

(12) PATENT
(19) AUSTRALIAN PATENT OFFICE

(11) Application No. **AU 199951510 B2**
(10) Patent No. **753316**

(54) Title
Device for transmitting signals in a vehicle

(51)⁶ International Patent Classification(s)
H04B 005/00

(21) Application No: **199951510**

(22) Application Date: **1999 .05 .29**

(87) WIPO No: **WO00/05824**

(30) Priority Data

(31) Number	(32) Date	(33) Country
19832911	1998 .07 .22	DE

(43) Publication Date : **2000 .02 .14**

(43) Publication Journal Date : **2000 .04 .20**

(44) Accepted Journal Date : **2002 .10 .17**

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(56) Related Art
DE 4423191
DE 3131246
US 4806943

51510/99



PCT
WELTORGANISATION FÜR GEISTIGES EIGENTUM
Internationales Büro
INTERNATIONALE ANMELDUNG VERÖFFENTLICHT NACH DEM VERTRAG ÜBER DIE
INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT)

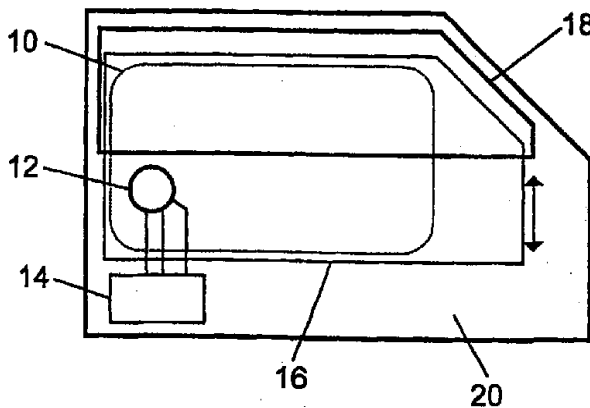
(51) Internationale Patentklassifikation ⁷ : H04B 5/00		A2	(11) Internationale Veröffentlichungsnummer: WO 00/05824
			(43) Internationales Veröffentlichungsdatum: 3. Februar 2000 (03.02.00)
(21) Internationales Aktenzeichen: PCT/DE99/01597		(81) Bestimmungsstaaten: AU, CZ, KR, US, europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).	
(22) Internationales Anmeldedatum: 29. Mai 1999 (29.05.99)			
(30) Prioritätsdaten: 198 32 911.3 22. Juli 1998 (22.07.98) DE		Veröffentlicht <i>Ohne internationalen Recherchenbericht und erneut zu veröffentlichen nach Erhalt des Berichts.</i>	
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(54) Title: DEVICE FOR TRANSMITTING SIGNALS IN A VEHICLE

(54) Bezeichnung: VORRICHTUNG ZUR SIGNALÜBERTRAGUNG IN EINEM FAHRZEUG

(57) Abstract

The invention relates to a device for transmitting signals and energy in a vehicle, comprising an antenna coil (10) disposed in or on a movable part (16). A coupling coil (12) is mounted in the vicinity of the antenna coil (10) on a part (20) that is stationary in relation to the movable part (16) in such a way that the antenna coil (10) and the coupling coil (12) can exchange energy and signals by means of inductance/transformation.



(57) Zusammenfassung

Es wird eine Vorrichtung zur Signal- und Energieübertragung in einem Fahrzeug vorgeschlagen. Sie weist eine Antennenspule (10) auf, die an oder in einem bewegbaren Teil (16) angeordnet ist. Eine Koppelspule (12) ist an einem gegenüber dem bewegbaren Teil (16) feststehenden Teil (20) in räumlicher Nähe zu der Antennenspule (10) in der Weise angebracht, daß die Antennenspule (10) und die Koppelspule (12) induktiv/transformatrisch Energie und Signale austauschen können.

DEVICE FOR TRANSMITTING SIGNALS IN A VEHICLE

Prior Art

5 The invention relates to a device for transmitting signals in a vehicle.

From DE-A 44 23 191 a window pane antenna for vehicles with an extreme bandwidth is known. This window pane antenna consists of a metallic frame which comprises the window pane of the vehicle, a first antenna conductor positioned on or in the window pane
10 and a connection point on the antenna conductor. The voltage-carrying connection of the antenna connection point is connected to a connection unit belonging to it by a short electric lead.

A lead of this type interferes when the antenna structure in or on a pane which can be
15 wound down and the connection unit belonging to it is immovably assembled; alongside the increased mechanical flexural load of the line because of the movement, appropriate space for free movement must be provided. Other disadvantages are the cost of assembly, the danger of catching of moveable parts in this connection line and possible rattling sounds.

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The object of the invention is to improve the electrical and functional connection between the antenna in or on a movable pane and the fixed electronic unit belonging to it with respect to the above disadvantages.

25 **Advantages of the Invention**



The device of the invention for transmitting electric energy and/or electric signals in a vehicle features an antenna coil, which is arranged on or in a moveable part, for example a windable side window. A coupling coil is positioned on a fixed part opposite a moveable part in close proximity to the antenna coil in such a way that the coupling coil and the antenna coil are coupled together inductively and electric energy and signals can be transmitted in both directions between the antenna coil and the coupling coil. By this means, a line-connected signal and energy transmission between the antenna coil as the actual transmission / reception antenna of a keyless access control system for vehicles and the electronics associated with it can be dispensed with. The antenna coil serves, in a keyless access control system, both the inductive transmission and the data necessary for the authorisation to lock and unlock the vehicle between one or more portable transponder(s) as electronic authorisation and the vehicle and the inductive transmission of electric energy to transponders without their own sources of energy with the aid of electromagnetic fields. In addition, the transponders likewise contain antenna coils, which, like the antenna coil and/or the coupling coil, can be part of a resonance circuit tuned to the operating frequencies.

The exchange of data between transponder and vehicle is preferably a question-answer dialogue so that the arrangement of the invention is designed for transmission and reception. The transformation means of signal transmission also permits, with appropriate dimensioning, a simple adaptation to various impedances or signal levels of the keyless access control system. A particularly advantageous design permits, by means of a control device belonging to it, as occasion demands, the controlled change of the effective number of turns of the coupling coil, an improved adaptation of the level of currents and voltages (= variable transformation ratio of the transformer formed by the antenna coil and the coupling coil). All necessary parts (lines, circuitry, winding taps) are fixed-assembled or parts of the immovable, inbuilt components (control devices, coupling coils).

In an advantageous further development it is planned that a windowpane of the vehicle be used as the moveable part and the vehicle door to which it belongs be used



as the fixed part. The integration of the moveable antenna coil into the window pane, in particular a side pane, enables the exchange of energy and data between the vehicle and a portable transponder for the purpose of identifying and checking the right to access this vehicle.

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In an advantageous design it is planned that the coupling coil and/or the transmission/reception antenna coil are parts of an oscillating circuit. With appropriate tuning and coupling, external signals and unwanted interference signals such as harmonic components can be reduced or suppressed. The coils are at the

10 same time parts of a corresponding filter.

Further advantageous designs result from the other dependent claims and from the description.

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Drawing

20 An embodiment of the invention is depicted in the drawing and will be described in the following in greater detail. The figure shows the schematic construction of the embodiment.

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Description of the embodiment

30 An antenna coil 10 is positioned in or on a moveable windowpane 16. The antenna coil 10 moves in such a way before a coupling coil 12 that at least one transformation-coupling between both coils results when the window pane is at least half-way out of the lower door piece and is visible in the window 18. The coupling coil 12 is located



inside the door 20 of a vehicle and is functionally and electrically connected to a control device 14. The third connection between the coupling coil 12 and the control device 14 serves to tap the coupling coil 12 in order to adapt to the transformation ratio.

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The antenna coil 10 is arranged in a side windowpane 16 of the vehicle, which can be lowered. The antenna coil 10 runs near the edge of this window pane 16 and can exchange signals with a transponder not depicted which must emit a signal from the control device 14 indicating authorisation recognition, in order to enable the user of the transponder access to the vehicle. Then the vehicle firstly transmits a request signal via the coupling coil 12 and the antenna coil 10 coupled to produce a transformation; the transponder recognises that this request is intended for it, processes it in the data contained in the request and transmits a response signal. This response is received by the antenna coil 10 and is likewise transmitted by means of transformation to the coupling coil 12, which, for its part, forwards the signal to the control device 14. The control device 14 compares the answer with an answer correlated previously by itself with the request data and grants access in the case of agreement.

20 If the transponder contains no energy source of its own, if the design is appropriate, it can draw and if necessary store sufficient energy from the radiated electromagnetic alternating field of the vehicle. The transmission frequencies for this energy transport, the request and transponder response can lie in the LF range < 150 kHz or another frequency band permissible for it (so-called ISM frequency).

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The coupling coil 12 is fixed on the inner side of the door and dimensioned in such a way that in any given position of the moveable window pane 16 and consequently the antenna coil 10 the signal and energy transmission between the antenna coil and the coupling coil 12 is guaranteed. By this means it is ensured that even in the case of a slightly opened window a communication between vehicle and transponder is possible. It is not necessary that the coupling coil 12 be positioned in the window itself 18 of the door and is visible.

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As the antenna coil 10 should enable as large a range of communication as possible and the range increases with the surface surrounded by the antenna coil 10, its large area design for the transforming coupling with the fixed coil 12 over a large position area of the pane and the antenna coil connected to it is no contradiction.

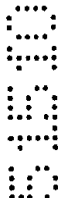
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Both the antenna coil and the coupling coil 12 can be advantageously used as parts of the oscillating circuits tuned to the desired frequencies. It is particularly advantageous when the antenna coil is realised in the conductor structure (foil, wire) in the pane or it is vapour-coated etc. and the oscillating circuit condenser is also designed as conductor structure

10 with the same technology.

As the antenna coil 10 and the coupling coil 12 should be coupled together as well as possible without stray field, a parallel alignment to one another and as close a positioning of them to one another as possible without a large air gap between them is advisable; by
15 this means the space for the construction is kept as small as possible. Numbers of turns, conductor cross sections etc. are dependent on the system (current strength, allowable resistance etc.).

The coupling coil 12 can also feature several partial windings, which are selected by the
20 control device 14 according to requirements – connected up or disconnected. By this means, through the changing of the transformation ratio between the antenna coil 10 and the coupling coil 12, a variable adaptation or transformation of impedances, voltages and/or currents is possible. This tapping is realised via a third connection of the coupling coil.



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The device of the invention can be used wherever a signal transmission between a moveable part and a fixed part is necessary.



The claims defining the invention are as follows:

1. Device for transmitting electrical energy and/or electric signals in a vehicle,
said device having an antenna coil arranged on or in a moveable part a coupling coil
5 positioned in close proximity to the antenna coil in such a way that the antenna coil and the
coupling coil are coupled inductively with one another and electrical energy and signals
can be transmitted in both directions between the antenna coil and the coupling coil.
2. Device according to Claim 1, wherein a window pane of the vehicle is used
10 as the moveable part.
3. Device according to any one of the preceding claims, wherein a door of the
vehicle is used as the fixed part.
- 15 4. Device according to any one of the preceding claims, wherein the antenna
coil and/or the coupling coil are parts of oscillating circuits.
5. Device according to any one of the preceding claims, wherein the
oscillating circuits can be tuned.
- 20 6. Device according to any one of the preceding claims, wherein the antenna
coil is inductively coupled with the coupling coil in every position of the moveable part.
7. Device according to any one of the preceding claims, wherein the antenna
25 coil transmits and receives a signal for access authorisation of the vehicle.
8. Device according to any one of the preceding claims, wherein the antenna
coil and the coupling coil alone or in connection with other components operate as electric
filters for frequency selectivity.
- 30 9. Device according to any one of the preceding claims, wherein the numbers
of windings of antenna coil and coupling coil are so tuned to one another that they form a
transformer for impedance and/or signal level adaptation.



10. Device according to any one of the preceding claims, wherein the transformation ratio between antenna coil and coupling coil can be controlled by modifying the effective winding of the coupling coil of the control device through the connecting or disconnecting of part winding of the coupling coil.

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11. Device for transmitting electrical energy and/or electrical signals in vehicle substantially as hereinbefore described with reference to the accompanying drawing.

10 Dated this 20th day of August, 2002.

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