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(54) SCANNING DEVICE

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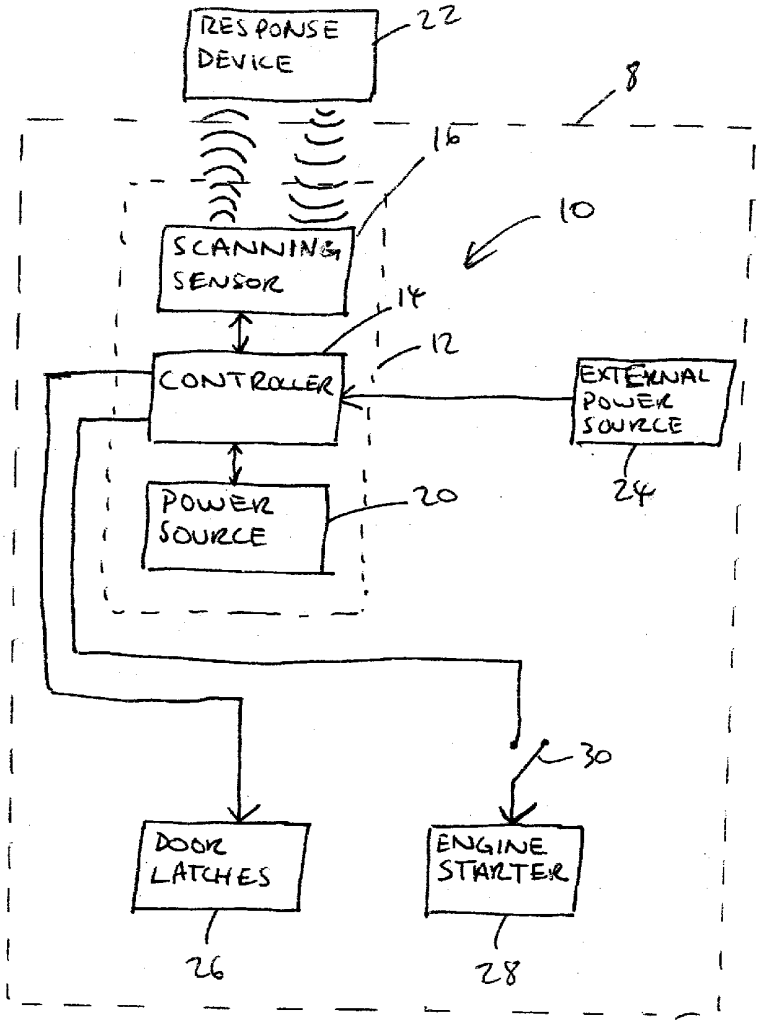
(57) **ABSTRACT**

A scanning device (**12**) for use in periodically scanning for the existence of at least one corresponding remote response device (**22**) wherein, in use, the rate at which the scanning device scans for the response device decreases as the time since the detection of a previous response device increases, such that the rate of power consumption of the scanning device reduces during periods of non-use.



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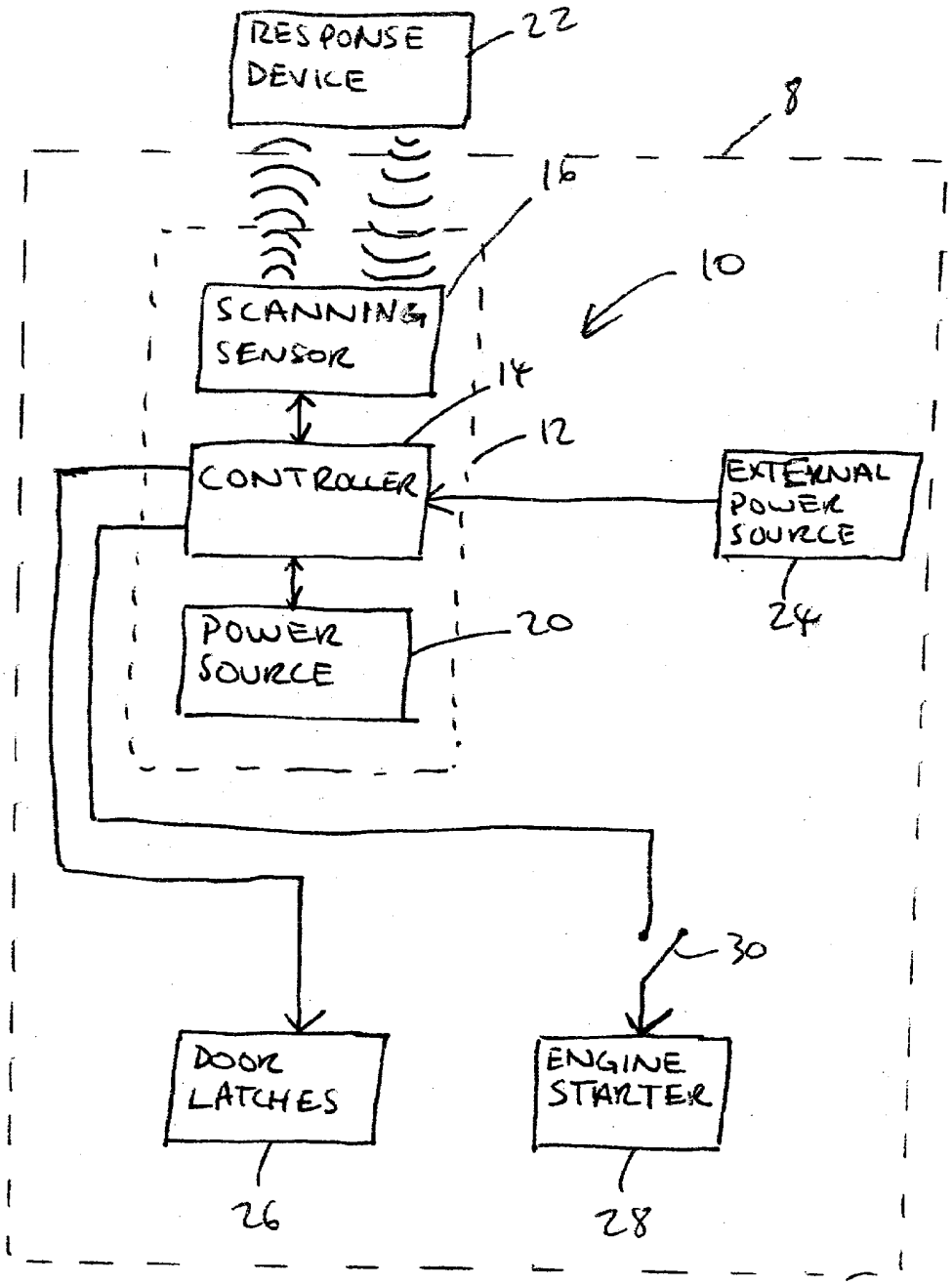

FIGURE 1

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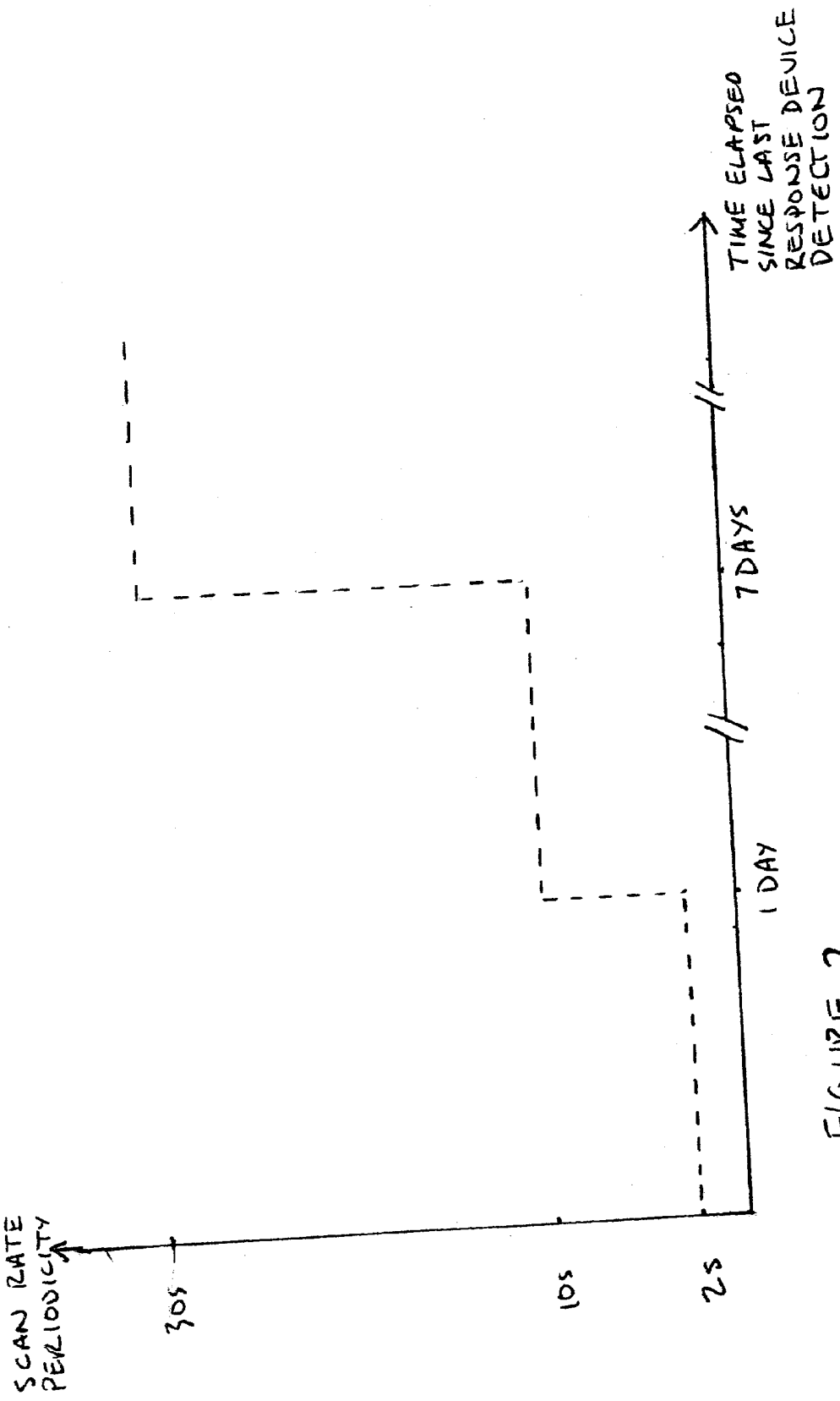

FIGURE 2

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SCANNING DEVICE

This application claims priority to United Kingdom (GB) Patent Application No. 0110976.8 filed on May 4, 2001.

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a scanning device. More particularly, the present invention relates to a scanning device for use in vehicle access control systems, for example, which periodically scans for the existence of associated remote response devices.

[0002] As an alternative to the use of a key or remote 'plip' type devices for gaining access to a vehicle and/or starting the engine of a vehicle once inside, it is known to provide a scanning device that is associated with the vehicle and which scans for the existence of response devices within a given range by using radio frequency waves, for example. Only if a code held by the response device matches an access code held by the scanning device will access to the vehicle be permitted.

[0003] From the point of view of the vehicle user, it is desirable that the rate of scanning by such devices is relatively high so that the user does not have to wait for a relatively long period of a time before being able to enter the vehicle. However, the higher the scan rate, the greater the rate at which power is consumed by the scanning device.

[0004] The power available from either the vehicle battery or a dedicated power source for the scanning device is effectively finite when there is no other source such as a running engine to charge the battery/power source. Thus, if a vehicle having such a scanning device is left for an extended period of time whilst operating at a high scanning frequency, the power source may be exhausted which makes entry into the vehicle difficult and/or prevents the starting of the vehicle.

SUMMARY OF THE INVENTION

[0005] The present invention seeks to overcome or at least mitigate the problems of the prior art.

[0006] According to one aspect of the present invention there is provided a scanning device for use in periodically scanning for the existence of at least one corresponding remote response device wherein, in use, the rate at which the scanning device scans for the response device decreases as the time since the detection of a previous response device increases, such that the rate of power consumption of the scanning device reduces over prolonged periods of non-use.

[0007] According to another aspect of the present invention there is provided a method of scanning for the existence of at least one corresponding remote response device comprising the steps of:

[0008] i) providing a scanning device operating at a first scanning rate;

[0009] ii) reducing the scanning rate of the scanning device as the time lapsed since a previous detection of a response device increases.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The various features and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the currently preferred embodiment. The drawings that accompany the detailed description can be briefly described as follows:

[0011] **FIG. 1** is a schematic diagram of an access control system for a vehicle incorporating a scanning device according to one embodiment of the present invention.

[0012] **FIG. 2** is a graph illustrating the relationship between the scan rate periodicity and the time elapsed since the last detection of a response device by the scanning device of **FIG. 1**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0013] Referring to **FIG. 1** there is indicated generally at **10** an access control system for a vehicle **8**. In this version, the system **10** incorporates a scanning device **12** comprising a controller **14** (preferably a microprocessor), a scanning sensor **16** and a dedicated power source **20** such as a rechargeable battery. The scanning device **12** in this embodiment is also supplied with power by an external power source **24** such as the vehicle battery.

[0014] The scanning sensor **16** is capable of communicating with one or more associated response devices **22** using radio frequency waves, for example. Outputs from the controller **14** are connected to one or more door latches **26** as well as, in this embodiment, the engine starter **28**. A switch **30** is preferably provided between the controller output and the starter **28** such that the driver of the vehicle may close the switch to start the engine only once an appropriate output signal is received from controller **14**. In this way, the scanning device may act as an engine immobilizer.

[0015] In use, authorized users of the vehicle carry the response device **22** which preferably takes the form of a transponder having an identifier code stored therein. The scanning sensor **16** periodically scans for the existence of such response devices **22** within its range of operation under the control of controller **14** and when such a response device **22** is detected, the scanning sensor **16** interrogates the response device to obtain the identifier code which is then passed to the controller **14** so that it may be authenticated against codes held within a memory associated with the controller **14**. If there is a match, the controller then sends a signal instructing the unlatching of door latches **26**, and the authorizing of the starting of the engine starter. Once the user is seated in the vehicle, switch **30** may be closed to start the vehicle engine.

[0016] In normal use, the scanning device **12** preferably draws its power from the external power source **24** and the controller ensures that dedicated power source **20** is fully charged from the external power source **24** (e.g., a battery of the vehicle to which the device is fitted). However, during long term parking, when the vehicle is not being used, the external power source **24** may become exhausted. In such circumstances, the controller **14** senses when the external power source falls below a predetermined certain level of charge and instead draws power from the dedicated power source **20** (e.g., a battery associated with the device), in order to prolong the period during which the vehicle may be accessed beyond the point at which the external power source becomes exhausted.

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[0017] Because vehicle users wish to gain access to the vehicle rapidly, the scanning rate (frequency) is normally set relatively high at, say, two second intervals (0.5 Hz). However, at this scanning rate, the external power source **24** and in particular the dedicated power source **20**, become rapidly exhausted during a long period of non-use.

[0018] Therefore, the scanning device **12** of the present invention reduces the scan rate dependent upon the time elapsed since a response device was previously detected. In some classes of embodiment, the scan rate reduction may be in direct proportion to the time elapsed or may reduce exponentially, logarithmically or in accordance with another suitable mathematical relationship. However, in preferred embodiments, the scan rate reduces in a 'stepped' manner. The reduction may be a single step or multiple steps.

[0019] Referring now to **FIG. 2, a** graph illustrating a notional example of such variable scan rate is shown. The scan rate, elapsed times and number of reduction steps may, of course, be altered according to particular user requirements. It can be seen from **FIG. 2** that for an initial period of one day since the last response device was detected, the scan rate is once every two seconds (in order to allow for a rapid response to the approach of a potential vehicle user when the vehicle is merely left overnight, for example). Beyond one day, the rate then drops to once every ten seconds (0.1 Hz) to allow for a slightly less rapid response when the vehicle is left for a longer period, such as airport parking, for example. This rate reduction results in a reduction in power consumption that potentially extends the life of the power source by five times in comparison with the two second scan rate.

[0020] After seven days of non-use, which could in practical terms represent the vehicle being left for sale with a dealer, or in winter layup, the scan rate reduces to once every thirty second (0.033 Hz), thereby potentially increasing the battery life fifteen fold with respect to the two second interval scan rate.

[0021] Clearly, such a response delay would be unacceptable in day to day use, but would not present a problem when the vehicle is to be operated for the first time after a long period of non-use.

[0022] In order to determine the time elapsed since the last detection of a response device, a time logging device such as an in-built quartz timer and counter (not shown) are advantageously incorporated into the controller **14**.

[0023] It should be understood that numerous changes may be made within the scope of the present invention. For example, alternative types of scanner using other forms of electromagnetic radiation such as microwave, or infra-red, may be employed, as may sonar scanners. The controller may also output to actuators and the like for adjusting the seating, steering wheel and mirror positions, for example, in order to personalize the vehicle settings for a particular user carrying a response device. Furthermore, the controller may be incorporated into the overall vehicle control system rather than being part of the stand-alone scanning device. It is envisaged that the scanning device may be used in other fields such as building access control, for example.

[0024] The aforementioned description is exemplary rather that limiting. Many modifications and variations of the present invention are possible in light of the above teachings. The preferred embodiments of this invention have been disclosed. However, one of ordinary skill in the art would recognize that certain modifications would come within the scope of this invention. Hence, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described. For this reason the following claims should be studied to determine the true scope and content of this invention.

1. A scanning device for use in periodically scanning for the existence of at least one corresponding remote response device wherein the rate at which the scanning device scans for the response device decreases as the time since the detection of a previous response device increases, such that the rate of power consumption of the scanning device reduces during periods of non-use.

2. A scanning device according to claim 1 suitable for use in an access control system.

3. A scanning device according to claim 1 suitable for use in an engine immobilizer.

4. A scanning device according to claim 1 wherein the scanning device is associated with a vehicle.

5. A scanning device according to claim 1 wherein the device scans using electromagnetic radiation.

6. A scanning device according to claim 1 wherein the device is powered by a remote power source associated with the vehicle.

7. A scanning device according to claim 1 wherein the device is powered by a dedicated power source associated with the device.

8. A scanning device according to claim 7 wherein the dedicated power source provides a back-up to remote vehicle power source.

9. A scanning device according to claim 8 wherein the dedicated power source supplies power to the scanning device once the power stored by the remote power source falls below a predetermined level.

10. A scanning device according to claim 1 wherein the decrease in the scan rate is at least single step.

11. An access control system, comprising:

a scanning device:

a remote response device; and

a security device wherein the scanning device scans for a security code that unlocks the security device, the security code held by the response device, wherein the rate at which the scanning device scans for the response device decreases as the time since the detection of a previous response device increases.

12. A method of scanning for the existence of at least one corresponding remote response device comprising the steps of:

providing a scanning device operating at a first scanning rate; and

reducing the scanning rate of the scanning device as the time lapsed since a previous detection of a response device increases.

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