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(54) **Security alarm systems.**

(57) An alarm system uses piezo electric crystals (2) which when vibrated produce an electrical signal that can be amplified and used to generate an alarm or perform some other action. Each crystal and amplifier (3) are in a sensor unit (1) with a latch circuit (7) and indicator (9). Vibrations latch the indicator on, and the signal is also passed to a central control unit (15). This responds with an alarm or other action, relay (25) controlled, and an energised indicator (24). The control unit also has a re-set facility (20) and an indicator (22) for showing that the system is active. If the cable connection between any sensor unit and the control unit is cut, the effect at the control unit is that of a disturbed sensor unit.

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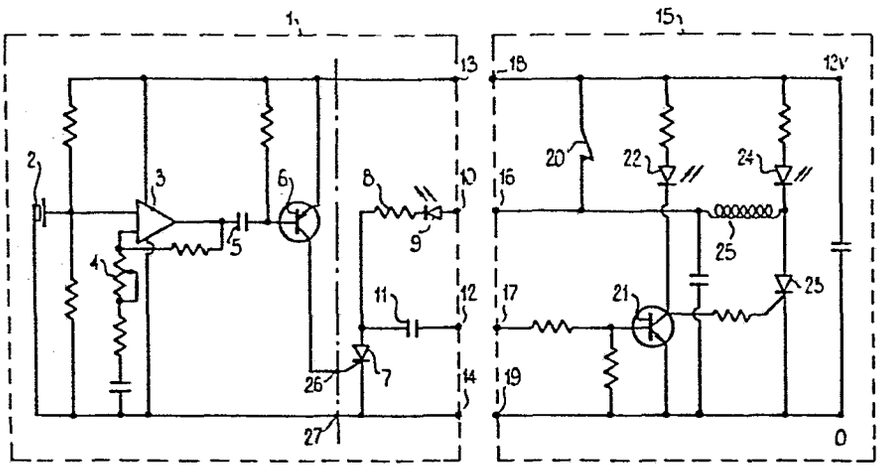
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# Security Alarm Systems

This invention relates to security alarm systems. It is particularly concerned with perimeter protection which is a system that gives a warning or initiates some preventive or retaliatory action when any disturbance of the perimeter of the zone to be protected occurs. For example, external windows and doors of a building may be fitted with sensors which, when primed, respond to any shaking, vibration or other interference and send a signal to a central alarm.

The sensor in most general use for this type of system is an inertia sensor. This usually takes the form of a metallic body resting in almost unstable equilibrium on electrical contacts. Any small disturbance lifts it

clear of at least one contact, thus breaking a circuit. It is virtually impossible to adjust their sensitivity, and they are very prone to giving false alarms as a result of quite harmless sources, such as heavy lorries and aircraft. Also, the metallic body is subject to surface pitting, and this can produce an imperfect contact and a false alarm.

It is also common practice to wire such sensors in series, and there is then no means of telling which alarm has set the system off. If it is a fault in the sensor, it can be extremely laborious and difficult to trace.

The sensitivity of the whole circuit can be adjusted, but not each sensor individually. The adjustment requires an analyser, which is an expensive piece of equipment, and the sensitivity has to be set to an average. It is desirable to have each sensor with its own individual response to suit its position.

It is also desirable to have some means for recording or indicating which sensor is being or has been actuated. This is useful not only to find out where a break-in was attempted, but also to show if any particular sensor is faulty and too sensitive.

It is the aim of this invention to provide an alarm system which answers some of these problems.

According to the present invention there is provided a security alarm system comprising a piezo-

electric crystal responsive to stress to produce an electrical signal, amplifying means for such a signal, and means responsive to the amplified signal to give an indication and/or perform a physical action when the crystal is vibrated.

The combination of a crystal and amplifying circuit makes it very easy to provide sensitivity adjustment, which can be done by a simple potentiometer, for example, in the amplifying circuit. The crystal and its amplifier are small and easily housed in a compact container which can be inconspicuously installed at almost any point where illegal entry is possible.

Conveniently, the amplified signal is applied to a latch circuit which stays latched after the disturbance has ceased. This latch circuit can be used to govern at least one indicating light emitting diode (LED). The main response may be from a remote relay or other means for initiating an alarm or performing another security function. There can be a large number of such sensors all connected in parallel to a common control panel, which contains or governs the main alarm. If one of the sensors is actuated, its indicating light will go on to show where the trouble lies, while the main alarm is also tripped. The control panel may also have an indicating light latched on where any of the sensors is disturbed.

As well as having an alarm that will be tripped when any one of the sensors is disturbed, there may also be a response if the cable connection to any one of the sensors is

cut.

Part of the system can be used to check existing systems using inertia sensors, or any closed circuit device, as will be described in more detail later.

For a better understanding of the invention, one embodiment will now be described, by way of example, with reference to the accompanying drawings, in which the single figure is a circuit diagram of a sensor and a control panel.

The sensor is housed in an enclosure indicated diagrammatically by the broken line 1. It has a piezo-electric crystal 2, preferably a Sodium Potassium Tartrate crystal under stress. When disturbed, this produces a small voltage which is applied to an integrated amplifier circuit 3, whose sensitivity can be adjusted by a potentio-meter 4. The output of this circuit is applied through capacitor 5 to the base of PNP transistor 6, whose collector is coupled to the gate of a silicon controlled rectifier (SCR) 7. This SCR is in series with a resistor 8 and a light emitting diode (LED) 8, which connects with voltage supply terminal 10. A capacitor 11 couples the junction of SCR 7 and resistor 8 to output terminal 12. The sensor 1 has two further terminals 13 and 14 for the permanent positive and negative supply as indicated.

The control panel is housed in an enclosure indicated diagrammatically by the broken line 15. It has four terminals 16, 17, 18 and 19 which are connected by a

four core cable to each sensor 1 in the system, the cable running to the first sensor and thence to the next and so on. A permanent 12 volts, which may be from a battery, is supplied to the line with terminal 18 and thence to terminal(s) 13, while this voltage is also applied through normally closed reset switch 20 to terminal 16 and thence to terminal(s) 10. Terminals 14 and 19 are on the permanent negative line, while the sensor output from terminal 12 is fed to terminal 17 and thence to the base of normally conductive NPN transistor 21. In the collector circuit of this transistor there is an LED 22, which glows when the system is on. The collector of transistor 21 is also coupled to the gate of an SCR 23. The anode of this SCR is connected to the permanent positive via an LED 24 and to the switched positive via a relay 25 which closes contacts (not shown) when energised to operate an alarm or initiate some emergency action.

The circuit also includes various capacitors and resistors as shown which need not be described in detail.

If any one of the crystals 2 is disturbed above a threshold determined by the potentiometer 4, signals are transmitted by amplifier 3 to turn on transistor 6, and thus SCR 7. The flow of current through this energises LED 9, which glows to give an indication at the point of disturbance. It also causes a negative signal to be applied to the base of transistor 21, with a consequent decrease of collector current. Thus SCR 23 receives a positive gate signal.

This triggers conduction, energising both the LED 24 and the relay 25. The alarm will therefore be actuated, and a light will glow on the control panel to show that a sensor has been disturbed.

When the disturbance ceases, the sensor 1 continues to show a light through LED 9, since the SCR 7 acts as a latch. Thus the point of disturbance can be identified hours later. LED 24 also remains on. However, it is not always required for the alarm or other device actuated by relay 25 to stay actuated for longer than a few minutes, say. There may therefore be associated with that alarm or other device means for switching if off after a predetermined time delay.

The pressing of the reset switch 20 at the control panel removes the 12 volts from terminal(s) 10 and thus restores any conducting SCR 7 to its non-conductive state. It also de-energises relay 25 and SCR 23 reverts to its non-conductive state.

If there is disturbance of another sensor, after one has already set off the alarm, there will still be an indication at that other sensor on its LED.

If there is any circuit fault, for example if the cable between control panel and sensors is cut, the control panel responds in the same way to give an alarm. A check on the sensors will show that none of them has been disturbed, and that therefore the fault will lie elsewhere.

Part of the sensor 1 (to the right of the chain-dotted line) can be used for form the basis of a test circuit for an existing system, for example using old-type mechanical sensors. Test units incorporating that right hand part of the sensor 1 can be temporarily installed adjacent all the existing sensors and connected back to a control panel 15, exactly the same as that illustrated. Each old sensor is connected across the SCR gate and negative, at points 26 and 27. No alarm or malfunction means that the SCR is maintained non-conductive, but as soon as points 26 and 27 are open-circuited, the SCR gate goes positive, the SCR conducts and the LED 9 is latched on.

Conveniently, these test units have jack-plug connectors to make for rapid installation and dis-assembly.

WHAT WE CLAIM IS:

1. A security alarm system comprising a piezo electric crystal responsive to stress to produce an electrical signal, amplifying means for such a signal, and means responsive to the amplified signal to give an indication and/or perform a physical action when the crystal is vibrated.

2. A system as claimed in claim 1, wherein the amplified signal is applied to the responsive means via a latch circuit which stays latched after vibrations have ceased.

3. A system as claimed in claim 1 or 2, wherein the amplifier has associated sensitivity adjusting means whereby only vibrations of a selected magnitude and above can generate a signal to activate the responsive means.

4. A system as claimed in claim 1, 2 or 3, wherein the crystal and amplifying means are in a sensor unit remote from, and cable connected to, a control unit housing the responsive means.

5. A system as claimed in claims 2 and 4, wherein the sensor unit also contains the latch circuit and an indicator governed thereby to show if vibrations have occurred.

6. A system as claimed in claim 4 or 5, wherein the control unit has an indicator to show whether the system is active.

7. A system as claimed in claim 4, 5 or 6, wherein at least

part of the responsive means is an indicator on the control unit.

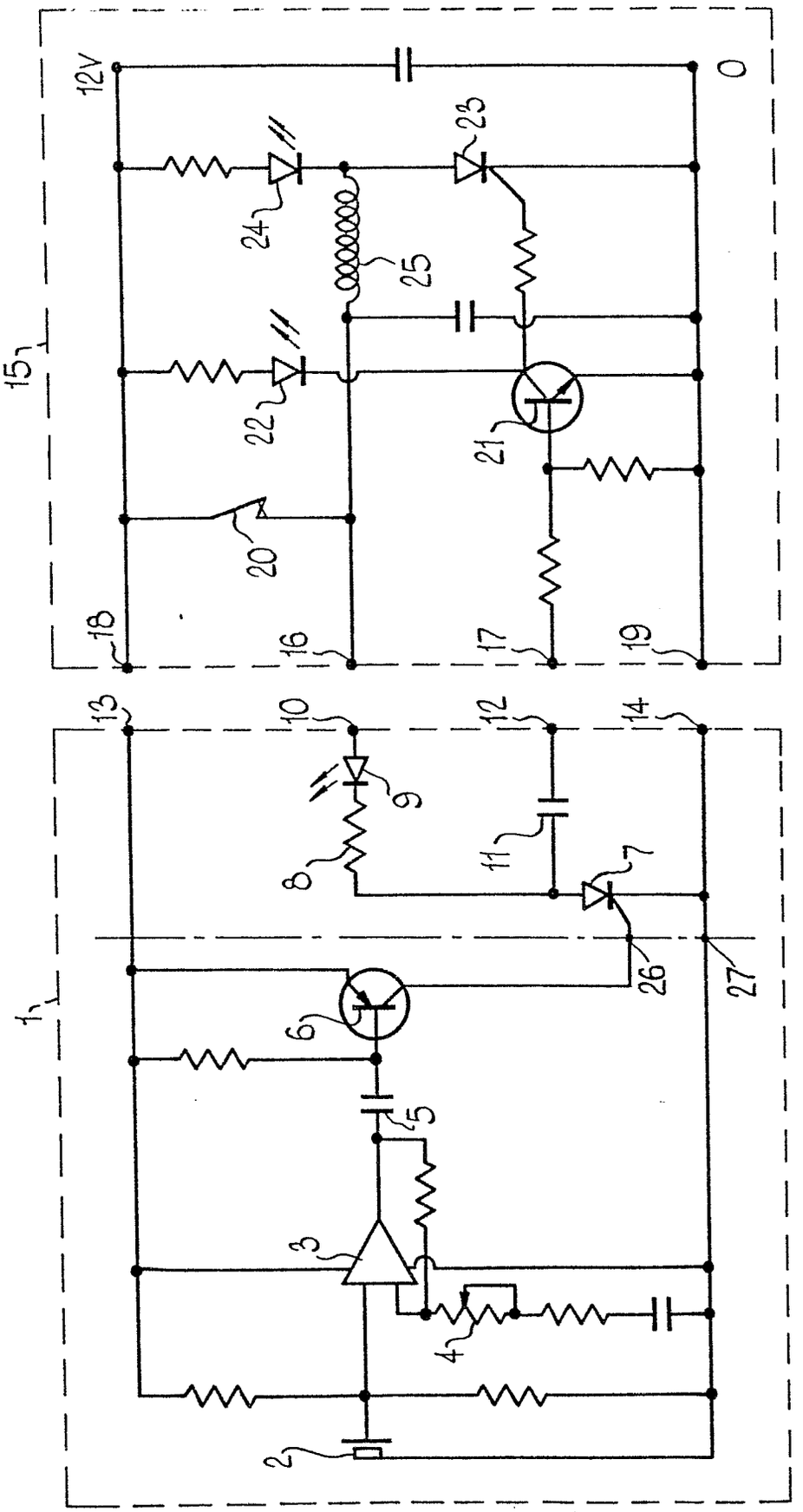
8. A system as claimed in claim 7, wherein means are provided for neutralising another part of the responsive means, after activation, without affecting the indicator part.

9. A system as claimed in any one of claims 4 to 8, wherein the control unit has reset means by which the system can be restored to its active, pre-vibrated state.

10. A system as claimed in any one of claims 4 to 9, wherein the control unit and the cable connection are such that if the latter is cut or otherwise removed while the system is active there is a response from said responsive means.

11. A system as claimed in any preceding claim, wherein there is a plurality of crystals and associated amplifying means connected in parallel to common said responsive means.

12. A security alarm system substantially as hereinbefore described with reference to the accompanying drawing.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European Patent Office

# EUROPEAN SEARCH REPORT

Application number
EP 79 30 2514

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | CLASSIFICATION OF THE APPLICATION (Int. Cl. 3) |
|---|---|---|---|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | |
| X | DE - A - 2 611 692 (WEKATRONIK SICHERUNGSSYSTEME G.m.b.H.)<br>* Page 4, lines 15-22; page 7, line 3, - page 8, line 28; page 9, lines 18-26 *<br>-- | 1,4,5, 7,11 | G 08 B 13/12<br>G 08 B 13/16 |
| X | FUNKSCHAU, vol. 49, no. 14, July 1977<br>München DE<br>G. WETZLER: "Glasscheibenbruchmelder für Einbruchsicherungsanlagen" pages 618-619<br>* Page 618, right-hand column, line 22 -page 619, right-hand column, line 24 *<br>-- | 1,2,4, 5,7,9, 10 | TECHNICAL FIELDS SEARCHED (Int.Cl. 3)<br>G 08 B 13/12<br>G 08 B 13/04<br>G 08 B 13/16 |
| X | US - A - 3 863 250 (McCLUSKEY)<br>* Title-page, abstract; column 1, line 19 - column 2, line 4 *<br>---- | 1-3 | |

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 18-02-1980 | ORNELIS |