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(54) **Programmable security locks**

Programmierbare Sicherheitsschlösser

Serrures de sécurité programmables

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EP-A- 0 218 251 **EP-A- 0 320 373**
GB-A- 2 236 354 **US-A- 3 911 397**
US-A- 4 831 374

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Description

This invention relates to programmable security locks and is particularly applicable to such locks for providing restricted access in hotels, commercial offices, industrial complexes and the like.

Programmable door locks are finding increased use throughout the world and are being used in some large hotels, where security can be an increasing problem, a programmable lock being provided for each of the hotel rooms. When a new guest registers at a hotel, a particular room is allocated to him/her and the programmable door lock to the room is coded with a unique code which would be applicable for the duration of the guest's stay. The guest is also provided with an "electronic key" which is coded with the same unique code and this allows the guest access to the hotel room when the key is inserted in the programmable door lock. When the guest checks out of the hotel, the programmable door lock is re-programmed with a different code so that the electronic key allocated to the departing guest no longer operates the lock of the hotel room which had been allocated to him/her. The "electronic key" may take a variety of forms and may be constructed in the form of a thin strip of card or plastic, similar to a cheque card, and the code may normally be stored, for example, on a magnetic strip contained on the key or it may be electronically or optically stored within the body of the key or stored in the form of physical holes or deformations on part of the key.

In EP-A-0 320 373 there is disclosed a programmable security lock which is programmable with a security code which controls the opening thereof, said lock comprising an electronic key which is programmable with a security code which corresponds to the security code of said lock.

It is an object of the present invention to provide an improved form of such a programmable security lock.

This is achieved in accordance with the present invention by providing that said lock is remotely programmable and by means for remotely interrogating the security code of said electronic key for the purpose of opening said lock.

A programmable lock is known from EP-A-0 218 251 in which means is provided for remotely interrogating the security code stored on the key of an automobile, but the lock on the automobile is not remotely programmable.

In a preferred arrangement according to the invention, said electronic key will comprise a transponder arrangement, in which case said lock may comprise means for transmitting an interrogating signal to said electronic key and means for receiving a transponding signal from said electronic key, said transponding signal being indicative of the security code of said electronic key.

Advantageously, said lock comprises memory means for storing the security code of said lock, and processor means for comparing the security code of the

received transponding signal from said electronic key with the security code of said memory means and for causing a lock mechanism of said lock to be opened when said security codes correspond.

It may be arranged that said means for receiving a transponding signal is also effective for receiving a programming signal indicative of the security code to be programmed into said lock, said processor means being operable in response to said programming signal for causing the security code thereof to be stored in said memory.

In a preferred arrangement according to the present invention a remote lock controller may be provided which includes means for transmitting said programming signal, and means for receiving a signal transmitted from said lock.

It may be arranged that said lock comprises means for transmitting an alarm signal to said remote lock controller when said security codes do not correspond, or alternatively for transmitting said security code of a received transponding signal to said remote lock controller.

The security code of each received transponding signal may be stored in said memory means, and the security codes stored in said memory means transmitted to said remote lock controller, in which latter case the security codes stored in said memory means may be transmitted to said remote lock controller at predetermined time intervals, or in response to a signal received therefrom.

Actuating means may be provided for causing said means for transmitting said interrogating signal to said electronic key to be operated, said actuating means conveniently comprising a door handle, e.g. of a door on which said lock is mounted.

Preferably, said electronic key comprises memory means for storing the security code of said key, means for receiving the interrogating signal from said lock and means for transmitting a transponding signal indicative of the security code stored in the memory means of said key.

According to another aspect of the present invention there is provided an electronic key for use with a programmable security lock according to said first aspect.

An exemplary embodiment of the invention will now be described reference being made to the accompanying drawings, in which:

Figure 1, is a block schematic diagram of a hotel access control system incorporating a plurality of programmable security locks according to the present invention;

Figure 2, is a diagrammatic perspective view of a programmable door lock in accordance with the present invention for use in the system of Figure 1; Figure 3, is a block schematic diagram of the programmable door lock of Figure 2; and

Figure 4, is a block schematic diagram of an electronic key for use with the programmable door lock of Figures 2 and 3.

The exemplary embodiment of the invention to be described is based on use in a hotel access control system such as that which is described in U.K. Patent Application Publication No. 2236354A. However, it should be appreciated that the invention has much wider application and may be used, for example, within commercial, industrial, business, sports and leisure environments.

The access control system which is to be described is based on the use of a programmable door lock which is fitted to each of the rooms of a hotel, each of the door locks being programmed with a unique code such that it can only be opened, to gain access to the room, by an electronic key which is coded with the same unique code.

In Figure 1 of the drawings there is shown a hotel access control system which comprises a control unit 1 which is typically located on or near the hotel reception desk. Each of the rooms of the hotel is fitted with a programmable door lock 2, and each guest of the hotel is provided with an electronic key 3, in the form of a "smart" card and similar to a thin pocket calculator, for gaining access to the room which has been allocated to him/her.

The control unit 1 comprises a reception check-in console 4, a key and lock programmer 5 and a transmitter/receiver Tx/Rx 6.

When a new guest checks into the hotel, the receptionist identifies a suitable room for the guest via the check-in console 4 which also generates a suitable security code which is to be allocated to that particular room for the period that the room is to be allocated to the new guest. The code generated by check-in console 4 is fed to the key and lock programmer 5 into which is inserted the electronic key 3 which is to be allocated to the new guest. The key and lock programmer 5 codes the electronic key 3 with the required code and the code is also fed to the transmitter/receiver 6 where it is transmitted via aerial 7 to the programmable door lock 2, via its aerial 8, of the room which has been allocated to the new guest. The coded electronic key 3 is then issued to the new guest which enables him/her to gain access, as will hereinafter be described, only to the room which has been allocated to him/her. Other areas of the hotel which are provided only for the benefit of hotel guests, such as gymnasiums, saunas, swimming pools, etc. may also be provided with programmable door locks 2, which may be programmed such that any guest having a valid electronic key can gain access thereto.

In Figure 2 of the drawings there is shown a diagrammatic view of a programmable door lock 2 which is attached to the door 9 of a hotel room. An electronic key 3 is also depicted for opening the lock 2 as will be described. The lock 2 comprises a door handle 10, the spindle of which is provided with a cam 11 which, when

the handle 10 is turned, causes a microswitch 12, or other suitable switch, to be operated. The output from the microswitch 12 is applied to an access control module 13 which will be described in greater detail with reference to Figure 3. The access control module 13 is powered from a battery 14 and is connected to the antenna 8 (Figure 1) and to the solenoid 15 of a lock mechanism 16. The lock mechanism 16 is provided with a protruding door catch 17 which normally locks the hotel door closed but which is retracted when the solenoid 15 of the lock mechanism 16 is activated to release the door.

In Figure 3, the access control module 13 of Figure 2 is shown in greater detail and comprises a transmit/receive (T/R) switch 20 to which the antenna 8 is connected, a receiver (Rx) 21, a central processor unit (CPU) 22, a memory 23, a short range transmitter (Tx) 24 and input/output (I/O) driver 25 to which the lock mechanism 16 and the microswitch 12 are connected.

The programmable door lock 2 of Figures 2 and 3 operates as follows. Remote programming of the programmable door lock 2 is achieved by transmitting an appropriately coded signal from the transmitter/receiver 6 of Figure 1. This signal is received by the antenna 8 and applied via T/R switch 20 to receiver 21 in which it is received and demodulated. The transmitted code is decoded by CPU 22 and stored in memory 23.

When a guest requires access to his hotel room, he operates the door handle 10 of the programmable door lock 2 and this causes the microswitch 12 to be closed. The closing of the microswitch 12 is detected by the CPU 22 via I/O driver 25, and is used to generate an interrogation signal which is transmitted by transmitter 24 and antenna 8 via I/O driver 25 and T/R switch 20.

Assuming that the hotel guest has with him his electronic key 3, which may be carried in a pocket or bag or in any other convenient way, the interrogation signal transmitted by the antenna 8 of the programmable door lock 2 will be received by the electronic key 3. When the interrogation signal is received by the electronic key 3, it responds by transmitting a transponding signal which is indicative of its own security code and this is received by the receiver 21 of Figure 3 via the antenna 8 and T/R switch 20. The received security code is decoded by CPU 22 and if it corresponds to its own code stored in memory 23 it causes the solenoid 15 of the lock mechanism 16 to be activated to cause the door catch 17 (Figure 2) to be retracted to release the door and allow access to the hotel room. If the received security code does not correspond to the code stored in memory 23, this may be indicative of someone trying to make a forced or illegal entry and an alarm signal is generated which is transmitted by the transmitter 24 via the aerial 8 and the T/R switch 20, to the Tx/Rx 6 of the control unit 1 of Figure 1 where it is used to inform the hotel staff of the illegal entry attempt.

In Figure 4 of the drawings there is shown the block schematic diagram of the electronic key 3 referred to in Figures 1 and 2. When an interrogation signal is re-

ceived by the electronic key 3, it is received by an antenna 30 and is fed via a transmit/receive (T/R) switch 31 to a receiver 32. The presence of the interrogation signal is detected by a central processor unit (CPU) 33 and the security code which has been programmed into the electronic key 3 and which is stored in memory 34 thereof is used, via an input/output (I/O) driver 35, to generate a transponding signal which is transmitted by short range transmitter 36 via the transmit/receive (T/R) switch 31 and antenna 30, back to the programmable door lock 2 which initiated the interrogation signal as has already been described.

In this way, the electronic key 3 does not need to be inserted in the programmable door lock and it is only necessary for it to be in the vicinity of the door lock 2 in order that it may be used to open the door lock and allow access to the hotel room.

It will be appreciated that the security code which is programmed into the programmable door lock 2 and electronic key 3 may take various forms dependent upon any particular application, and, in the hotel system described with reference to Figure 1 of the drawings, may typically comprise a 16 bit "GUEST" code in combination with a 12 bit "ROOM" code.

The embodiment of the invention which has been described has been given by way of example only and various modifications may be made whilst still utilising the basic principles thereof. For example, instead of using transmitted signals for programming the programmable door locks 2, they may be programmed, for example, using fixed electrical or optical links between the locks and a programming console, by using relay optical signalling techniques, or through the electrical mains wiring using, for example, frequency shift keying (FSK) techniques.

It may also be arranged that when the security code of each transponded signal received by the receiver (Rx) 21 of the access control module 13 of Figure 3, as well as being compared with the stored code in memory 23, may itself be stored in the memory 23. In this way the security codes of all of the electronic keys which have attempted to access a particular door lock, whether legitimately or illegally, may be transmitted back to the control unit 1 of Figure 1. This may be done at the time the access is attempted, at predetermined time intervals or as a result of an interrogate signal transmitted by the control unit 1 to the access control module 13 of Figure 3. This would enable the hotel to have accurate information on activities taking place in the hotel. Also, although in the embodiment of the invention which has been described, the programmable door lock 2 has been fitted to a door, it could equally well be fitted, for example, to a door frame, and instead of being operated by the door handle it may be operated in some other way, e.g. by means of a manual switch or a proximity switch.

It will also be appreciated that the integrated architecture of the electronic key allows it to be readily used

as what might be called an electronic purse, charge or credit card. In operation purchases made within the hotel environs may be recorded within the electronic key 3 and debited from a pre-stored credit level or added to a running total of transaction charges.

Claims

1. A programmable security lock (2) which is programmable with a security code which controls the opening thereof, said lock (2) comprising an electronic key (3) which is programmable with a security code which corresponds to the security code of said lock (2), characterised in that said lock is remotely programmable and by means (13) for remotely interrogating the security code of said electronic key (3) for the purpose of opening said lock (2).
2. A lock as claimed in claim 1, in which the electronic key (3) comprises a transponder arrangement (31-36).
3. A lock as claimed in claim 2, comprising means (24) for transmitting an interrogating signal to said electronic key (3) and means (21) for receiving a transponding signal from said electronic key (3), said transponding signal being indicative of the security code of said electronic key (3).
4. A lock as claimed in claim 3, comprising memory means (23) for storing the security code of said lock (2), processor means (22) for comparing the security code of the received transponding signal from said electronic key (3) with security code of said memory means (23) and for causing a lock mechanism (16) of said lock (2) to be opened when said security codes correspond.
5. A lock as claimed in claim 4, in which said means (21) for receiving a transponding signal is also effective for receiving a programming signal indicative of the security code to be programmed into said lock (2), said processor means (22) being operable in response to said programming signal for causing the security code thereof to be stored in said memory means (23).
6. A lock as claimed in claim 4 or claim 5, comprising a remote lock controller (1) including means (6,7) for transmitting said programming signal, and means (6,7) for receiving a signal transmitted from said lock (2).
7. A lock as claimed in claim 6, comprising means (22-24) for transmitting an alarm signal to said remote lock controller (1) when said security codes do not correspond.

8. A lock as claimed in claim 6, comprising means (22-24) for transmitting said security code of a received transponding signal to said remote lock controller (1).
9. A lock as claimed in claim 8, in which the security code of each received transponding signal is stored in said memory means (23), and the security codes stored in said memory means (23) are transmitted to said remote lock controller (1).
10. A lock as claimed in claim 9, in which the security codes stored in said memory means (23) are transmitted to said remote lock controller (1) at predetermined time intervals.
11. A lock as claimed in claim 9, in which said security codes stored in said memory means (23) are transmitted to said remote lock controller (1) in response to a signal received therefrom.
12. A lock as claimed in any of claims 4 to 11, comprising actuating means (10) for causing said means for transmitting said interrogating signal to said electronic key (3) to be operated.
13. A lock as claimed in claim 12, in which said actuating means (10) comprises a door handle (10).
14. A lock as claimed in any of claims 3 to 13, in which said electronic key (3) comprises memory means (34) for storing the security code of said key (3), means (20,21) for receiving the interrogating signal from said lock (2) and means (20,24) for transmitting a transponding signal indicative of the security code stored in the memory means (34) of said key.

Patentansprüche

1. Programmierbares Sicherheitsschloß (2), das mit einem dessen Öffnen steuernden Sicherheitscode programmierbar ist, wobei das Schloß (2) einen elektronischen Schlüssel (3) aufweist, der mit einem dem Sicherheitscode des Schlosses (2) entsprechenden Sicherheitscode programmierbar ist, **dadurch gekennzeichnet, daß**

das Schloß fernprogrammierbar ist, und eine Einrichtung (13) zum Fernabfragen des Sicherheitscodes des elektronischen Schlüssels (3) vorgesehen ist, damit das Schloß (2) geöffnet wird.
2. Schloß nach Anspruch 1, **dadurch gekennzeichnet, daß** der elektronische Schlüssel (3) eine Transponder-Anordnung (31 - 36) aufweist.

3. Schloß nach Anspruch 2, **gekennzeichnet durch** eine Einrichtung (24) zum Senden und zum Abfragen eines Signals für den elektronischen Schlüssel (3) und eine Einrichtung (21) zum Empfang eines Transpondersignals aus dem elektronischen Schlüssel (3), wobei das Transpondersignal den Sicherheitscode des elektronischen Schlüssel (3) darstellt.
4. Schloß nach Anspruch 3, **gekennzeichnet durch** eine Speichereinrichtung (23) zum Speichern des Sicherheitscodes des Schlosses (2) und eine Verarbeitungseinrichtung (22) zum Vergleich des Sicherheitscodes des aus dem elektronischen Schlüssel (3) empfangenen Transpondersignals mit dem Sicherheitscode der Speichereinrichtung (23) und zum Veranlassen, daß ein Schließmechanismus (16) des Schlosses (2) geöffnet wird, wenn die Sicherheitscodes einander entsprechen.
5. Schloß nach Anspruch 4, **dadurch gekennzeichnet, daß** die Einrichtung (21) zum Empfang des Transpondersignals ebenfalls zum Empfang eines Programmiersignals wirksam ist, das den in das Schloß (2) zu programmierenden Sicherheitscode darstellt, wobei die Verarbeitungseinrichtung (22) im Ansprechen auf das Programmiersignal betreibbar ist, damit ein Speichern von dessen Sicherheitscode in die Speichereinrichtung (23) veranlaßt wird.
6. Schloß nach Anspruch 4 oder 5, **gekennzeichnet durch** eine Fern-Schloßsteuereinrichtung (1) mit Einrichtungen (6, 7) zum Senden des Programmiersignals und Einrichtungen (6, 7) zum Empfang eines aus dem Schloß (2) gesendeten Signals.
7. Schloß nach Anspruch 6, **gekennzeichnet durch** Einrichtungen (22 - 24) zum Senden eines Alarmsignals zu der Fern-Schloßsteuereinrichtung (1), wenn die Sicherheitscodes nicht einander entsprechen.
8. Schloß nach Anspruch 6, **gekennzeichnet durch** Einrichtungen (22 - 24) zum Senden des Sicherheitscodes eines empfangenen Transpondersignals zu der Fern-Schloßsteuereinrichtung (1).
9. Schloß nach Anspruch 8, **dadurch gekennzeichnet, daß** der Sicherheitscode jedes empfangenen Transpondersignals in der Speichereinrichtung (23) gespeichert und die in der Speichereinrichtung (23)

gespeicherten Sicherheitscodes zu der Fern-Schloßsteuereinrichtung (1) gesendet werden.

10. Schloß nach Anspruch 9,
dadurch gekennzeichnet, daß
die in der Speichereinrichtung (23) gespeicherten Sicherheitscodes bei vorbestimmten Zeitintervallen zu der Fern-Schloßsteuereinrichtung gesendet werden.

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11. Schloß nach Anspruch 9,
dadurch gekennzeichnet, daß
die in der Speichereinrichtung (23) gespeicherten Sicherheitscodes zu der Fern-Schloßsteuereinrichtung (1) im Ansprechen auf ein aus dieser empfangenes Signal gesendet werden.

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12. Schloß nach einem der Ansprüche 4 bis 11,
gekennzeichnet durch
eine Stelleinrichtung (10), die veranlaßt, daß die Einrichtung zum Senden des Abfragesignals zu dem elektronischen Schlüssel (3) betrieben wird.

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13. Schloß nach Anspruch 12,
dadurch gekennzeichnet, daß
die Stelleinrichtung (10) einen Türgriff (10) aufweist.

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14. Schloß nach einem der Ansprüche 3 bis 13,
dadurch gekennzeichnet, daß
der elektronische Schlüssel (3) eine Speichereinrichtung (34) zum Speichern des Sicherheitscodes des Schlüssels. (3), Einrichtungen (20, 21) zum Empfang des Abfragesignals aus dem Schloß (2) und Einrichtungen (20, 24) zum Senden eines Transpondersignals aufweist, das den in der Speichereinrichtung (34) des Schlüssels gespeicherten Sicherheitscode darstellt.

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Revendications

1. Serrure programmable (2) de sécurité, qui peut être programmée avec un code de sécurité qui commande son ouverture, la serrure (2) comprenant une clé électronique (3) programmable par un code de sécurité qui correspond au code de sécurité de la serrure (2), caractérisée en ce que la serrure est programmable à distance et par un dispositif (13) d'interrogation à distance du code de sécurité de la clé électronique (3) dans le but de l'ouverture de la serrure (2) .
2. Serrure selon la revendication 1, dans laquelle la clé électronique (3) comprend un ensemble à émetteur-récepteur (31-36).
3. Serrure selon la revendication 2, comprenant un

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dispositif (24) d'émission d'un signal d'interrogation vers la clé électronique (3) et un dispositif (21) de réception d'un signal d'émission-réception de la clé électronique (3), le signal d'émission-réception étant représentatif du code de sécurité de la clé électronique (3).

4. Serrure selon la revendication 3, comprenant une mémoire (23) destinée à conserver le code de sécurité de la serrure (2), un processeur (22) destiné à comparer le code de sécurité du signal d'émission-réception reçu de la clé électronique (3) au code de sécurité de la mémoire (23) et à provoquer l'ouverture d'un mécanisme (16) de la serrure (2) lorsque les codes de sécurité se correspondent.

5. Serrure selon la revendication 4, dans laquelle le dispositif (21) de réception d'un signal d'émission-réception assure aussi la réception d'un signal de programmation représentatif du code de sécurité à programmer dans la serrure (2), le processeur (22) pouvant être commandé par le signal de programmation afin qu'il provoque la conservation du code de sécurité dans la mémoire (23).

6. Serrure selon la revendication 4 ou 5, comprenant un organe (1) de commande à distance de serrure comportant un dispositif (6, 7) destiné à émettre le signal de programmation, et un dispositif (6, 7) destiné à recevoir un signal émis par la serrure (2).

7. Serrure selon la revendication 6, comprenant un dispositif (22-24) destiné à émettre un signal d'alarme vers l'organe (1) de commande à distance de la serrure lorsque les codes de sécurité ne correspondent pas.

8. Serrure selon la revendication 6, comprenant un dispositif (22-24) de transmission du code de sécurité d'un signal d'émission-réception reçu à l'organe (1) de commande à distance de la serrure.

9. Serrure selon la revendication 8, dans laquelle le code de sécurité de chaque signal d'émission-réception reçu est conservé dans la mémoire (23), et les codes de sécurité conservés dans la mémoire (23) sont transmis à l'organe (1) de commande à distance de la serrure.

10. Serrure selon la revendication 9, dans laquelle les codes de sécurité conservés dans la mémoire (23) sont transmis à l'organe (1) de commande à distance de serrure à des intervalles de temps prédéterminés.

11. Serrure selon la revendication 9, dans laquelle les codes de sécurité conservés dans la mémoire (23) sont transmis à l'organe (1) de commande à distance

ce de serrure en fonction d'un signal reçu de celui-ci.

- 12.** Serrure selon l'une quelconque des revendications 4 à 11, comprenant un dispositif de manoeuvre (10) 5
destiné à provoquer la commande du dispositif de transmission du signal d'interrogation à la clé électronique (3).
- 13.** Serrure selon la revendication 12, dans laquelle le 10
dispositif de manoeuvre (10) comprend une poignée de porte (10).
- 14.** Serrure selon l'une quelconque des revendications 3 à 13, dans laquelle la clé électronique (3) com- 15
porte une mémoire (34) destinée à conserver le code de sécurité de la clé (3), un dispositif (20, 21) destiné à recevoir le signal d'interrogation de la serrure (2), et un dispositif (20, 24) destiné à transmet- 20
tre un signal d'émission-réception représentatif du code de sécurité conservé dans la mémoire (34) de la clé.

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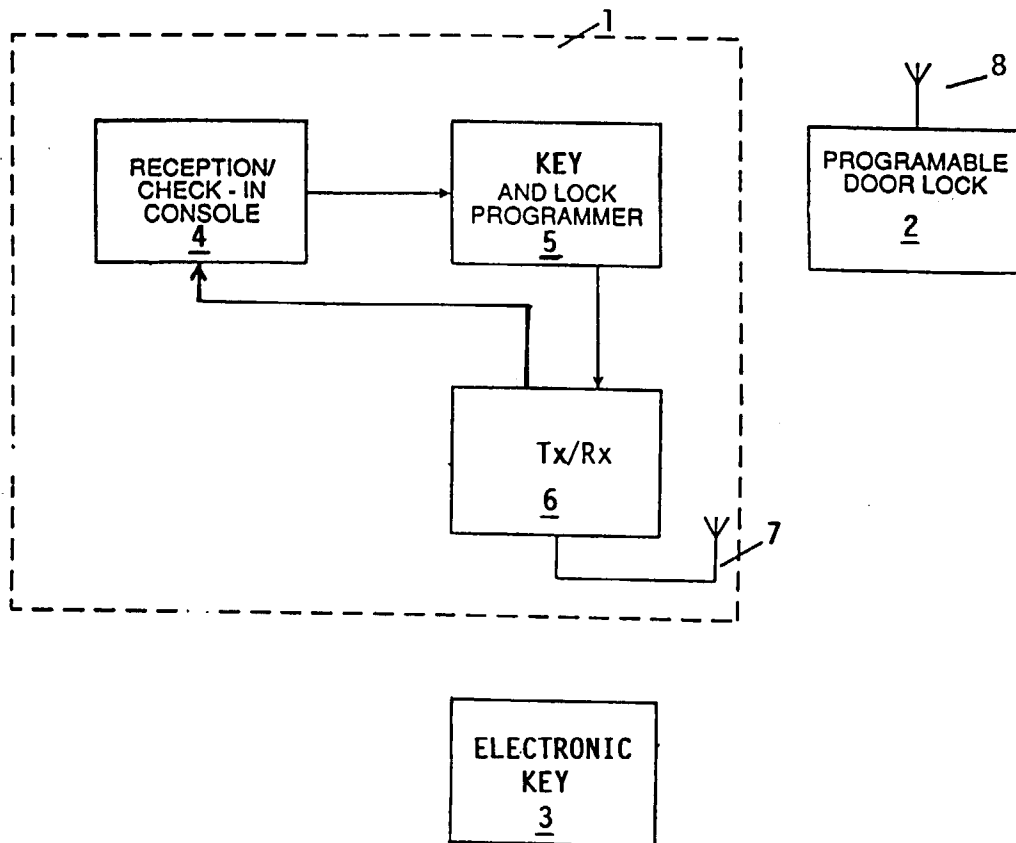
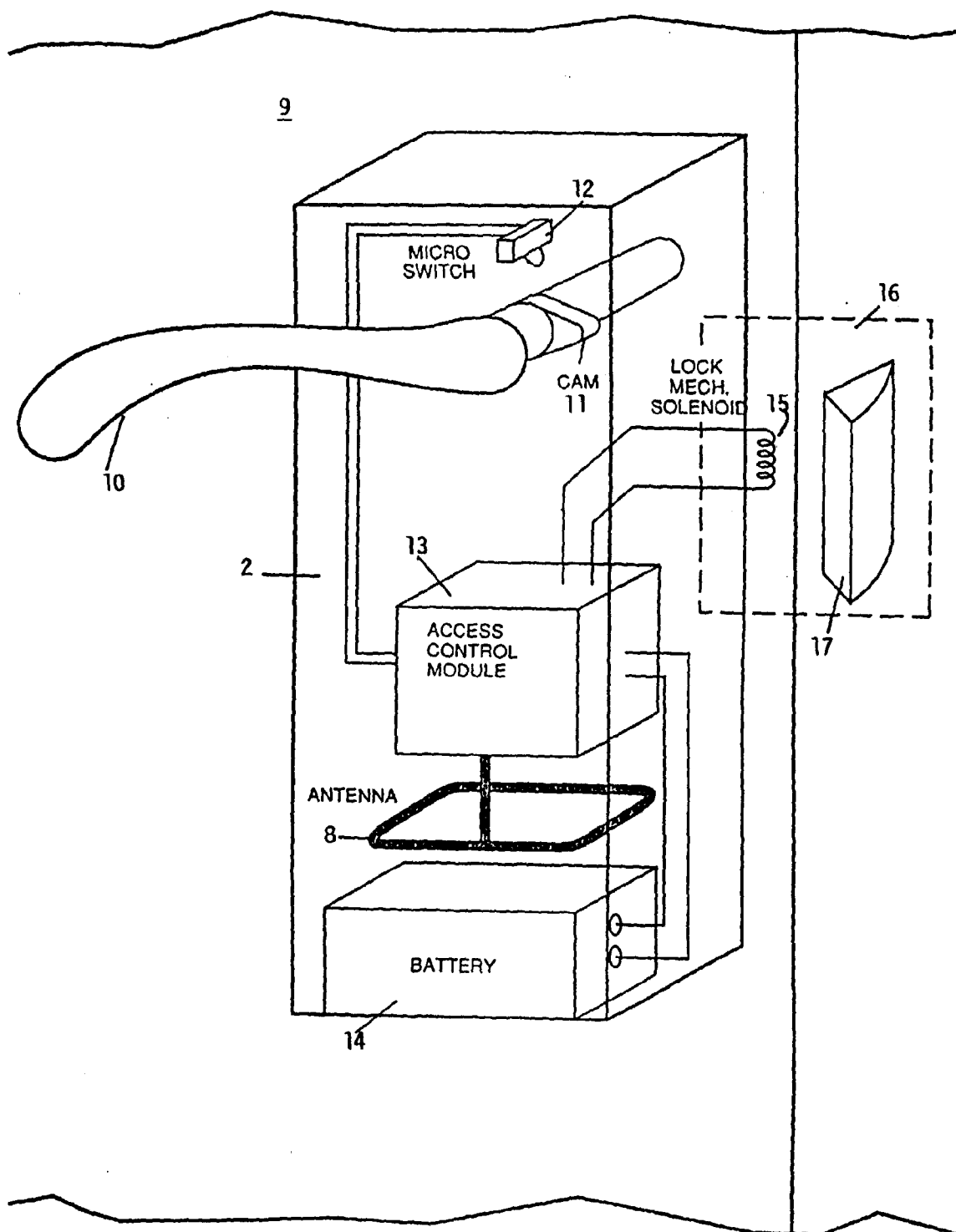


FIGURE 1



ELECTRONIC
KEY

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FIGURE 2

