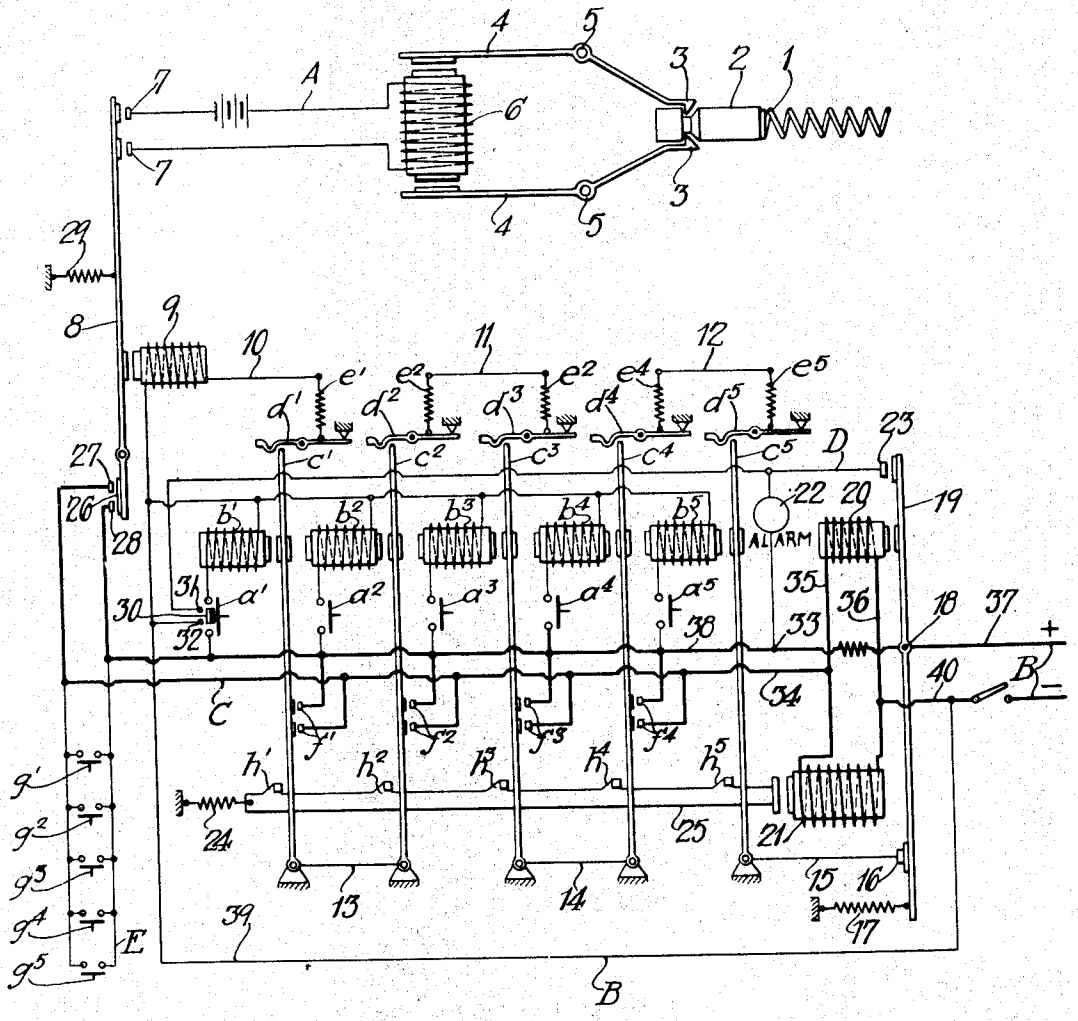
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ELECTRIC LOCKING DEVICE

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ELECTRIC LOCKING DEVICE

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This invention relates to electromagnetically acting burglar-proofing devices equipped with alarm-giving means, of the type in which the rendering inoperative of the protecting device is effected by means of a controlling relay. Protecting devices of this description have already been proposed, but these devices are very complicated in construction, consume a great deal of electric current, and are subject to premature wear since their electrical parts are kept permanently under current.

The present invention enables these drawbacks to be obviated by arranging for the operation of the control relay by means of which the protecting device is rendered inoperative to be effected by means of a plurality of switch members actuated by switching relays and adapted to close the current circuit to the control relay only provided the switching relays are operated in a certain predetermined order; at the same time these latter relays are deprived of current again after each closure of the current circuit, whereas when they are operated in any other but predetermined order these relays interrupt the switching current, and the switch members return into their position of rest.

In the accompanying drawing there is shown diagrammatically, and by way of example, an embodiment of the invention comprising a control relay and five switching relays.

The locking bolt 2 is stressed by a spring 1 which strives to retain the bolt in the unlocking position, and is retained in its locking position by two pawls 3 pivoted at 5 and forming with their free ends 4 the armatures of an electromagnet 6 interposed in a current circuit A which can be closed at the contacts 7 by the armature 8 of a control relay 9. When this circuit is closed the electromagnet 6 lifts the pawls 3 of the locking device out of engagement with the bolt 2, with the result that this device is unlocked.

In accordance with the invention it only becomes possible to operate the control relay when switch members interposed in the switching current circuit of this control relay are actuated in a certain order which is predetermined and adjustable at will. In the present instance five switching relays b^1–b^5 are connected in parallel in the current circuit B, each of these switching relays being adapted to be selectively connected into the current circuit by means of a switch element, for example by means of the press-button switches a^1–a^5. Each of these switching relays coacts with one of the armatures c^1–c^5 which are current-conducting and take the form of switch members. With the one end of each of these armatures there is associated one of a set of hook-shaped and likewise current-conducting retaining members d^1–d^5, which hold these armatures fast in the circuit-closing position provided the switch members be operated in the predetermined order or succession. These retaining members are stressed by current-conducting springs e^1–e^5. The armatures c^1–c^5 are connected one after the other into the switching current circuit in the following manner. From the control relay 9 a wire 10 to the spring e^1 from which the circuit continues through the retaining member d^1 to the armature c^1, from the other end of the armature through a conductor 13 to the armature c^2, through d^2 and e^2 to a wire 11, thence through e^3 and d^3 to c^3, from the other end of this armature and through a conductor 14 to the armature c^4, through d^4 and e^4 to a conductor 12, through e^5 and d^5 to the armature c^5, and thence through a conductor 15 to a contact 16. This contact 16 coacts with a spring-stressed contact lever 19 which is connected at 18 to the one branch of the switching current circuit. The spring 17 causes the contact lever 19 to bear constantly against the contact 16. The second branch of the current circuit B is directly connected to the control relay 9. The armatures c^1–c^5 only come into the above-described circuit closing position provided they are actuated in a certain predetermined order. In the present instant it is assumed that this order is that indicated by the indices.

On actuation of the press-button a^1 electric current flows through conduits 37, 38, 39 and 40 whereby the switching relay b^1 is excited and the armature c^1 attracted. This armature thereby comes into engaging contact with the retaining member d^1 which then retains the armature in this position. No current flows yet through the control relay 9, since the current passes from a^1, b^1 at once through the return line to the negative conductor of the current circuit B. The press-button a^2 is then actuated, with the result that b^2 is excited and c^2 brought into contacting engagement with d^2. The armatures c^1 and c^2 are thereby conductively interconnected, and the switching current circuit put in readiness for the operation of the control relay up to the conductor 11. On continued actuation of the press-buttons a^3, a^4, and a^5, in this order, the corresponding armatures are operated in the same manner, so that finally, after actuation of the switch a^5, the switching current circuit for the control relay 9 is closed, with the result that this relay is op-

erated. The armature 8 of this relay, when attracted, bridges the interruption points 7, brings about excitation of the electromagnet 6, and thereby unlocks the locking device. In the described cycle of operation each of the switching relays is only temporarily connected into the current circuit, since when the press-button is released, the current-branch for the respective relay (b^1 to b^5) is immediately interrupted. Independently thereof, however, the armatures c^1–c^5 designed to act as switch members are arrested in the circuit-closing position by the respective retaining members.

Operation of the control-relay 9 is prevented from occurring on actuation of the switch members or switch elements in an order other than the prescribed order, in the following manner:

To the current circuit B is connected a current circuit C in which two electromagnets 20 and 21 are connected in parallel. This current circuit is normally interrupted at sets of contacts f^1–f^4 which are connected in parallel, and which may be bridged over, as required, by the current-conducting armatures c^1–c^5.

If now, for example, instead of the press-button a^1 the press-button a^2 were to be actuated first the switching relay b^2 would thereby be excited first. This relay then attracts, however, not only the armature c^2 but also the armature c^1 since this latter armature has not been attracted by b^1 and therefore has not been arrested by d^1. As soon as the armature c^1 is attracted by the switching relay b^2 it bridges over the contacts f^1 and closes the current circuit C. The consequence is that the magnet 20 and also the magnet 21 are excited. The magnet 20 attracts the switch lever 19 which is connected with the current supply line 37 at and swings about point 18, and consequently interrupts the switching current circuit at 16, so that it becomes impossible under any circumstances to excite the control relay 9. The electromagnet 21 actuates an unlocking rod 25 furnished with cam lugs h^1–h^5 adapted to coact with the armatures c^1–c^5, in such a sense that this rod restores, against the action of a spring 24, all the armatures c^1 to c^5 into the starting position, i. e. into a position in which the armatures also interrupt the switching current circuit. The same result is brought about if any one of the other switches a^3 to a^5 is actuated first instead of the switch a^1. The respective armatures are then attracted by the next following switching relays in the sequence (i. e. in the present instance by the relays denoted by higher index figures). But even in the event of the switching relay a^1 being actuated first while the order in which the succeeding relays are operated is changed from that to which the protecting device has been set the same result will be achieved, since the switch member c^1 is thrown out of the current circuit closing position again by the rod 25 on operation of the electromagnet 21. To the current circuit C there is preferably connected an alarm current circuit D which is normally interrupted at the contacts 23. If then on actuation of the switch members in any sequence other than that for which the protecting device is set, for example, if switch a^5 is closed current flows through conduits 37, 38, 39 and 40 and relay b^5 is excited and the armature c^4 is attracted so that current also flows from conduit 37 through conduit 38, switch f^4, conduits 34, 35, relay 20, conduit 36 to conduit 40 and the relay 20 is operated whereby the armature 19 is attracted and not only the switching current circuit is interrupted at 16 but at the same time the alarm current circuit is closed at 23, so that current flows from conduit 37 through armature 19, conduits D and 38, and the alarm signalling device 22 which is interposed between conduits D and 38 is brought into operation.

To enable the armatures arrested in the circuit closing position as a result of actuating the switch members in the prescribed sequence to be returned into the position of rest there is connected to the current circuit C a current circuit E in which there are connected in parallel five press-buttons g^1–g^5 constructed similarly to the press-buttons a^1–a^5. On actuation of any one of the press-buttons g^1–g^5 the current circuit E—C is closed, the electromagnets 20 and 21 are excited, and the latter of these two magnets by means of the rod 25 returns all the armatures c^1–c^5 into their starting position.

In the form of construction of the invention shown by way of example in the accompanying drawings the order in which the switch members have to be operated to put the protecting device in a condition to enable the protected locking device to be unlocked is assumed to be that indicated by the index figures used. The number of switch elements used is a matter of choice. It is also possible to make the switching device in the form of a dialling disc.

The described form of construction may be simplified by making the relay armature 8 itself a locking member for the bolt. This relay armature is preferably provided with a contact bridge 26 adapted to interconnect two contacts 27, 28 pertaining to the positive arm and the negative arm, respectively, in which latter the restoring relay 21 is interposed. When therefore, after actuation of the switching relays b^1 to b^5, the control relay 9 is operated to liberate the locking member the relay 21 is simultaneously operated through the current circuit closed by the contacts 27, 28, and 26, and the armatures c^1–c^5 are returned into the position of rest, with the result that the relay 9 becomes dead. The armature 8 of this relay is then moved by a restoring spring 29 so as to bring about interruption of the circuit at the contacts 27, 28.

In addition there is provided at the press-button a^1 a contact bridge 30 which is insulated from bridge a^1 and is adapted to interconnect two contacts 31, 32. From the contact 31 a wire leads to the supply line 23 to the alarm device, and from the contact 32 a wire leads to the negative arm of the main current circuit. If therefore one result of actuating the press-button a^1 is to close the current circuit for the switching relay b^1 a further result, achieved simultaneously by the set of contacts 31 and 32 which is insulated from the set of contacts for the relay b^1, is to close the negative circuit arm for the alarm device 22, of which the positive arm is directly connected with the supply line 37 at the branching off point 33. By virtue of this arrangement it becomes possible to use the alarm device as a signalling device, while in addition persons tampering with the device are given no clue as to the proper sequence of operation of the press-buttons by the absence of an alarm signal.

The electric protecting device according to the invention may be used for protecting doors of buildings, flats, safes and other receptacles, and also vehicles and the like. It is likewise possible to protect not only doors but also any other mechanical or electrical parts with the aid of this invention.

I claim:

1. The combination of a keyboard having a number of keys with a source of electrical energy, a series of electromagnets, electric switches operated by said electromagnets, retaining catches for holding said switches in closed position, an electromagnetic switch opener for opening said switches against the action of said catches, an electromagnetic lock operating device, an auxiliary switch connected with said lock operating device and with said switch opener, such connections between said keyboard, said source of electrical energy, said electromagnets, said electric switches, said electromagnetic switch opener, said electromagnetic lock operating device, and said auxiliary switch that when a certain combination of keys on the keyboard is operated in a certain sequence the electromagnetic lock operating device is connected to said source of electrical energy whereby said lock operating device is actuated and said auxiliary switch is closed whereby said switch opener is actuated, but when any other combination of said keys is operated at least one of said electric switches is directly opened against the action of said catches and said lock operating device is disconnected from said source.

2. The combination of a keyboard having a number of keys with a source of electrical energy, a series of electromagnets, electric switches operated by said electromagnets, an electromagnetic lock operating device, such connections between said keyboard, said source of electrical energy, said electromagnets, said electric switches, and said electromagnetic lock operating device, that when a certain combination of keys on the keyboard is operated in a certain sequence the electromagnetic lock operating device is connected to said source of electrical energy, whereby said lock operating device is actuated, but when one of said keys pertaining to said certain combination is operated in another but said certain sequence one of said electromagnets definitely opens one of said switches and said lock operating device is disconnected from said source.

3. The combination of a keyboard having a number of keys with a source of electrical energy, a series of electromagnets, electric switches operated by said electromagnets, an electromagnetic lock operating device, such connections between said keyboard, said source of electrical energy, said electromagnets, said electric switches, and said electromagnetic lock operating device, that when a certain combination of keys on the keyboard is operated in a certain sequence the electromagnetic lock operating device is connected to said source of electrical energy, whereby said lock operating device is actuated, but when one of said keys pertaining to said certain combination is operated in another but said certain sequence one of said electromagnets definitely opens one of said switches and said lock operating device is disconnected from said source, said lock operating device comprising a control relay, an independent electric circuit, a switch in said independent circuit and being adapted to be operated by said control relay, an electromagnet in said independent circuit, and a lock releasing mechanism forming the armature of said last mentioned electromagnet.

4. In an electrical device of the type described, the combination of a keyboard having a number of keys, a source of electrical energy, a step by step mechanism, said mechanism including a series of electromagnets, electric switches operated by said electromagnets, an electromagnetic release mechanism for re-setting said step by step mechanism, an electromagnetic lock operating device including an auxiliary switch for controlling current flow for actuating said release mechanism, connections from the source of electrical energy to said key board, said step by step mechanism, said release mechanism, and said lock operating device, such connections within the step by step mechanism that when certain predetermined keys of the key board are manipulated in a certain predetermined order said lock operating device is connected by the step by step mechanism to the source of electrical energy whereby said lock operating device is actuated and said auxiliary switch is closed whereby said release mechanism resets said step by step mechanism, and when said certain keys are manipulated in any other than the certain predetermined order at least one of said electromagnets opens at least one of said switches and said lock operating device is disconnected from said source.

5. An electric combination device comprising a control circuit, a control relay in said circuit, a plurality of switch means forming, when in closed condition, part of said control circuit, a plurality of switching relays individually operatively connected with said switch means and, when excited, being adapted to close said switch means, an auxiliary circuit arranged in parallel with said control circuit, a switch interposed in said auxiliary circuit and being operatively connected with and adapted to be closed by said control relays when the latter is excited, and auxiliary relay interposed in said auxiliary circuit, and a control circuit switch interposed in said control circuit and being operatively connected with and adapted to be opened by said auxiliary relay upon excitation thereof and interrupting said control circuit whenever said control relay has been excited.

6. An electric control system comprising a control circuit, a control relay in said control circuit, a plurality of switch means interposed in series in and forming, when in closed condition, part of said control circuit, each of said switch means comprising a switch member, and a plurality of switching circuits arranged in parallel with respect to current flow and being shunted to said control circuit, a switch and a switching relay interposed in series in each of said switching circuits, said switching relays being pairwise and counteractively operatively associated with said switch members, said switching relays individually actuating said switch members upon consecutively closing of said switches in predetermined sequence and said switching relays, except one, pairwise actuating said switch members upon closing of said switches in another sequence, said switch members, when individually actuated, closing said switch means and said control circuit for actuating said control relay and, when pairwise actuated, one of said switch members constituting a simultaneously actuated pair closing and the other member opening the switch means with which it is associated and interrupting said control circuit.

7. An electric control system comprising a control circuit, a control relay in said circuit, a plurality of switch means forming, when in closed condition, part of said control circuit, a plurality of switching relays individually operatively connected with said switch means and, when excited, being adapted to close said switch means, an auxiliary circuit arranged in parallel with said

control circuit, a switch interposed in said auxiliary circuit and being operatively connected with and adapted to be closed by said control relays when the latter is excited, an auxiliary relay interposed in said auxiliary circuit, a control circuit switch interposed in said control circuit and being operatively connected with and adapted to be opened by said auxiliary relay upon excitation thereof and interrupting said control circuit whenever said control relay has been excited, and another auxiliary relay interposed in said auxiliary circuit, switch opening means operatively connected with said other auxiliary relay and also with said switch means and being operated by said other auxiliary relay upon excitation thereof and, when operated, opening said switch means.

8. An electric combination device comprising a control circuit, a control relay in said control circuit, a plurality of switch means interposed in series in and forming, when in closed condition, part of said control circuit, each of said switch means comprising a switch member, a plurality of switching circuits arranged in parallel with respect to current flow and being shunted to said control circuit, a switch and a switching relay interposed in series in each of said switching circuits, said switching relays being pairwise and counteractively operatively associated with said switch members, said switching relays individually actuating said switch members upon consecutively closing of said switches in predetermined sequence and said switching relays, except one, pairwise actuating said switch members upon closing of said switches in another sequence, said switch members, when individually actuated, closing said switch means and said control circuit for actuating said control relay and, when pairwise actuated, one of said switch members constituting a simultaneously actuated pair closing and the other member opening the switch means with which it is associated and interrupting said control circuit, and an alarm circuit, an alarm means and an electromagnetically operated alarm switch in said alarm circuit, an alarm operating circuit and a relay for operating said alarm switch therein, a plurality of other alarm switches in said alarm operating circuit and being arranged in parallel with respect to current flow and being individually operatively connected with said switch members and individually closed thereby upon such operation of said switch members that they open said switch means.

9. An electric combination device comprising a control circuit, a control relay in said circuit, a plurality of switch means forming, when in closed condition, part of said control circuit, a plurality of switching relays individually operatively connected with said switch means and, when excited, being adapted to close said switch means, an auxiliary circuit arranged in parallel with said control circuit, a switch interposed in said auxiliary circuit and being operatively connected with and adapted to be closed by said control relays when the latter is excited, an auxiliary relay interposed in said auxiliary circuit, and an alarm circuit and an electrically operated alarm means therein, an alarm switch interposed in said alarm circuit and being operatively connected with and adapted to be closed by said auxiliary relay upon excitation thereof and causing said alarm to report whenever said control relay is excited and said switch is closed.

10. An electric combination device comprising a control circuit, a control relay in said control circuit, a plurality of switch means interposed in series in and forming, when in closed condition, part of said control circuit, each of said switch means comprising a switch member, a plurality ofof switching circuits arranged in parallel with respect to current flow and being shunted to said control circuit, a switch and a switching relay interposed in series in each of said switching circuits, said switching relays being pairwise and counteractively operatively associated with said switch members, said switching relays individually actuating said switch members upon consecutively closing of said switches in predetermined sequence and said switching relays, except one, pairwise actuating said switch members upon closing of said switches in another sequence, said switch members, when individually actuated, closing said switch means and said control circuit for actuating said control relay and, when pairwise actuated, one of said switch members constituting a simultaneously actuated pair closing and the other member opening the switch means with which it is associated and interrupting said control circuit, and an alarm circuit, an alarm means and an alarm switch in said alarm circuit, said alarm switch being connected and adapted to be simultaneously closed with that one of said switches which is closed first in said predetermined sequence, whereby the alarm reports also when the device is operated correctly.

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