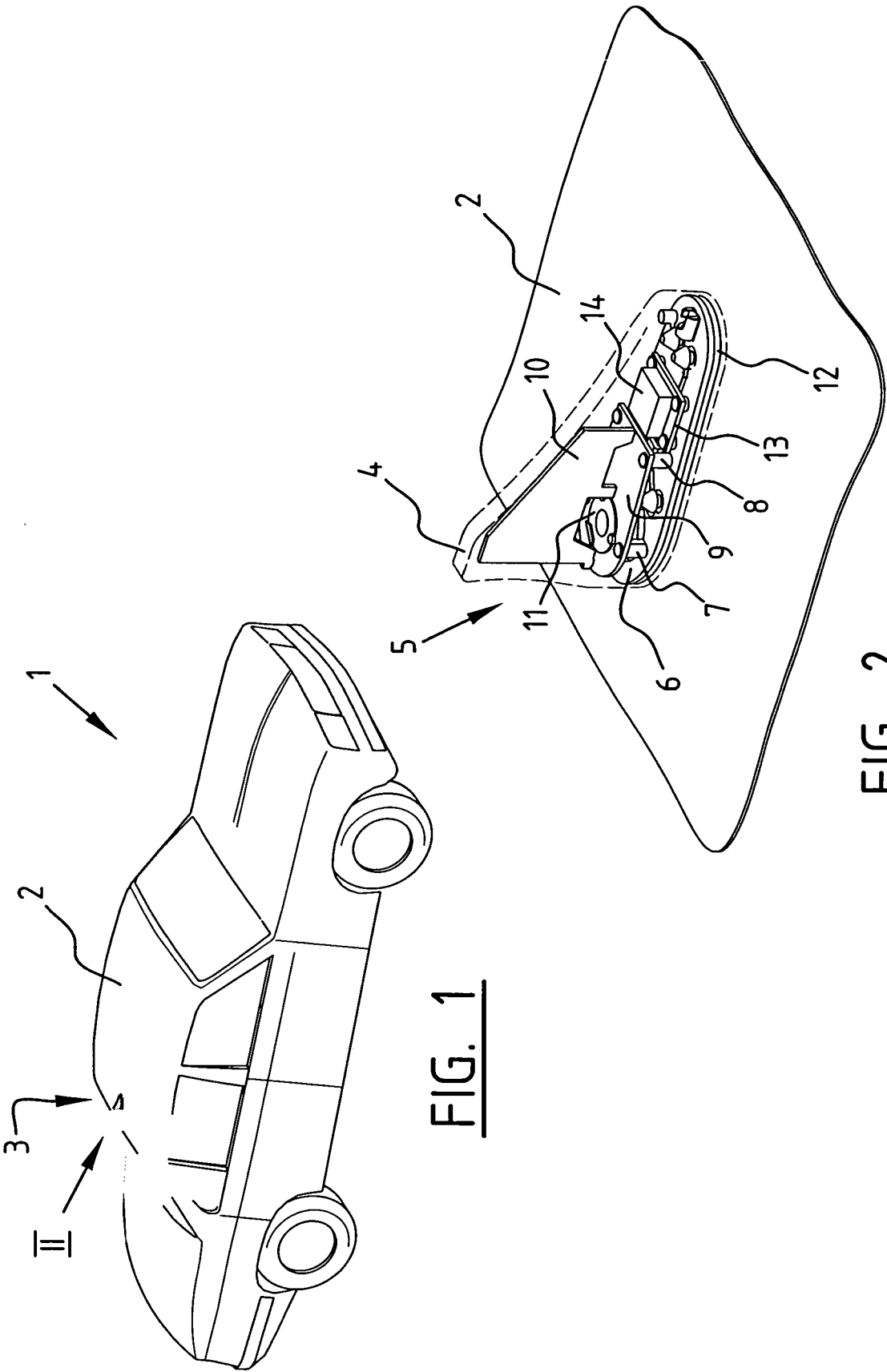


FIG. 1

FIG. 2

FIG. 3A

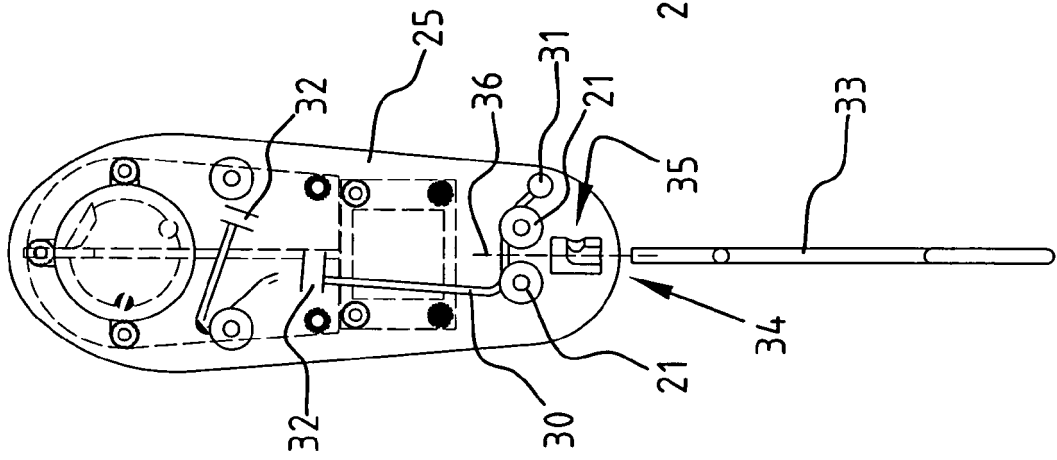


FIG. 3B

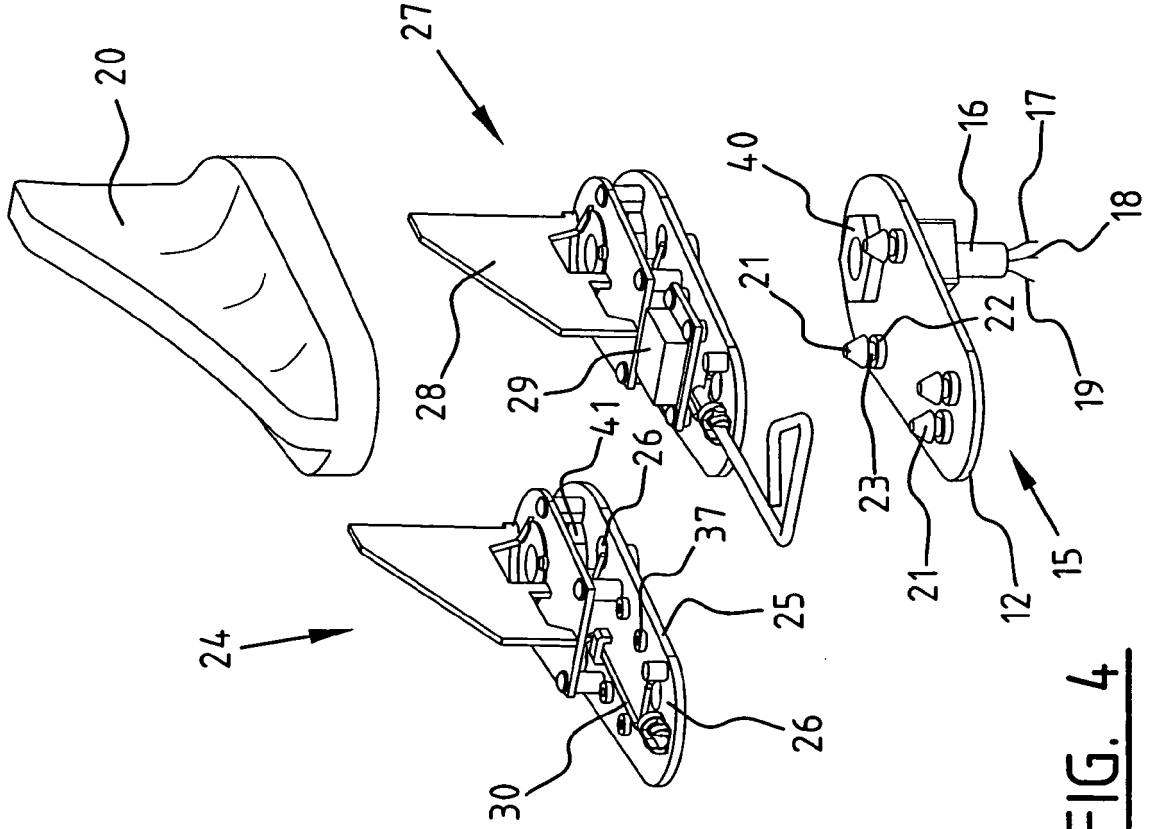
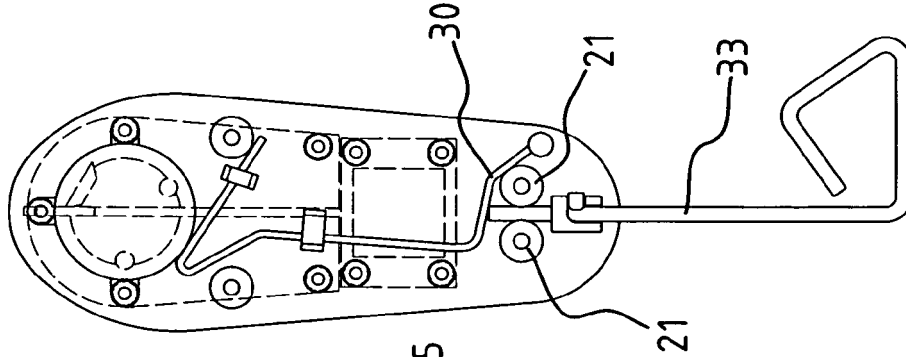


FIG. 4



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 11 October 2006	Examiner Moumen, Abderrahim
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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