



- (51) International Patent Classification:
G07D 11/00 (2006.01) E05G 1/14 (2006.01)
- (21) International Application Number:
PCT/IB2016/057641
- (22) International Filing Date:
15 December 2016 (15.12.2016)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
2015/09120 15 December 2015 (15.12.2015) ZA
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- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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(54) Title: A SAFE APPARATUS FOR DISCOURAGING THEFT OF BANKNOTES

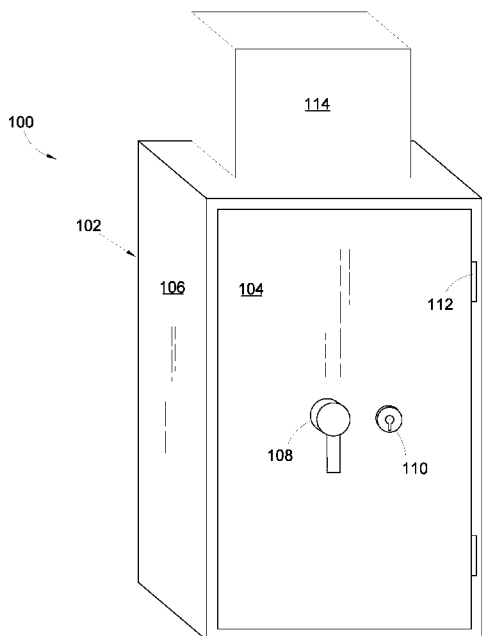


FIG. 1

(57) Abstract: A safe apparatus (e.g., an ATM) is configured to store physical banknotes inside at least one removable cassette. The safe apparatus has an electronic control module including an input and an output and at least one sensor which is connected to the input to the control module, the sensor being coupled to the safe enclosure and being configured to sense mechanical damage and in response to generate a tamper signal. The safe apparatus includes a dye reservoir, a dye dispensing trigger, and a conduit network connected between the dye reservoir and the cassette, the conduit network including at least one coupling mechanism to connect or disconnect the cassette from the dye reservoir. The control module generates a trigger signal in response to receipt of the tamper signal, to cause dye from the dye reservoir to be dispensed via the conduit network into the cassette and onto the banknotes contained therein.

WO 2017/103829 A1

Declarations under Rule 4.17:

- as to the identity of the inventor (Rule 4.17(i))
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

— of inventorship (Rule 4.17(iv))

Published:

— with international search report (Art. 21(3))

A safe apparatus for discouraging theft of banknotes

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FIELD OF INVENTION

This invention relates to the physical security of valuable documents, and it relates more specifically to a safe or ATM, with anti-theft security features, for storing and securing banknotes.

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BACKGROUND OF INVENTION

The Applicant has noted that ATMs (Automatic Teller Machines or cash dispensing machines) are high-value targets for robbers and thieves because of the quantity of usually high-value currency contained therein. Accordingly, ATMs have been constructed to be as secure as practicably possible, effectively being in the form of a safe enclosure with a user interface and a note conveying mechanism.

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Thieves have adapted to the secure nature of ATMs by finding ways to breach the safe enclosure. Most ATMs are alarmed and have a communication arrangement to communicate with, e.g., a head office or security company when tampering is detected. However, thieves often anticipate the response time before security personnel can arrive to protect the ATM and its contents, and ensure that they have left by then. Accordingly, the Applicant is focusing on automated mechanisms for preventing or inhibiting these ATM attacks.

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The Applicant has studied methodologies used by would-be thieves and has noted two main method of breach: i. use of explosives, and ii. mechanically damaging the safe

enclosure. When explosives are used, the amount of explosive has to be selected carefully: too little, and the outer safe enclosure might remain intact, but too much and the banknotes inside could be damaged. Just enough should be used to breach the safe enclosure without destroying the banknotes. Mechanically breach tactics may include drilling, grinding, and cutting. The Applicant has noticed that it is becoming increasingly common for thieves to use a powerful angle grinder, circular saw, or cutting torch to damage a portion of the safe enclosure, e.g., hinges of a door. This grinding ensures that the ATM contents are intact.

Accordingly, the Applicant desires a safe apparatus which overcomes or at least ameliorates the above drawbacks by discouraging theft of banknotes. The Applicant desires a safe apparatus which does not rely on a human response (e.g., armed security guards) but rather automatically defeats and diminishes attempts of thieves to gain viable value in the form of usable banknotes.

SUMMARY OF INVENTION

Accordingly, the invention provides a safe apparatus which is configured to store physical banknotes, the banknotes being stacked inside at least one removable cassette and the safe apparatus having a safe enclosure which defines at least one channel matched to the cassette for removably accommodating the cassette and the banknotes therein, wherein the safe apparatus includes:

an electronic control module including at least one input and at least one output;

at least one sensor which is connected to the input to the control module, the sensor being coupled to the safe enclosure and being configured i) to sense mechanical damage or physical breach of the safe enclosure and ii) to generate a tamper signal in response to detection of mechanical damage or physical breach of the safe enclosure;

a dye reservoir and a dye dispensing trigger coupled to the dye reservoir, the dye dispensing trigger connected to the output of the control module and responsive to the trigger signal,

a conduit network connected between the dye reservoir and the cassette, the conduit network including at least one coupling mechanism to connect or disconnect the cassette from the dye reservoir,

wherein:

5 the control module is operable to generate the trigger signal in response to receipt of the tamper signal from the sensor, the trigger signal being communicated via the output to the dye dispensing trigger thereby to cause dye from the dye reservoir to be dispensed via the conduit network into the cassette and onto the banknotes contained therein.

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The safe apparatus may be in the form of an ATM (Automatic Teller Machine) for dispensing the banknotes to authorised bank customers. As such, the safe apparatus may include many of the features traditionally associated with ATMs, e.g., display screen, input arrangement (e.g., keypad), a banknote conveyor system, a communication module, etc. In fact, this invention is further described with reference to ATMs but it will be appreciated that the invention may find application in other safe apparatus when money is stored in cassettes or ordered stacks, e.g., drop safes, cash-in-transit vehicles, etc.

20 The sensor may be a simple electrical circuit configured to change state from normally open (NO) to closed, or normally closed (NC) to open, in response to damage or breach (generally referred to as tampering). Thus, the tamper signal may be a change of state of a circuit.

25 The sensor may be a NC wire grid. The wire grid may comprise a long wire, or a series of wires, in a convoluted or serpentine layout to cover an area. Tampering with the enclosure may damage or interrupt part of the wire grid, causing the NC grid to present on open circuit and thereby generating a tamper signal.

30 The sensor may include a plurality of NO anti-tamper panels arranged in parallel. The panels may be spaced a very short distance apart from each other. Tampering with

the enclosure may deform or displace the panels, causing two to make electrical contact with each other, thus closing the NO circuit and thereby generating a tamper signal.

- 5 The control module may include plural inputs. The safe apparatus may include plural sensors, each connected to a respective input. In one embodiment, the safe apparatus may include both the NC wire grid and the NO anti-tamper panels, to enhance detection of tampering.
- 10 The control module may include a plurality of outputs. One of the outputs may be connected to an alarm module. The trigger signal may be operable to activate the alarm module. The alarm module may be configured to raise a local alarm, e.g., siren, claxon, or flashing light. The alarm module may be configured to send an alarm communication to a remote recipient, e.g., to a control station via a telecommunications
- 15 network.

One of the outputs of the control module may be connected to an ATM processing system. The trigger signal of the control module may be operable to deactivate at least part of an ATM control system, e.g., to prevent any banknotes from being dispensed.

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- The safe apparatus may include a plurality of channels which are operable to accommodate a plurality of banknote cassettes. ATMs may be configured to dispense banknotes of different denominations. Typically, a single denomination is packed into a single cassette. Accordingly, if the ATM is configured to dispense a combination of,
- 25 say, four banknote denominations, the ATM would need four cassettes, one for each denomination. Accordingly, the safe apparatus may include a rack which defines a series of channels, each channel of the series operable to accommodate a cassette.

- The conduit network may include a plurality of branches, one for each of the cassettes.
- 30 The conduit network may include a plurality of coupling mechanisms, one for each branch.

The safe enclosure may include an outer safe door. The outer safe door may be a conventional safe door normally associated with safe apparatus such as ATMs. However, in accordance with the invention, the safe apparatus may also include an inner safe door. The inner safe door may be arranged between the outer safe door and the cassettes. More specifically, the inner safe door may be arranged at a rear of the rack defining the channels, behind the cassettes (when loaded in the channels).

The coupling mechanism may be provided between the inner safe door and the, or each, cassette (further referred to simply as the cassettes). The dye reservoir may be provided within the safe enclosure, but outside the rack. Accordingly, the conduit network may be configured to conduct the dye through the inner safe door into the rack and into each of the cassettes. The coupling mechanism may include a male connector (e.g., a spigot) and an aligned female connector (e.g., a socket), or a bank of male connectors and a bank aligned of female connectors. One connector, or one bank of connectors, may be provided on the inner safe door. The other connector, or other bank of connectors, may be provided on the cassettes. Opening and closing of the inner safe door may cause the connectors automatically to decouple and couple with their aligned counterparts.

The dye reservoir may be in the form of a dye canister. In one embodiment, the dye dispensing trigger may be an explosive mechanism, e.g., a small explosive charge contained within the dye canister. Detonation of the explosive charge may cause the dye to be dispensed. In another embodiment, the dye canister may be a pressurised dye canister and the dye dispensing trigger may be a switch, e.g., a solenoid valve. Actuating, e.g., opening, of the valve may cause the dye, under pressure, to be dispensed.

The dye may be any suitable coloured liquid dye or ink composition, e.g., being indelible. Examples include methyl violet (https://en.wikipedia.org/wiki/Methyl_violet) and Disperse Red 9 (https://en.wikipedia.org/wiki/Disperse_Red_9).

The conduit network may include a spray outlet provided within the cassette. The spray outlet may be in the form of a spray arm and may include a plurality of nozzles directed to a banknote storage cavity within the cassette. The cassette may include a
5 secondary dye reservoir provided therein, the secondary dye reservoir being made of a frangible material.

The trigger signal generated by the control module may be a coded signal, even if the coding is very basic. This may inhibit unauthorised or inadvertent dispensing of the
10 dye.

The safe apparatus may include an auxiliary power supply unit (PSU), e.g., a battery. The auxiliary PSU may ensure that the electronic control module can operate even after external supply of power has been interrupted.
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The safe apparatus may be operable to combat breaches due to grinding, drilling, cutting, sawing, torch cutting, hammering, etc.

The invention extends to a cassette for a safe apparatus as described above, the
20 cassette including:

at least part of the coupling mechanism of the conduit network configured to couple the cassette to the dye reservoir; and

a spray outlet provided within the cassette and in fluid flow communication with the part of the coupling mechanism, thereby to spray any banknotes
25 accommodated within the cassette with dye in response to dispensing of the dye from the dye reservoir.

The invention extends to a method of reducing theft or reducing the effectiveness of theft in a safe apparatus which is configured to store physical banknotes, the
30 banknotes being stacked inside at least one removable cassette and the safe

apparatus having a safe enclosure which defines at least one channel matched to the cassette for removably accommodating the cassette and the banknotes therein, wherein the method includes:

- 5 sensing, by at least one sensor which is connected to an input of a control module having and which is coupled to the safe enclosure, mechanical damage or physical breach of the safe enclosure;
- generating, by the sensor, a tamper signal in response to detection of mechanical damage or physical breach of the safe enclosure;
- 10 generating, by the control module, a trigger signal in response to receipt of the tamper signal from the sensor, the trigger signal being communicated via an output; and
- triggering, by the control module, a dye reservoir and a dye dispensing trigger coupled to the dye reservoir, the dye dispensing trigger connected to the output of the control module and responsive to the trigger signal, thereby to cause dye
- 15 from the dye reservoir to be dispensed via a conduit network into the cassette and onto the banknotes contained therein, wherein the conduit network is connected between the dye reservoir and the cassette, the conduit network including at least one coupling mechanism to connect or disconnect the cassette from the dye reservoir.

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The method may be implemented by the safe apparatus as described above.

The method may include the prior step of arming the control module. Instead, the control module may be permanently armed.

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BRIEF DESCRIPTION OF DRAWINGS

The invention will now be further described, by way of example, with reference to the accompanying diagrammatic drawings.

In the drawings:

FIG. 1 shows a rear three-dimensional view of a safe apparatus, in accordance with the invention;

FIG. 2 shows a rear view of the safe apparatus of FIG. 1 with an outer safe door opened;

FIG. 3 shows a rear view of the safe apparatus of FIG. 2 with an inner safe door opened;

FIG. 4 shows a rear three-dimensional view of the safe apparatus of FIG. 3 (with the outer safe door not illustrated);

FIG. 5 shows an enlarged view of a coupling mechanism of the safe apparatus of FIG. 4;

FIG. 6 shows a three-dimensional view of a cassette for use in the safe apparatus of FIG. 1;

FIG. 7 shows a three-dimensional view of the cassette of FIG. 6 (with a lid not illustrated) in use;

FIG. 8 shows a schematic view of a control module of the safe apparatus of FIG. 1; and

FIG. 9 shows a flow diagram of a method of reducing theft or reducing the effectiveness of theft in a safe apparatus, in accordance with the invention.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENT

The following description of the invention is provided as an enabling teaching of the invention. Those skilled in the relevant art will recognise that many changes can be made to the embodiment described, while still attaining the beneficial results of the present invention. It will also be apparent that some of the desired benefits of the present invention can be attained by selecting some of the features of the present invention without utilising other features. Accordingly, those skilled in the art will recognise that modifications and adaptations to the present invention are possible and can even be desirable in certain circumstances, and are a part of the present invention.

Thus, the following description is provided as illustrative of the principles of the present invention and not a limitation thereof.

5 FIG. 1 illustrates a safe apparatus 100 in accordance with the invention. Initially, the mechanical/hardware aspects of the safe apparatus 100 will be described; later, the electronic aspects of the safe apparatus 100 will be described. The safe apparatus 100 in this example is an ATM 100 and FIG. 1 illustrates a rear of the ATM 100. The ATM 100 may have an outward appearance that is innocuous, for example, resembling or being identical to prior art ATMs. Instead, if desired, warnings could be placed on
10 the outside of the ATM 100, warning would-be thieves of the dye dispensing system therein, and discouraging theft attempts.

Many of the external features of the ATM 100 are shared with conventional ATMs. For instance, the ATM 100 comprises a strong safe enclosure 102 which is cuboid and
15 defines a safe storage cavity therein. The safe enclosure comprises walls 106 and a rear, outer safe door 104. The walls 106 and the door 104 are typically made out of steel or a similarly strong material. The outer safe door 104 has a door handle 108 and a lock 110. The lock 110 may be a key lock, a combination lock, or a remotely accessible electronic lock. The specifics of the handle 108 and the lock 110 are not
20 germane to this invention. The outer safe door 104 is pivotally mounted to one of the walls 106 by means of robust hinges 112.

The ATM 100 includes electronic banking components (generally referred to by reference numeral 114) usually associated with ATMs. The banking components 114
25 include a display screen, an input device (e.g., keypad or touchscreen), a communication arrangement to communicate transaction data with a remote bank server, and a banknote conveyance mechanism operable to convey and dispense banknotes from the safe storage cavity in response to approval of a cash withdrawal transaction. The safe enclosure 102 is legitimately accessible via only two routes: the
30 outer safe door 104 and the note conveyance mechanism.

FIG. 2 illustrates the ATM 100 with the outer safe door 104 open. Inside is an inner safe door 202 which is parallel with, and smaller than, the outer safe door 104 (when both are closed). The inner safe door 202 is mounted by means of inner hinges (not illustrated) to an inside of one of the walls 106 and stabilised by gas pistons 204 (or similar guiding/stabilising apparatus) mounted between the inner and outer safe doors 104, 202. (In other embodiments, the inner safe door 202 could be mounted directly to the outer safe door 104. This will be determined by the make, model or specification of the safe/ATM being outfitted.)

Although the inner safe door 202 may provide an extra barrier or an extra degree of physical protection, this is not its primary purpose. As will become apparent from FIGS 3-4, the inner safe door 202 provides a convenient and reliable coupling mechanism between banknote cassettes and a dye reservoir.

FIGS 3-4 illustrate the ATM 100 with the inner safe door 202 open (and, in FIG. 4, with the outer safe door 104 not illustrated) to reveal the innards of the ATM 100. This ATM 100 is the variety which uses removable cassettes 302. ATM cassettes are well known in the art and provide a modular and removable mechanism for stocking an ATM with a stack of banknotes, usually of a particular denomination. In this example, a rack 304 provides a framework which defines four channels, each channel for accommodating one of the cassettes 302. The cassettes 302 can be slid in and out of the channels, by means of a handle provided at the end of each cassette 302. Usually, each cassette 302 will be stacked with a single denomination of banknotes, different cassettes 302 optionally having different denominations therein.

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Importantly, and in accordance with the invention, the ATM 100 has a dye reservoir 310. In this embodiment, the dye reservoir is in the form of a pair of dye canisters or tubes 310 which are mildly pressurised. A specially designed conduit network 312, 314, 316 is configured to conduct dye from the dye canisters 310 into the cassettes 302 (in response to a trigger signal – see further below). A membrane 318 is provided in-line with conduits 312, near an outlet of the dye canisters 310. A small explosive charge (not illustrated) is provided within each dye canister 310. The dye canisters

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310 are of sufficient strength to remain intact upon detonation of the explosive charge. In this example, the explosive charge thus acts as the dye dispensing trigger.

5 The conduit network 312, 314, 316 has a coupling mechanism 314, 316. The coupling mechanism 314, 316 includes two complementary formations: a female connector 314 (e.g., a socket) and a male connector 316 (e.g., a spigot). More specifically, there are four pairs of complementary formations, one pair for each cassette 302. The male connector 316 is provided at the end of the cassette 302, adjacent the handle. The female connectors 314 are provided at vertically spaced apart locations on an inner
10 surface of the inner safe door 202, each pair of male and female connectors 314, 316 being horizontally aligned. Each pair of male and female connectors 314, 316 are also arcuately co-axially aligned as illustrated by axis 500 (refer to FIG. 5) such that closing of the inner safe door 202 causes the pair of male and female connectors 314, 316 to couple. The coupling is preferably fluid-tight.

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FIGS 6-7 illustrate the cassette 302 in more detail. The conduit network 312 terminates in a spray outlet 602 in the form of a purposely designed spray arm or tube 602 to integrate into the cash cassette 302 and based on available space inside the cassette 302. The spray arm 602 is in fluid flow communication with the male connector 316.
20 The spray arm 602 is arranged in a lid of the cassette 302 so as not to interfere with movement of the banknotes 600 stacked inside the cassette 302. The spray arm 602 defines a series of nozzles or apertures 604 along its length, the nozzles 604 being directed inwardly towards a banknote storage space defined within the cassette 302, along all of the length of the storage space. Thus, any dye propelled along the conduit
25 network 312, 314, 316 will be sprayed 700 from the nozzles 604 onto the banknotes 600. The banking components 114 of the ATM 100 are agnostic with regard to the dye dispensing components; in other words, the banknote conveyance mechanism of the ATM 100 will operate to accordance with prior art principles.

30 Optionally, the cassette 302 also includes a frangible container 606, for example, attached to a centre of the lid between branches of the spray arm 602. The frangible container is designed to fracture by a shockwave caused by an explosive blast.

Accordingly, even in the unlikely event of a blast disabling circuitry or the dye reservoir 310, the frangible container 606 would still fracture and dispense dye all of the banknotes 600.

5 The ATM 100 has a control module 330 (which may be separate from the prior art transaction modules present as part of the existing ATM components 114). The control module 330 in accordance with the invention is specifically designed to monitor for tampering or breach, by means of sensors, and then issue a trigger signal in response to detection of tampering. The control module 330 is housed within the safe enclosure
10 102 (refer to FIGS 3-4) so that it enjoys the same degree of protection as many of the other components of the invention. The control module 330 is, for example, mounted to an inside of one of the walls 106 adjacent the rack 304.

The control module may be one or more microprocessors, controllers, digital signal
15 processors (DSPs), or any other suitable computing device, resource, hardware, software, or embedded logic. The control module 330 may include a computer processor and a computer-readable medium having stored thereon computer software operable to direct the operation of the computer processor. The control module 330 includes a plurality of inputs (collectively referred to by numeral 802) and a plurality of
20 outputs (collectively referred to by numeral 804).

Referring particularly to FIG. 8, the control module 330 includes processor circuitry 806 at its heart. The circuitry is installed inside a robust housing 808 and connected to a UPS (Uninterruptible Power Supply) 810 including a battery. A power input 802.1 is
25 connected to the UPS 810 both to charge the battery and to power the control module 330 under normal operating conditions. The power input 802.1 may be an external mains input (e.g., from a power utility) and may be connected to the power input that supplies the whole ATM 100. However, if the external mains input is interrupted (e.g., because there is a power failure or because thieves have cut the power supply in
30 contemplation of breaching the ATM 100), the control module 330 will continue to be powered via the UPS 810 and thus can continue to function.

A key switch 802.2 is also attached to an input of the control module 330. The key switch 802.2 serves to disarm the control module 330 for controlled servicing of the ATM 100 and in the event of there being a fault with, for example, the locking 110 of the ATM 100. The control module 330 can be switched off for repairing or replacing of
5 the ATM 100 components and/or locks 110.

The sensors 400 are connected via sensor inputs 802.3 to the control module 330. While many high-tech and sophisticated sensors are available, including proximity sensors, motion sensors, accelerometers, etc., and may be used in accordance with
10 this invention, the Applicant envisages that two relatively simple sensors 400 would suffice. Drilling or grinding the steel safe enclosure 102 is a relatively low-tech option, and simple sensors may thus provide a cheap, convenient and reliable solution.

A first sensor, or array of sensors, is a NC wire grid 400.1 with a series of electrical
15 conductions. The wire grid 400.1 may be positioned inside the walls 106, inside the outer safe door 104, and/or at the hinges 112. Because the wires are connected in series, severing or interrupting even one single wire switches the sensor from a closed circuit to an open circuit: this serves as a tamper signal.

A second sensor, or array of sensors, is an anti-tamper panel 400.2. This sensor 400.2
20 comprises at least two closely spaced apart metallic sheets separated by an insulating film. Normally, the sheets of the anti-tamper panel 400.2 are close but do not actually touch, and therefore present an open circuit. The anti-tamper panel 400.2 can be mounted on an inside of the walls 106, the outer safe door 106, etc. The anti-tamper
25 panel 400.2 can be combined with, or positioned proximate, the wire grid 400.1. Damaging the safe enclosure 102, e.g., by grinding or drilling, usually causes some degree of deformation of the safe enclosure 102 which is transmitted to the anti-tamper panel 400.2 and causes the sheets to make contact, forming a closed circuit which constitutes a tamper signal.

The control module 330 also includes a plurality of outputs 804. A solenoid output 804.1 is provided to actuate any connected solenoid switches. Regulated 5 VDC and 12 VDC outputs 804.2 are provided to power any peripheral requiring such power levels, as well as an unregulated 12 VDC output 804.5. Relay outputs 804.3 are provided to activate other security features, including an alarm module and a cut-off to the ATM control system, to prevent the ATM 100 from dispensing any dye-stained notes.

In this example, the control module 330 has an electronic dye circuit 804.4 which is operable to produce a coded trigger signal in the form of a sequenced pulse output 808 to detonate the explosive charge within the dye canisters 310. The coding scheme may be simple and is not necessary intended to provide encryption but merely to prevent inadvertent or unauthorised dispensing of the dye.

The invention will be further described in use with reference to FIG. 9 which illustrates a method 900 of discouraging theft of banknotes, in accordance with the invention.

The method 900 may include retrofitting (at block 910) an existing ATM with the additional components of the safe apparatus 100. The sensors 400.1, 400.2 can be installed where desired. These can be installed throughout an inner surface of the safe enclosure 102. Ideally, the sensors 400.1, 400.2 are installed where any weak points may exist in the safe 100 because those are the points that a thief would be most likely to attempt to breach. For example, if the ATM 100 is going to be built into a concrete structure, with only the outer safe door 104 exposed, it might only be necessary to fit the sensors 400.1, 400.2 to the outer safe door 104 and hinges 112. Fitting fewer sensors 400.1, 400.2 and only where required might reduce installation costs and complexities.

The dye canisters 310 and conduits 12 are installed (at block 914). This involves mounting the dye canisters 310 securely on an inner floor of the ATM 100 or on an inner wall 106. Also, the inner safe door 202 is pivotally mounted (at block 915)

between the rack 304 and the outer safe door 104. The conduits 312 of the conduit network 312, 314, 316 are connected between the dye reservoirs 310 and the inner safe door 202 terminating at the female connectors 314.

5 The control module 330 is fitted inside the safe enclosure 102 and the inputs 802 and outputs 804 are connected (at block 916). Specifically, the sensors 400.1, 400.2 are connected to the inputs 802, as is the key switch 802.2 and the power supply 802.1. The electronic dye circuit 804.4 is connected to the dye dispensing trigger 318 and dye reservoir 310. The ATM 100 is then technically ready for use.

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To enable use, the ATM 100 is stocked with currency in the form of banknotes 600 and locked (at block 920). First, the specifically modified cassettes 302 are stacked with banknotes 600 and inserted (at block 922) by sliding into position in their proper channel in the rack 304. The inner safe door 202 is then closed (at block 924). This causes the female connectors 314 on the inner side of the inner safe door 202 to couple with the male connectors 316 on the cassettes 302 to form a fluid-tight flow path from the dye canisters 310 to the interior of the cassettes 302 out of the spray arms 602. The outer safe door 104 is closed and locked (at block 926).

20 The control module 330, once installed, is always "on" or armed and does not require a special arming signal or on switch. The control module 330 is thus always armed and continually performs (at block 930) its monitoring function. The control module 330 constantly monitors (at block 932) the sensors 400.1, 400.2 for receipt of a tamper signal. If, as an example, a thief endeavours to breach the ATM 100 by grinding away (e.g., using a handheld angle grinder) a portion of the safe enclosure 102, at least one of the sensors 400.1, 400.2 (and probably both) will change electrical state, at least briefly, with the NC wire grid 400.1 presenting an open circuit and/or the anti-tamper panel 400.2 presenting a closed circuit.

30 If the control module 330 receives (at block 934) the tamper signal, it will automatically and immediately generate (at block 936) a trigger signal. More specifically, the

electronic dye circuit 804.4 generate the coded trigger signal 808 to ensure that the dye is dispensed (at block 940). The dye trigger circuit 804.4 activates the dye canister 302 but detonating the small explosive charges therein. This causes the dye to breach the membrane 318 be propelled rapidly and forcefully along the conduit network 312, 314, 316. The dye is sprayed 700 from the nozzles 604 of the spray arm 602 and permanently taints the banknotes 600. Now, even if the thief succeeds in breaching the safe enclosure 102, the banknotes 600 contained therein will be unusable.

Optionally, the control module 330 may trigger additional alarm measures using the other outputs 804, e.g., the relays 804.3. The additional alarm measures could include a loud alarm siren, an alert communication sent to the bank responsible for the ATM 100, and an ATM cut-off which prevents the ATM components 114 even from dispensing legitimate cash.

The Applicant believes that the invention as exemplified provides an effective and reliable mechanism for reducing the effectiveness of breaking into or breaching ATMs 100. Even if the thief is successful in penetrating the safe enclosure 102, all of the banknotes 600 will have been rendered unusable. This will render his efforts futile and may even assist with his apprehension, e.g., if he is found in possession with the marked banknotes 100. Over time, thieves may become aware of the futility of attacking ATMs 100 with this anti-theft technology and merely cease their futile attempts.

The control module 330 is readily configurable and can be adapted to other implementations of the ATM 100, e.g., dispensing of expandable foam.

CLAIMS

1. A safe apparatus which is configured to store physical banknotes, the banknotes being stacked inside at least one removable cassette and the safe apparatus having a safe enclosure which defines at least one channel matched to the cassette for removably accommodating the cassette and the banknotes therein, wherein the safe apparatus includes:

an electronic control module including at least one input and at least one output;

at least one sensor which is connected to the input to the control module, the sensor being coupled to the safe enclosure and being configured i) to sense mechanical damage or physical breach of the safe enclosure and ii) to generate a tamper signal in response to detection of mechanical damage or physical breach of the safe enclosure;

a dye reservoir and a dye dispensing trigger coupled to the dye reservoir, the dye dispensing trigger connected to the output of the control module and responsive to a trigger signal; and

a conduit network connected between the dye reservoir and the cassette, the conduit network including at least one coupling mechanism to connect or disconnect the cassette from the dye reservoir, wherein:

the control module is operable to generate the trigger signal in response to receipt of the tamper signal from the sensor, the trigger signal being communicated via the output to the dye dispensing trigger thereby to cause dye from the dye reservoir to be dispensed via the conduit network into the cassette and onto the banknotes contained therein.

2. The safe apparatus as claimed in claim 1, in which the sensor is one or more of:

an electrical circuit configured to change state from normally open (NO) to closed, in response to damage or breach; or

an electrical circuit configured to change state from normally closed (NC) to open, in response to damage or breach.

3. The safe apparatus as claimed in claim 2, in which the sensor is one or more of:

5 a plurality of NO anti-tamper panels arranged in parallel and spaced a very short distance apart from each other, such that tampering with the enclosure may deform or displace the panels, causing two of the panels to make electrical contact with each other, thus closing the NO circuit and thereby generating the tamper signal; or

10 a NC wire grid which comprises a long wire, or a series of wires, in a convoluted or serpentine layout to cover an area, such that tampering with the enclosure may damage or interrupt part of the wire grid, causing the NC grid to present an open circuit and thereby generating the tamper signal.

- 15 4. The safe apparatus as claimed in any one of claims 1-3, in which the control module includes plural inputs and the safe apparatus includes plural sensors, each connected to a respective input.

- 20 5. The safe apparatus as claimed in any one of claims 1-4, in which the control module includes a plurality of outputs and an alarm module, one of the outputs being connected to the alarm module.

6. The safe apparatus as claimed in claim 5, in which the trigger signal is operable to activate the alarm module, thereby to raise an alarm.

- 25 7. The safe apparatus as claimed in any one of claims 5-6, in which the alarm module is configured to send an alarm communication to a remote recipient via a telecommunications network.

- 30 8. The safe apparatus as claimed in any one of claims 5-7, which is an ATM (Automatic Teller Machine) and in which one of the outputs of the control module is connected to an ATM processing system which is operable to deactivate at

least part of an ATM control system to prevent any banknotes from being dispensed.

5 **9.** The safe apparatus as claimed in any one of claims 1-8, which includes a plurality of channels which are operable to accommodate a plurality of banknote cassettes.

10. The safe apparatus as claimed in claim 9, in which:

10 the conduit network includes a plurality of branches, one for each of the cassettes; and

 the conduit network includes a plurality of coupling mechanisms, one for each branch.

15 **11.** The safe apparatus as claimed in any one of claims 1-10, which includes an outer safe door and an inner safe door which is arranged between the outer safe door and the cassette.

12. The safe apparatus as claimed in claim 11, in which the coupling mechanism is provided between the inner safe door and the cassette.

20 **13.** The safe apparatus as claimed in claim 12, in which a portion of the conduit network is provided inside the inner safe door, the conduit network being arranged to conduct the dye from the dye reservoir, through the inner safe door, via the coupling mechanism, and into the cassette.

25 **14.** The safe apparatus as claimed in any one of claims 12-13, in which the dye reservoir is provided within the safe enclosure inside the inner safe door.

15. The safe apparatus as claimed in any one of claims 11-14, in which the coupling mechanism includes aligned complementary connectors, or a bank of aligned complementary connectors.
- 5 16. The safe apparatus as claimed in claim 15, in which one connector, or one bank of connectors, is provided on the inner safe door and the complementary connector, or bank of complementary connectors, is provided on the cassettes.
- 10 17. The safe apparatus as claimed in claim 16, in which, due to the alignment of the complementary connectors, opening and closing of the inner safe door causes the connectors automatically to decouple and couple with their aligned complementary counterparts.
- 15 18. The safe apparatus as claimed in any one of claims 1-17, in which the dye reservoir is in the form of a dye canister which contains a suitable coloured liquid dye or ink composition.
19. The safe apparatus as claimed in claim 18, in which the dye dispensing trigger is one or more of:
- 20 an explosive mechanism, detonation of which causes the dye to be dispensed; or
- a switch or valve, wherein the dye reservoir is a pressurised dye canister and opening of the switch or valve causes the dye, under pressure, to be dispensed.
- 25
20. The safe apparatus as claimed in any one of claims 1-19, in which the conduit network includes a spray outlet provided within the cassette.
- 30 21. The safe apparatus as claimed in any one of claims 1-20, in which the trigger signal generated by the control module is a coded signal.

22. A cassette for a safe apparatus as claimed in any one of claims 1-21, the cassette including:

at least part of the coupling mechanism of the conduit network configured to couple the cassette to the dye reservoir; and

a spray outlet provided within the cassette and in fluid flow communication with the part of the coupling mechanism, thereby to spray any banknotes accommodated within the cassette with dye in response to dispensing of the dye from the dye reservoir.

23. The cassette as claimed in claim 22, which includes a secondary dye reservoir provided therein, the secondary dye reservoir being made of a frangible material.

24. A method of reducing theft or reducing the effectiveness of theft in a safe apparatus which is configured to store physical banknotes, the banknotes being stacked inside at least one removable cassette and the safe apparatus having a safe enclosure which defines at least one channel matched to the cassette for removably accommodating the cassette and the banknotes therein, wherein the method includes:

sensing, by at least one sensor which is connected to an input of a control module having and which is coupled to the safe enclosure, mechanical damage or physical breach of the safe enclosure;

generating, by the sensor, a tamper signal in response to detection of mechanical damage or physical breach of the safe enclosure;

generating, by the control module, a trigger signal in response to receipt of the tamper signal from the sensor, the trigger signal being communicated via an output; and

triggering, by the control module, a dye reservoir and a dye dispensing trigger coupled to the dye reservoir, the dye dispensing trigger connected to the output of the control module and responsive to the trigger signal, thereby

to cause dye from the dye reservoir to be dispensed via a conduit network into the cassette and onto the banknotes contained therein, wherein the conduit network is connected between the dye reservoir and the cassette, the conduit network including at least one coupling mechanism to connect or disconnect the cassette from the dye reservoir.

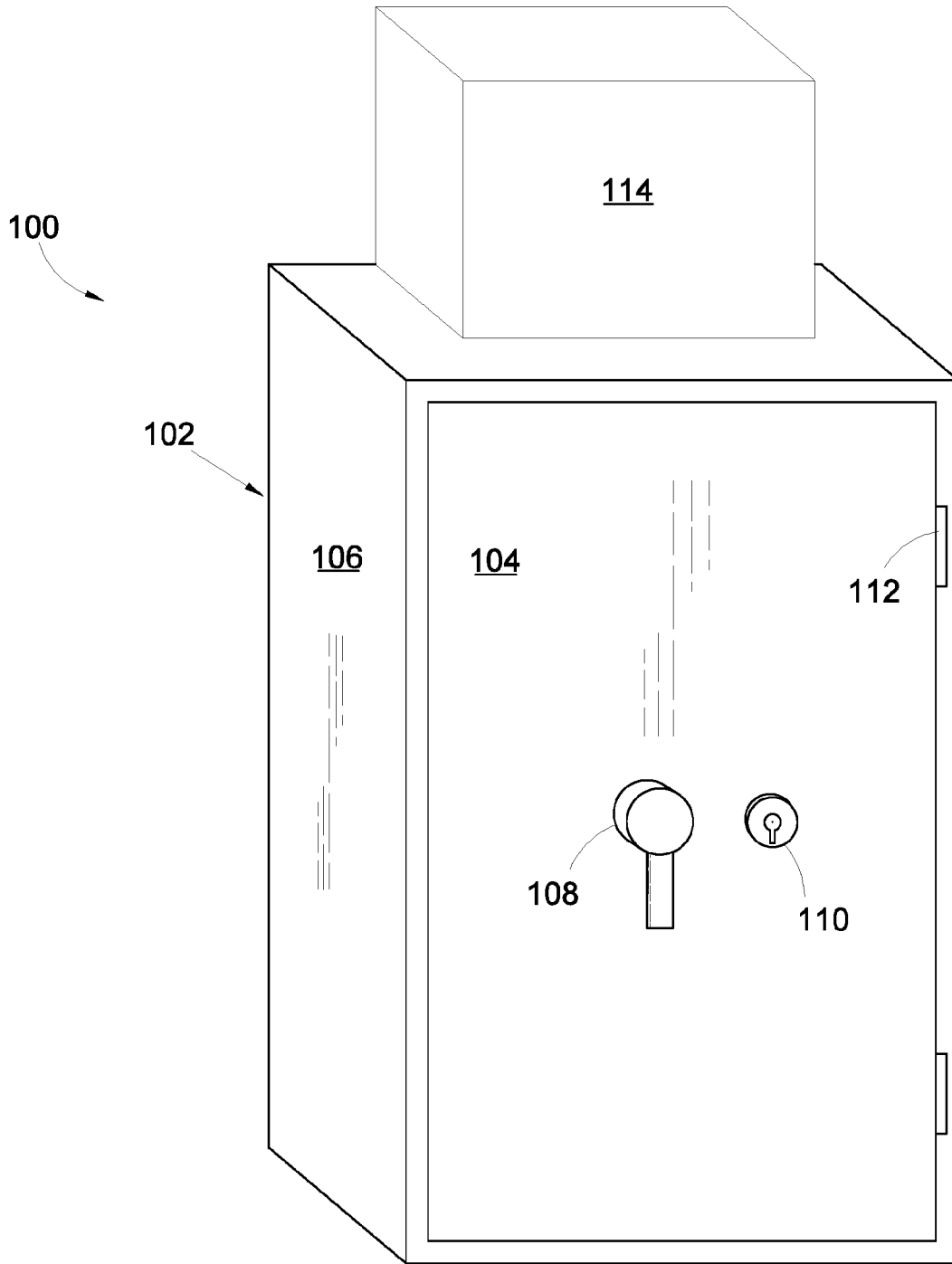


FIG. 1

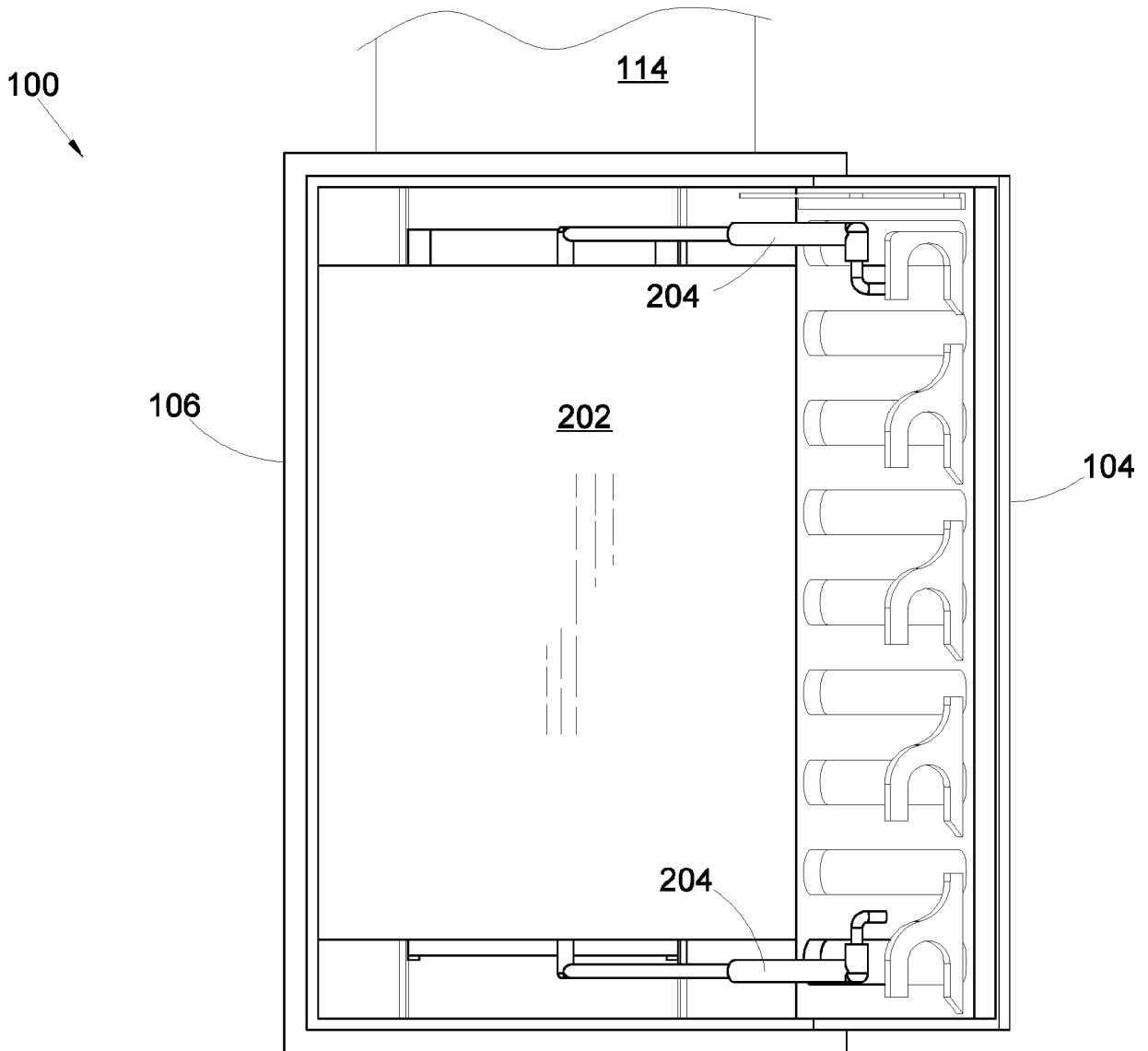


FIG. 2

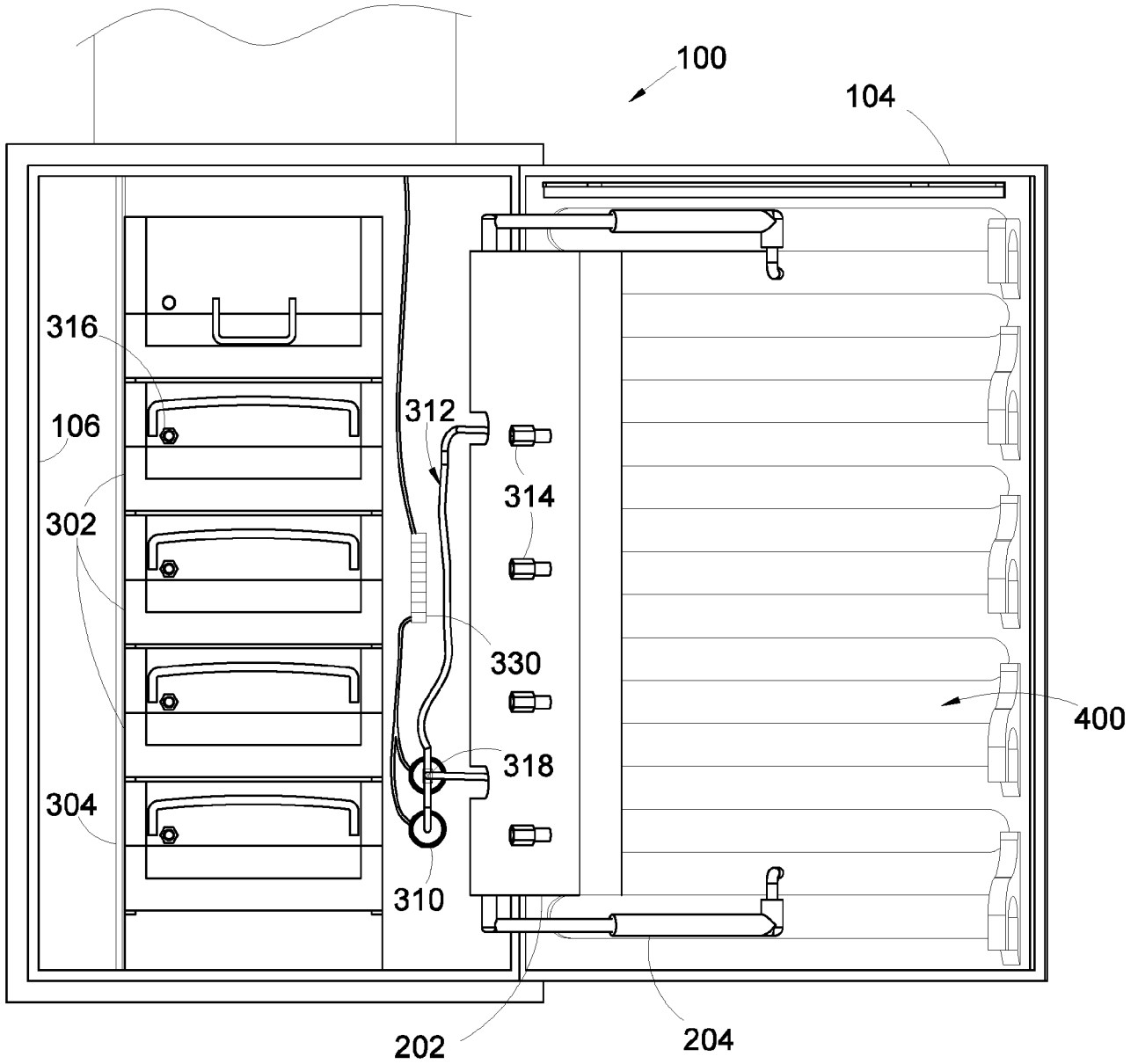


FIG. 3

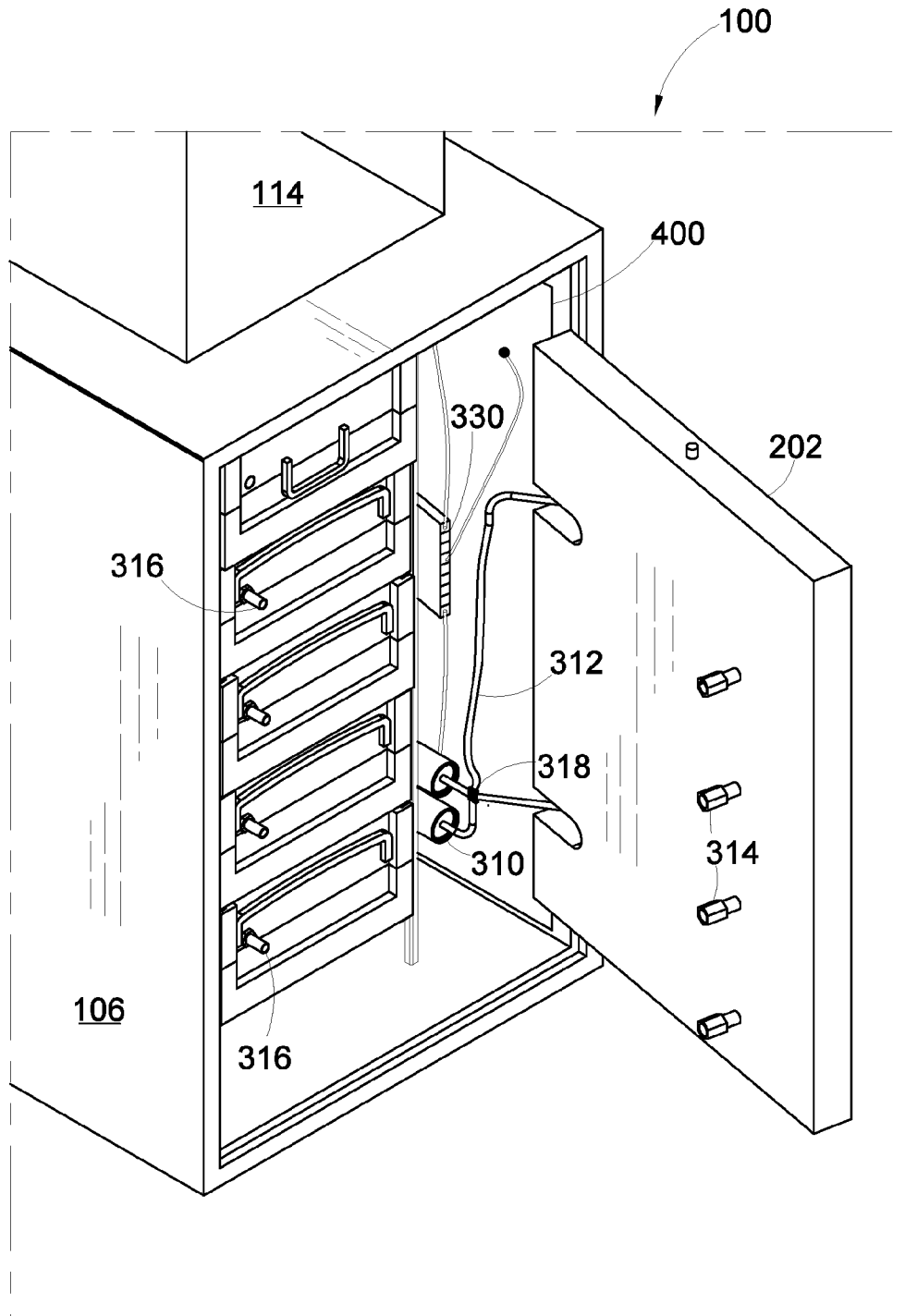


FIG. 4

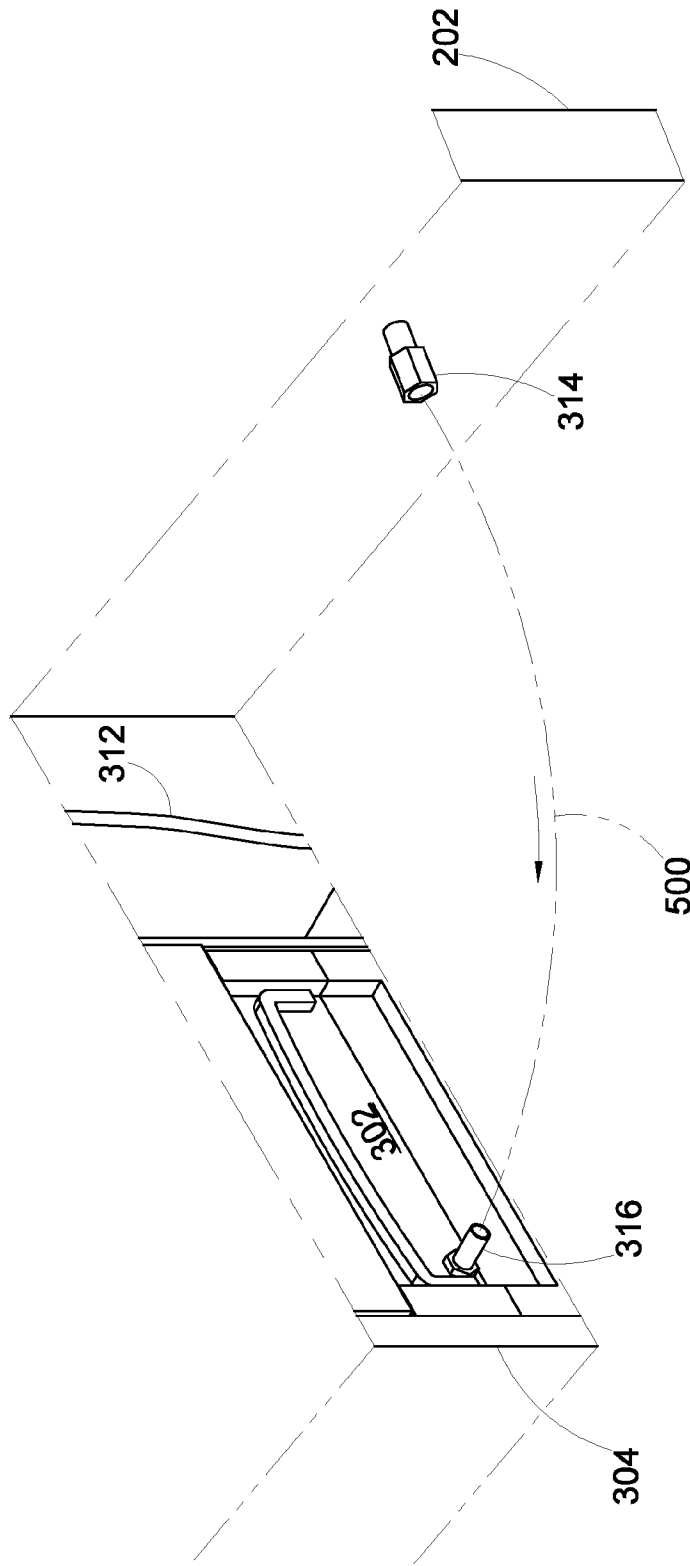


FIG. 5

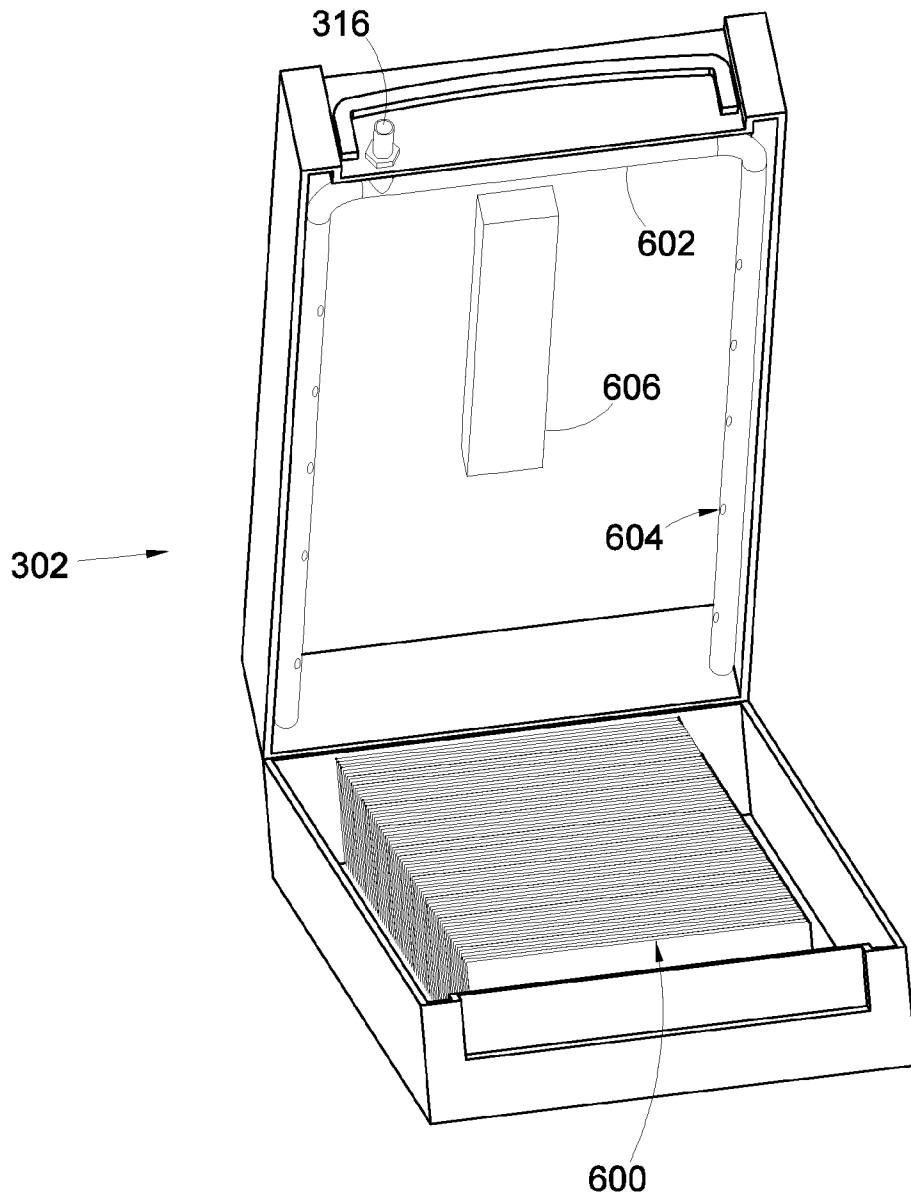


FIG. 6

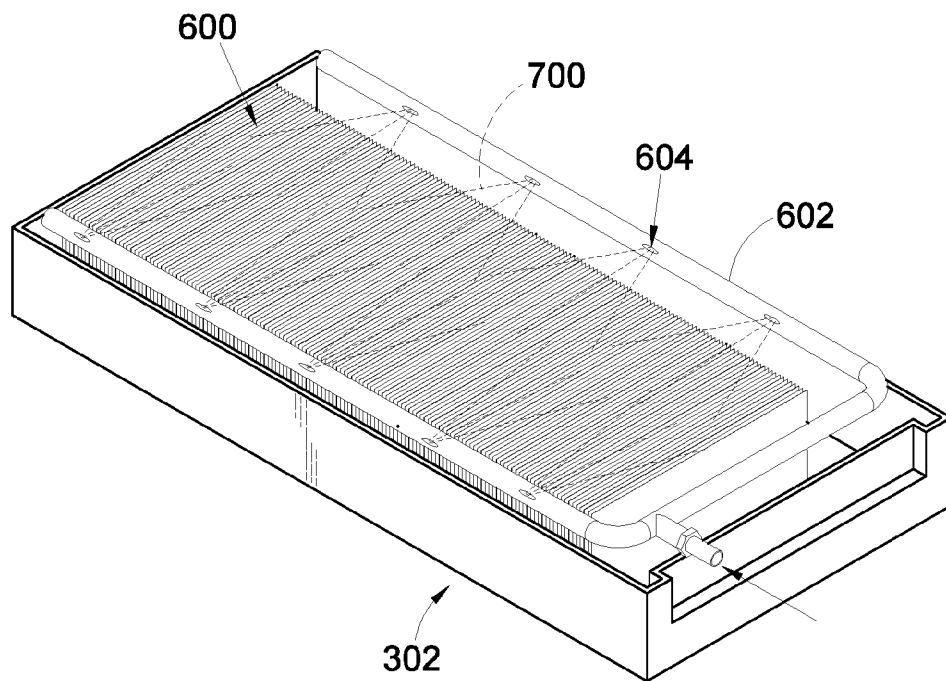


FIG. 7

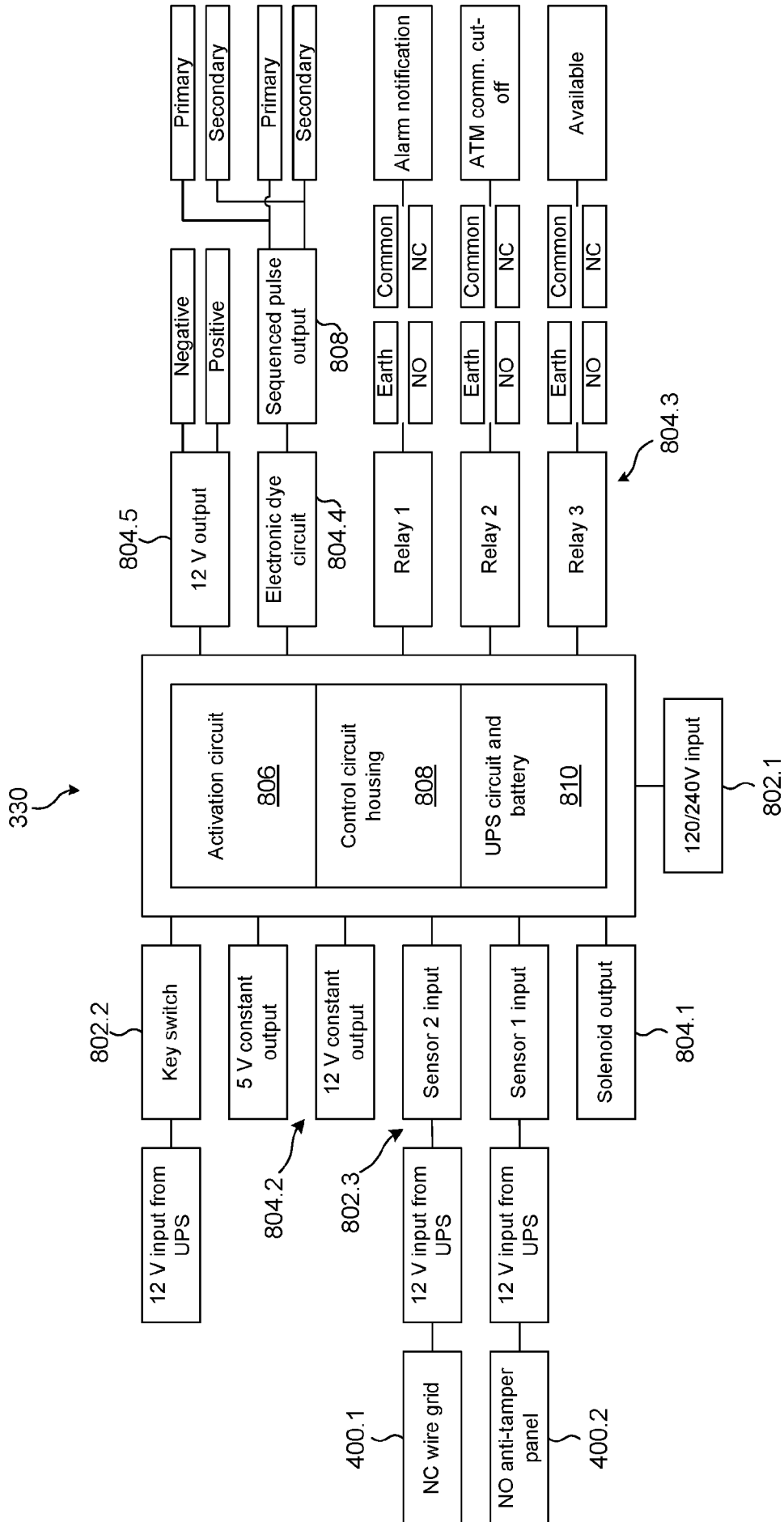


FIG. 8

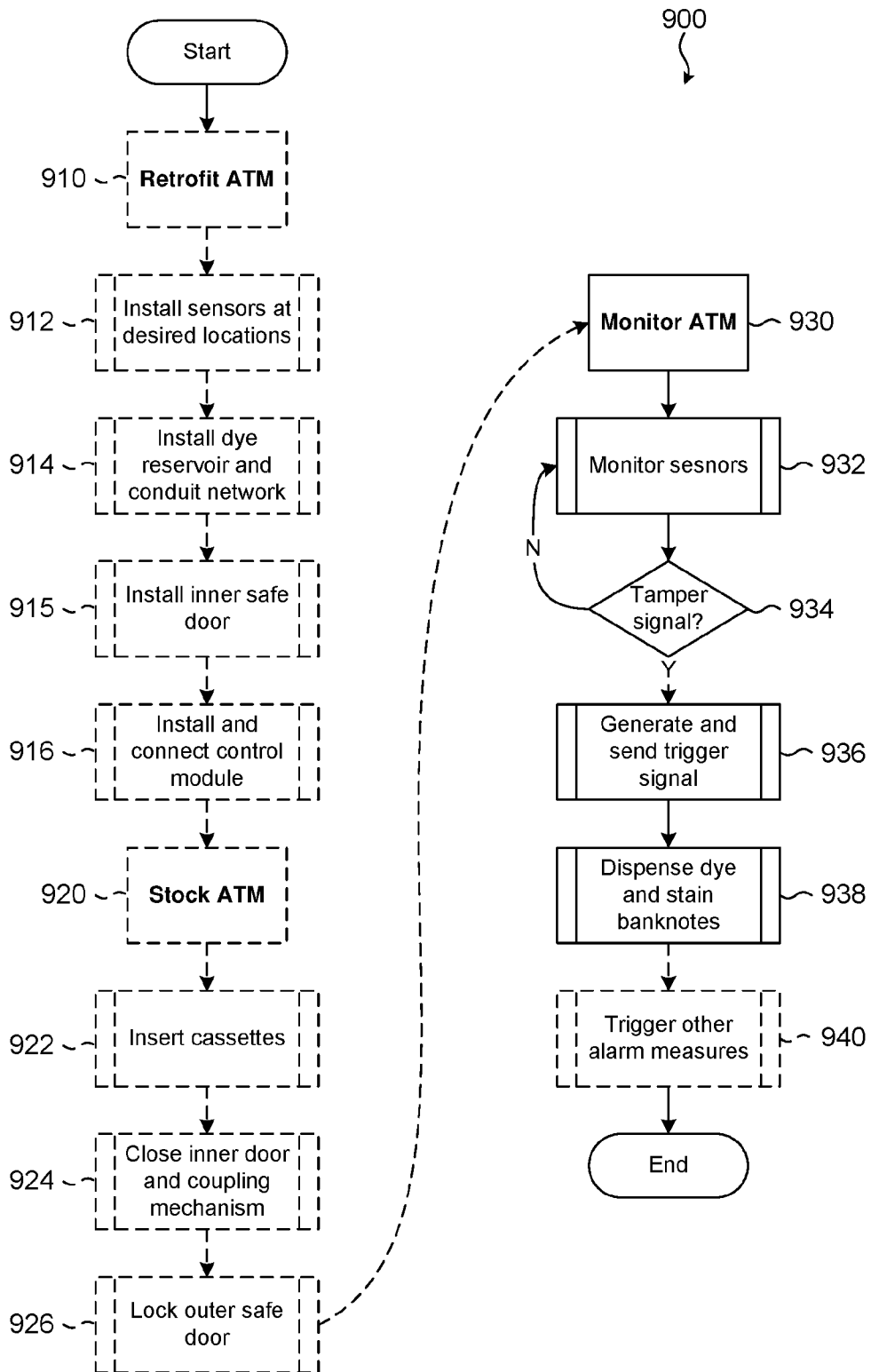


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/057641

A. CLASSIFICATION OF SUBJECT MATTER
INV. G07D11/00 E05G1/14
ADD.
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)
G07D E05G
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		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	WO 93/02435 A1 (TRANSALARM LTD [GB]) 4 February 1993 (1993-02-04) page 6, line 3 - page 9, line 18 page 16, lines 6-16 page 17, line 7 - page 20, line 8 figures 3-7	1-10, 22-24 11-21
A	----- JP 2008 007944 A (YAMATO PROTEC CORP) 17 January 2008 (2008-01-17) paragraphs [0002], [0003] paragraph [0012] - paragraph [0021] figures 1-3,5	1-24
A	----- US 5 787 819 A (FUMANELLI GIUSEPPE EZIO [IT]) 4 August 1998 (1998-08-04) column 2, line 34 - column 3 figures 1-3 ----- -/--	1-24

Further documents are listed in the continuation of Box C.

See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search 10 February 2017	Date of mailing of the international search report 06/03/2017
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Espuela, Vicente

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2016/057641

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	EP 0 473 471 A1 (FICHET BAUCHE [FR]) 4 March 1992 (1992-03-04) column 2, line 13 - column 3, line 8 column 3, line 53 - column 4, line 18 column 5, lines 35-52 figures 1-3,14,15 -----	1,8-10, 14, 18-20, 22-24

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Information on patent family members

International application No PCT/IB2016/057641

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