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(54) Break sensor.

(57) Break sensor of electronic type composed of a circuit comprising the following six separate blocks, connected to one another: a detector circuit (A), an amplifier circuit (B), an analyzing circuit (C), an alarm signal timing circuit (D), an alarm signal circuit (E) and a power circuit (F).

The sensor functions like a reflection type photocoupler, which, positioned in front of a reflecting surface not linked to it, permits any movement of said surface to be detected.

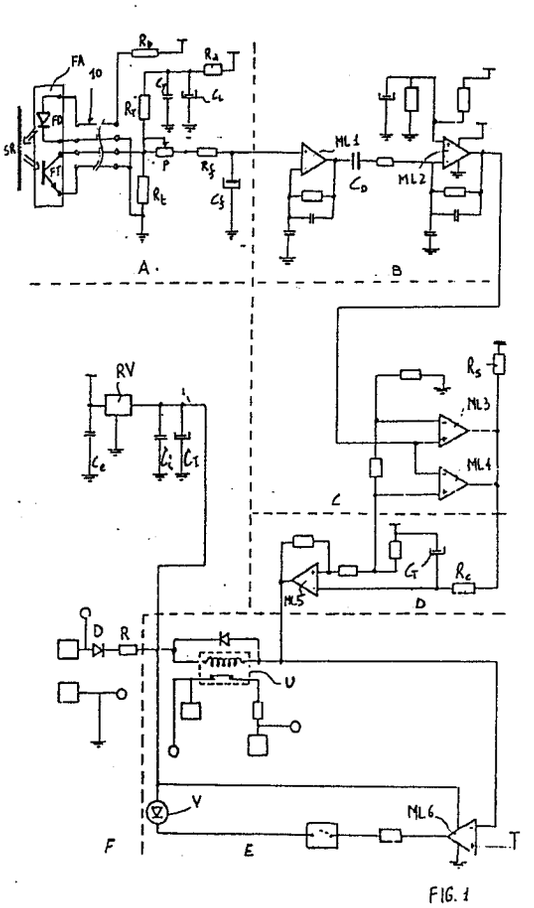

FIG. 1

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BREAK SENSOR

This invention refers to a break sensor.

More in particular, it refers to a break sensor that can be used to control a reflecting surface connected to a possible object to be broken open. The sensor detects the stress or movements to which the object and reflecting surface are submitted in the attempt to break them open.

There are many known types of electronic sensors and devices designed for alarm signal systems, e.g. for flats, villas, shops etc.

Many such devices, while guaranteeing efficient intervention, have the drawback of being rather sophisticated and therefore fairly expensive.

Other types of alarm devices are specially designed for local applications, e.g. doors, windows and similar, but they also present various problems, among them the fact that they are rather vunerable.

The object of this invention is to provide a break sensor that does not present the above problems.

According to this invention, a break sensor without said problems consists of six functional blocks suitably connected to one another, which make it possible to transduce the physical phenomenon under control in the switching of an electric contact. In this way, any known device designed to generate an alarm signal can suitably control this electric contact.

The break sensor of this invention consists of:
- a detector circuit (A),
- an amplifier circuit (B),
- an analyzing circuit (C),
- a timing circuit (D),
- a signal circuit (E) and
- a power circuit (F)

connected to one another to form a single circuit.

The detector circuit (A) comprises a photocoupler comprising a photodiode supplied by a resistor and a phototransistor supplied by a resistance divider with a filter formed by a resistor and capacity.

The amplifier circuit (B) comprises two operational amplifiers cascade-connected and de-coupled from a capacity. The analyzing circuit (C) comprises two comparators of the type with signalling, connected in windowed discriminator, which signal the positive or negative variations of the signal detected by the photocoupler.

The timing circuit comprises a condensor, resistors and a comparator.

Said circuit provides an intervention delay time of the signals and a stop delay time of same.

The signal circuit comprises a relay, generally connected, whose contact is in open position during signalling. Said relay may be fitted with a signal lamp.

The break sensor of this invention permits us to obtain the following results and advantages: the sensor is substantially based on a reflection type photo-coupling system, which, positioned in front of a reflecting surface, permits us to detect any movement of the sensor with respect to said surface; the processing of the signal obtained from the isolating object makes it possible to distinguish even minimum variations of any body; the entire sensor, formed by different circuits with well preestablished functions, is substantially simple from the functional and constructive point of view, efficient and substantially economical.

The constructive and operating characteristics of this break sensor can be better understood from the following detailed description in which reference is made to the electronic layout of the attached drawing.

With reference to said layout, the break sensor basically consists of six separate circuits, or blocks, each with a very precise function, each divided with dotted lines. Said circuits, or blocks, are: the detector circuit (A); the amplifier circuit (B); the analyzing circuit (C); the alarm signal timing circuit (D); the alarm signal circuit (E) and the power circuit (F).

Block A refers to the detector circuit. It is formed by the photo-coupler FA, which integrates a diode FD and a transistor FT with photo-electric characteristics.

The photo diode FD is supplied by the resistor Rd. The photo transistor FT receives the power filtered by the capacities Cv and C1 by means of the resistor Ra, through the resistive part RT and Rt with annexed the input filter composed of the variable resistor P, the resistor R1 and the capacity C1.

The capacities CV and CL have respectively the function of eliminating the slow and quick variations. The function of this block A is as follows:

1) Control condition: the photodiode FD constantly illuminates the reflecting surface SR, which, in turn, constantly illuminates the phototransistor FT.

2) Detection condition: if the reflecting surface SR moves, it will be variously illuminated by the photodiode FD and will variously illuminate, more rightly, the phototransistor FT with obvious electric consequences for the circuit of the following block

Block B refers to the amplifier circuit and consists of the operational amplifiers ML1 and ML2, connected in cascade and de-coupled from the

capacity CD, which produce, for high frequency band, a signal suitable for the following block.

The two amplifiers are cascade-connected with a gain at band centre of approximately 50 and a band type filtering preferably comprised between 1 H_z and 16 H_z, with a central frequency of approximately 10 H_z.

These frequency values have been chosen as their field comprises movements corresponding to possible breaks, removal, impact, etc.

Block C refers to the analyzing circuit and is composed of the comparators ML3 and ML4, connected in windowed discriminator, which produce, for positive and negative variations over a certain level of the abovementioned suitable signal, a signal effective for the following block.

Block D refers to the timing circuit and consists of the condensor G, the resistors Rc and RS and the comparator ML5 which produces, for short effective signals, a timed signal of at least one second for the following block.

Said resistance Rc, sensorized by the comparator ML5, gives:

a) indication of alarm signal, with minimum signal duration, detected from the output of comparators ML3 and ML4, preferably of at least 100 ms;

b) indication of alarm permanence, whose "reed" opening duration from the end of alarm detection is preferably at least one second.

Indication a), in substance, for a time of preferably about 100 ms, detects any movements without triggering the alarm signal; this prevents intervention of the system for instantaneous and involuntary movements produced by possible other accidental causes.

Indication b) serves to maintain the alarm state for a certain time (e.g. one second) following the disturbance detected. Block E refers to the alarm signal circuit and is formed by a U "reed" relay, generally connected, which opens its contact when the alarm signal arrives, and a red V "led", which can be cut out, which lights up when the alarm signal arrives. The U relay, connected to signal the alarm when its contact opens, is designed to intervene even when it is necessary to cut the connecting wires.

The U relay produces, stressed by the timed signal, the switching of the electric contact, which is displayed by the V LED, piloted by comparator ML6.

Block F has the function of correctly supplying all the circuits of the previous blocks with power; it protects from reverse polarities by means of the diode D and resistor R, supplying power directly to blocks C, D and E.

By means of the voltage regulator RV, for example of type 78 L O 5, and the capacities C_i, Ce and Ci, it supplies stabilized power to blocks A and B.

In the actual construction, the hreak sensor of this invention consists of a printed circuit plate, on which are placed all circuit parts described, apart from the photocoupler FA, which is connected to it by a special connecting cable (10). This permits this component to be placed near the devices to be protected, even if there is not much space.

The sensor of this invention operates like a reflection type photocoupler, which, positioned in front of a reflecting surface not mechanically linked to it, permits us to detect any even minimum movement (e.g. 0.5 mm) of the sensor with respect to said surface, providing this movement is continuous.

The processing of the signal obtained from the isolating object permits us to distinguish the position variations of any body, e.g. a door, window, gate, roller gate or similar, submitted to impact, force, attempts to open and break them open, pressure or other undesired actions.

As an example, if the break sensor is applied on a door or window, the photocoupler FA is preferably applied near the vertical bolts that slide longitudinally, controlled by the locks.

On said bolts are prepared the reflecting surfaces SR, on which the photodiode FD sends the infra-red rays emitted, and from which the phototransistor FT receives the infra-red rays on the rebound.

The remaining electronic system, or the other circuits, can be positioned in any other part of said doors or windows. When the bolts are regularly driven by the locks, their longitudinal movement does not cause the intervention of the alarm system, as it does not detect faulty transversal movements. However, when, for example, in an attempt to force them or break them open, the bolts are subject to unusual transversal movements, the phototransistor FT detects the movement variation by means of the emission of infra-red rays and causes the intervention of the alarm system.

Claims

1) Break sensor characterized by the fact of comprising a detector circuit (A), an amplifier circuit (B), an analyzing circuit (C), a timing circuit (D), a signalling circuit (E) and a power circuit (F).

2) Break sensor according to claim 1, characterized by the fact that the detector circuit (A) comprises a photocoupler FA including a photodiode D supplied by a resistor RD and a phototransistor FT supplied by a resistance divider RT and RE with a filter formed by a resistor (Ra) and by capacities Cv and CL.

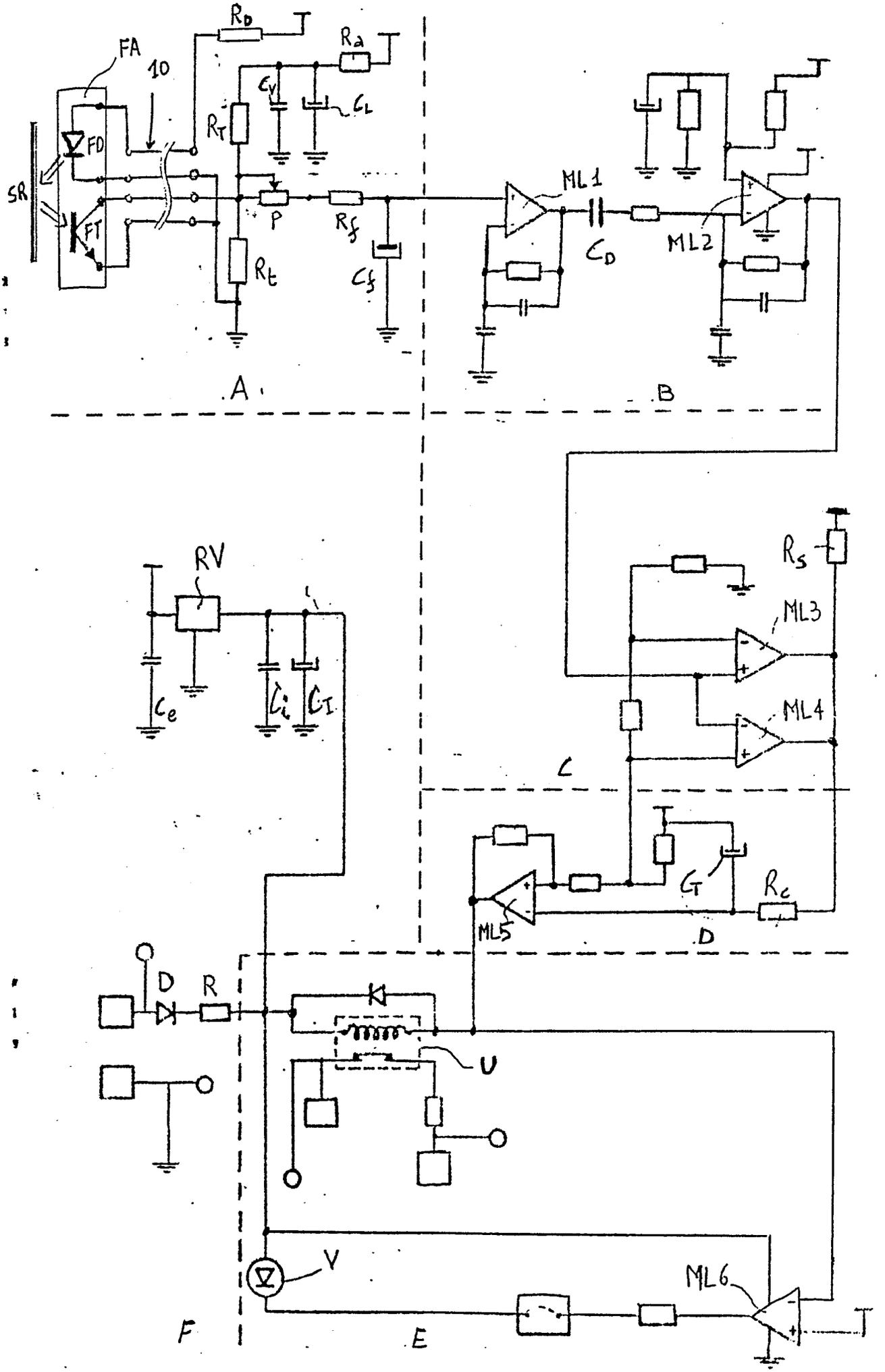
3) Break sensor according to claim 1 or 2, characterized by the fact that the amplifier circuit (B) comprises two operational amplifiers ML1 and ML2, cascade-connected and de-coupled from the capacity CD.

4) Break sensor according to any one of the previous claims characterized by the fact that the analyzing circuit (C) comprises two comparators ML3 and ML4 of the type connected in windowed discriminator and which signal the positive or negative variations of the signal detected by the photocoupler (FA).

5) Break sensor according to any of the previous claims, characterized by the fact that the signal timing circuit (D) comprises a condensor G, resistor Rc and Rs and a comparator ML5.

6) Break sensor according to any of the previous claims, characterized by the fact that the signalling circuit (E) comprises a reed (U) relay, generally connected, whose contact is in open position during signalling and a red (V) led which may light up when the alarm signal arrives.

7) Break sensor according to claim 5, characterized by the fact that the timing circuit (D) provides a delay time of signal intervention and a delay time of stop of same.


RD
Ra
FA
10
CV
CL
RT
FD
SR
FT
P
Rf
Rt
Cf
ML1
CD
ML2
A
B
RV
Rs
ML3
ML4
Ce
Ci
CI
C
CT
Rc
ML5
D
D
R
U
V
ML6
F
E