

Description

Field of the Art

The present invention relates to an electronic device for operating locks. More precisely said device is used for controlling and actuating the opening and closing of locks which equip doors, main entrances and other equivalent systems having the same function, such as gates, shutters and also pivoting doors, which are provided or can be provided with electromechanical locks, the opening and closing of which is controlled by electric or electronic systems.

State of the Art

Electromechanical locks which are capable of opening and closing doors and gates by means of electric or electronic devices are currently known.

Security systems for opening or closing these locks are also known, said systems using electronic codes which are formulated by means of key-pads, written on magnetic cards or memorized in an electronic circuit.

The common feature of all these systems is that they have a single code allowing the status of a single corresponding lock to be controlled. Moreover the reliability of such systems may be classified according to different levels, starting from a lower level such as that typical of systems using magnetic cards, up to the level of more complex systems, which, on the other hand, always involve an easy reading and reproducibility of the codes of the magnetic cards.

The limitation of the known art therefore lies in the fact that there is no possibility that different locks should be operated by means of a series of codes or combinations which are memorized on a single physical medium and at the same time should not be easily read.

Objects and Advantages of the Invention

The object of the present invention is that of providing and making available an electronic device for operating locks, which is designed to control the opening and closing of an electromechanical lock of several different doors and equivalent systems, i.e. having the same function, such as shutters, gates, etc., using a single chip-card that is one or more electronic devices of the sequential logic type, which is or are mounted on a single pocket-size medium which can be made from various state-of-the-art materials.

The object of the present invention is therefore that of controlling the opening and closing of the aforementioned different locks using a single chip-card as described above.

This chip-card therefore performs the same function as the key used in any lock or, rather, the function of several different keys: in fact it may contain several enabling codes and therefore allow the opening and

closing of other locks for which it has been enabled.

By means of this device it is therefore possible, unlike the products which are currently commercially available, to use a single key allowing opening and closing of a very large number of locks, each of which has a specific code different from the other codes. Furthermore, the various codes entered on the chip-card are inaccessible to third parties, thus ensuring the maximum degree of security.

This device offers the following advantages:

- Firstly it guarantees a more reliable way of operating the locks which perform and ensure the closing of doors, main entrances and gates;
- It allows the use of a chip-card reader, via a simple slot formed in the metal container which may or may not protect and contain the lock mechanism;
- It may be applied to any lock which is provided with the necessary electromagnetic operating means;
- Said device is powered by batteries and hence operation is ensured even when there is no mains electricity supply, said batteries acting as back-up batteries.

Drawings

In order to explain the invention in question more clearly, a more detailed structural and functional description thereof will now be given, with reference to the accompanying drawings provided purely by way of a non-limiting example, in which:

- Figure 1 is a block diagram showing the individual elements and the corresponding electrical and logic connections according to the present invention;
- Figure 2 shows in schematic form the various components mounted in a unit having a form equivalent to that of a normal lock for doors according to the present invention.

Structural Description of the Device

The drawings illustrate the invention in question and from them it can be understood how, with the said invention, it is possible to obtain the opening and closing of electromechanical locks and the guaranteed security which the new device offers, as well as which are the basic elements which make up the said device.

Said elements are as follows:

- An electromechanical lock (1) and an associated actuator or bolt (1'). This consists of any mechanism, the opening and closing devices of which are actuated by means of an electric consent com-

mand;

- A device (5) for processing data and operating the lock. This device consists of a microprocessor or a single chip and a serial interface for communicating with a chip-card and a parallel interface for commanding opening or closing of the lock. This parallel interface is a circuit and consists of a power driver which converts the low-power signal, typical of microprocessors, into signals having a power and form necessary for operating the electromagnetic actuator.

The data processing and lock-operating device (5) may be mounted on the lock itself or in the immediate vicinity thereof. The chip-card is activated via the contacts in a reader (3);

- A chip-card (2) consisting of an electronic sequential-logic digital system, contained in one or more electronic components integrated on a chip, having contact terminals for external communication and being mounted on a rigid medium having forms and being made from various materials suitable for the purpose;
- A reader (3) for the chip-card (2), provided with a pre-shaped entry slot (6) into which the chip-card (2) is inserted so that it may be read. Said reader establishes physical contact between the contact terminals on the edge of the chip-card and the digital processing device (5) integral with the lock (1);
- A power supply unit (4), consisting of a battery and a system for converting the external power supplied via two leads, one of which is located on the door (or movable part of the element which performs closure) and the other one on the jamb (or fixed part of the aforementioned closing element) which come into contact when the door is closed.

Operating Mode of the Device

Said combined elements, as described above and arranged for use as illustrated in Figures 1 and 2, must be operated in accordance with a precise procedure necessary both for opening and for closing the lock in question.

Said procedure can be summerized as follows;

The person intending to open or close a door provided with a security system of this kind, i.e. an operating device of this kind, must insert the chip-card (2) into the corresponding reader device (3) incorporated inside the lock itself or arranged in the immediate vicinity thereof.

The two electronic apparatuses (2) and (3) exchange electronic signals in order to check their respective status.

More specifically the device (5) and the chip-card

(2) communicate with each other via their own respective procedures assigned to corresponding memories and consisting of sequential steps for opening and closing the locks.

As regards the microprocessor of the device (5), with said procedure the following steps are performed:

a) It waits for the chip-card (2) to be inserted into the reader (3): this operation is signalled by a microswitch, not shown in the figures, which is tripped when the chip-card (2) is inserted into the reader (3);

b) It sends a sequence of predetermined length (string) to the chip-card (2) in order to signal its presence;

c) It waits for a bit identification sequence (called RANDOM SEQ 1) of predetermined length from the chip-card (2);

d) It performs a routine (called CODIFY), the start of which consists of the bit sequence RANDOM SEQ 1);

e) The routine CODIFY generates two bit sequences: RESULT 1 and CIPHERED MASK 1;

f) It generates and then sends, together with RESULT 1 a random bit sequence, called RANDOM SEQ 2;

g) It performs the CODIFY routine, the start of which consists of the bit sequence RANDOM SEQ 2;

h) The routine CODIFY produces two bit sequences: RESULT 2 CIPHERED MASK 2;

i) It waits for a bit sequence which comprises RESULT 3 and CIPHERED CODES from the chip-card (2);

l) If the RESULT 3 is equal to RESULT 2, then it passes to step m) at the present point, otherwise it goes to the point step n);

m) It deciphers the codes and if, among those sent, there is the code corresponding to the lock (1), it generates the opening command, if the door is closed, or the closing command, if the door is open;

n) It returns to point a).

Correspondingly the chip-card (2) in turn, with said procedure, performs the following functional steps:

a) It waits for the presence signalling string from the microprocessor (5);

b) It generates and sends a random bit sequence called RANDOM SEQ 1 of predetermined length;

c) It performs a routine called CODIFY, the start of which consists of a bit sequence RANDOM SEQ 1;

d) The routine CODIFY generates two bit sequences called RESULT 4 and CIPHERED MASK 3;

e) It waits for two bit sequences, a random sequence called RANDOM SEQ 2 of predetermined length and another sequence corresponding to the sequence RESULT 2, from the microprocessor (5);

f) It performs the routine CODIFY, the start of which consists of the bit sequence RANDOM SEQ 2;

g) The routine CODIFY generates two bit sequences called, respectively, RESULT 3 and CIPHERED MASK 4;

h) If the RESULT 4 is equal to RESULT 2, then it passes to the next step i), otherwise it goes to the following step n);

i) It ciphers the codes in accordance with the information supplied by CIPHERED MASK 3 and CIPHERED MASK 4;

l) It sends the ciphered codes and RESULT 3 to the microprocessor (5);

m) It returns to the point a);

n) It sends a random bit sequence with a length equivalent to the ciphered codes and to RESULT 3;

o) It returns to point a).

The routine CODIFY is present both on the microprocessor (5) and on the chip-card (2). It consists of a series of logic operations, i.e. of suitable selected pulses for the lock activating function.

The perfect verification of the correspondence between the aforementioned steps in the processing device (5) and in the chip-card (2) ensures that opening or closing of the lock in question is reliably performed.

The chip-card (2) therefore performs the function of a key which effects opening and closing of the lock to be operated, or acts in place of the pushbutton activating electromagnets installed in the lock.

The chip-card (2) is able to perform the function of several keys because various enabling codes may be memorized on it and can therefore be used for opening and closing other different locks for which it has been enabled.

The routine CODIFY may be parameterized in the original codes by the user, thus enabling the latter to

create a personalized control procedure which only he/she is aware of, prior to initial use, via memory means.

Obviously additional variations with regards to the parameters and circuitry are possible, all of which falling within the inventive scope of the present invention.

Claims

1. Electronic device for operating locks of the type comprising a lock (1) connected to a processing device (5) and activated by means of a chip-card (2) which can be introduced into a reader (3), characterized in that a plurality of different identification codes relating to as many different locks are memorized on said chip-card, the latter interacting with said processing device (5) in accordance with a sequence consisting of comparative functional steps following which opening or not a lock is actuated depending on the correspondence between said steps;

2. Device according to Claim 1, characterized in that said processing device consists of a microprocessor having memorized on it a procedure comprising the following functional steps:

a) It waits for the chip-card (2) to be inserted into the reader (3): this operation is signalled by a microswitch, not shown in the figures, which is tripped when the chip-card (2) is inserted into the reader (3);

b) It sends a sequence of predetermined length (string) to the chip-card (2) in order to signal its presence;

c) It waits for a bit identification sequence (called RANDOM SEQ 1) of predetermined length from the chip-card (2);

d) It performs a routine (called CODIFY), the start of which consists of the bit sequence RANDOM SEQ 1);

e) The routine CODIFY generates two bit sequences: RESULT 1 and CIPHERED MASK 1;

f) It generates and then sends, together with RESULT 1, a random bit sequence, called RANDOM SEQ 2;

g) It performs the CODIFY routine, the start of which consists of the bit sequence RANDOM SEQ 2;

h) The routine CODIFY produces two bit sequences: RESULT 2 CIPHERED MASK 2;

- i) It waits for a bit sequence which comprises RESULT 3 and CIPHERED CODES from the chip-card (2);
- l) If the RESULT 3 is equal to RESULT 2, then it passes to step m) at the present point, otherwise it goes to the point step n);
- m) It decipheres the codes and if, among those sent, there is the code corresponding to the lock (1), it generates the opening command, if the door is closed, or the closing command, if the door is open;
- n) It returns to point a).
3. Device according to Claim 1, characterized in that said chip-card has stored on it a procedure comprising the following functional steps:
- a) It waits for the presence signalling string from the microprocessor (5);
- b) It generates and sends a random bit sequence called RANDOM SEQ 1 of predetermined length;
- c) It performs a routine called CODIFY, the start of which consists of the bit sequence RANDOM SEQ 1;
- d) The routine CODIFY generates two bit sequences called RESULT 4 and CIPHERED MASK 3;
- e) It waits two bit sequences, a random sequence called RANDOM SEQ 2 of predetermined length and another sequence corresponding to the sequence RESULT 2, from the microprocessor (5);
- f) It performs the routine CODIFY, the start of which consists of the bit sequence RANDOM SEQ 2;
- g) The routine CODIFY generates two bit sequences called, respectively, RESULT 3 and CIPHERED MASK 4;
- h) If the RESULT 4 is equal to RESULT 2, then it passes to the next step i), otherwise it goes to the later step n);
- i) It ciphers the codes in accordance with the information supplied by CIPHERED MASK 3 and CIPHERED MASK 4;
- l) It sends the ciphered codes and RESULT 3
- to the microprocessor (5);
- m) It returns to the point a);
- n) It sends a random bit sequence with a length equivalent to the ciphered codes and to RESULT 3;
- o) It returns to point a).
4. Device according to Claim 1, characterized in that said procedure comprises a routine called CODIFY consisting of a series of logic operations, i.e. pulses, selected for the lock opening and closing command function.
5. Device according to Claim 1, characterized in that said routine may be parameterized in the codes by the user prior to initial use, via memory means.

FIG. 1

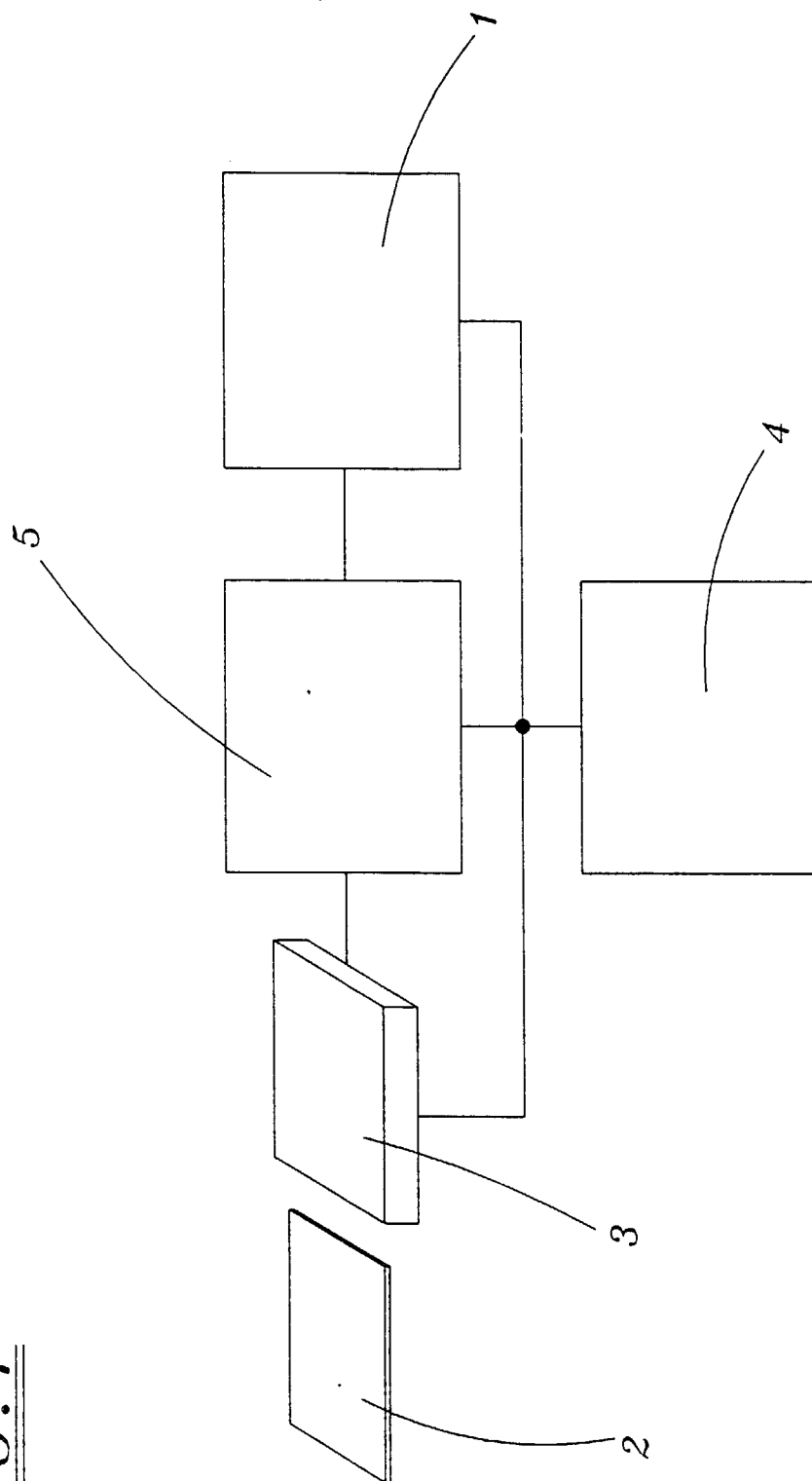


FIG. 2

