Title: ELECTRONIC DEVICE FOR DRIVING A LOCK

Fig.1

Abstract: An electronic device for driving a lock (100), comprises a support (2) for connection with the cylinder (104) of an existing lock having at least one through opening (3) for receiving a projecting portion (107) of the cylinder (104) and fastening means (4) to block the support (2) with respect to the projecting portion, and a gear motor (6) provided with an actuator (7) and a transmission (8) configured for rotating the cylinder (104) and allowing the opening or closing of the lock (100), in which the actuator (7) is defined by an electric motor (7a) having axis of rotation (B) parallel and offset with a central axis (a) of the opening (3) so as to be parallel to the cylinder (104).
DESCRIPTION

ELECTRONIC DEVICE FOR DRIVING A LOCK

The present invention relates to an electronic device for driving a lock, an electronic lock comprising said device, and a system for driving the lock. Therefore, the present invention finds particular application in the field of security, and in particular in products for public or private building security.

Over the last years, the research in the field of the locks is mainly directed along two distinct currents, namely the realization of more and more performing products from the point of view of the anti-break-in security and, contextually, the realization of more and more technological and user-friendly products.

In this respect, electric and electronic locks are well known, in which the cylinder rotation is imparted by drives or suitably controlled electric motors. To allow the movement of the cylinder reducing the overall dimensions, in the prior art devices for driving the lock are known in which the axis of rotation of the electric motor is perpendicular to that of the cylinder and coupled to it by means of specific transmissions of the bevel gears type, or the like.

Disadvantageously, this kind of coupling forces the manufacturer to a predetermined positioning of the motor and limits also the freedom in its dimensioning.

In fact, this kind of direct coupling of such type requires the motor to be placed perpendicularly to the axis of the cylinder, which makes the motor diameter a very limiting parameter.

Moreover, the direct coupling between the motor and the shaft or tang of the cylinder makes the balance between the need to have a performing motor and that to impact in a limited way on the possibility of manual operation by the user very hard.

Furthermore, in the known solutions the electric motor is connected, sometimes in a reversible way, through specific "universal" supports, to a
pre-existing cylinder, and has a number of wirings, which are integrated in the frame together with a control and driving interface.
Disadvantageously, such solutions entail a considerable investment for the user, or for the manufacturer, who must change the frame structure to integrate all the electronics of the driving device.
Object of the present invention is therefore to provide an electronic device for driving a lock, an electronic lock comprising said device and a system for driving a lock which overcome the aforementioned drawbacks of the prior art.
In particular, object of the present invention is to provide an electronic device for driving a lock easily applicable to pre-existing locks and having limited overall dimensions.
In addition, it is an object of the present invention to provide an electronic device for driving a lock, which does not impact, on the frame structure.
Furthermore, object of the present invention is to provide a user-friendly, highly performing and interactive system for driving a lock.
Said objects are achieved by an electronic device for driving a lock having the features of one or more of claims 1 to 17 and by a lock according to claim 18.
More precisely, the intended objects are achieved by an electronic device for driving a lock comprising a support for connection with the cylinder of an existing lock having at least one through opening for receiving a projecting portion of said cylinder and fastening means to block the support with respect to said projecting portion, a gear motor provided with an actuator, and a transmission configured to rotate said cylinder and allow the opening or closing of the lock.
According to one aspect of the present invention, the actuator is defined by an electric motor having an axis of rotation parallel and offset with respect to a central axis of said through opening of the support so as to be parallel to the cylinder.
Advantageously, in this way, the motor diameter is no longer a constraint for the producer, who has the possibility to select the most performing as well as the most powerful motor, without increasing the overall dimensions of the device.

5 Preferably, the transmission comprises at least a first and a second toothed wheel rotatably connected to each other, wherein the first toothed wheel is rigidly connected to the motor and the second toothed wheel has a coupling portion with a shaft or tang of the cylinder.

Note that, in order to increase the multiplication or reduction effect, depending on the motor type, the transmission comprises a cascade of gears extending between said first and said second gear.

To facilitate the positioning and the operation of the device on pre-existing locks, minimizing the overall dimensions, the coupling portion is defined by an opening, which can be coupled with the projecting portion of said shaft or tang of the cylinder and shaped so as to prevent a relative rotation (preferably substantially in a "D"-shape).

The driving system of the present invention also fulfills the aforementioned objects.

In particular, in such system is provided the presence of a driving device as described above further comprising a driving tab associated with said actuator, and provided with a communication module configured to put the tab in communication with a remote device.

More precisely, the system also comprises at least one remote server connected to said driving tab via said communication module and a remote device provided with a programming interface connectable to said communication module of the device via said server, and configured to exchange data with said device in order to display the lock condition and/or allow an operator to set one or more operating parameters of the device.

30 Advantageously, in this way, the user has the possibility to remotely drive and change the status and the response of the device, both by
programming the opening/closing condition and enabling or disabling the users.

These and other advantages will become more apparent from the following exemplary, and therefore non-limiting description of a preferred, and therefore not exclusive embodiment of an electronic device for driving a lock as shown in the following drawing tables, in which:

- Figure 1 shows a perspective view of an electronic device for driving a lock according to the present invention in an assembled configuration;
- Figure 2 shows the device of Figure 1 with some parts removed in order to highlight others;
- Figure 3 shows the device of Figure 1 and 2, with further parts removed in order to highlight others;
- Figure 4 shows a cross-sectional view of the electronic driving device;
- Figure 5 shows a rear perspective view of the device of Figure 1 in a disassembled configuration;
- Figure 6 shows a rear view of the device of Figure 5;
- Figure 7 is a schematic side view of a driving system comprising the driving device of Figure 1.

With reference to the appended figures, number 1 indicates a device for driving a lock 100 according to the present invention.

The lock 100 is assembled or integrated in a frame 101 or door, preferably outdoor.

The lock 100 thus comprises a box body 102 inserted (or insertable) in a recessed area formed in the frame 101.

In the box body 102 a plurality of sliding locks and the set of (upper and/or lower) rods are provided, all moved by a moving mechanism, not illustrated nor described in detail as known perse.

In the lock 100 is also provided a latch bolt, preferably operable also by means of a handle.
Preferably, both the latch bolt and the mechanism are operable via the lock 100 both manually, through a key or a knob 103, and by means of the device 1 according to the present invention.

In any case, the lock 100 comprises a cylinder 104 inserted in the frame 101 and extending along its own main extension axis "A" which, in use, is preferably horizontal.

In the illustrated embodiment, the cylinder 104 comprises at least a first 104a and a second half-part 104b arranged in succession along said extension axis "A".

The first half-part 104a of the cylinder 104 has a fixed portion, which can be anchored to the frame 101 and a rotatable portion crossed by a passage 105 for inserting a key.

The second half-part 104b of the cylinder 104, instead, has a shaft 106 or tang extending along the extension axis "A" away from the first half-part 104a.

Preferably, the shaft 106 or tang is connected to the rotatable portion of the first half-part 104a, in series to it.

Note that the shaft 106 has a free end, distal from the first half-part 104a, shaped to couple with a rotatable knob 103 suitable for allowing a quick opening/closing of the lock from the inside environment.

In use, in fact, the first half-part 104a is faced from an outer side of the frame 101, while the first half-part 104b is faced from an inner side of the frame 101.

In this regard, the shaft 106 or tang has at least one flattened portion of rotational coupling with the knob 103.

Note that the cylinder 104 comprises at least one portion (fixed) 107 projecting from the frame 101, or from a face of the frame, connected in series with the shaft 106 or tang.

The projecting portion 107 is thus part of the second half-part 104b.

The electronic device 1 for driving the lock 100 is coupled, in use, to the cylinder 104 and in particular to the above projecting portion 107.
Preferably, the electronic device 1 comprises a support 2 for connection with the cylinder 104 of the lock 100. Such support 2 has at least one through opening 3 for receiving the aforementioned projecting portion 107 of the cylinder 104 and fastening means 4 to block the support 2 with respect to the projecting portion 107. More precisely, the opening 2 is shaped so as to fit on the projecting portion 107, and the fastening means 4 are configured to block the support 2 on the projecting portion 107. Therefore, the opening 3 extends crossing the support 2 along a central axis "B" which, in use, is parallel (or corresponding) to the extension axis of the cylinder 104.

In the preferred embodiment, the support 2 is defined by a plate 5 provided with a hole 5a substantially complementarity shaped to the projecting portion 107 of a common European cylinder lock 100 and defining said opening 3.

The fastening means 3 are preferably of the screw type in order to allow an accurate tightening of the support 2 on the projecting portion 107, which is also suitable for cylinders with slightly variable dimensions.

In a first embodiment, the fastening means 4 comprise pressure elements translatable by means of a screw towards and away from the projecting portion 107 (or from a centre of the opening 3) as a vice. Alternatively, such fastening means 4 may be defined by the two sides of the opening 3 elastically movable towards and away from each other by means of said screw.

The support 2 is also connected to a gear motor 6 provided with an actuator 7 and a transmission 8. Such gear motor 6 is configured to rotate the cylinder 104 and allow the opening or closing of the lock 100. According to one aspect of the invention, the actuator 7 is defined by an electric motor 7a having an axis of rotation "B" parallel and offset with
respect to the central axis of said opening 3 so as to be parallel in use to the cylinder 104.

Note that the motor 7a is not aligned to the cylinder 104 (or to the opening 3), but is parallel and moved with respect to it.

Advantageously, in this way the diameter of the electric motor 7a is not a critical parameter in the dimensioning of the device 1, allowing the manufacturer to use motors having different powers according to the needs, without structural limits to the choice.

Preferably, the transmission 8 comprises at least a first 9 and a second wheel 10 rotatably connected to each other, wherein the first wheel 9 is rigidly connected to the motor 9 and the second wheel 10 has a coupling portion 10a with the shaft 106 or tang of the cylinder 104.

More precisely, the second wheel 10 is aligned with the opening 3 of the support, preferably disposed along its central axis "B".

Preferably, the coupling portion 10a of the second wheel is defined by a hole 11, which can be coupled with the shaft 106 or tang of the cylinder 104 and shaped so as to prevent a relative rotation.

In other words, the hole 11 is shaped so that the shaft 106 or tang of the cylinder 104 is slidingly insertable therein but is constrained to it during the rotation.

In this respect, the hole 11 has non-circular section, preferably complementarity shaped to the cross section of the shaft 106 or tang of the cylinder 104.

More preferably, the hole 11 has at least one flattened portion 11a, which can be coupled with a corresponding flattened portion 106a of the shaft 106 or tang.

In the illustrated embodiment, the hole 11 has a substantially "D"-shaped section or passage.

Advantageously, it is the typical and standard shape of the "tangs" currently on the market, which allows the application of the device 1 to any pre-existing lock.
Preferably, in order to allow maximum reduction or multiplication of ratios, the transmission 8 comprises a cascade of gears 12 extending between the first 9 and the second wheel 10. Therefore, the first 9 and the second wheel 10 are toothed wheels.

To facilitate the compactness of the device 1 a plate 13 is provided, having at least a first 13a and a second face 13b opposite to each other. The actuator 7, or the electric motor 7a, and the support 2 are connected to and projecting from the first face 13a. The transmission 8, instead, is associated with the second face 13b. Therefore, the cascade of gears 12 (at least the first 9 and the second wheel 10) are pivoted to said second face 13a. Advantageously, in this way the support 2 (i.e., in use, the shaft 106 or tang) and the motor 7a are arranged one above the other and abutted to the frame, allowing maximum axial compactness of the device 1.

In the preferred embodiment, the device comprises a box body 14 provided with at least a first 13 and a second plate 15 facing each other and defining a housing for the transmission 8 therewithin. Therefore, the first plate 13 corresponds to the plate described above. Both the first 13 and the second plate 15 are provided with respective through holes substantially aligned with the coupling portion 10a of the second wheel 10.

In this way, the shaft 106 or tang of the cylinder 104 projects from the second plate 15 with a free end to which the knob 103 is anchored or anchorable.

Therefore, the device comprises a box body 14 inside which the transmission 8, a support 2 and a motor 7a are arranged, the latter two elements being both anchored to a same external face of the box body. Advantageously, in this way, the device is compact and robust. To allow the driving of the actuator 7, the device comprises a driving tab 16 associated therewith.
Such driving tab 16 is arranged to receive a driving signal from a user and configured to send to said actuator 7 a signal representative of an opening or a closing of the lock 100 in order to move the actuator. Structurally, the driving tab 16 is constrained to the transmission 8, so that the transmission 8 itself is interposed between the tab 16 and said actuator 7.

More precisely, the tab 16 is abutted, preferably constrained, to the second plate 15 of the box body 14. Such arrangement further strengthens the concept of compactness that the driving device 1 described herein aims to achieve. Note that, also the tab 16 is provided with its own through hole 16b aligned to the central axis "B" of the support 2 (and hence to the holes of the plates 13, 15).

Preferably, the tab 16 comprises at least one microprocessor 17 or microcontroller, which can be set by the manufacturer to respond to one or more predetermined external or internal signals.

Moreover, the driving tab 16 comprises a receiving module 18 associated with the microprocessor 17 or microcontroller and configured to receive a signal sent by an opening element or transponder 108.

In particular, the driving tab 16 is configured to:
- compare the signal (received by the transponder) with at least one preset value, and
- send to said actuator 7 a signal representative of an opening or a closing of the lock 100 as a function of a result of said comparison.

Preferably, the driving device 1 comprises at least one memory 22 associated with the driving tab 16 and programmable with the inclusion of one or more reference values (or preset values) corresponding to one or more opening elements 108 (or transponder).

Note that the opening element could also be a smartphone provided with BlueTooth® connection.
Furthermore, the device 1 also comprises a communication module 19 associated with the driving tab 16 and configured to place it in communication with a remote device 109 (as will be better clarified hereafter).

Furthermore, in the preferred embodiments, a signalling module (not shown) is provided connected to the microcontroller 17. Similarly, an end-stop striker is also associated with the driving tab 16 and configured to detect the position of the frame with respect to the striker, and to prevent the operation of the device 1 when the frame is not in abutment.

In the preferred embodiment, the driving tab 16 is configured to adapt the movement of the actuator 7 (motor 7a) to the stroke of the lock on which the device is installed.

More precisely, the tab 16 is configured to measure a parameter representative of the lock stroke from a retracted position of the sliding lock to an end-stop or abutment position.

Preferably, both said positions (retracted and in abutment) are detected in terms of electric current; therefore, the tab 16 is configured to measure the electric current absorption by the motor 7 and to evaluate a stall current corresponding to a condition of "blocked motor".

In detail, said "stall current" is preset in the control tab 16 (or in the microcontroller 17) and is limited to an acceptable value by acting on the control of the drive pulses (PWM signal, Pulse Width Modulation).

In the preferred embodiment, the device 1 comprises a timer associated with the tab 16 and configured to measure at least the time between said retracted position and said abutment position of the motor.

Said tab 16 is thus arranged, in a learning configuration, to receive a signal representative of such time in order to determine the activation time of the actuator 7 necessary to a complete closing/opening of the lock.

Said learning configuration is maintained by the tab at least to a first switching on of the device 1.
Subsequently to said first switching on, the tab 16 switches into an operating configuration, in which it drives the actuator 7 in opening or closing for a time equal to, preferably slightly lower than, the detected value in said learning configuration.

Advantageously, in this way the sliding lock is not brought in abutment, with advantages from the point of view of the user's liking and the wear of the system.

Moreover, in the preferred embodiment the control tab 16 is configured to activate periodically the "learning" configuration, in order to update said time value.

The update period may be temporally fixed, through said timer, or (preferably) linked to the cycle number of opening/closing of the device through, for example, a counter associated with the tab.

Advantageously, this allows compensating the mechanical parameters variations of the motorized system, due to the wear or settling of the components in motion and to the effects of the room temperature and the internal temperature on the system itself to allow the device operation without the need to perform masonry works. The device 1 also comprises a battery 20 connected to the actuator 7 and/or to the driving tab 16.

Such battery may be connected to the device in a removable or irremovable way.

In the second case, the battery 20 should be rechargeable in situ by a cable or connector, which is extractable or externally faceable to the device 1.

Alternatively, or in combination, the battery 20 is connected in a reversible way to the actuator 7 and/or to the driving tab 16 in order to allow its replacement.

Thus, in the preferred embodiment the battery 20 is provided with a reversible connector, which can be coupled with a respective socket formed in or associated with the tab 16. More preferably, sliding contacts are used.
Preferably, the device 1 comprises a covering element 21, which can be anchored to the frame 101.

This covering element 21 preferably has a first 21a and a second concavity 21b adjacent to each other.

In the first concavity 21a are housed, in use, the support 2 and the gear motor 6 (and the tab 16).

In the second concavity 21b is instead housed, in use, the battery 20.

Preferably, the covering element has two separable half-parts, each defining a concavity.

Advantageously, in this way, it is possible to replace the battery 20 without the need to remove the device 1 or its covering.

As mentioned above, the device 1 preferably is inserted into an electronic system for driving the lock 100.

Preferably, the system is composed of the device 1, at least one remote server 200 and at least one remote device 201.

The remote server 200 is therefore operatively interposed, from a point of view of the communication and data transfer, between the device 1 and the remote device 201.

It is connected to the driving tab 16 of the device 1 through the communication module 19 mentioned above.

Note that the expression "remote device 201" herein refers to any programmable electronic device through which it is possible to connect remotely to the server and interface with the tab 16 of the device, such as, for instance, a PC, a smartphone, a tablet, or the like.

In this respect, the remote device 201 is provided with a programming interface 202 connectable to the communication module 19 of the device 1 through said server 200.

Preferably, the programming interface 202 is defined by a web application or software, which can be installed or downloaded by a user on the remote device 201 through the common channels used.
Such remote device 201, through the programming interface 202, is therefore configured to exchange data with the driving device 1 in order to display the condition of the lock 200 and/or to allow an operator to set one or more operating parameters of the driving device 1 itself.

In a first functionality, the programming interface 202 comprises at least a selection module 203 operable by a user control interfaced with said remote device 201, and configured to send to said driving device 1 a signal representative of an opening or closing condition of the lock 100.

Advantageously, in this way, an enabled user can remotely open or close the lock 100, resolving numerous problems and daily uncertainties related to the need for currently verifying in situ the correct closing or opening of the lock, or the need for constantly verifying the possession of the keys.

In a further functionality, independent but preferably complementary to the previous one, the programming interface 202 comprises at least one management module 204 activated by a command of a user interfaced with said remote device 201.

Such management module 204 is configured to enable or disable one or more opening elements 108 (or transponders) through an insertion or a deletion of the respective opening element 108 into or from said memory 22.

Similarly, the programming interface 202 may comprise, in turn, a memory 202a in which one or more remote devices 201 enabled to the use of the driving device 1 are insertable and disinsertable, through specific encoding.

Preferably, moreover, the management module 204 is arranged to allow the creation and/or modification and/or deletion of personal profiles provided with respective identification parameters enabled for opening the lock 200.

The invention achieves the intended objects and achieves important advantages.
In fact, the presence of a motor coaxial to the opening of the support allows reducing the overall dimensions of the device, making it easily coupled to all the existing locks. Moreover, the presence of a transmission with perforated wheel in which the tang of the existing cylinder is slidably insertable makes the device easily to assemble and intuitive. Furthermore, the presence of a remote interface that allows both the activation and the enabling of the transponders to the use of the device, makes the system safe and easily to control.
CLAIMS

1. Electronic device for driving a lock (100), comprising:
   - a support (2) for connection with the cylinder (104) of an existing lock having at least one through opening (3) for accommodate a projecting portion of said cylinder (104), and fastening means (4) to block the support (2) with respect to said projecting portion;
   - a gear motor (6) provided with an actuator (7) and a transmission (8) configured to rotate said cylinder (104) and allow the opening or closing of the lock (100);
   characterized in that the actuator (7) is defined by an electric motor (7a) having an axis of rotation (B) parallel and offset with respect to a central axis (A) of said opening (3) so as to be parallel to the cylinder (104).

2. The electronic device according to claim 1, characterized in that said transmission (8) comprises at least a first (9) and a second wheels (10) rotatably connected to each other, wherein the first wheel (9) is rigidly connected to the motor (7a) and the second wheel (10) has a coupling portion (10a) with a shaft (106) or tang of the cylinder (104).

3. The electronic device according to claim 2, characterized in that said second wheel (10) is aligned with said central axis (A) of the opening (3) of the support (2).

4. Electronic device according to claim 2 or 3, characterized in that said coupling portion (10a) is defined by a hole (1) which can be coupled to said shaft (106) or tang of the cylinder (104), and shaped so as to allow its insertion into the hole (1) preventing its relative rotation.

5. The electronic device according to claim 4, characterized in that said hole (1) has a non-circular section and is complementarity shaped with
6. Electronic device according to claim 4 or 5, characterized in that said hole (11) has at least one flattened portion (11a) which can be coupled with a corresponding flattened portion (106a) of the shaft (106) or tang.

7. Device according to any one of claims from 2 to 6, characterized in that said transmission comprises a cascade of gears (12) extending between said first (9) and said second wheels (10).

8. The electronic device according to any one of the preceding claims, characterized in that it comprises at least one plate (13) having at least a first (13a) and a second face (13b) opposite to each other; said actuator (7) and said support (2) being connected to and projecting from said first face (13a), and said transmission (8) being associated with said second face (13b).

9. The electronic device according to claim 8, characterized in that it comprises a box body (14) having at least a first (13) and a second plates (15) facing each other, and defining an internal housing for said transmission (8); said first (13) and said second plate (15) being provided with respective through holes substantially aligned with said coupling portion (10a) of the second wheel (10).

10. The electronic device according to any one of the preceding claims, characterized in that it comprises a battery (20) connected to said actuator (7) and/or to a driving tab (16).

11. The electronic device according to claim 10, characterized in that said battery (20) is connected in a reversible manner to the actuator (7) and/or the driving tab (16) in order to allow for its replacement.
12. The electronic device according to claim 10 or 11, characterized in that it comprises a covering element (21) having a first concavity (21a) for housing the support (2) and the gear motor (6), and a second concavity (21b) for accommodating the battery (20) adjacent to each other.

13. The electronic device according to any one of the preceding claims, characterized in that it comprises a driving tab (16) associated with said actuator (7), arranged to receive a driving signal from a user and configured to send to said actuator (7) a signal representative of an opening or a closing of the lock in order to move the actuator.

14. The electronic device according to claim 13, characterized in that said driving tab (16) is associated with the transmission, so that said transmission (8) is interposed between the tab (16) and said actuator (7).

15. The electronic device according to claim 13 or 14, characterized in that it comprises a box body (14) having at least a first (13) and a second plates (15) facing each other and defining an internal housing for said transmission (8); said actuator (7) and said support (2) being connected to said first plate (13), said transmission (8) being located in said housing, and said driving tab (16) being connected to said second plate (15).

16. An electronic device according to any one of claims 13 to 15, characterized in that said driving tab (16) comprises a receiving module (18) configured to receive a signal sent by an opening element (108); said driving tab (16) being configured to compare said signal with at least one preset value, and to send to said actuator (7) a signal
representative of an opening or a closing of the lock (100) as a function of a result of said comparison.

17. An electronic device according to any one of claims from 12 to 16, characterized in that it comprises a communication module (19) associated with said driving tab (16) and configured to put in communication said driving tab (16) with a remote device (201).

18. Electronic lock, comprising:
   - a cylinder (104), preferably of the European type, extending along an own axis from which a shaft (106) or tang protrudes, parallel to said axis (A); said cylinder (104) having at least a portion (107) in use protruding from one face of a frame (101);
   - an electronic driving device (1) according to any one of the preceding claims, wherein the fastening means (3) are rigidly connected to said protruding portion (107).

19. Electronic lock according to claim 18, characterized in that said driving electronic device (1) comprises a tab (16) configured to adapt the movement of the actuator (7) to a useful stroke of the shaft (106).
A. CLASSIFICATION OF SUBJECT MATTER

INV. E05B47/02
ADD. E05B9/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols):
E05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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