

(19)



(11)

EP 3 239 948 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
18.03.2020 Bulletin 2020/12

(51) Int Cl.:
G08B 29/04 (2006.01) **G08B 13/14 (2006.01)**

(21) Application number: **17167010.2**

(22) Date of filing: **19.04.2017**

(54) AN ANTI-THEFT AND ANTI-TAMPERING PROTECTION SYSTEM

EINBRUCHHEMM- UND FÄLSCHUNGSSICHERUNGSSYSTEM

SYSTÈME DE PROTECTION ANTI-FALSIFICATION ET ANTI-VOL

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(30) Priority: **26.04.2016 IT UA20162874**

(43) Date of publication of application:
01.11.2017 Bulletin 2017/44

(73) Proprietor: **Coges S.p.A.
36015 Schio (VI) (IT)**

(72) Inventors:
• **BALDISSEROTTO, Piero
36010 Zanè (VI) (IT)**

• **MENEGOTTO, Fabio
36015 Schio (VI) (IT)**
• **MURARO, Andrea
36015 Schio (VI) (IT)**
• **DE PRETTO, Andrea
36013 Piovene Rocchette (VI) (IT)**

(74) Representative: **Trentin, Michele et al
Eureka IP Consulting
Via Lanza, 40-44
36100 Vicenza (IT)**

(56) References cited:
**GB-A- 2 038 399 GB-A- 2 233 486
US-A- 4 295 132 US-A- 5 075 670
US-A1- 2012 139 558**

EP 3 239 948 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

Field of application

[0001] The present invention can be applied to the security field and relates, in particular, to the field of anti-theft and anti-tampering systems.

[0002] More in detail, the present invention relates to an anti-theft and/or anti-tampering protection system, particularly, but not exclusively, suitable to be coupled to electrical or electronic systems such as, for example, automatic payment systems or cash dispensers.

State of the art

[0003] The protection of objects from theft has become a more and more evident issue over the years and techniques related to it have been strongly developed. The aim is to provide increasingly effective anti-theft or anti-tampering systems that are cost-effective and easy to implement at the same time.

[0004] Known systems generally comprise a logic control unit to which one or more sensors, suitable to detect the object conditions, are associated, in order to signal anomalies that generally correspond to theft or tampering attempts. Alarm means, often consisting of one or more sirens, or one or more flashing lights, or other, are then associated to the same logic control unit.

[0005] In some cases, there are also appropriate connections for deleting sensitive data from local databases. For example, as for automatic payment systems or cash dispensers, local memories exist that contain users' confidential information and which, in the event of tampering or fraudulent removal of the payment system, ought to be immediately deleted.

[0006] The used sensors are the most diverse. For example, optical sensors are known, consisting of a light emitter and a receiver in order to create an optical barrier whose interruption means attempted theft, and magnetic sensors consisting of a magnet located next to a magnetic switch whose displacement means attempted theft. If automatic payment systems are involved, however, they are typically constituted by a mechanical switch that detects if the system itself is in contact with a fixed wall. The change of state of this contact corresponds to system removal which, if fraudulent, triggers the alarm state.

[0007] In any case, as a general rule, any type of sensor for detecting theft or tampering attempts is connected to a switch, which is normally either open or closed and whose change of state means alarm.

[0008] The typically known protection systems are connected to the power supply of the apparatus or object that they must protect. Since the power supply may be temporarily unavailable, they often include a battery. In some cases, however, the device to which the protection system is connected may supply little electricity for the operation of the protection system, which must therefore be substantially autonomous. Even in this case, in the

known art, the problem is solved by using batteries.

[0009] However, known systems have some known drawbacks that compromise their functionality in certain situations.

[0010] A first drawback is that the battery has a limited life time and must therefore be regularly replaced. Moreover, it is bulky and generally heavy. However, rechargeable batteries are often used, but these need a special recharging circuit that not only takes up space, but also takes time to charge the batteries and often has unacceptable levels of electrical consumption.

[0011] All this affects not only the size of the protection system, but also production and maintenance costs.

[0012] Documents US 5,075,670 A, GB 2 038 399 A, US 4,295,132 A, US 2012/139558 A1, GB 2 233 486 A are known. They do not solve the underlined drawbacks. In particular, some of them use a capacitor as antitheft indicator. However, when the systems are powered off, they lose the status indication because the capacitors discharge.

Presentation of the invention

[0013] The present invention aims, at least, at partially overcoming the above-mentioned drawbacks by providing an anti-theft and anti-tampering protection system which is capable of detecting theft or tampering attempts, even if power supply is interrupted.

[0014] An additional aim is to make a protection system available, whose size, footprint and weight are optimized for it to be easily integrated into any device.

[0015] Another additional aim is that the operation of the protection system must not undergo periodic maintenance such as, for example, the replacement of batteries.

[0016] An additional aim is that the protection system consumes less power than the known systems.

[0017] Such aims, as well as others which will become clearer below, are achieved by an anti-theft and anti-tampering protection system according to the following claims, which are to be considered as an integral part of this patent.

[0018] In particular, it includes at least one electric accumulator, which will discharge rapidly if the system is tampered with. In this sense, it comprises at least one rapid discharge electrical circuit of the same accumulator and at least one actuator to activate such discharge electrical circuit if the system is subject to theft or tampering.

[0019] In other words, the accumulator integrated in the system of the invention is a rapid discharge accumulator, so that its charged/discharged state indicates that a theft or a tampering attempt was made.

[0020] Since it is the charged state of the accumulator which indicates that a theft or a tampering attempt was made, it is clear that the same accumulator needs a small charge and, therefore, not only the charging process is just as fast, but its energy absorption is also very limited and lower than the known equivalent systems.

[0021] Typically, but not necessarily, such an accumulator comprises a condenser, in such a way that the use of one or more batteries involving the above-mentioned drawbacks is not necessary.

[0022] According to one aspect of the invention, the protection system also includes at least one electrical circuit replicating the charged and discharged states, which is operably connected to the accumulator. Such replicating electrical circuit has a very high input impedance (tending to infinity) on the connection to the accumulator, so as to substantially isolate the accumulator both when the replicating electrical circuit is powered and when it is disconnected.

[0023] In other words, the replicating electrical circuit allows the rapid discharge accumulator to advantageously retain its charged/discharged state in case of power failure. Typically, electrical circuits tend to have parasitic resistances or inductances, which are enough to allow a discharge process of capacitors in a few minutes or seconds, especially if no power is supplied. The circuit of the invention, on the other hand, prevents this from happening by substantially isolating the accumulator, thereby limiting the energy absorption from the outside even more.

[0024] According to another aspect of the invention, the replicating electrical circuit comprises at least one MosFet-type transistor, whose gate is operatively connected to the accumulator. Since one of the main features of such a transistor is to have an almost infinite input impedance on the gate, this advantageously allows to achieve the above-mentioned electrical isolation.

[0025] Still advantageously, the simplicity of the chosen electrical components makes it possible to obtain a small, easy to assemble and low energy consumption protection system. It is thus easy to integrate in essentially any known device.

Brief description of the drawings

[0026] Further features and advantages of the invention will be more evident in light of the detailed description of some preferred, but not exclusive, embodiments of an anti-theft and anti-tampering protection system according to the invention, illustrated by way of a non-limiting example with the aid of the accompanying drawings, wherein:

- FIG. 1 is an example of an anti-theft and anti-tampering protection system according to the invention in a partially exploded perspective view;
- FIGS. 2 and 3 are an example of an anti-theft and anti-tampering protection system in a schematic view in two different operation moments.

Detailed description of a preferred embodiment example

[0027] With reference to the above-mentioned figures, and in particular to Fig. 1, described herein is an anti-

theft and anti-tampering protection system 1.

[0028] Such a system 1 can be associated with any device that needs protection, although in this description it is applied to an automatic payment system. In this sense, as it is typically the case and as shown in Fig. 1, the system 1 is stably coupled to a wall P so that any removal attempt of the same is easily detectable. Obviously, this feature should not be considered as a limiting feature for this invention.

[0029] In any case, the protection system 1 of the invention comprises, as shown in Fig. 2, an electrical accumulator 2 of a type that allows rapid discharge processes when, for example, its poles are short-circuited or connected by a low impedance. It is therefore sufficient to make this happen in case of an attempted theft or tampering with the system 1.

[0030] For this reason, the system 1 also includes a rapid discharge electric circuit 3 of the accumulator 2.

[0031] In the example of the described embodiment, the accumulator 2 is made of an electrolytic capacitor 4. This should not be considered as a limitation for different embodiments of the invention, where different types of capacitors or accumulators other than a condenser are used, provided that they cause a nearly instantaneous discharge process as it is the case of a capacitor should the poles generate a short circuit.

[0032] Regarding the rapid discharge circuit 3, it comprises an actuator 5 for activating said discharge circuit 3 in case of attempted theft or tampering with the system 1.

[0033] In the example herein described, such actuator 5 is constituted by a mechanical switch operably connected to the wall P so that its disconnection - even just a temporary one - activates the rapid discharge electrical circuit 3, causing the virtually immediate discharge of the accumulator 2. However, as stated above, the actuator can be of any type, since, in any case, its practical layout is still constituted by a switch whose activation closes the rapid discharge circuit.

[0034] The latter is constituted by the electrical series of a resistor 6 and the actuator 5 connected at the two ends of the accumulator 2 so that the closure of the switch, shown in Fig. 3, causes the discharge current to circulate on the accumulator 2. The presence of the resistor 6 allows to set a limit to the maximum discharge current in order to avoid any damage to the accumulator 2 while maintaining the discharge time of the accumulator substantially equal to zero.

[0035] An important aspect of a protection system is the detection of the alarm state. In such a case, this means detecting the charged/discharged state of the accumulator 2. However, this must take place without taking away the electrical charge from the same accumulator 2.

[0036] In order to achieve this, electrical circuits called buffers are typically used that have high input impedances so as not to charge the accumulator. However, the drawback characterising such circuits is the fact that they all absorb electrical current when no power is supplied.

[0037] Since such a situation can easily occur when the system is in use, according to another aspect of the invention, the protection system **1** also includes at least one replicating electrical circuit **10** of the charged and discharged states, which is operably connected to the accumulator **2** to replicate its state. Moreover, such replicating electrical circuit **10** is configured to always have, on the connection to the accumulator **2**, a high-input impedance so as to substantially isolate the accumulator **2** even when the replicating electrical circuit **10** is not powered.

[0038] Advantageously, therefore, the unwanted discharge process of the accumulator **2** is limited, if not almost cancelled, when the protection system **1** is not powered.

[0039] According to the described embodiment, the replicating electrical circuit **10** comprises one MosFet-type transistor **11**, whose gate is operatively connected to the accumulator **2**. Such a configuration advantageously allows to save the charge of the accumulator **2** when the system **1** is either powered or not powered. This allows the use of simple, small and low energy consumption electrical components such as capacitors as accumulators.

[0040] It is thus clear that the system **1** of the invention is advantageously compact since it is made of particularly small electronic components. The same components that have been herein mentioned as an example of an embodiment are very low energy consumption components and therefore the system **1** can be easily applied to any device.

[0041] More advantageously, such components do not need regular maintenance. In particular, accumulators with an unlimited average lifetime may be chosen.

[0042] According to another aspect of the invention, the system **1** also includes a recharging circuit **12** of the accumulator **2** so as to keep it charged over time and avoid that, even though it is substantially isolated, it may accidentally discharge over a long time and trigger a false alarm state.

[0043] In particular, such recharging circuit **12** comprises an electrical decoupling component **13**, constituted, for example, by a diode, and such as to allow to substantially isolate the accumulator **2** from such recharging circuit **12** when it is not powered. A resistor **14** is then present, placed in series with respect to the recharging circuit **12** to protect it should the actuator **5** be activated when the system **1** is powered.

[0044] According to another aspect of the invention, the protection system **1** comprises a control circuit **15** of the threshold value of the charged/discharged state detected by the replicating electrical circuit **10**. In the described embodiment, it consists of a voltage divider to increase the voltage at the drain of the MosFet transistor **11** so as to push to the maximum limit the transition threshold between the charged state and the discharged state. Such embodiment is obviously a non-limiting example for the invention.

[0045] In any case, this advantageously allows to prevent any non-linear behaviour of the discharge process of the accumulator **2** from affecting the detection of the change of state.

[0046] According to another aspect of the invention, the system **1** also includes an insulating cover, not shown in the figures, which is made of, for example, a suitable resin.

[0047] First, such coverage allows to improve the isolation of the accumulator **2** whose parasitic discharge process is even more limited. Secondly, the isolation does not allow access to the electrical poles of the accumulator **2**, thus preventing tampering with its charge state by any attacker or intruder.

[0048] As to what has been said so far, what is clear is that there might be any number of accumulators, discharging circuits, recharging circuits, actuators and replicating circuits, without this representing a limitation to this invention.

[0049] As to what has been said, it is clear that the anti-theft and anti-tampering protection system of the invention achieves all the intended objectives.

[0050] In particular, it is able to detect theft or tampering attempts, even when not powered.

[0051] Its size, footprint and weight are smaller than those of the other similar and known systems so that it can easily be integrated into any device and, in particular, in an automatic payment system.

[0052] The described protection system must not undergo compulsory regular maintenance operations and it absorbs less external energy than the known systems.

[0053] The invention may be subject to many changes and variations, which are all included in the appended claims. Moreover, all the details may furthermore be replaced by other technically equivalent elements, and materials may be different depending on the needs, without departing from the scope of protection of the invention defined by the appended claims.

Claims

1. An anti-theft and anti-tampering protection system comprising:

- at least one electrical accumulator (**2**) designed to discharge rapidly at least in the event of any theft or tampering attempts on the system (**1**);
- at least one rapid discharge electrical circuit (**3**) of said accumulator (**2**);
- at least one actuator (**5**) to activate said discharge electrical circuit (**3**) of said accumulator (**2**) in case said system (**1**) is tampered with;
- at least one electrical circuit (**10**) for replicating the charged and discharged state operatively connected to said accumulator (**2**) to replicate its state, said replicating circuit (**10**) having, on the connection to said accumulator (**2**), a high-

input impedance so as to substantially isolate said accumulator (2) when said replicating electrical circuit (10) is not supplied, so as to limit the undesirable discharge process of said accumulator (2) when said protection system (1) is not powered.

2. Protection system according to claim 1, wherein said replicating electrical circuit (10) comprises at least one MosFet-type transistor (11), whose gate is operatively connected to said accumulator (2). 10
3. Protection system according to claim 1 or 2, wherein said accumulator (2) comprises at least one capacitor (4). 15
4. Protection system according to any one of the preceding claims, wherein said actuator (5) comprises at least one mechanically actuated switch. 20
5. Protection system according to any one of the preceding claims, wherein said discharge electrical circuit (3) comprises at least one resistor (6) operatively connected to said actuator (5) and said accumulator (2) so as to obtain, when said actuator (5) is activated, a closed circuit in which a discharge electrical current of said accumulator (2) can circulate, even if said protection system (1) is not supplied. 25
6. Protection system according to any one of the preceding claims, comprising at least one recharging circuit (12) of said accumulator (2). 30
7. Protection system according to claim 6, comprising at least one electrical decoupling component (13) between said recharging circuit (12) and said accumulator (2) able to substantially isolate said accumulator (2) when said recharging circuit (12) is not powered. 35
8. Protection system according to claim 7, wherein said decoupling electrical component (13) is a diode. 40
9. Protection system according to any one of the preceding claims, comprising at least one control circuit (15) of the threshold value of the charged/discharged state of said replicating electrical circuit (10) to change the charge level of said accumulator (2) beyond which said replicating electrical circuit (10) changes its state. 45
10. Protection system according to any one of the preceding claims, comprising an insulating cover of at least said accumulator (2) at least to prevent access to its electrical poles in order to avoid tampering with its charge state. 50

Patentansprüche

1. Diebstahl- und Manipulationsschutzsystem, welches umfasst:
 - wenigstens einen elektrischen Akkumulator (2), der dafür ausgelegt ist, sich wenigstens im Fall eventueller Diebstahl- oder Manipulationsversuche an dem System (1) schnell zu entladen;
 - wenigstens eine elektrische Schnellentladeschaltung (3) des Akkumulators (2);
 - wenigstens einen Aktuator (5), um die elektrische Entladeschaltung (3) des Akkumulators (2) zu aktivieren, falls das System (1) manipuliert wird;
 - wenigstens eine elektrische Schaltung (10) zum Replizieren des geladenen und entladenen Zustands, die mit dem Akkumulator (2) in Wirkverbindung steht, um seinen Zustand zu replizieren, wobei die Replizierschaltung (10) an der Verbindung mit dem Akkumulator (2) eine hohe Eingangsimpedanz aufweist, um so den Akkumulator (2) im Wesentlichen zu isolieren, wenn die elektrische Replizierschaltung (10) nicht mit Strom versorgt wird, um so den unerwünschten Entladevorgang des Akkumulators (2) zu begrenzen, wenn das Schutzsystem (1) nicht eingeschaltet ist.
2. Schutzsystem nach Anspruch 1, wobei die elektrische Replizierschaltung (10) wenigstens einen Transistor vom Typ MOSFET (11) umfasst, dessen Gate mit dem Akkumulator (2) in Wirkverbindung steht.
3. Schutzsystem nach Anspruch 1 oder 2, wobei der Akkumulator (2) wenigstens einen Kondensator (4) umfasst.
4. Schutzsystem nach einem der vorhergehenden Ansprüche, wobei der Aktuator (5) wenigstens einen mechanisch betätigten Schalter umfasst.
5. Schutzsystem nach einem der vorhergehenden Ansprüche, wobei die elektrische Entladeschaltung (3) wenigstens einen Widerstand (6) umfasst, der mit dem Aktuator (5) und dem Akkumulator (2) in Wirkverbindung steht, um so, wenn der Aktuator (5) aktiviert ist, einen geschlossenen Stromkreis zu erhalten, in welchem ein elektrischer Entladestrom des Akkumulators (2) fließen kann, sogar wenn das Schutzsystem (1) nicht mit Strom versorgt wird.
6. Schutzsystem nach einem der vorhergehenden Ansprüche, welches wenigstens eine Aufladeschaltung (12) des Akkumulators (2) umfasst.

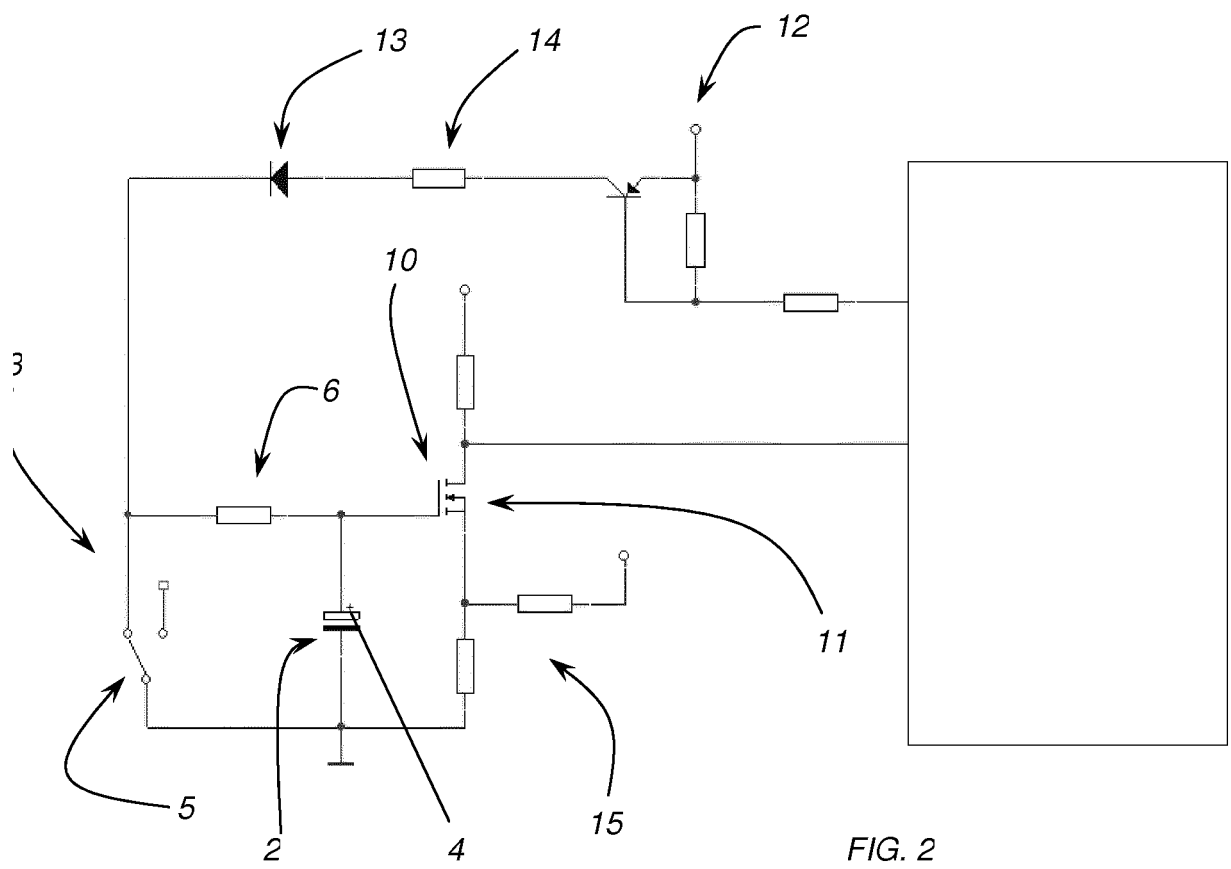
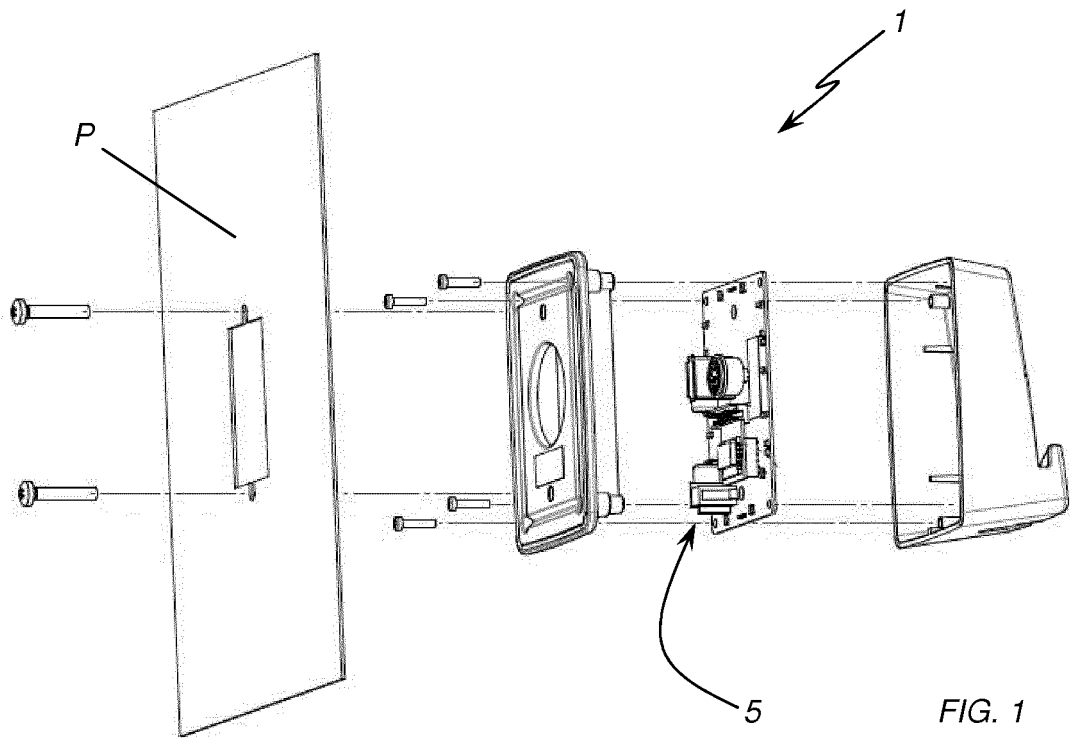
7. Schutzsystem nach Anspruch 6, welches wenigstens eine elektrische Entkopplungskomponente (13) zwischen der Aufladeschaltung (12) und dem Akkumulator (2) umfasst, die in der Lage ist, den Akkumulator (2) im Wesentlichen zu isolieren, wenn die Aufladeschaltung (12) nicht mit Strom versorgt wird.
8. Schutzsystem nach Anspruch 7, wobei die elektrische Entkopplungskomponente (13) eine Diode ist.
9. Schutzsystem nach einem der vorhergehenden Ansprüche, welches wenigstens eine Steuerschaltung (15) für den Schwellenwert des geladenen/entladenen Zustands der elektrischen Replizierschaltung (10) umfasst, um den Ladungspegel des Akkumulators (2) zu ändern, bei dessen Überschreitung die elektrische Replizierschaltung (10) ihren Zustand ändert.
10. Schutzsystem nach einem der vorhergehenden Ansprüche, welches eine Isolierabdeckung wenigstens des Akkumulators (2) umfasst, um wenigstens den Zugang zu dessen elektrischen Polen zu verhindern, um ein Manipulieren seines Ladezustands zu vermeiden.

Revendications

1. Système de protection antivol et anti-manipulation illicite comprenant :
 - au moins un accumulateur électrique (2) conçu pour se décharger rapidement au moins en cas de tentative de vol ou de manipulation illicite sur le système (1) ;
 - au moins un circuit électrique à décharge rapide (3) dudit accumulateur (2) ;
 - au moins un actionneur (5) pour activer ledit circuit électrique à décharge (3) dudit accumulateur (2) en cas de manipulation illicite dudit système (1) ;
 - au moins un circuit électrique (10) permettant la réplique de l'état chargé et de l'état déchargé, raccordé opérationnellement audit accumulateur (2) pour répliquer son état, ledit circuit de réplique (10) ayant, lors du raccordement audit accumulateur (2), une haute impédance d'entrée de manière à isoler sensiblement ledit accumulateur (2) lorsque ledit circuit électrique de réplique (10) n'est pas alimenté, de manière à limiter le processus de décharge indésirable dudit accumulateur (2) lorsque ledit système de protection (1) n'est pas sous tension.
2. Système de protection selon la revendication 1, dans lequel ledit circuit électrique de réplique (10) comprend au moins un transistor de type MosFet (11)

dont une grille est raccordée opérationnellement audit accumulateur (2).

3. Système de protection selon la revendication 1 ou 2, dans lequel ledit accumulateur (2) comprend au moins un condensateur (4).
4. Système de protection selon l'une quelconque des revendications précédentes, dans lequel ledit actionneur (5) comprend au moins un commutateur actionné mécaniquement.
5. Système de protection selon l'une quelconque des revendications précédentes, dans lequel ledit circuit électrique de décharge (3) comprend au moins une résistance (6) raccordée opérationnellement audit actionneur (5) et audit accumulateur (2) de manière à obtenir, lorsque ledit actionneur (5) est activé, un circuit fermé dans lequel un courant électrique de décharge dudit accumulateur (2) peut circuler, même si ledit système de protection (1) n'est pas alimenté.
6. Système de protection selon l'une quelconque des revendications précédentes, comprenant au moins un circuit de recharge (12) dudit accumulateur (2).
7. Système de protection selon la revendication 6, comprenant au moins un composant de découplage électrique (13) entre ledit circuit de recharge (12) et ledit accumulateur (2) apte à isoler sensiblement ledit accumulateur (2) lorsque ledit circuit de recharge (12) n'est pas sous tension.
8. Système de protection selon la revendication 7, dans lequel ledit composant électrique de découplage (13) est une diode.
9. Système de protection selon l'une quelconque des revendications précédentes, comprenant au moins un circuit de commande (15) de la valeur de seuil de l'état chargé/déchargé dudit circuit électrique de réplique (10) pour changer le niveau de charge dudit accumulateur (2) au-delà duquel ledit circuit électrique de réplique (10) change son état.
10. Système de protection selon l'une quelconque des revendications précédentes, comprenant un couvercle isolant au moins dudit accumulateur (2) au moins pour empêcher tout accès à ses pôles électriques afin d'éviter toute manipulation illicite de son état de charge.



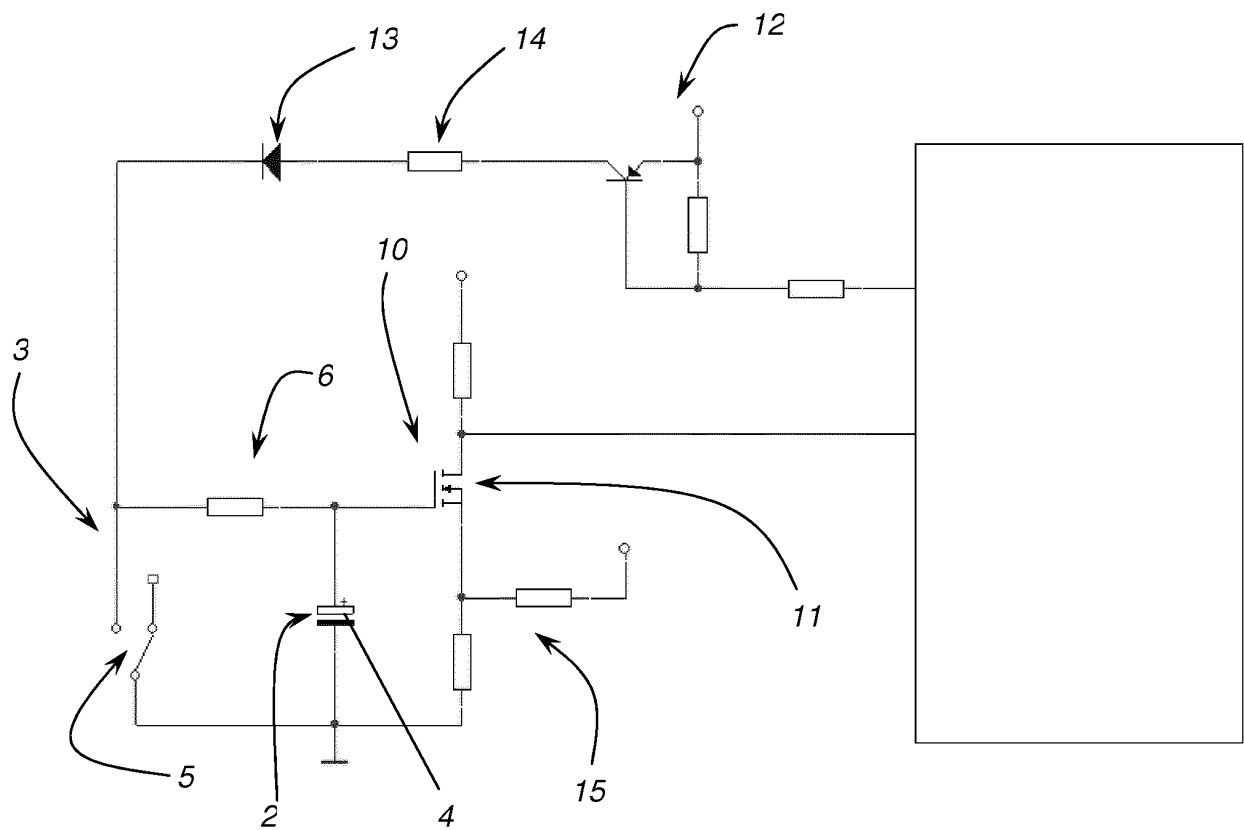


FIG. 3

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 5075670 A [0012]
- GB 2038399 A [0012]
- US 4295132 A [0012]
- US 2012139558 A1 [0012]
- GB 2233486 A [0012]