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(54) A security system.

(57) A security system for protecting the contents of a security container such as a safe or strong box (11) from attack comprises detector means (33, 48, 121) for detecting any attempt to move the container (11) or to enter it other than by authorised means, and the apparatus includes trigger means (118) fired in response to signals generated by the sensors (33, 48, 121) when such signals are identified by trigger control circuits (51, 52, 107, 130) as constituting an alarm event. Firing of the trigger (118) causes release of dye, smoke or other contaminants whereby to render the contents of the safe or strong box valueless and to mark the perpetrators of the crime for ease of subsequent identification.

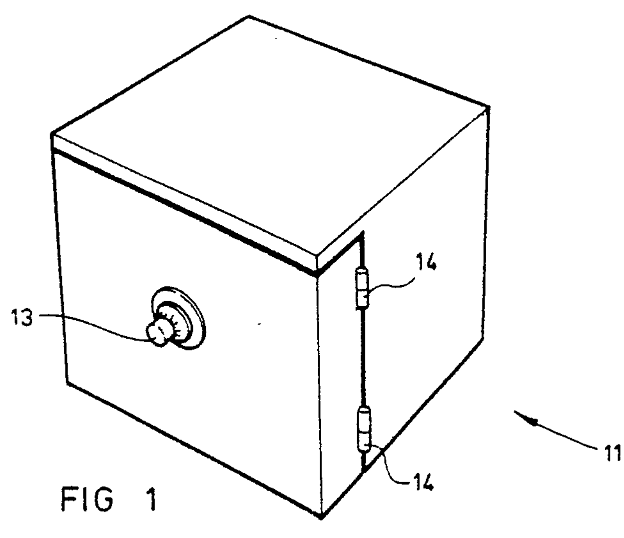


FIG 1

EP 0 347 091 A2

A SECURITY SYSTEM

The present invention relates generally to a security system, and particularly, although not exclusively, to a security system for use in providing additional security for a strong box, safe or other container housing items requiring protection from theft.

Valuable items which are highly susceptible to theft are usually maintained in a secure environment in the form of a strong box or safe which may itself be held within a vault or other secure room within a building. Security systems for preventing access to the premises and for discouraging potential thieves are well known, but because the detectors and circuitry protecting an environment are accessible to unauthorised personnel they are therefore subject to corruption and or disablement by intending intruders if they have appropriate knowledge of the nature of the circuits involved. For this reason increasing sophistication is used in the surveillance of premises.

Even so, it is frequently found that the surveillance system has been confounded and access has been gained to what was considered to be a secure environment. Once the security system has been penetrated intending thieves may attack a strong box or safe in one of a number of ways.

It has been known, for example, for the whole safe to be lifted and carried away from the secure environment to be subjected to the attempts at opening it, which may include explosives. Attempts to open a safe or strong box within the secure environment usually stops short of the use of explosives, but may involve, for example, attempts to cut through the metal of the safe using oxyacetylene burners or other high temperature cutting equipment, or by drilling or grinding the heavy metal casing. Massive steel wedges are sometimes used in an attempt to prise the door away from its hinges. All of these attempts involve the generation of some form of detectable signal. For example oxyacetylene cutters cause the temperature within the safe or strong box to rise quite considerably whereas the use of a drill or grinding equipment can cause a characteristic vibration of the casing. Hammer blows either directly applied to the safe or applied to wedges likewise give rise to a characteristic pattern of vibrations all of which may be detected from within the secure environment to give rise to an alarm signal. However, because as mentioned above external security systems may be confounded by tampering due to their accessibility, such systems cannot offer total security even for a strong box or safe: indeed, the only security system which could possibly offer complete security against tampering by intending thieves would need to be housed within the interior of the safe or strong box itself. However, since detection of attempts to open the safe or strong box in an unauthorised manner would have to be communicated to the exterior there would still remain the possibility of tampering to prevent the signal from being transmitted. The present invention seeks to provide, therefore, a self-contained security system which, although it is not able to prevent unauthorised attempts to gain access to a container (and by the term "container" will be understood any form of a strong box, safe or other receptacle within which valuable items may be placed for safekeeping) inhibits or discourages such attempts by acting to render any such attempts, other than via the authorised access opening, futile by corrupting the contents and/or contaminating the clothing and/or skin of those attempting the forced entry, thereby at the same time making the previously valuable contents valueless and making detection of the perpetrator of the crime much easier and more certain.

The system of the present invention is particularly useful for containers housing security documents such as bank notes, airline tickets and other negotiable bonds or documents, equity certificates and the like which are usually printed on paper which is absorbent, at least to a limited extent, and which therefore will absorb and retain a contaminating dye which may be sprayed or otherwise ejected onto them inside the container when an unauthorised attempt at entry is detected. Even non-permeable valuable items such as gem stones or jewellery may be contaminated, even if not rendered entirely valueless, by the use of sophisticated liquid, vapour or gaseous dyes, particularly if these are partly encapsulated in pressurised and/or rupturable capsules which may break open after the initial ejection and whilst the jewellery is being handled, thereby contaminating the handlers who would be assumed to be the criminals involved in the unauthorised opening of the container. Further, detection of the unauthorised attempts at opening the container may also be used to trigger the emission of a foul smelling or noxious gas likely to pervade the skin and clothing of the criminals and, again, make detection easier. Thus, although the protection system of the present invention does not seek physically to prevent criminals from attempting to open a secure container, the action from within the interior of the container can render such attempts so hazardous and unlikely to succeed as to inhibit and discourage future attempts whilst at the same time protecting the contents of the container in such a way as to make insurance thereof a more economical proposition. Contaminated bank notes, for example, although they cannot be used directly, are much less costly to replace than the face value of the notes themselves and consequently insurance expenses in restitution after a crime will be expected to be significantly reduced.

According to one aspect of the present invention, therefore, a container protection system for inhibiting unauthorised access to the interior of the container, comprises detector means for detecting any attempt to move or to open the container other than by the normal access opening, a trigger ciruit sensitive to the operation of the sensor means and operative in response thereto to cause release of a contaminant which corrupts the contents of the container rendering them valueless.

The use of a non-drying liquid dye in a penetrating excipient, together with the encapsulation referred to above, will drastically reduce the value of theft to such an extent that a notice placed on the outside of a secure container indicating the presence of a security system in accordance with the invention should be sufficient to deter criminals from what will be appreciated as a totally pointless exercise in attempting to break open a safe which will certainly contain nothing which the thieves may exchange for value because of its contamination.

The protection system of the present invention may also include a second trigger circuit sensitive to a light intensity threshold which, after preliminary triggering of the first-mentioned trigger circuit, will release a second contaminant spray after a predetermined delay. Thus, if the criminals persist in opening the container even after having realised that their attempts have been detected and the contamination device energised, then they will be at risk of themselves being contaminated by the dye and/or noxious gases which are ejected at a timed interval after the container has been opened. Any number of successive ejections of such staining fluid and/or contaminating gases may be made so that the criminals cannot avoid being stained simply by remaining out of the immediate vicinity of the opening until a first ejection has been seen to take place.

The present invention also comprehends a detector circuit suitable for use in a container protection system such as that outlined above, comprising at least one of a plurality of detectors comprising a temperature sensor operative to produce an output signal when the ambient temperature exceeds a predetermined threshold value, a motion sensor operative to produce successive discrete output pulse signals upon displacement of the sensor, means being provided to integrate the output signals to produce a triggering output once a certain threshold value has been exceeded, and an acoustic transducer having associated filter means for isolating those parts of the spectrum associated with one or more anticipated attacks on the container.

The detector circuit of the present invention may includeone or any combination of the abovementioned sensors, but preferably includes all of them so that any attempt at opening the container will be frustrated by contamination of the contents before the container can be opened.

The present invention also comprehends apparatus for contaminating the contents of a security container such as a safe or strong box when attempts to force the container open are detected, comprising means for releasing a contaminating agent into the interior of the container, a triggering circuit for activating the contaminating agent release means, and at least one detector device connected to the triggering circuit and operable to initiate triggering thereof when a monitored condition is detected, the said detector device being sensitive to at least one of the following conditions, namely a rise in temperature above a critical threshold value, physical displacement of the container from a stationary position, and acoustic vibrations within a range characteristic of repeated impacts or continuous cutting, grinding or drilling of the container casing.

Apparatus formed in accordance with the principles of the present invention may include discrimination means for determining selected frequency ranges from the acoustic signals generated by the acoustic vibration sensor.

Moreover, means may be provided to ensure that the events which normally occur during day to day use of a container, and which may contain elements of the signal to which the sensors are responsive, do not cause spurious triggering of the system. As far as physical displacement is concerned, this is unlikely to happen on a day to day basis since most safes or strong boxes are of such weight that they would not be dislodged by mere accidental impact. Nevertheless, in case a situation should arise where one or two accidental impacts may cause dislodgement of a safe (for example if heavy furniture is being moved in the vicinity and should strike against a safe carelessly) means are provided for integrating a plurality of movements sufficient to ensure that any displacement of the safe or strong box is deliberate and persistent, such as may be required to displace it from its position as far as the door of the room in which it is housed before triggering the release of the contaminating agent. This may be achieved, for example, by providing a motion sensor such as a mercury switch which repeatedly closes or opens contacts normally held open or closed when accelerations or tilting of the container are detected. Likewise, in order to ensure that the sound of any normal object striking hard against the case does not trigger release of the contaminating agent, the detector circuit may include integrating means which require a plurality of successive such blows in a regular sequence to occur, with means for gradually discharging the integrated signal during any period when no such signals are received. Of course, because only authorised access to the safe can result in the door being opened the sensor system must be disabled against all monitored conditions when the door is open, and this may be achieved by incorporating an optical sensor for detecting a level of light within the container above a predetermined minimum threshold (it being appreciated that when the safe is closed there will be absolutely no light whatsoever within it so that such optical sensors can be extremely sensitive) or by incorporating some means in association with the lock to disable the detector circuit when the lock is in an open configuration.

Embodiments of the present invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a safe with its door closed to indicate the likely attacks which may be made on it by criminals to effect unauthorised entry;

Figure 2 is a similar perspective view of the same safe with the door partly open illustrating the location of the security device of the present invention therein;

Figure 3 is a circuit diagram illustrating the detector and triggering parts of a circuit constituting a first embodiment of the present invention;

Figure 4 is a circuit diagram of a second embodiment of the present invention; and

Figure 5 is a schematic diagram illustrating the sensor mounting of the embodiment of Figure 4.

Referring first to Figures 1 and 2, a safe generally indicated 11 has a door 12 and a combination lock 13 centrally located on the door panel, which latter is attached to the casing 11 by robust hinges 14. Modern combination locks such as the lock 13 are sufficiently sophisticated and difficult to operate without preliminary knowledge of the code as to make traditional "lock picking" impracticable. Attempts to enter such a safe have, therefore, concentrated on forcing the hinges 14 by means of steel wedges, cutting the lock and/or the hinges using oxyacetylene high temperature cutting equipment or the so-called thermic lance, or by the use of modern electrical drilling or grinding tools such as angle grinders to cut off the hinges or part of the casing itself in order to gain access to the interior.

As will be described below the present invention frustrates all of these attempts without requiring any external electrical or other connections for the safe. In Figure 2 is shown a protection system casing 15 secured by adhesive to the under face of the top of the safe. The protection system casing 15 houses all the detectors required to detect the occurrence of any of the events described above, together with electrical power supply in the form of dry cell batteries and a warning circuit for producing an indication when the battery is running low so that it can be changed to maintain the detector system in an effective state.

When one of the detected events occurs the protection system acts to release a contaminating dye or noxious gas by any suitable technique and the following description of the detector circuit will not make specific reference to the manner in which the physical release of liquid or gas takes place, such systems being known in the art and therefore requiring no further description.

It is sufficient to state that from its position at a high level within the safe 11 the protection system 15 is capable of ejecting liquid and/or gaseous dyes or other noxious gases with sufficient force completely to contaminate any contents thereof, even if stacked tightly in bundles such as bundles of Bank notes so that any attempt to force open the safe will result in the whole of the contents being rendered entirely valueless and, furthermore, even dangerous to remove from the safe due to the potential contamination of the criminal which would make his detection much easier.

Turning now to Figure 3, the detection circuit illustrated broadly falls into four parts, namely a first part 16 (surrounding by the broken outline identified with the reference numeral 16) which detects a rise in temperature above a critical threshold value and triggers the load, identified with the reference numeral 17, which may be any electrical or electromechanical means for releasing the contaminant, for example a relay operating a mechanical switch to open a valve in a pressurised container. The second part of the circuit is that within the broken outline 18, which comprises means for detecting motion of the casing, the third part of the circuit, within the broken outline 19 comprises means for detecting acoustic signals indicative of drilling or grinding operations; and the fourth part of the circuit, represented within the broken outline 20 comprises means for disabling operation of the sensors when the door is open to allow normal use of the safe without risk of contamination.

The temperature sensing circuit 16 comprises a heat sensitive diode 21 connected, via a capacitor 22 between a positive source of supply and earth. Between the diode 21 and the capacitor 22 is connected a latching circuit comprising two inverters 23, 24 the output from the latter of which is fed via a variable resistor 25 and a fixed resistor 26 back to the input of the former. At low temperatures the reverse bias resistance of the diode 21 is high and, consequently, little or no current flows therethrough so that the input to the inverter 23 is held at substantially the same value as the positive supply voltage. If any attempt is made to cut into the safe 11 using high temperature cutting equipment such as oxyacetylene or a thermic lance, or even laser cutting equipment, the rise in temperature of the air within the safe 21 beyond normal ambient limits (say, for example, between 35 and 40° C) the reverse bias resistance of the diode 21 falls so that a small current can start to flow thereby lowering the voltage at the input of the inverter 23. The output of the inverter 23 thus goes high causing the output of the inverter 24 to go low at a threshold determined by the adjustment of the variable resistor 25. This situation remains latched by the feedback effected through the resistor 26 to the input of the inverter 23 so that, via the diode 25 and inverter 26 and associated resistors 27, 28 and diode 29 cause the biasing on the base of a transistor 30 to rise thereby triggering the transistor pair comprising the above-mentioned transistor 30 and a further transistor 31 the base of which is connected to the emitter of the transistor 30 and to earth via a resistor 32. The transistor 31 is thus switched into its conduction state allowing current to pass through the load 17 which, as mentioned above, may be any form of electrical current sensor resulting in release of the contaminating dye.

The motion sensitive part 18 of the circuit comprises a sensitive mercury switch 33 having two fixed contacts 34, 35 and a movable contact 36 the latter of which is connected via a resistor 37 and capacitor 38 to earth. The fixed terminal 34 is connected to the positive supply via a resistor 39 whilst the fixed contact 35 is connected to a latching detector circuit including a capacitor 40 connected across an earthed leakage resistor 41 and connected to the triggering part of the circuit as described above via a latching arrangement comprising an inverter 42, resistor 43, two series connected inverters 44, 45 and a feedback resistor 46.

The mercury switch 33 is positioned so that when the container within which it is housed is stationary in a normal orientation the movable contact 36 is physically positioned between but out of contact with the two fixed contacts 34, 35. Any attempt to move the safe, however, will result in the movable contact 36 being displaced from one side to the other by any slight vibrations above a threshold value determined as the normal range which the safe will experience in its environment. As the contact 36 moves into engagement with the fixed contact 34 a capacitor 38 will be charged via the resistor 39 and the resistor 37 from the positive supply and as the movable contact comes into engagement with the fixed contact 35 the capacitor 38 will share its charge with the capacitor 40. Repeated small movements causing displacement of the movable contact 36 successively from the fixed contact 34 to the fixed contact 35 will thus cause a gradually increasing charge to build up on the capacitor 40 until a triggering threshold is reached at the input of the inverter 42 the output of which thus produces a low output which latches the pair of inverters 44, 45 in the same way as the inverters 23, 24 were latched when the input to the inverter 23 goes low as the heat sensitive diode 21 detects a rise in temperature. The output from the inverter 45 is fed via a diode 47 to the point between the diode 25 and the inverter 26 so that the same load-triggering sequence takes place via the inverter 26 and the transistors 30 and 31. If, on the other hand, the displacement to the safe is only periodic and random any small charge built up on the capacitor 40 will leak away through the resistor 41 the value of which is chosen such that the charge on the capacitor 40 can only build up if the successive movements detected by the switch 33 occur sufficiently often to represent a deliberate attempt at movement.

The acoustic detection part 19 of the circuit comprises a microphone 48 which is connected via a resistor 49 and inverter 50 in parallel to two channels the first of which is generally identified with the reference numeral 51 and the second of which is generally indicated 52. A first channel 51 comprises a band pass filter comprising series and parallel connected resistors and capacitors linked by a coupling capacitor 54 to a threshold detector circuit comprising inverter 55 across which is connected a fixed resistor 56 and the output of which is connected via a variable resistor 57 to a pair of series connected inverters 58, 59 and feedback resistor 60. The output of the threshold detector circuit is connected via a coupling capacitor 62 to a pulse shaping circuit 63 comprising rectifying diodes 64, 65, earthed capacitor and resistor 66, 67, resistor 68 and a pair of latching inverters 69, 70 with a feedback resistor 71. The output from the latch circuit is fed to a transistor triggered pump circuit generally indicated 72 comprising capacitor 73, transistor 74, diode 75 and capacitor 76, together with a leakage resistor 77.

In operation the microphone 48 detects all acoustic vibrations within the safe and these are filtered by the band pass filter 53 in the first channel 51 to isolate the frequency range characteristic of individual shock blows such as would be caused by striking the safe casing with a hammer. The sound pressure level must exceed the threshold determined by the threshold circuit 61 otherwise the channel 51 is unresponsive. Thus, small shocks and knocks which might occur during the course of the working day will not cause any response from the circuit. Any louder signal such as would be caused by a large impact is detected by the threshold circuit 61 and the output signal from this is passed to the pulse shaping circuit 63 which produces a square wave rectified signal which, via the coupling capacitor 73 and the diode 75 applies a small charge to the capacitor 76. The base of the transistor 74 is also connected to the capacitor 76 so that the voltage charge remains on the capacitor 76 and is gradually leaked away through the resistor 77. The time constants of this circuit are quite long so that a second hammer blow occuring within a period of several minutes will likewise be detected, shaped and applied to the capacitor 76 to increase its charge. After a predetermined number of pulses have been received by the capacitor 76 the charge is sufficiently high to trigger a latch circuit 78 comprising a pair of inverters 79, 80 and feedback resistor 81 which, via a diode 82 and resistor 83 is connected to the base of the transistor 30 of the triggering circuit thereby causing this to operate to trigger the load 17 as in the previously described conditions.

The second channel 52 connected to the microphone 48 comprises a second band pass filter 84 which is tuned to the part of the spectrum characteristic of the sound of cutting tools. The output from the band pass filter 84 is coupled by a coupling capacitor 85 to an amplifier/rectifier circuit comprising an inverter 86 with feedback resistor 87, the output of which is coupled via a capacitor 88 to pulse shaping diodes 89, 90, smoothing capacitor 91 and level adjusting resistor 92.

A level detector in the form of an inverter 93 is connected via a clamp diode 94 to a timer circuit comprising timing capacitor 95, resistor 96, diode 97, inverter 98 and resistor 99. The output from the timer is fed via a latch comprising two inverters 100, 101 and feedback resistor 102, a diode 103 and resistor 104 to the base of the transistor 30 in common with the output from the first channel 51.

Continuous sound detected by the microphone 48 and filtered by the band pass filter 84 is amplified and rectified by the amplifier/rectifier circuit described above to produce a square wave signal which, if it is of sufficient amplitude, is fed via the level detector inverter 93 and the clamp diode 94 to the timing circuit. The inverter 98 of the timing circuit normally experiences a high input via the capacitor 95 and resistor 96 so that the input to the first inverter 100 of the latching circuit is low. A train of pulses arriving from the clamp diode 94 gradually balance the charge on the capacitor 95 causing the voltage at the input of the invertor 98 to rise. If the sound is stopped before the inverter threshold is reached the voltage leaks away through the resistor 96. If the sound continues for a period of several seconds, however, the threshold will eventually be reached causing the inverter 98 to produce a high output signal which is latched via the latch comprising the inverters 100, 101 and the latched output signal is applied to the base of the transistor 30 to cause triggering of the load 17.

In order to prevent operation of any of the detectors when the door is open the disabling circuit 20 comprises a light sensitive diode 105 the anode of which is connected to the positive supply and the cathode of which is earthed via a diode 106 and capacitor 107 the other terminal of which is connected, via an inverter 108 and resistor 109 to a latching circuit comprising two series connected inverters 110, 111 and feedback resistor 112. The output of the latching circuit, taken from the inverter 111 is fed, via respective diodes 113, 114 and 115 to the base of the transistor 30, to the base of the pump triggered circuit 74 and to the input of the level detecting inverter 93 in the second channel 52 as well as, via a diode 116 to the input of the inverter 42. When light falls on the diode 105 its reverse bias voltage falls causing the inverter 108 to produce a low output which is latched by the latching inverters 110, 111 so that a clamped low voltage is applied to the base of the transistor 30, preventing this from being triggered, to the base of the transistor 74 likewise preventing this from becoming conductive, to the input of the inverter 93 preventing this from going high and to the input of the inverter 42 likewise preventing this from going high and thereby disabling all of the detectors. During normal use, therefore, when the door is opened and closed the circuits do not operate and only when in total darkness, and after a given period determined by the time constant of the capacitor 107 does the circuit again become sensitive.

The positive supply to the circuit may be a dry cell battery offering the possibility of making the system entirely self-contained, and the insert to Figure 3 illustrates a battery condition indicator circuit comprising a Zener diode 117, light emitting diode 118, two inverters 119, 120, capacitor 121, diode 122 and resistor 123. This circuit indicates the battery condition when the battery is disconnected for a short time and then reconnected. Periodic tests must therefore be made to ensure that the circuit is still offering the required protection.

In the circuit shown in Figure 4 a single microphone 48 serves as the sensor for detecting both small movements such as when a safe or strong box is moved (replacing the mercury switch detector 33 of Figure 3) as well as the higher frequency acoustic noises generated by attempts to cut into or force open the safe or container. In this embodiment the acoustic transducer 48 is a piezo-electric crystal microphone connected to a first channel generally indicated 105 comprising a very low pass filter 107 (having a cut off of the order of 1 to 2 Hertz) the signal from which is fed via a second low pass filter 109 to a pump and amplifier circuit 110. The two low pass filters are based on operational amplifiers 106, 108 whilst the amplifier 110 is based on transistor 116 the output from which charges a capacitor 111 at the input to a Schmidt trigger 112. The mechanical arrangement of the piezo-electric microphone 48 will be described in more detail in relation to Figure 5. In operation, when an attempt is made to move the strong box or container to which the apparatus of the invention is connected the microphone 48 acts as an accelerometer and low frequency signals generated thereby, passed by the filters 107, 109 are amplified by the transistor 116 and successive pulses charge the capacitor 111 which, if the movements are repeated a sufficient number of times (sufficient, that is, to indicate a persistent and deliberate attempt to move the container) the Schmidt trigger 112 fires. The output of the Schmidt trigger 112 is connected, via a diode 113 to a potential divider consisting of a biasing resistor 117 and a thermistor 121. The junction between these two is connected, via a trigger 118 to a transistor 119 which is connected to the load 120. In this case the load is the firing mechanism for a smoke and dye cannister. Firing of the Schmidt trigger 112 causes a fall in the voltage at the junction between the resistor 117 and the thermistor 121 firing the trigger 118 and causing the transistor 119 to conduct thereby setting off the dye and smoke cannister 120.

The microphone 48 is also connected to two further channels which function in a manner similar to the channels 51, 52 of the embodiment of Figure 3, but are simplified with respect thereto. In this embodiment the second channel, generally indicated 126 comprises a series of high pass filters, a diode network 125 leading to a Schmidt trigger 124 firing of which is controlled via a trigger control circuit constituted by a capacitor 122 and resistor 123 which has a reverse bias diode connected across it. Sustained, continuous noise will result in a transducer signal which, filtered by the high pass filters in the high frequency channel 126 will result in gradual charging of the capacitor 122 via the resistor 123. Any break in the noise will result in rapid discharge of the capacitor 122 via the diode across the resistor 123 so that short shocks or other small bursts of high frequency noise such as might occur during everyday activities will not fire the trigger 124. Once the trigger firing voltage has been accumulated by the capacitor 122, however, the trigger 124 fires to cause the same effect, via the diode 114 as firing of the trigger 112.

The third channel detects pulsed noise from the microphone 48 through a gain control circuit 128 and inverter 129. In this channel a capacitor 140 is connected in a trigger control circuit 130, including two diodes 141, 142 connected so as to allow slow discharge of the capacitor 140 and rapid charging thereof. The capacitor 140 is thus charged by signals from the microphone 48, providing they exceed the thresholds set by the gain control circuit 128, and the capacitor charge leaks away only very slowly, for example in a period of 30-35 seconds. Several successive blows will result in charging of the capacitor 140, therefore, which, via an inverter 131 fires a Schmidt trigger 132 acting via a diode 115 on the junction between the resistor 117 and thermistor 121 as the other two channels. The thermistor 121 itself acts to detect any temperature rise, such as would be caused by an attempted entry into the container using heat cutting equipment and the change in resistance of the thermistor causes an appropriate fall in the voltage at the input to the trigger 118 to fire the load.

As in the embodiment of Figure 3 a light sensor 135 is provided so that the detector will not operate when the door is open, and this acts on the power supply to the input side of the circuit (+3V normally) thereby disabling the three channels, but leaving the thermistor activated so that light generated by sparks from an attempt to cut into the safe using heat cutting equipment will not deactivate this sensor before the temperature rise causes firing of the smoke cannister 120.

Also illustrated in Figure 4 is a power supply constituted by a field effect transistor 133 and a battery-condition indicator circuit similar to that illustrated in the insert to Figure 3, comprising a trigger 136, transistor 137, diode 138 and light emitting diode 139. The circuit of Figure 4 thus acts to detect the same conditions as the circuit of Figure 3, but, as will be appreciated, is a simpler embodiment and requires only a single piezo-electric transducer in place of the two sensors.

Figure 5 illustrates how the piezo-electric transducer is mounted to act as an accelerometer. The casing 15 of the apparatus is, as illustrated in Figures 1 and 2, fitted to the interior of a safe 11, such as by adhesive, and is shown in Figure 5 as being mounted on foam pads 142. The casing 15 has an opening 144 through which projects a further foam pad 143. The piezo-electric element 48 is mounted spanning the opening 144 and in contact with the foam pad 143, and is biased by a mechanical weight 146 suspended therefrom by a connection 145. Any attempt to move the safe 11 thus causes the piezo-electric transducer 48 to flex, this motion being amplified by the movements of the mass 146 which acts as an inertia element.

Claims

1. Apparatus for protecting the contents of a security container such as a safe or strong box from attack, comprising detector means for detecting any attempt to move the container or to enter it other than by authorised means, operable in response to such an attempt to trigger means for contaminating the contents of the container whereby to render them valueless.

2. Apparatus as claimed in Claim 1, in which the detector means includes a single motion and forced entry sensor device for detecting any movement of the container and any attempt to open it by mechanical means.

3. Apparatus as claimed in Claim 1 or Claim 2, in which there is provided a further sensor for detecting a rise in temperature within the container beyond a predetermined threshold.

4. Apparatus as claimed in any of Claims 1 to 3, in which there are further provided light sensitive means for detecting when the container is open, operable to disable the motion and forced entry sensor or sensors when the ambient illumination thereof exceeds a predetermined threshold.

5. Apparatus as claimed in Claim 4 when dependent on Claim 3, in which the said illumination detector is isolated from the temperature detector.

6. Apparatus as claimed in any preceding Claim, in which the said single motion and forced entry sensor device is an acoustic transducer connected to a first detector channel having a high pass filter and a first trigger circuit having trigger control means acting to delay attainment of the triggering threshold thereof until the transducer output signal has been produced continuously for a predetermined time.

7. Apparatus as claimed in Claim 6, in which the acoustic transducer has a movable element relatively movable with respect to a casing thereof directly connectable to the container, and the apparatus includes a second detector channel including a low pass filter, a trigger circuit and means for accumulating signals from the low pass filter to fire the trigger when a firing threshold value of the trigger circuit is reached.

8. Apparatus as claimed in Claim 6 or Claim 7, in which the acoustic transducer is further connected to a third detector channel having a third trigger circuit and trigger control means therefor including capacitive elements connected in a circuit causing the capacitive element to be charged by the acoustic transducer signal more rapidly than it discharges when no acoustic transducer signal is present whereby to acquire a charge up to the trigger firing threshold when the acoustic transducer is activated to produce a plurality of sequential signals such as by a sequence of blows.

9. Apparatus as claimed in any of Claims 1 to 8, in which the said means for contaminating the container contents comprises means for releasing into the container a non-drying ink dye in a penetrating excipient when any of the trigger circuits is fired.

10. Apparatus as claimed in any preceding Claim, in which the sensor element of the detector is a piezo-electric transducer mounted on a casing secured to the interior of the container and mechanically connected through an opening in the casing to the interior of the container whereby to detect relative movement between the casing and the container.

11. Apparatus as claimed in Claim 10, in which static biasing of the piezo-electric element is effected by mechanical biasing means whereby to cause initial static stressing of the piezo-electric element such that relative movement in any direction causes generation of a transducer signal.

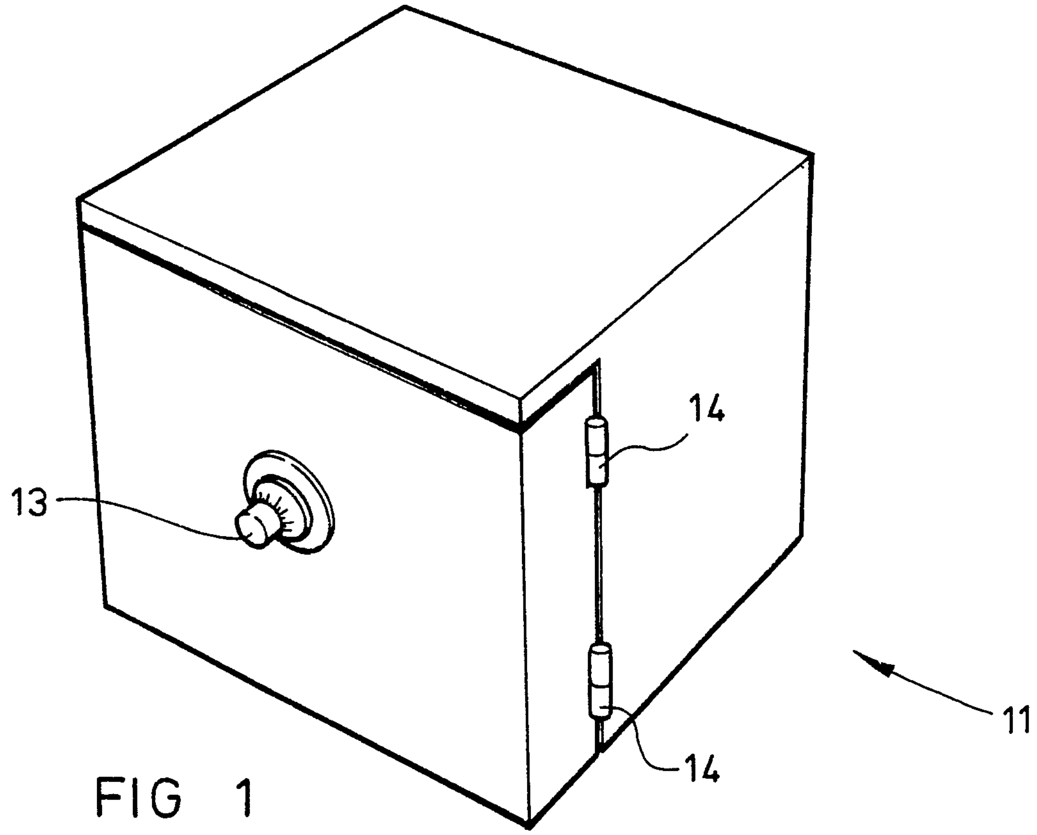


FIG 1

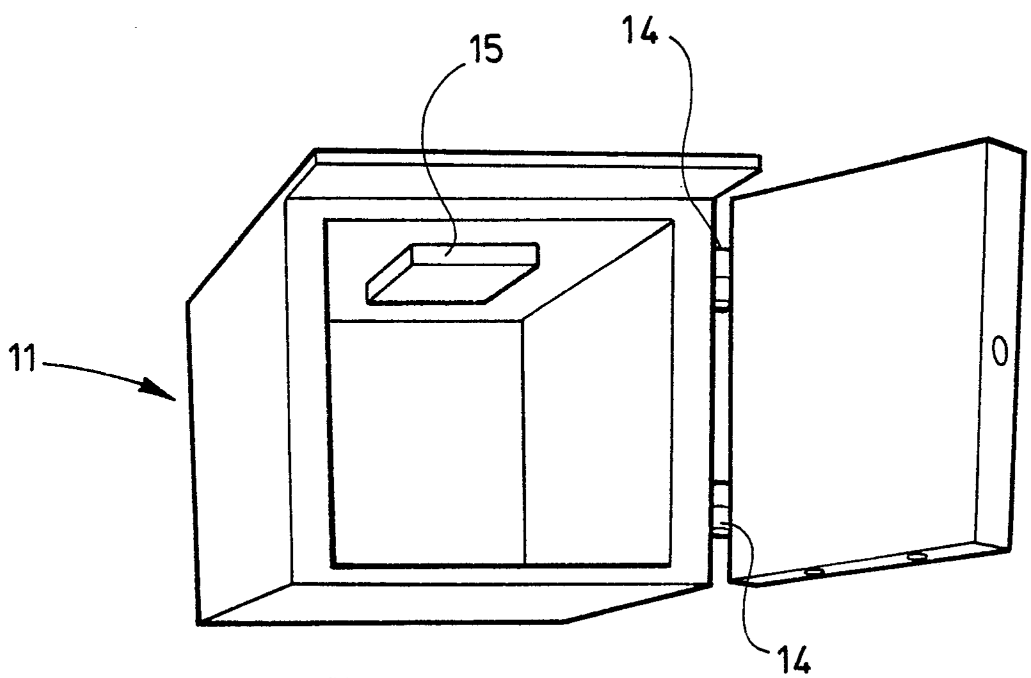


FIG 2

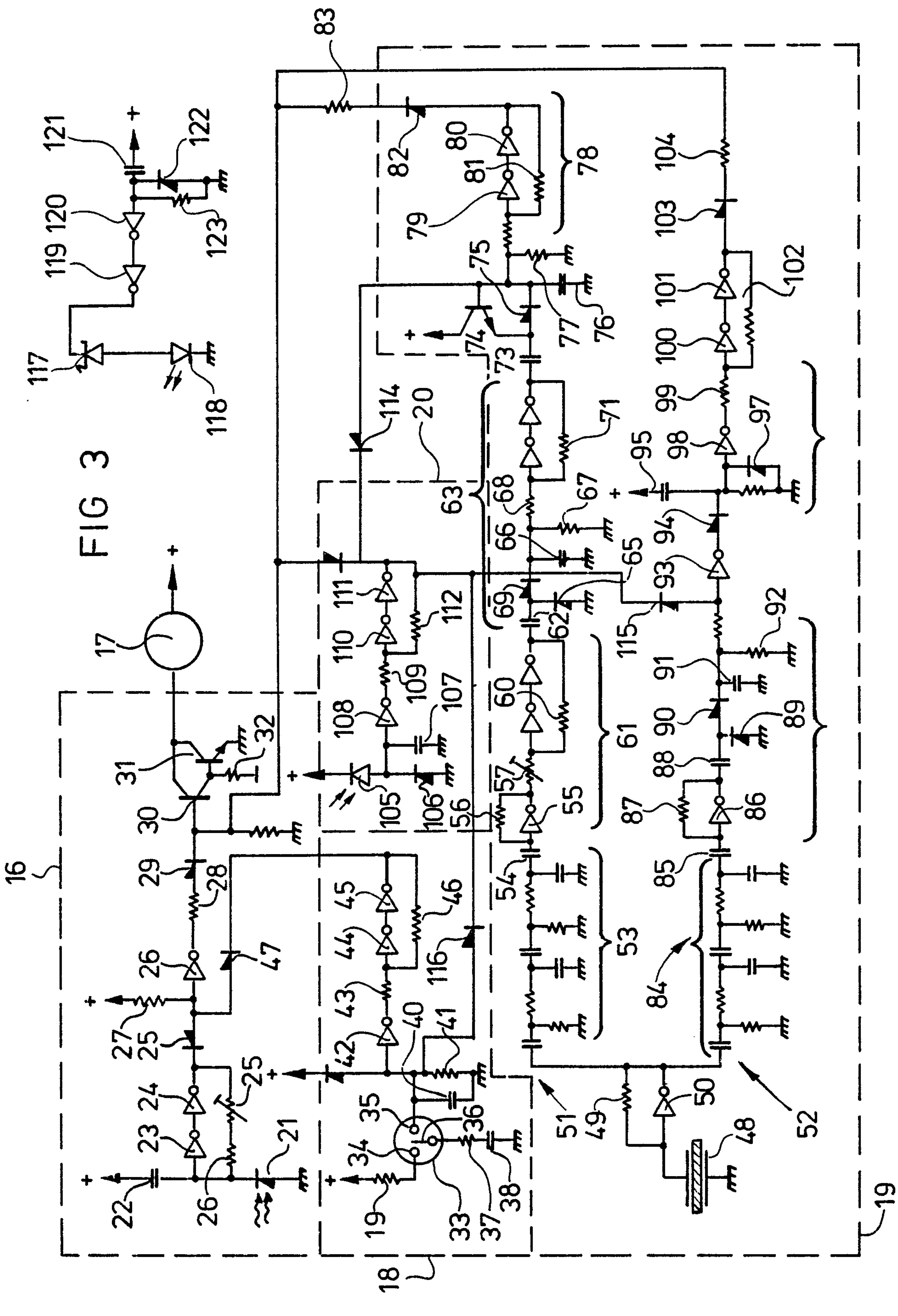
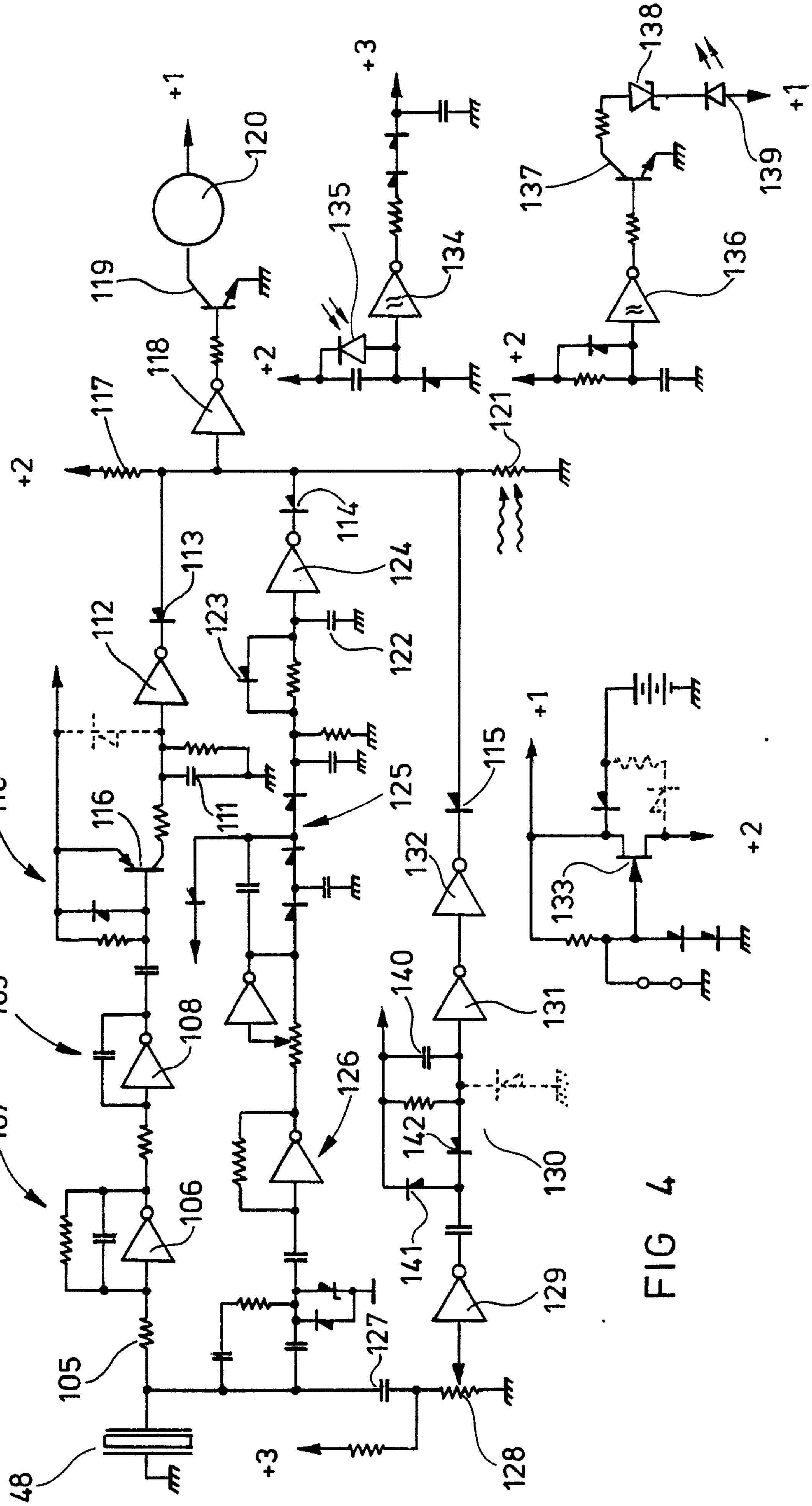


FIG 3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133
134
135
136
137
138
139
+1
+2
+3

FIG 4

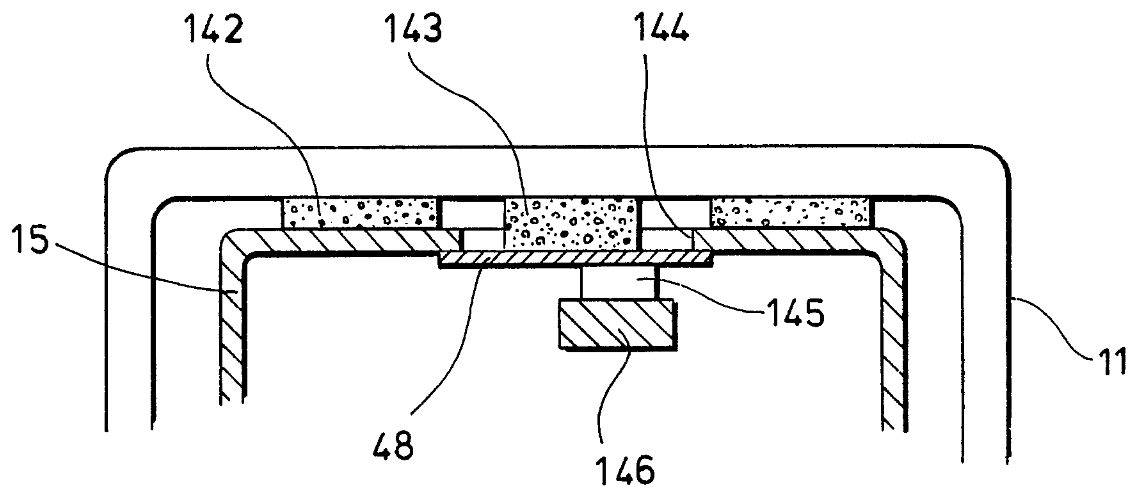

FIG 5