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None

(58) Field of Search

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(54) Abstract Title

Motor vehicle anti-theft system

(57) An anti-theft system for a motor vehicle having a disabling device (6) for disabling the operation of the motor vehicle and a control unit (2) which, in the event of actuation of a starting arrangement (8), by way of a search signal addresses a code signal transmitter (22) which transmits a code signal to the control unit, in which case the control unit only renders the disabling device inoperative if a comparison of the code signal with information stored in it (the control unit) is positive, is distinguished by the fact that the control unit transmits a test signal at a point in time which is independent of any actuation of the starting arrangement (8) and triggers an error message if the code signal is received thereupon. This thwarts a method of theft involving removing the transponder (22) from a key and installing it in the vehicle (hire-car) to permit theft later.

FIG. 1

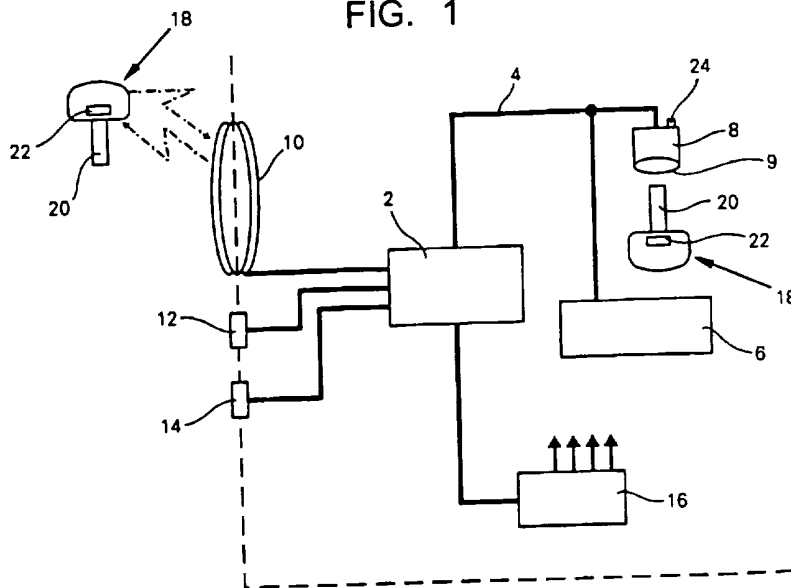


FIG. 1

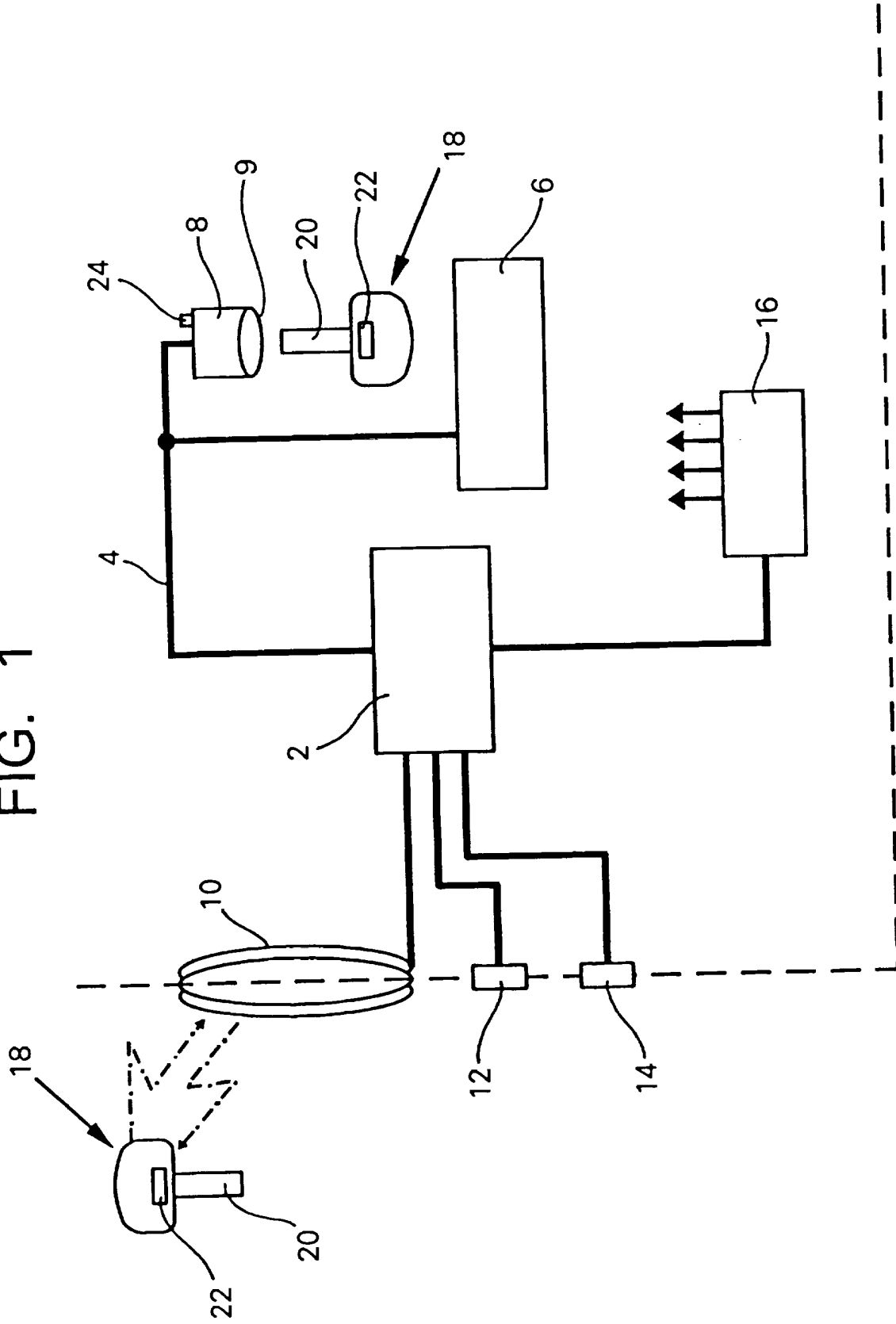
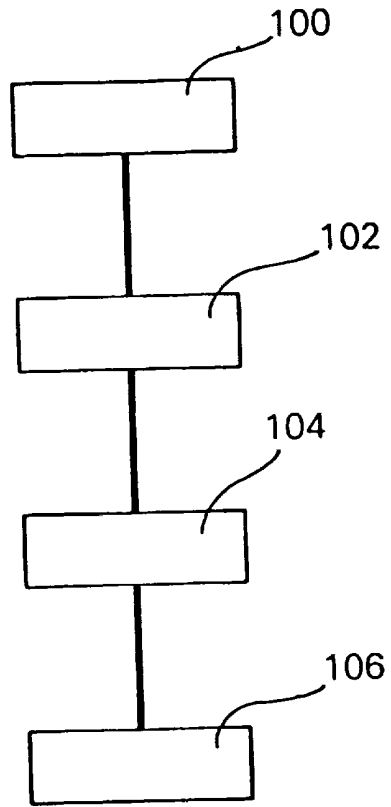


FIG. 2



ANTI-THEFT SYSTEM FOR A MOTOR VEHICLE

This invention relates to an anti-theft system for a motor vehicle.

Such an anti-theft system is described, for example, in the previously unpublished German Patent Application 197 11 901.8. The disabling device is formed by an immobilizer which, for example, by disconnecting the ignition and/or a starting circuit and/or an electrical engine-control, prevents the motor vehicle from being started if it is found that the code signal, which is emitted by the code signal transmitter, which is normally arranged on the ignition key, is false. For the purposes of the dialog with the code signal transmitter on the ignition key that is normally formed as a transponder, an antenna coil is arranged in the ignition lock of the motor vehicle. If the engine of the motor vehicle is to be started, the transponder is addressed by means of magnetic field coupling by way of the search signal which is emitted by the control unit by way of the antenna. If this address is not successful (no transponder in the magnetic field of the antenna) or if the transponder responds with a false code signal (the key does not belong to the motor vehicle), the disabling device is activated by the control unit so that it is impossible to drive away the vehicle.

It has been possible to lower the number of thefts to a considerable extent with anti-theft systems of the kind mentioned. However, professional thieves have developed the following method which renders possible theft of motor vehicles equipped with such anti-theft systems.

If, for example, a hire-car is to be stolen, the hire-car is hired in the usual fashion. The mechanical key bit of the original key is copied on a duplicate key. The transponder is removed from the original key

and is arranged in the immediate vicinity of the antenna, which is fixed with respect to the vehicle, in such a way that it can not be seen, yet receives the field of the antenna. If problems should arise when starting the motor vehicle with the aid of the duplicate key, if the latter is also equipped with a transponder, the transponder of the duplicate key is rendered ineffective without this of course being noticeable. The vehicle is then returned to the hire company together with the duplicate key. The hire company will not then ascertain that the immobilizer of the motor vehicle has been disabled at the time of delivery of the vehicle, since the vehicle, which is only made secure by means of the mechanics of the key bit, can easily be started. At a suitable opportunity, the motor vehicle is stolen with the original key. If an access-control system is fitted to the vehicle, this can also be disengaged by use of the original key.

The present invention seeks to improve the level of protection against theft that is achieved with an anti-theft system of the above described type.

According to the present invention, there is provided an anti-theft system for a motor vehicle having a disabling device for disabling the operation of the motor vehicle and a control unit which, in the event of actuation of a starting arrangement, by way of a search signal addresses a code signal transmitter which transmits a code signal to the control unit, in which case the control unit only renders the disabling device inoperative if a comparison of the code signal with information stored in it (the control unit) is positive, characterised in that the control unit transmits a test signal at a point in time which is independent of any actuation of the starting arrangement and triggers an error signal if the code signal is received thereupon.

An anti-theft system in accordance with an embodiment of the invention carries out checks to establish whether a code signal transmitter is present at points in time at which a code signal transmitter is not normally present. If the presence of the code signal transmitter is established at these points in time, an error message is triggered so that manipulation of the kind described above (in which the code signal transmitter, which is normally formed as a transponder within a card or an ignition key, is secured to the vehicle) is recognized.

Preferably, the code signal transmitter is formed as an insert card, in which case the antenna, which is activated by the control unit, is located in the region of the insertion channel. The code signal transmitter can also be contacted directly mechanically, in which case the manipulation described above is rendered difficult, yet is still possible.

Advantageously, the code signal transmitter is an ignition key, with which the ignition or the supply of electrical energy to the motor vehicle can be switched on and the engine can be started. The starting arrangement is then the ignition lock itself.

Advantageously, the test signal is transmitted if a door of the motor vehicle is opened or closed. Normally, the ignition key is not then located in the ignition lock.

Alternatively, the test signal can also be transmitted a predetermined period of time after the ignition has been switched off, if applicable with cyclical repetition.

In a preferred embodiment, a test signal for testing to establish whether a code signal transmitter is present is only generated if no code signal transmitter or ignition key has been inserted into the arrangement provided therefor. In this way, it is

possible to avoid a situation where an error message is triggered if, for example, after switching off the ignition a driver deliberately leaves the ignition key in the ignition lock.

5 If the test signal is transmitted irrespective of whether the code signal transmitter has been inserted into the starting arrangement, the error message can additionally be used to draw the driver's attention to the fact that he has left the ignition key in the
10 ignition lock after switching off the engine or after closing a door.

The invention is explained in greater detail by way of example in the following and with reference to diagrammatic drawings, in which:

15 Figure 1 shows a block diagram of an anti-theft system; and

 Figure 2 shows a flow chart for the purpose of explaining the mode of operation of the anti-theft system of Figure 1.

20 According to Figure 1, an anti-theft system has a control unit 2 with a microprocessor and associated memory devices. A disabling device 6 and a starting arrangement 8 are connected to the control unit 2 by way of a data line 4.

25 An antenna 10 arranged, for example, in the driver's rear-view mirror (the broken line indicates the boundary between the interior space and the exterior of a motor vehicle), a door handle contact 12 and a door-closing contact 14 as well as a central
30 locking system 16 are connected to the control unit 2 by way of conventional leads.

 An ignition key 18 has a bit 20 and a transponder 22.

35 The structure of the anti-theft system and its components is known per se and is therefore only explained in brief.

If the door handle contact 12 is actuated in order to get into the vehicle, the control unit 2, by way of the antenna 10, transmits a search signal to which the transponder 22 of the ignition key 18 responds, the
5 ignition key 18 being located, for example, in a driver's pocket within the range of the antenna 10. The transponder 22 transmits its code signal which is received by the antenna 10 and is recognized as being correct in the control unit 2. Thereupon the central
10 locking system 16 releases the door locks so that access can be gained to the vehicle.

The ignition key 18 is now inserted into the ignition lock forming the starting arrangement 8 and is turned. When the ignition key 18 is turned, the on-
15 board system is switched on (terminal 15), whereupon a search signal is transmitted from the control unit 2 to an antenna 9 which is located in the ignition lock 8, to which search signal the transponder 22 responds and transmits a code signal which is recognized by the
20 control unit 2 as being correct. The vehicle can be started.

If the code signal is identified as being false by the control unit 2 (wrong key 18), the disabling device 6 is activated, causing the starting circuit to be
25 disconnected and/or an engine-control unit to be triggered in such a way that the engine is rendered inoperative.

In order to solve the problem outlined by way of introduction, the anti-theft system is provided with
30 further functions which become apparent primarily in the programming of the control unit 2.

Unauthorised tampering, by means of which the anti-theft system can be rendered ineffective at least with regard to the disabling device 6, is achieved, as
35 explained by way of introduction, by removing the transponder 22 from the ignition key 18 and fitting it

on the ignition lock 8 in such a way that it is located within the transmitting and receiving range of the antenna 9. In this case, in particular if the vehicle is not provided with an access-control system (antenna 5 10), the vehicle can be started by means of an ignition key 18 which merely has a correct mechanical bit 20.

In order to prevent this, the anti-theft system functions as follows:

10 Case A: presence of a door sensor mechanism

In accordance with Figure 2 in Step 100 the control unit 2 establishes with the aid of the door-closing contact 14 that a vehicle door has been opened 15 or closed. In Step 102 a test signal, which can be identical with the afore-mentioned search signal, is transmitted by the control unit 2 by way of the antenna 9. If no tampering with the anti-theft system has taken place and no ignition key or transponder is 20 located within the range of the antenna 9, there is no response to this test signal. If, however, in response to the test signal a code signal is received by the antenna 9, this indicates either that there is a key in the ignition lock 8 (this being unusual) or that a 25 transponder is irregularly located in the vicinity of the ignition lock 8. As a reaction to the reception of a code signal in Step 104, the control unit 2 generates an error message in Step 106, the effects of which will be explained later.

30

Case B: no sensor mechanism for the doors

If there is no sensor mechanism for establishing whether the doors are open or closed, the testing 35 process can be triggered by establishing in Step 100 that the ignition (terminal 15 off) has been switched

off. Thereupon the control unit generates the test signal, which addresses the transponder, either once or at regular intervals or at intervals determined by a random-check generator. If a code signal is received thereupon (Step 104), the error message is generated (Step 106).

The transponder can be addressed cyclically by means of a test signal until the ignition is switched on again (terminal 15 is activated) or just for a certain period of time after the ignition has been switched off. If the transponder or key is removed within this period of time, the anti-theft system or the immobilizer device behaves as it usually does; otherwise, the starting circuit can, for example, be disabled for a comparatively long period of time or only be activated again by special measures.

In response to an error message generated by the control unit 2 in Step 106, the following functions can be triggered together or separately:

- (a) an immobilizer LED, present in most cases in anti-theft systems, starts to flash;
- (b) an acoustic signal transmitter, for example a horn, is activated;
- (c) the direction-indicator lights of the motor vehicle start to flash and/or
- (d) the starting circuit and the engine control are disabled by the disabling device 6.

So that the vehicle can still be used again in the case where the starting circuit and the engine control are blocked when the ignition key 18 is located in the ignition lock 8, the procedure may be as follows:

A test signal or search signal is generated at regular intervals. If the transponder does not respond to this search signal over a certain period of time

(ignition key removed), the blocking of the starting circuit and the engine control is cancelled.

5 A door of the motor vehicle is opened and re-closed. Subsequently, a test signal is generated again. If no code signal is received thereupon, the blocking of the starting circuit and the engine control is only maintained for so long until the terminal 15 is activated again or a valid transponder is recognized.

10 Only every nth attempt to start the engine is successful. In this way, the behaviour error is easily noticed by the vehicle user.

15 The mode of operation of the anti-theft system described has the advantage that leaving the ignition key in the ignition lock by mistake after switching off the engine results in an error message and this fact is thus recognized. The disadvantage of course is that error messages are also triggered when the key is left in the ignition lock on purpose.

20 In order to avoid an error message for the last-mentioned case, the ignition lock 8 can be provided with a sensor 24, which is formed, for example, as a contact switch, which establishes whether the key 18 is located in the lock. In this case, the generation of any error message is stopped.

25 It is self-evident that the system which has been described can be modified in many different ways. For example, the ignition key can also be formed as a card which contains a transponder and can be inserted into a slot which is provided with an antenna. Keyless
30 actuation elements can then be provided for the ignition and for starting the engine. Furthermore, the system can also be formed in such a way that the key for access to the vehicle is different from the ignition key, or the associated search signals and code
35 signals are different.

CLAIMS

1. Anti-theft system for a motor vehicle having a disabling device for disabling the operation of the motor vehicle and a control unit which, in the event of actuation of a starting arrangement, by way of a search signal addresses a code signal transmitter which transmits a code signal to the control unit, in which case the control unit only renders the disabling device inoperative if a comparison of the code signal with information stored in it (the control unit) is positive, characterised in that the control unit transmits a test signal at a point in time which is independent of any actuation of the starting arrangement and triggers an error signal if the code signal is received thereupon.

2. Anti-theft system according to claim 1, characterised in that the code signal transmitter is an ignition key and the starting arrangement is an ignition lock.

3. Anti-theft system according to claim 1 or 2, characterised in that the test signal is transmitted if a door of the motor vehicle is opened or closed.

4. Anti-theft system according to one of claims 1 to 3, characterised in that the test signal is transmitted after the ignition has been switched off.

5. Anti-theft system according to one of claims 1 to 4, characterised in that the code signal transmitter can be inserted into the starting arrangement, in that the starting arrangement contains a sensor for establishing the presence of the code signal transmitter and in that the test signal is only transmitted if the code signal transmitter is not located in the starting arrangement.

6. Anti-theft system according to one of claims 1 to 5, characterised in that an error signal is indicated visually.

7. Anti-theft system according to claim 6, characterised in that an error signal triggers a light element causing it to flash.

5 8. Anti-theft system according to one of claims 1 to 7, characterised in that an error signal is indicated acoustically.

10 9. Anti-theft system according to one of claims 1 to 8, characterised in that in the case of an error signal a starting circuit and/or an electrical engine-control are/is disconnected.

10. Anti-theft system substantially as described herein with reference to the accompanying drawings.

15 11. A motor vehicle fitted with an anti-theft system as claimed in any one of the preceding claims.



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Claims searched: 1-11

Examiner: Mike Davis
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**Patents Act 1977
Search Report under Section 17**

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.P): G4H (HTG, HRD)

Int CI (Ed.6): B60R, E05B

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
	None	

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.
& Member of the same patent family

A Document indicating technological background and/or state of the art.
P Document published on or after the declared priority date but before the filing date of this invention.
E Patent document published on or after, but with priority date earlier than, the filing date of this application.