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(54) **Electric strike plate system**

(57) The invention relates to an electric strike plate system comprising an electric strike plate (7) with a movable blocking member (8). The blocking member (8) movement is controlled by means of an electric actuator (10). The actuator (10) is activated in response to a control signal by supplying the actuator (10) with power from a power supply circuit (23, 203) connected to a power

source (22, 220). The power supply circuit (23, 203) is adapted for providing a time-dependent voltage sequence with a first voltage level to change the actuator (10) state from deactivated to activated, followed by a second voltage level, which is lower than the first voltage level, to maintain the activated state of the actuator (10).

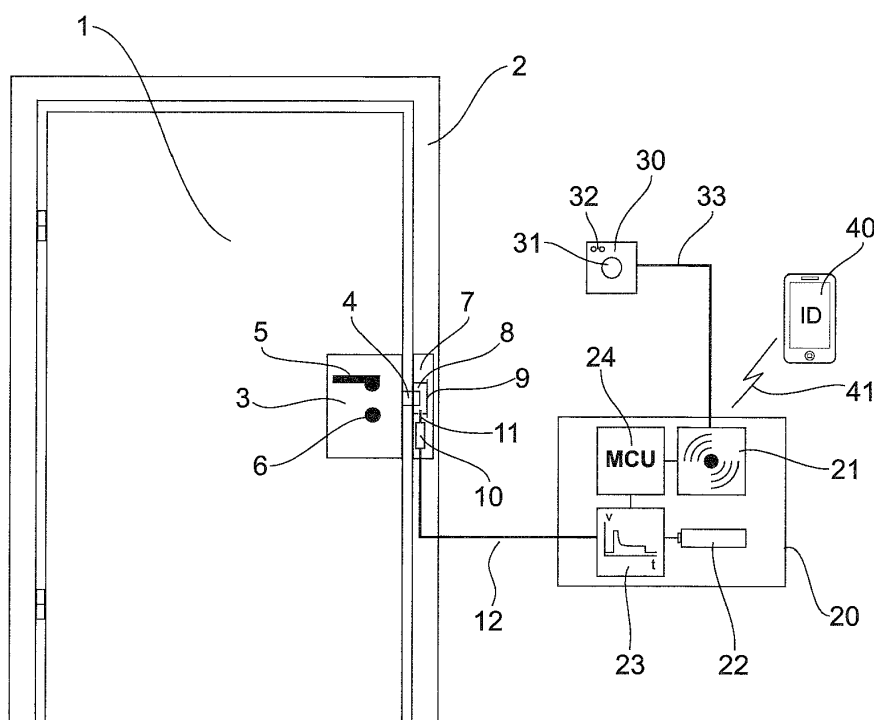


Fig. 1

Description

[0001] The invention relates to an electric strike plate system comprising an electric strike plate with a movable blocking member, an electric actuator, and a power supply circuit (23, 203), wherein the locking member movement is controlled by means of the actuator, where the actuator is activated in response to a control signal by supplying the actuator with power from the power supply circuit connected to a power source.

[0002] Pivotal elements, such as doors or windows, which are hinged in a frame, can often be locked in a closed position by means of a locking unit. The locking unit comprises a lock case arranged in the frame on the pivotable element and operates a locking element, such as a latch and/or bolt which can be pushed forward to engage with cooperating openings/recesses in a strike plate arranged in the frame. To be able to open the pivotable element without having to pull the latch and/or bolt back in the lock case, there is arranged an electric strike plate with a blocking member which can be moved away from the latch and/or bolt so that the locking effect is lifted. Typically, the blocking member movement is maintained or released as needed by means of a lock member, which is engageable with the blocking member. In an electric strike plate, the blocking member can be released by means of an electromagnetic actuator, such as a solenoid. In a common variant, the blocking member is released as the actuator is activated by switching on the power to the actuator and is kept in released state by maintaining the current through the actuator for as long as the locking effect of the lock should be lifted. For example, in the case of a door, the current is typically maintained until a person has passed through the door, or at least until the blocking member was released by opening the door with advanced latch/bolt. Electric strike plates are known in numerous applications to control the locking function in access doors and other pivotable elements, and it is more and more desirable to be able to remotely control opening and locking functions on existing buildings electrically, and preferably also in combination with some form of electronic access control, for example by wireless communication with an electronic key, mobile phone, or other mobile unit. There is therefore an increasing need for retrofitting electrically operated locking units, including systems with electric strike plate, in existing doors, windows, or gates.

[0003] The disadvantage of known electric strike plates of the type described above is relatively high energy consumption while the blocking member released state is maintained. The high energy consumption also makes it very difficult to reliably operate such electric strike plates by means of batteries and hence requires major installation measures also at retrofitting.

[0004] The object of the invention is to provide an electric strike plate which overcomes at least some of the above disadvantages and which is suitable for retrofitting.

[0005] The invention solves this problem by means of

an electric strike plate according to claim 1. Advantageous embodiments appear from the claims dependent thereof.

[0006] An electric strike plate system according to one embodiment of the invention comprises an electric strike plate with a movable blocking member, an electric actuator, and a power supply circuit, wherein the blocking member movement is controlled by means of the actuator, wherein the actuator is activated in response to a control signal by supplying the actuator with power from the power supply circuit connected to a power source, wherein the power supply circuit is adapted to provide a time-dependent voltage sequence with a first voltage level adapted to change the actuator state from deactivated to activated, followed by a second voltage level, which is lower than the first voltage level, adapted to maintain activated state of the actuator.

[0007] When the actuator is moved from the deactivated state to the activated state, a movable member is usually moved from a rest position to a working position. In order to maintain the activated state of the actuator, the movable member is typically merely retained in the operating position, for example against a spring load. Thus, the voltage sequence achieves a reduction in power consumption as an increased voltage level is applied to the actuator only to move the movable member, while a lower voltage level with a lower power consumption is sufficient for retaining the movable member in its operating position.

[0008] One advantage of the electric strike plate system according to the invention is that the electric strike plate with movable blocking member may be an existing electric strike plate already installed in a door/window/gate, or be an off-the-shelf-item, where the electric strike plate is provided with a prior art actuator, such as, for example, a solenoid operated at a supply voltage between 5 and 24 V, typically about 12 V or about 24 V.

[0009] According to a further embodiment of the electric strike plate system, the power supply circuit comprises a charge pump circuit. The charge pump circuit is adapted to increase the power supply output voltage as compared to the voltage supplied by the power source. When the charge pump circuit is connected, it is supplied from the power source, and a pump capacitor is charged from the power source by means of a switching circuit, which typically operates at switching frequencies in the kHz or MHz range. When the voltage built up in the charge pump circuit is to be released, the pump capacitor is discharged by supplying a voltage pulse to a load on the output side of the power supply circuit. The charge pump circuit is connected when the control signal requests activation of the actuator and is released to supply the first voltage level on the power supply output to bring the actuator from the deactivated state to the activated state as soon as an appropriate voltage has been achieved by means of the charge pump circuit. Subsequently, when the actuator has been brought to the activated state, the power supply output voltage drops from the first voltage

level to the second, lower voltage level, e.g. corresponding to the power source voltage level. The second voltage level entails a lower energy consumption, but is sufficient for maintaining the activated state of the actuator for as long as is wanted/needed. Thereby, an energy-conserving voltage sequence is obtained in a simple and energy-efficient manner, as indicated above.

[0010] According to a further embodiment of the electric strike plate system, the power source comprises one or more batteries. Thereby an electric strike plate system is achieved, which is independent of external power sources, and which is therefore easy to retrofit locally, for example in an existing access door, without the need for major installation measures. Because of the energy-saving voltage sequence, the battery will last longer than it would otherwise. Here, especially the combination with a power supply comprising a charge pump circuit is advantageous in that it allows use of a battery unit with lower output voltage.

[0011] According to a further embodiment of the electric strike plate system, the second voltage level can be maintained by means of the charge pump circuit. Thus, the charge pump circuit can be controlled by the MCU to compensate if the power source voltage level alone is not sufficient to maintain the actuator activated state. In this case, the charge pump circuit is supplied from the power source and operated to supply an, relative to the power source, increased voltage on the power supply output to maintain the actuator activated state. Thus, the second voltage level is lower than the first voltage level, but higher than the power source voltage level. This may be an advantage, for example, when the battery voltage in a battery-powered system decreases over time, since the time of replacing the batteries can be postponed thereby.

[0012] According to a further embodiment of the electric strike plate system, the actuator operates a lock member which retains the blocking member when the lock member is in engagement with the blocking member. Similarly, the blocking member is released when the lock member is not in engagement with the blocking member.

[0013] According to a further embodiment of the electric strike plate system, the blocking member movement is released when the actuator is activated. This embodiment is advantageous, because usually it has the lowest power consumption as the actuator only consumes power to lift the locking effect, while the actuator does not consume power to maintain the locking effect ("current-less closed").

[0014] According to a further embodiment of the electric strike plate system, the actuator is a solenoid.

[0015] According to a further embodiment of the electric strike plate system, the control signal is provided by a microcontroller (MCU) on the basis of an input signal from an input unit, which is in communication with the MCU.

[0016] According to a further embodiment of the electric strike plate system, the input unit is one or more of

an electronic lock cylinder, a keyboard, a touch screen, a biometric reader unit, a card reader, a chip reader.

[0017] According to a particularly advantageous embodiment of the electric strike plate system, the input unit is a wireless communication unit adapted to receive/exchange identification information and/or an access code from a mobile unit. The mobile unit may be of any suitable type, such as a mobile phone, a hardware token, a key with integrated ID chip, or the like.

[0018] In a further advantageous embodiment, the wireless communication is local and is established directly between a mobile unit and the strike plate/strike plate system input unit.

[0019] In a further advantageous embodiment of the electric strike plate system, the wireless communication unit uses a standardized technology for wireless communication over short distances, such as Bluetooth, 'Near Field Communication' (NFC), RFID, or the like.

[0020] In a further advantageous embodiment of the electric strike plate system, the wireless communication unit is adapted to be started or woken up from a sleep mode on the basis of a wake-up signal generated by a wake-up unit, such as a wake-up button, a motion sensor, a proximity sensor, or the like.

[0021] According to a further aspect, an electric locking unit comprises an electric strike plate system according to one or more of the mentioned embodiments, and a lock case with a locking element that can be deployed, such as a bolt and/or latch, where the locking element is adapted for cooperating with the strike plate blocking member to create a locking effect. The locking effect occurs in known manner when the locking element is deployed and the blocking member is in the fixed state, and the locking effect between the deployed locking element and the blocking member is lifted when the blocking member movement is released. As regards door locks, which are typically provided with both bolt and latch as locking elements, it is preferably the latch which cooperates with the movable blocking member of the electric strike plate, while the bolt is adapted to cooperate with a fixed strike plate in order to be able to maintain the locking effect independently of the electric strike plate.

[0022] In the following, the invention will be further described with reference to an advantageous embodiment as shown in the drawing. In the drawing,

FIG. 1 shows, schematically, a locking unit with an electric strike plate system according to an embodiment of the invention;

FIG. 2 shows, schematically, a block diagram of a control unit for an electric strike plate system according to an embodiment of the invention;

FIG. 3 shows a flowchart of the programmed control of the opening function of an electric strike plate system according to an embodiment of the invention;

FIG. 4 shows a schematic circuit diagram of a charge pump circuit in an electric strike plate system according to an embodiment of the invention, and

FIG. 5 shows a schematic circuit diagram of a release circuit in an electric strike plate system according to an embodiment of the invention.

[0023] FIG. 1 shows schematically a locking unit on an access door 1, which is pivotally hinged in a frame 2. The door 1 is provided with a lock case 3, which as locking element comprises a latch and/or bolt 4 which can be operated manually and/or be motor-operated by control elements 5, 6. The latch and/or bolt 4 cooperate(s) with an electric strike plate 7 in order to achieve a locking effect in a known manner when the latch and/or bolt 4 is/are in a deployed position. The electric strike plate 7 has a blocking member 8 which is pivotable about an axis of rotation 9 oriented substantially parallel to the frame 2. The blocking member 8 movement is controlled by an actuator 10 via lock member 11. The blocking member 8 is retained in a closed position when the lock member 11 is brought into engagement with the blocking member 8. Otherwise, the blocking member 8 movement is released, and the locking effect is lifted. The door can now be opened even if the locking element 4 of the lock case 3 is deployed. The electric strike plate 7 with pivotable blocking member 8 may be an existing electric strike plate already mounted in a door, or be an off-the-shelf-item, where the electric strike plate is provided with an actuator of known type, such as, for example, a solenoid operated with a supply voltage of 5-24 V.

[0024] In a preferred embodiment, the lock member 11 is in engagement with the blocking member 8 when the actuator 10 is in a deactivated state (current-less closed). When the actuator 10 is brought into an activated state, the actuator 10 moves the lock member 11 out of engagement with the blocking member 8 so that it is released, and the locking effect is lifted. The blocking member 8 is released as long as the actuator 10 is held in the activated state.

[0025] According to the invention, the electric strike plate 7 is combined with a control unit 20, which supplies the actuator with power via a power supply 23 from a power source 22, such as one or more 1.5 V batteries of type AA. The power supply 23 is adapted to provide an activation pulse for activating the actuator 10, where the activation pulse voltage reaches a first voltage level which is sufficient for moving the lock member 11 and subsequently to provide a holding current at a second voltage level to maintain the activated state of the actuator 10, where the second voltage level of the holding current is lower than the first voltage level of the activation pulse. Preferably, the first voltage level is at least 50% higher than, alternatively 100% higher than, or preferably 5-10 times as high as the power source 22 output voltage. Further, preferably the second voltage level corresponds to the power source 22 output voltage. The power supply

23 generates the time-dependent voltage sequence with an activation pulse followed by a holding voltage, preferably by means of a charge pump circuit, as further discussed below.

[0026] The power supply 23, and thus the actuator 10, is controlled by means of a microcontroller (MCU) 24 on the basis of an input signal received from a mobile unit 40 via a wireless communication unit 21. The input signal is typically a request for access based on identification information (ID), which is transmitted from the mobile unit 40, or is entered via it. If access is to be granted, the MCU sends a control signal to the power supply 23 to lift the locking effect. As regards the above "current-less closed" embodiment, this means that the power supply 23 activates the actuator 10 and keeps it activated to lift the locking effect until the door 1 has been opened and/or until a specified period of time has elapsed.

[0027] The wireless connection 41 may be established ad hoc between the mobile unit 40 and the wireless communication unit 21, where all necessary exchange can be made automatically and without user input - unless the control unit asks for information that is not stored on the mobile unit 40. In order to avoid unnecessary energy consumption, the control unit or parts thereof, and especially the wireless communication unit, can be put into sleep mode and be woken-up for operation from a wake-up unit 30 by operating a wake-up switch 31 disposed at the door and being coupled to the control unit 20 via connection 33. The wake-up unit 30 may further comprise a visualization device 32, such as LEDs or a display, which indicates the battery state when the wake-up unit 31 is operated and/or displays whether access may be granted or shall be denied. The wake-up unit 30 may further comprise a terminal for connecting an external battery (not shown). The wake-up unit 30 may be connected to the wireless communication unit 21 to wake it up directly and/or via the MCU 24.

[0028] FIG. 2 shows a schematic block diagram of the control unit 20 and the units 10, 30, 40 which during operation are in communication with the control unit 20: the actuator 10 is connected to the control unit 20 via connection 12; the wake-up unit 30 exchanges signals with the control unit 20 via connection 33; and the mobile unit 40 communicates wirelessly with the controller 20 via the wireless connection 41. The control unit 20 comprises a main board 200, a module 210 for wireless communication, for example a Bluetooth module, and a battery 220. The main board 200 has a connection circuit 201 for external connections; a power supply unit 202 for supplying the components/parts of the main board 200 with power from the battery 220; an actuator supply circuit 203 with charge pump; a microcontroller (MCU) 204 handling the control unit program logic; a data management unit 205; and a control unit 206 for communicating with the wireless communication module 210. The battery 220 supplies the main board 200 with power via connection 221, and via the power supply unit 202, the actuator supply circuit 203, and connection 12 also the actuator 10. In addition,

also the wireless communication module 210 is, via control unit 206 and connection 214, supplied with power from the battery 220. The wireless communication module 210 may itself be equipped with a microcontroller and communication unit 211, and handles the actual wireless communication and data management by means of the modules 212, 213.

[0029] Figure 3 shows a flowchart of a program sequence 300 in a current-less closed electric strike plate according to an embodiment of the invention. The program is started by input in the form of a wake-up signal at step 301. Step 301 may further comprise a battery check and report the battery status, for example as LED light signal. As a result of the wake-up signal, the wireless communication module is started in step 302. In step 303, the communication module now awaits a signal from a mobile unit to establish a wireless connection. If no valid signal is received within a given period of time ("timeout"), for example within one minute, the system goes back into sleep mode at loop 304 until a new input wakes up the system again at step 301. The same thing happens if a wireless communication is established in step 303, but a request for access cannot be met on the basis of the information exchanged. If, on the other hand, the system receives a valid request for access in step 303, the charge pump circuit is started in step 305 in order to charge a pump capacitor from the battery to a first voltage level above the battery output voltage. For example, the power source output voltage may be 3-6 V, whereas the pump capacitor is charged to a first voltage level of 24 V, i.e. about 5-10 times the power source output voltage. For example, the power source may have a supply voltage between 1 V and 10 V, alternatively between 2 V and 8 V, alternatively between 3 V and 6 V. Advantageously, the power source supply voltage corresponds to the voltage of a conventional battery, or a combination of several conventional batteries, such as 1.5 V batteries. In a variant, the batteries can be of a rechargeable type.

[0030] Alternatively to a request for access to a closed area from a user coming from the outside, a user coming from the inside, who wishes to leave the closed area, can also request that the locking effect be lifted. Since it is often not desired to check the people who leave a closed area, this request to leave the area may advantageously merely be produced as a single signal, for example by pressing an activation button ("EXIT button"), as shown in step 306. When the pump capacitor has been charged to the first voltage level (step 307), for example 24 V, it is released to generate an activation pulse with the first voltage level in step 308, and the blocking member movement is released in step 309; optionally while simultaneously giving off a sound signal. When the activation pulse has activated the actuator so as to lift the locking effect in steps 308, 309, the actuator is, in step 310, supplied with a holding current at a second voltage level corresponding to the battery output voltage, which is sufficient for maintaining the activated state. After a time-delay,

the system goes back into sleep mode at loop 311 until it is woken up again by a wake-up signal in step 301.

[0031] FIG. 4 shows a schematic circuit diagram of a charge pump circuit in an electric strike plate system according to an embodiment of the invention. The charge pump circuit is part of the power supply to the actuator, which is here a solenoid. The charge pump circuit is adapted to build up ("pump") energy in a pump capacitor with a voltage level that is suitable for activating the strike plate actuator. DC supply voltage (from battery) is applied onto the VBAT electrode via a pump switch Q4 to chassis ground GND. Advantageously, the pump switch Q4 may be a MOSFET with drain (D), source (S), and gate (G) electrodes. The drain-source-channel (D-S) of the pump switch Q4 is controlled by the SW signal on the gate G of the pump switch Q4. When the D-S channel of the pump switch Q4 is conductive, a DC current runs from VBAT via an energy-storing and time-delaying pump coil L1 and the D-S channel of the pump switch Q4 to chassis ground GND. When the D-S channel of the pump switch Q4 is interrupted, the current from the pump coil L1 is forced through the diode D5 to the pump capacitor C9, which thereby takes up charges unable to leave C9 because of the directivity of the diode D5. The pump coil L1 entails a time delay in the system response to changes in the state of the D-S channel of the pump switch Q4. The pump switch Q4 is opened and closed at such speed that the current does not reach chassis ground GND until the pump switch-over Q4 is interrupted and thereby forces the energy stored in the pump coil L1 over to the pump capacitor C9; whereafter the pump switch Q4 is immediately opened again as soon as the charge transport stops. The SW signal operates at a frequency adapted to the time constants following from the components L1 and C9, and C9 is charged from VBAT stepwise in pace with the SW signal. In this way, the pump capacitor C9 is charged to a potential corresponding to the first voltage level and is now ready for activating the electric strike plate actuator.

[0032] FIG. 5 shows a schematic circuit diagram of a release circuit in an electric strike plate system according to an embodiment of the invention. The release circuit is part of the power supply to the electric strike plate actuator, which is here a solenoid (not shown). The release circuit is arranged to send the energy built up in the pump capacitor C9 of the charge pump circuit (see Fig. 4) as an activation pulse through the solenoid and subsequently to supply the solenoid with a DC holding current at a voltage level corresponding to the system DC supply voltage from the battery (VBAT). The release circuit is controlled by a control signal RELEASE, which operates the switch Q3. The switch Q3 may advantageously be a MOSFET with drain (D), source (S), and gate (G) electrodes. The electrodes SOLENOID1 in Fig. 5 and SOLENOID1 in Fig. 4 are connected to one side of the solenoid. The electrode SOLENOID2 in Fig. 5 is connected to the other side of the solenoid, which via the DS channel of the switch Q3 is connected to chassis ground

GND. When the D-S channel of the switch Q3 is interrupted, no current runs through the solenoid, and the solenoid is deactivated. The release circuit may further comprise a protective circuit with components for protecting the solenoid, such as the diode D6, which is coupled in parallel to the solenoid. When the pump capacitor C9 in Fig. 4 has been charged, both SOLENOID1 and SOLENOID2 have the same potential corresponding to the first voltage level. The solenoid is activated by bringing the D-S channel of the switch Q3 into conductive state so that current can run to chassis ground GND. The energy built up in the pump capacitor C9 is now released to generate a current pulse at the first voltage level. The current pulse runs through the solenoid, whereby it is brought from the deactivated to the activated state. When the energy from the pump capacitor C9 has been used up, the voltage level drops to the second, lower voltage level, here corresponding to the battery voltage VBAT, which is sufficient for maintaining a DC holding current which maintains the activated state of the solenoid until the switch Q3 is again switched off, and the solenoid returns to the deactivated state.

Claims

1. An electric strike plate system comprising an electric strike plate (7) with a movable blocking member (8), an electric actuator (10), and a power supply circuit (23, 203), wherein the blocking member (8) movement is controlled by means of the actuator (10), where the actuator (10) is activated in response to a control signal by supplying the actuator (10) with power from the power supply circuit (23, 203), which is connected to a power source (22, 220), the electric strike plate system being **characterized in that** that the power supply circuit (23, 203) is adapted to provide a time-dependent voltage sequence with a first voltage level to change the actuator (10) state from deactivated to activated, followed by a second voltage level, which is lower than the first voltage level, to maintain the activated state of the actuator (10).
2. An electric strike plate system according to claim 1, wherein the power supply circuit (23, 203) comprises a charge pump circuit.
3. An electric strike plate system according to one or more of the preceding claims, wherein the power source (22, 220) comprises one or more batteries.
4. An electric strike plate system according to one or more of the preceding claims, wherein the second voltage level is maintained by means of the charge pump circuit.
5. An electric strike plate system according to one or more of the preceding claims, wherein the actuator

(10) operates a lock member (11), which retains the blocking member (8) when the lock member (11) is in engagement with the blocking member (8).

6. An electric strike plate system according to one or more of the preceding claims, wherein the blocking member (8) movement is released when the actuator (10) is activated.
7. An electric strike plate system according to one or more of the preceding claims, wherein the actuator (10) is a solenoid.
8. An electric strike plate system according to one or more of the preceding claims, wherein the control signal is provided by a microcontroller (MCU) (24, 204) on the basis of an input signal from an input unit (21, 210), which is in communication with the MCU.
9. An electric strike plate system according to one or more of the preceding claims, wherein the input unit (21, 210) is one or more of an electronic lock cylinder, a keyboard, a touch screen, a biometric reader unit, a card reader, a chip reader, a wireless communication unit adapted to receive/exchange identification information and/or an access code from a mobile unit (40).
10. An electric locking unit comprising an electric strike plate system according to one or more of the preceding claims, and a lock case (3) with a locking element (4) that can be deployed wherein the locking element (4) is adapted for cooperating with the strike plate blocking member (8) to produce a locking effect.

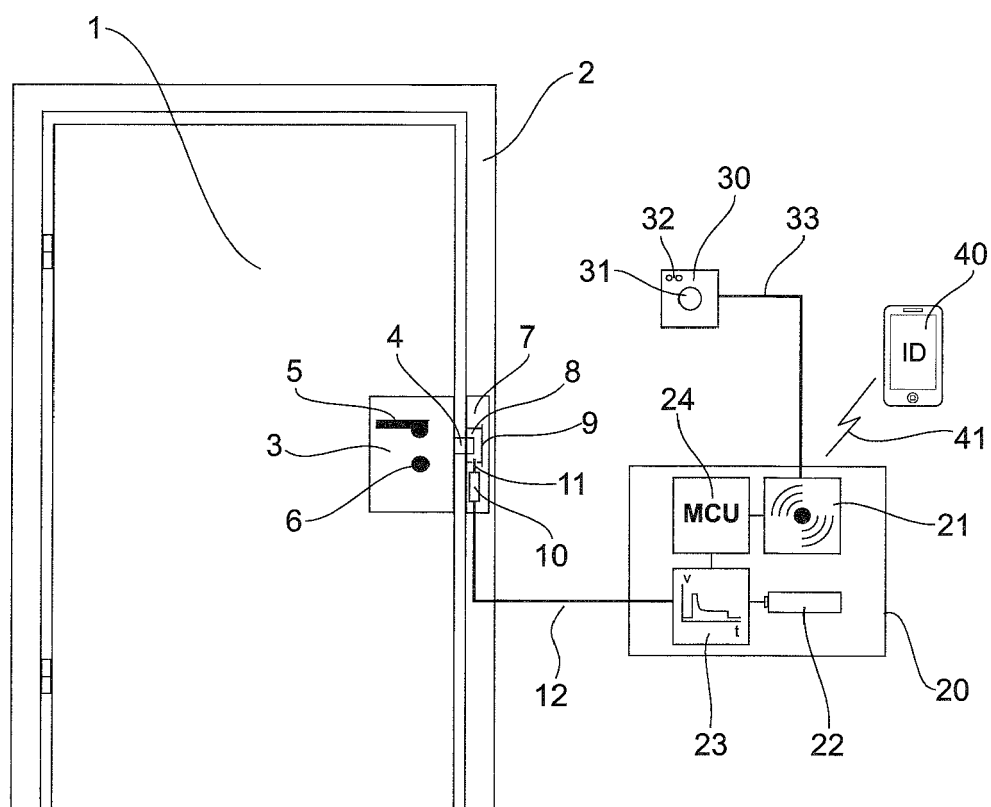


Fig. 1

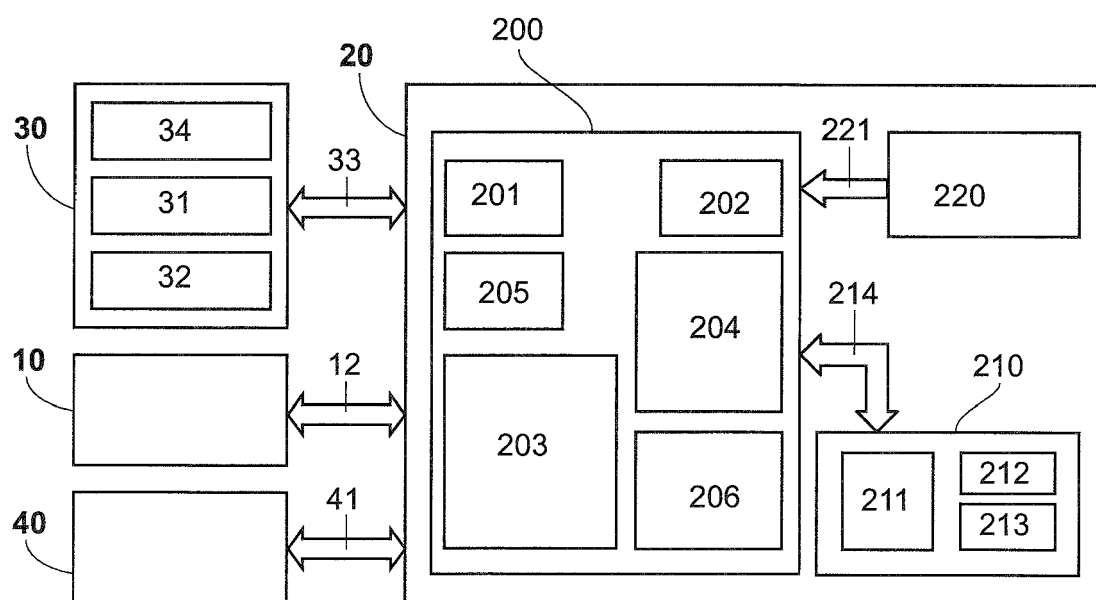


Fig. 2

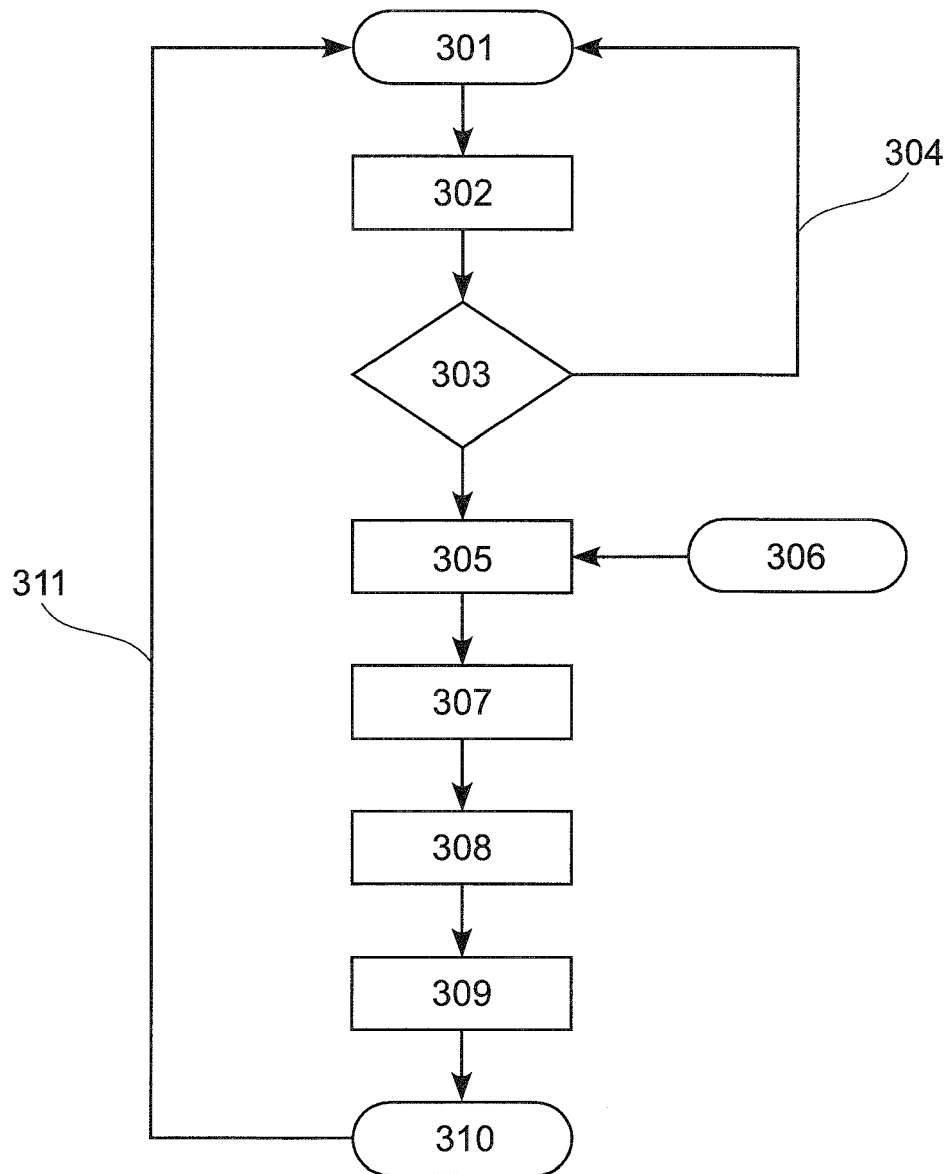


Fig. 3

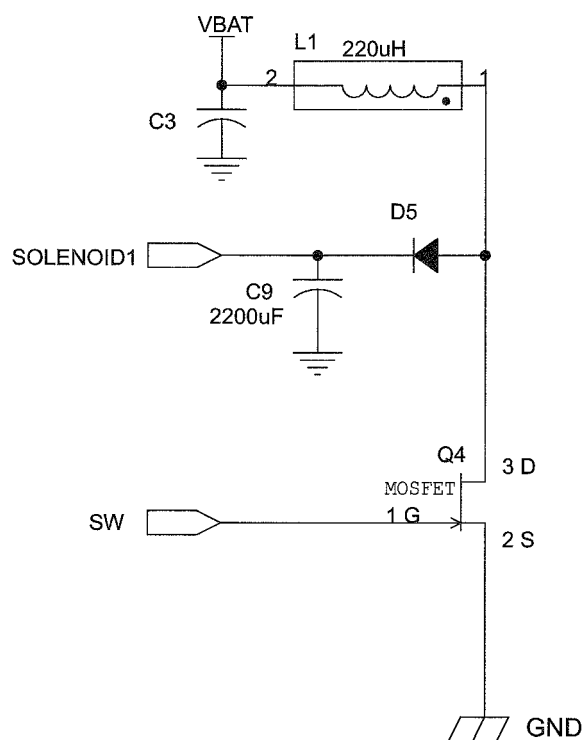


Fig. 4

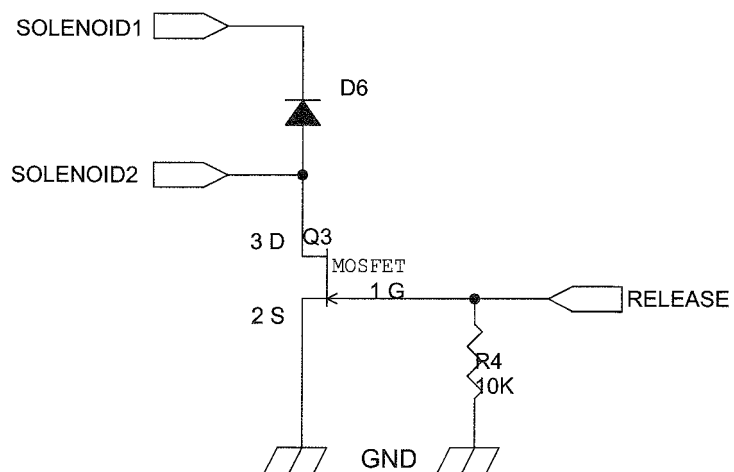


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 14 18 9694

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 602 408 A2 (ASSA ABLOY SICHERHEITSTECHNIK [DE]) 12 June 2013 (2013-06-12)	1,3,5-10	INV. E05B47/00 G07C9/00
Y	* paragraphs [0001], [0010], [0013], [0022], [0030], [0035], [0036]; figures 1-5 *	2,4	
X	DE 10 2008 014976 A1 (IST SYSTEMS GMBH [DE]) 13 November 2008 (2008-11-13) * the whole document *	1,7,8	
X	US 2011/194224 A1 (SCHOEPEKE EDWARD [US] ET AL) 11 August 2011 (2011-08-11) * paragraphs [0003], [0012], [0039]; claim 3 *	1,7,8	
X	US 5 654 865 A (RYAN SHEVLIN E [US]) 5 August 1997 (1997-08-05) * column 6, line 44 - column 7, line 7; figures 4,5 *	1,7,8	
Y	CN 1 641 173 A (SAFETY COMM CO LTD [AU]) 20 July 2005 (2005-07-20) * page 21 - page 23; figures 1,2,13,14, *	2,4	TECHNICAL FIELDS SEARCHED (IPC) E05B G07C
A	WO 2009/066003 A2 (ABLOY OY [FI]; KERVINEN PASI [FI]; JURVANEN MARKKU [FI]; PURMONEN MIKA) 28 May 2009 (2009-05-28) * the whole document *	1	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 17 February 2015	Examiner Ansel, Yannick
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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EPO FORM 1503 03.92 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 14 18 9694

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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17-02-2015

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20

25

30

35

40

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50

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2602408 A2	12-06-2013	DE 102011121702 A1 EP 2602408 A2	13-06-2013 12-06-2013
DE 102008014976 A1	13-11-2008	NONE	
US 2011194224 A1	11-08-2011	CA 2731571 A1 US 2011194224 A1	10-08-2011 11-08-2011
US 5654865 A	05-08-1997	NONE	
CN 1641173 A	20-07-2005	NONE	
WO 2009066003 A2	28-05-2009	AR 069377 A1 AU 2008327810 A1 CA 2702744 A1 CN 101868587 A EP 2212494 A2 FI 20075822 A IL 205111 A JP 5461417 B2 JP 2011505507 A KR 20100101604 A RU 2010125226 A TW 200923181 A US 2010275662 A1 WO 2009066003 A2	20-01-2010 28-05-2009 28-05-2009 20-10-2010 04-08-2010 21-05-2009 31-08-2014 02-04-2014 24-02-2011 17-09-2010 27-12-2011 01-06-2009 04-11-2010 28-05-2009

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82