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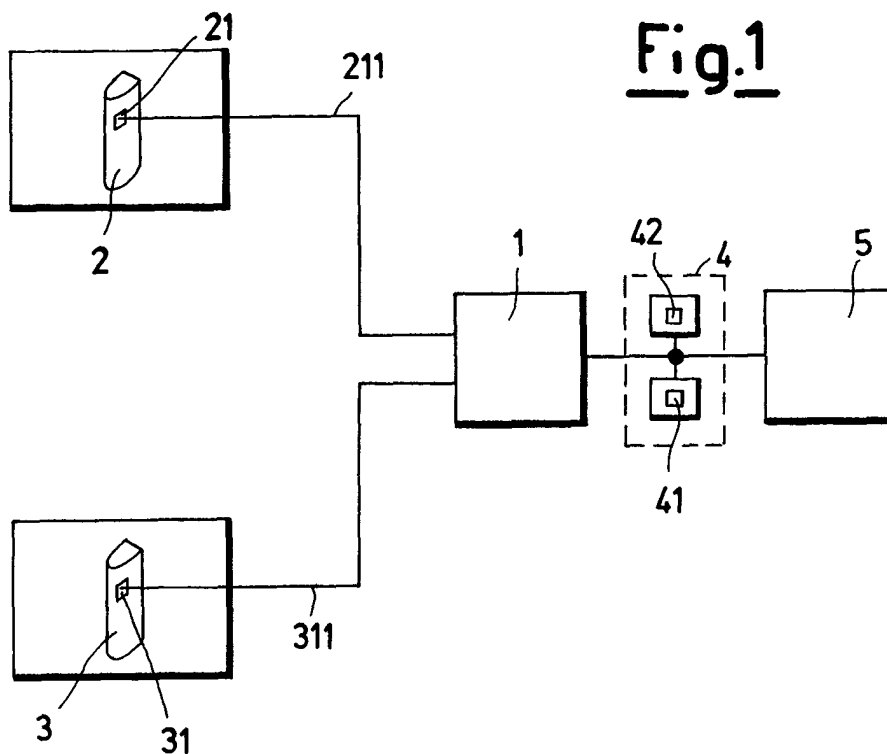
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(54) **Electronic safety device for automatic barriers**

(57) Safety device for an automatic barrier in which said barrier comprises an obstacle-sensitive mecha-

nism, connected via cable to a control unit of said barrier, and said mechanism is adapted to send, through said cable, a detection signal of contact with an obstacle.



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Description

[0001] The present invention refers to an electronic safety device for a mobile element, for example for edges of automatic gates or garage shutters, etc.

[0002] In particular, the present invention concerns an electronic safety device for automatic barriers provided with a mechanism sensitive to obstacles which the barrier may meet during an opening or closing operation.

[0003] The automatic gates of access to private areas, or usually the garage shutters, are operated by the users from fixed positions, through opening or closing buttons or keys or else by distance remote control means, which send an impulse via radio to an electronic switchboard, which then operates the barrier in the desired direction.

[0004] Furthermore, generally, in the case of distance transmissions via radio, after having commanded the opening, the subsequent closing occurs through the user's forwarding of a new command, or else it occurs automatically after a certain, predetermined time period.

[0005] These types of sliding barriers, nevertheless, may cause serious drawbacks from the point of view of the user's safety, since, due to the inherent conformation of the structures, these usually comprise moving parts which have sharp edges, quite dangerous for the user; such moving parts, if not adequately controlled, may even impact and squash the user's vehicle which crosses the barrier, or the user himself.

[0006] Indeed, these mobile elements being operated from a distance from fixed positions, the movement of the structure may not be automatically interrupted at the moment of impact with potential users or other objects with projecting portions of the above-mentioned structures, if not by manually interrupting the feeding of the system in the time period subsequent to that of actual necessity.

[0007] The edges of an automatic gate are sections fastened on the gate on its end portions, in particular positioned in correspondence with the most dangerous edges. For example, in the case of a sliding gate formed by two sliding rectangular shutters, two edges may be present, one per shutter, arranged vertically on the shutter's vertical sides, which join together when the gate is closed.

[0008] In order to brake or interrupt the course of an automatic gate in movement in case of imminent danger, without having to manually intervene, safety systems have been employed for sliding gates, substantially based on the use of edges comprising impact or obstacle sensors.

[0009] Edges of automatic gates are known, provided with an obstacle sensor made in rubber sections. In particular, such edge consists of two insulated, parallel layers of conductive rubber, within which an electric wire with current running through it is inserted. The current which flows in such zone is driven by an electronic unit. Executing a mechanical pressure on the rubber outer

edge, from any direction within 180 degrees, an electrical contact is created which induces the electronic unit to intervene, blocking the gate movement.

[0010] Also known are edges having a wire impact sensor. In particular, such edges are composed by a sustaining section in aluminium, with a rubber section inserted in which the obstacle detection system has been positioned, composed by a taut steel wire and connected to an equaliser which operates on two microswitches.

[0011] A pressure on each wire provokes the change of state of at least one of the two microswitches, which interrupts an enabled electronic switchboard, which blocks the gate movement.

[0012] The Applicant has observed that an irregularity of operation of the impact sensors is not detected by systems of the known art, since in case of irregularity no signal is sent to the gate operation control unit.

[0013] Such operation irregularities are rather frequent given the notable frequency of use of an automatic gate, for example of a condominium or garage.

[0014] The Applicant has posed the problem of rendering more secure the safety device supplied to barriers provided with a mechanism sensitive to obstacles which the barrier may meet.

[0015] To such purpose the Applicant has achieved an electronic safety device for automatic barriers capable of detecting, in addition to possible impacts of the barrier with objects or people, also irregularities of operation of the obstacle-sensitive mechanism, such as for example a short-circuit of a connection cable between said sensitive mechanism and the control unit which determines the constant disengaging of barrier function.

[0016] Such device may be advantageously associated with devices adapted to detect an intrusion or interference, such as anti-theft and safety devices in general.

[0017] One aspect of the present invention concerns a safety device for automatic barriers comprising an obstacle-sensitive mechanism connected via cable to a control unit of said barrier, said mechanism being adapted to send, through said cable, a detection signal of barrier contact with an object, characterised in that said device comprises an electronic board provided with at least one input gate to which said cable carrying the detection signal is connected, at least one output gate adapted to send a block to said control unit, at least one module inserted between said input gate and said output gate adapted to detect a barrier operation irregularity and to send through said output gate a block signal.

[0018] The characteristics and advantages of the device according to the present invention shall become clearer and more evident from the following exemplifying and non-limiting description, of an embodiment with reference to the attached figures, in which:

Figure 1 is a block diagram which shows two edges of a gate connected to the electronic safety device

according to the present invention and to a gate control unit;

Figure 2 is a block diagram of the electronic safety device according to the present invention;

Figure 3 represents an example of electric diagram of a module of the electronic safety device according to the present invention;

Figure 4 is an example of electric diagram of an alarm circuit electronic safety device according to the present invention;

Figure 5 is an example of electric diagram of a supply circuit electronic safety device according to the present invention.

[0019] With reference to the cited figures, a safety device 1 according to the present invention is associated with a barrier, which in the figure example is an automatic gate provided with at least one edge for the gate shutters and with a central control unit of the gate itself.

[0020] In figure 1, illustrated as example are a first edge 2 and a second edge 3, each edge for example being associated with a shutter of a two-shutter sliding gate.

[0021] Each edge comprises at least one mechanism sensitive to obstacles which the edge may meet during a gate opening or closing operation. Such mechanism is for example a steel wire sensor connected to a micro-switch.

[0022] The present invention is equivalently applicable to edges provided with an obstacle-sensitive mechanism which sends a signal via cable to the gate control unit in case of impact with an obstacle. In figure 1, such sensitive mechanisms are schematically shown with reference numbers 21 and 31 on respective edges 2 and 3.

[0023] The mechanisms 21 and 31 are connected to the safety device 1, object of the present invention, by way of respective electric cables 211 and 311.

[0024] In figure 2, a principle diagram of the device according to the present invention is illustrated which comprises a plurality of modules arranged along an electronic board, having the same characteristics, in which each module monitors one edge. In particular, in the figure, four modules 11, 12, 13, and 14 are represented, in which a first module 11 and a second module 12 are respectively connected to the cable 211 from the first edge 2 and to the cable 311 from the second edge 3.

[0025] In general, according to the present invention, the electronic safety device 1 comprises at least one module which may be connected to an edge. The number of modules may be increased as necessary according to the number of edges present in a gate. Alternatively, if the number of the edges is considerable, more safety devices may be arranged in series (for example, if the gate has 8 edges, two electronic boards may be present, each comprising four modules).

[0026] On the diagram of said safety device, an input gate is provided for each module; in the example of figure 2 four input gates 15, 16, 17 and 18 are illustrated.

[0027] Said board comprises, furthermore, at least one output gate 20 connected with a command group 4 comprising at least one relay whose output is connected to a control unit 5 of the mechanisms of the entire automatic gate.

[0028] In the figure, a first relay 41 and a second relay 42 are respectively illustrated, each respectively associated with two modules.

[0029] Each module 11 or 12 or 13 or 14, inserted between said input gate and said output gate, is adapted to detect an operation irregularity of the edge, for example a short-circuit of said cable, and is adapted to appropriately signal said irregularity for example through a pilot light 111 or 121 or 131 or 141 (normally lit in conditions of correct operation), and send through said output port a block signal for the relay group 4, which in turn determines, through the control unit, the stop of the gate movement.

[0030] The device comprises, furthermore, two alarm circuits 19, provided with an alarm pilot light 191, connected to all device modules and a supply group 21 for all electrical components of the board.

[0031] In the example of the embodiment of figure 3, the first module 11 is illustrated in detail; the diagrams of subsequent modules 12, 13 and 14 are analogous and therefore their illustration has been omitted. In particular, the module 11 comprises a voltage divider including an edge resistor R_c arranged in series with the sensitive mechanism of the edge itself and a resistor R_{16} connected to supply line V_{cc} . The two resistors of the divider have substantially the same value and are adapted to generate a constant voltage across the divider. A possible irregularity on the edge or on the cable of the edge will alter the equilibrium on the divider, generating a different voltage across it from that of normal operation.

[0032] The module comprises, furthermore, a ground, short-circuit capacitor C_5 for high-frequency voltages which may disrupt the efficiency of the device.

[0033] Downstream from such divider a piloting circuit 110 is present with a pilot light of correct operation 111, preferably formed by a couple of transistors Tr_7 and Tr_8 controlled by said divider, said transistors being normally in connected-supply conduction. The conducting transistors allow the pilot light, for example an LED diode, to remain on during correct operation. A possible imbalance of the voltage of the divider due to an irregularity on the monitored edge determines the cutoff of one of the two transistors, determining the switching off of the pilot light of correct operation.

[0034] The module comprises, moreover, downstream from said piloting circuit, an electronic insulator 112, formed by a LED diode coupled with a photodiode which electrically separates the piloting circuit from electrical components downstream, and an anti-reversal circuit 113.

[0035] The module output has a signal indicative of the correct operation of the edge, or signals an irregu-

larity.

[0036] The alarm circuit 19 receives at its input the output signals of the various modules. Alternatively, several alarm circuits may be present, each connected for example to two modules, or, in an equivalent manner, a single alarm circuit connected to all modules.

[0037] In detail, the alarm circuit preferably comprises a piloting circuit 190, including a transistor Tr1 and a capacitor C3, which allow the alarm pilot light 191 to) brighten intermittently due to its intrinsic characteristics when one of the modules sends an irregular signal to the circuit itself.

[0038] Parallel to said piloting circuit, there is an amplification stage 192 of the irregular signal coming from the modules. Such amplified signal is sent to the command group 4, in particular to the second relay 42, which sends a break signal to the control unit 5 of the gate.

[0039] The electronic board of the device, object of the present invention, furthermore comprises the supply circuit 21, which receives electrical energy from the outside, for example from the control unit of the gate, and provides a stabilised supply Vcc to the board.

[0040] The supply circuit is provided with a fuse 211 and an LED diode 210 arranged parallel to each other, such that possible breaking of the fuse is signalled in a luminous manner. Furthermore, the circuit comprises a voltage stabiliser 212 at whose output the stabilised voltage Vcc is drawn for the electronic board of the electronic safety device according to the invention.

[0041] The safety device according to the present invention, in case of noticeable irregularities from additional safety circuits present on the barrier, does not prevent the extension of a block signal sent by said circuits to the control unit. Furthermore, in case of possible failure, which may occur on the electronic board, the safety device according to the present invention blocks the operation of the mobile element to which it is associated.

Claims

1. Safety device for automatic barriers comprising an obstacle-sensitive mechanism connected via cable to a control unit of said barrier, said mechanism being adapted to send, through said cable, a signal of detection of barrier contact with an obstacle, **characterised in that** said device comprises an electronic board provided with at least one input gate to which said cable carrying the detection signal is connected, at least one output gate adapted to send a block to said control unit, at least one module inserted between said input gate and said output gate adapted to detect an operation irregularity of the barrier and to send a block signal through said output gate.
2. Safety device according to claim 1, in which said operation irregularity is a short-circuit of the connec-

tion cable.

3. Device according to claim 1, in which said module comprises a pilot light of correct operation of the edge.
4. Device according to claim 3, in which said module comprises a voltage divider, including an edge resistor, arranged in series with the sensitive mechanism of the edge itself, and a resistor, with resistivity value substantially equal to that of the edge resistor, connected to a supply line, adapted to provide a constant voltage across it of normal operation, an irregularity on the edge or edge cable will alter the equilibrium on the divider, generating a different voltage across it than that of normal operation.
5. Device according to claim 4, in which said module comprises a piloting circuit for said pilot light of correct operation, arranged downstream from said voltage divider, which provides an indicative signal of said irregularity.
6. Device according to claim 5, comprising furthermore an alarm pilot light for an irregularity signalled by any one of the modules present on said board.
7. Device according to claim 6, comprising furthermore an alarm circuit which receives at its input said indicative signal of the modules and drives in case of irregular operation of the edge said pilot light in an intermittent manner.
8. Device according to claim 7, in which said alarm circuit sends said block signal to said control unit of the gate.
9. Device according to claim 1, in which said block signal is a cancellation of an enabling signal to said control unit.

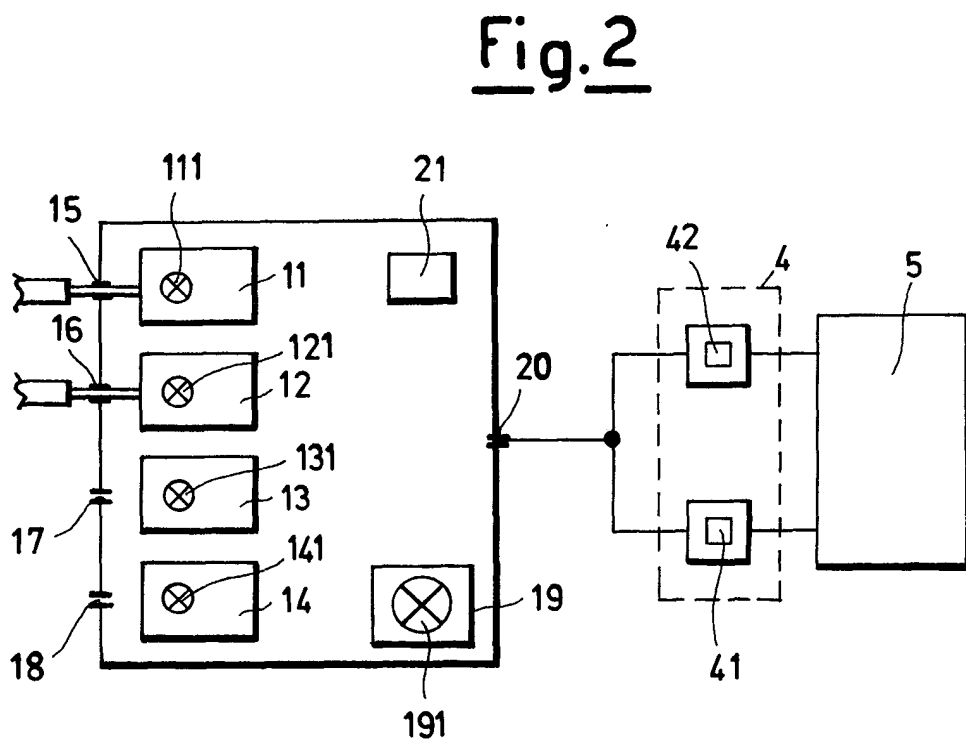
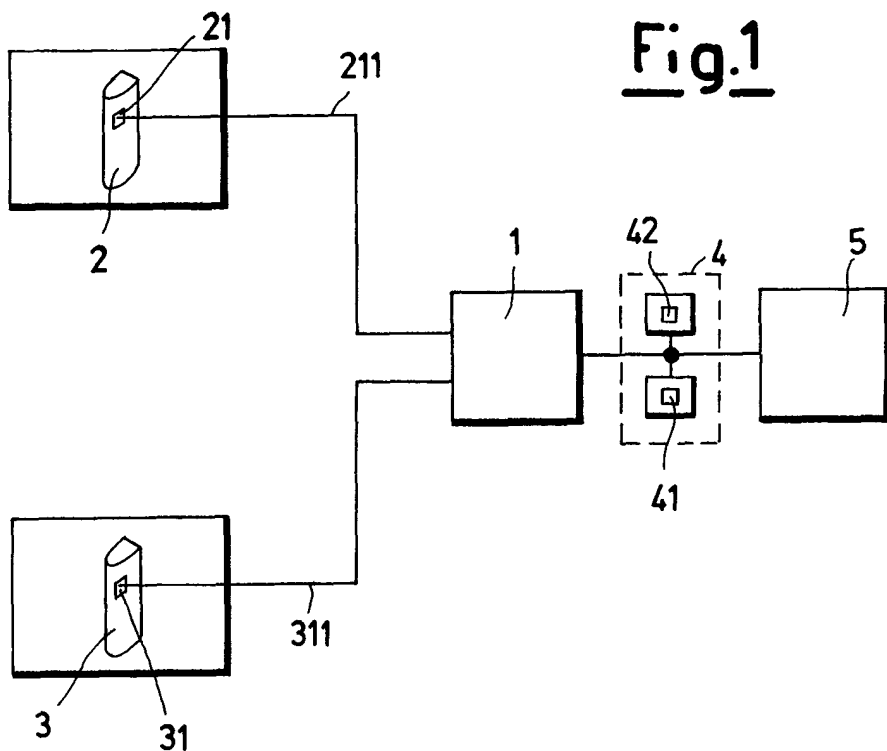
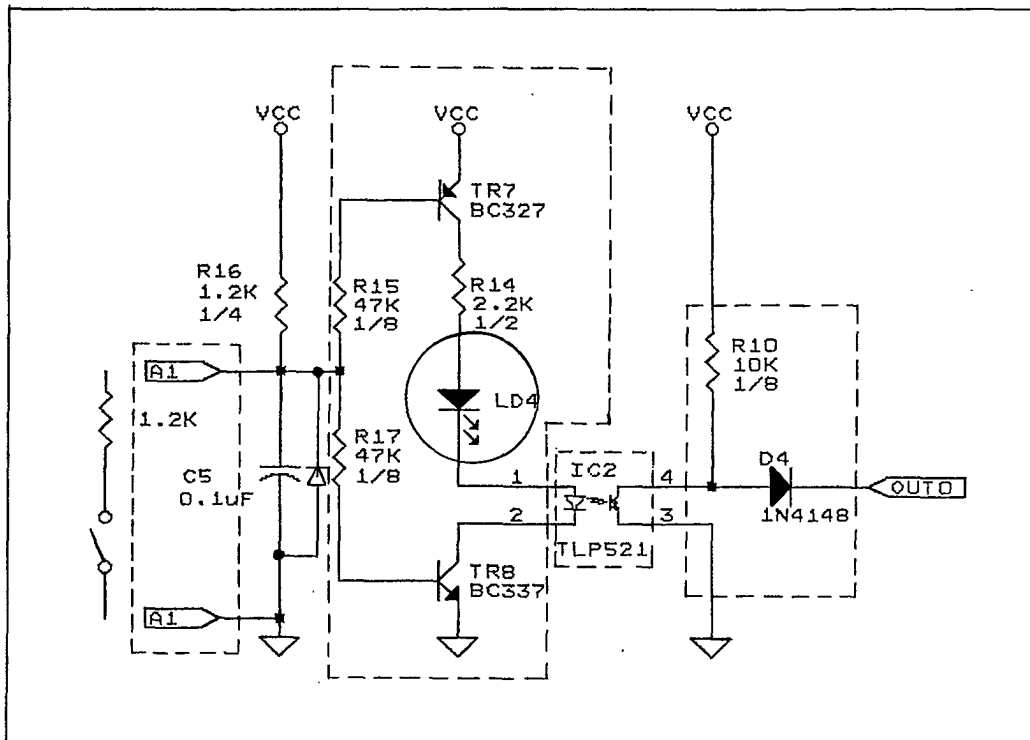


Fig.3



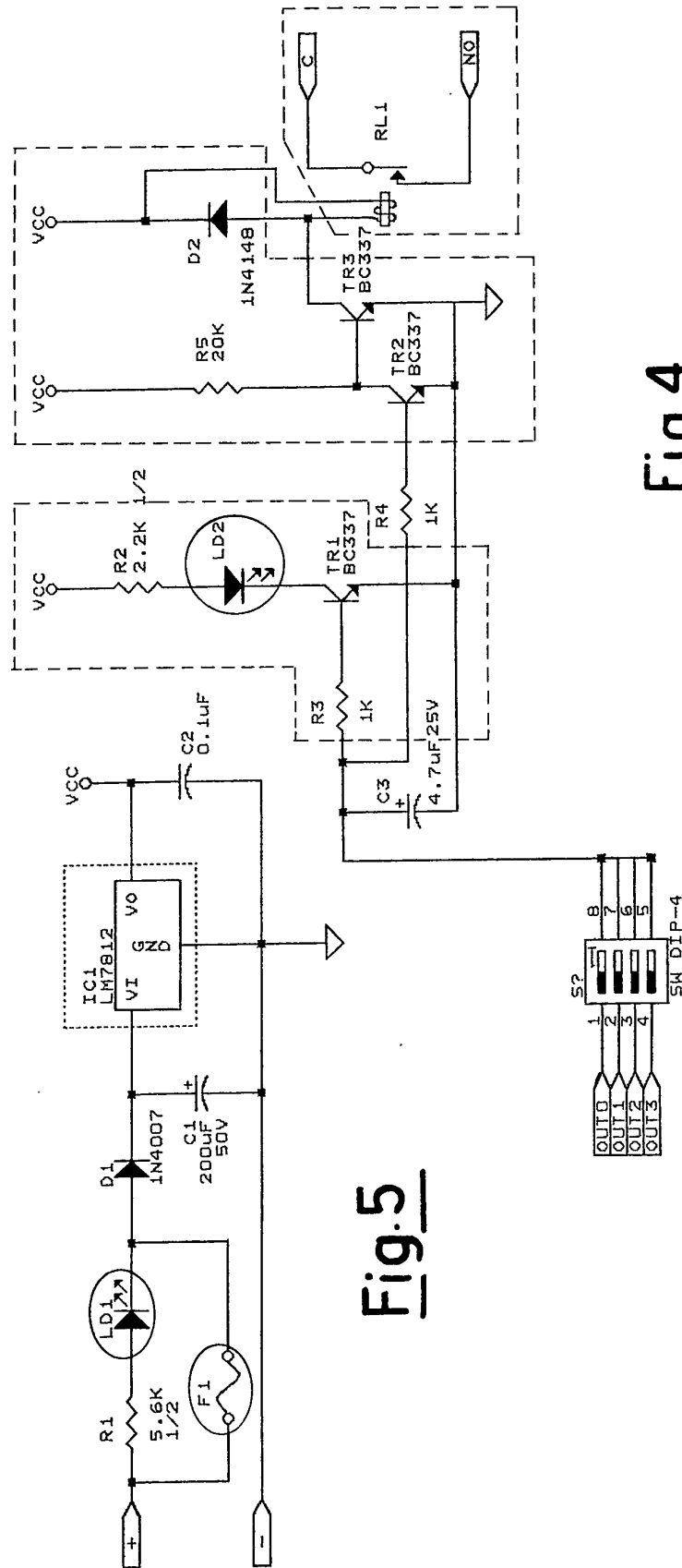


Fig.4

Fig.5