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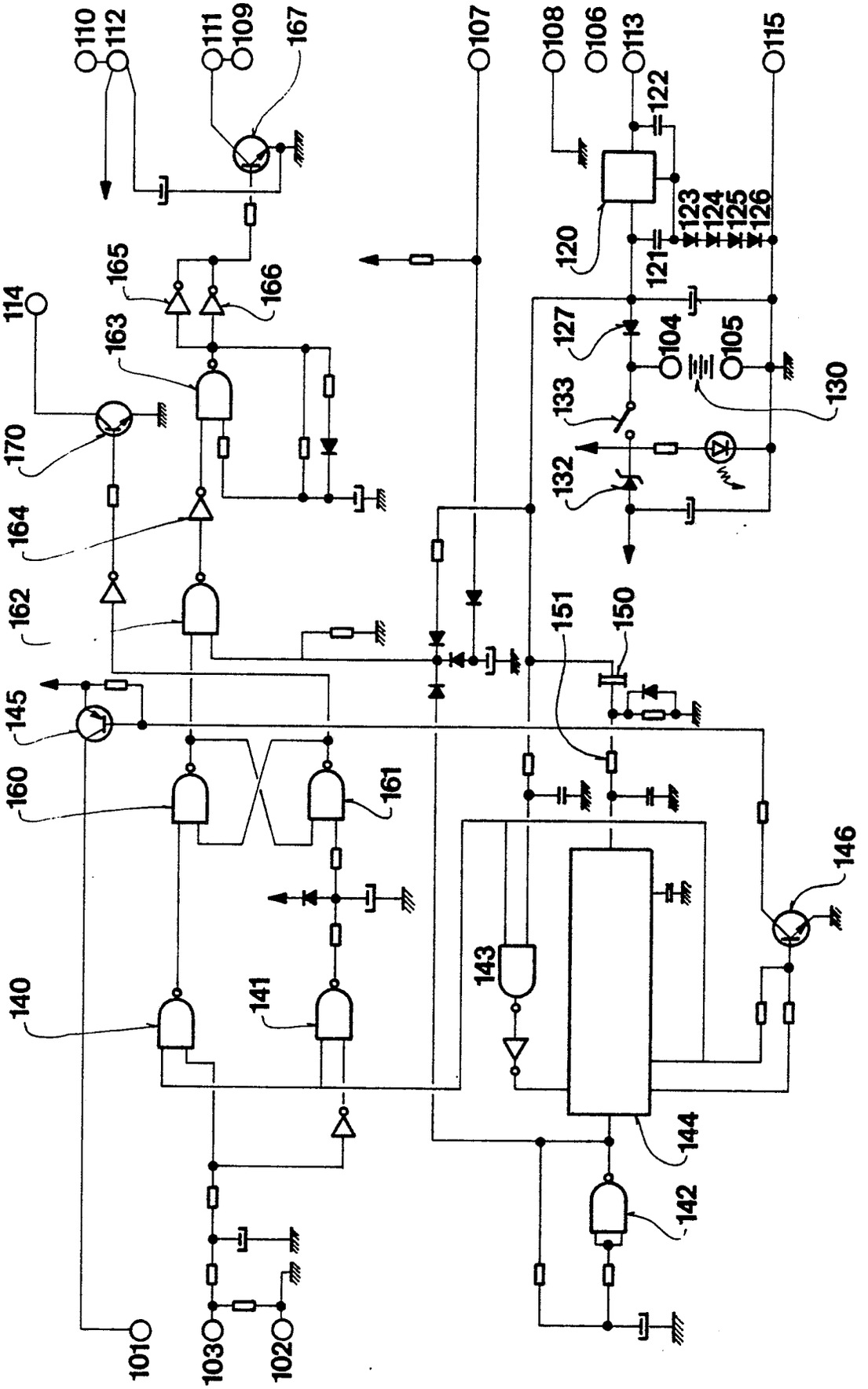
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(54) Apparatus for detecting the presence of gases in a closed environment.

(57) An apparatus is described for detecting in a closed environment the presence of even small quantities of gases which form explosive mixtures with air, for indicating said presence and for switching off the electricity supply to any appliance present in said environment.

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FIG 1


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APPARATUS FOR DETECTING THE PRESENCE OF GASES IN A CLOSED ENVIRONMENT

This invention relates to an apparatus for detecting the presence in a closed environment of even small quantities of gases which form an explosive mixture with air, for indicating said gas presence, and for switching off the electricity supply to any appliance present in said environment. The danger of gas presence in a closed environment, especially a domestic environment, is a well known problem where this derives from accidental leakages from domestic appliances such as water heaters, gas fires or gas cookers, or from fractures in their connection pipes, when they are fed with combustible gas either from the mains or from cylinders.

This gas forms an explosive mixture with air, which easily ignites by accidental triggering with a spark from any automatic switch for appliances present in the environment (such as a refrigerator) or from any switch for other equipment present in said environment which is operated either intentionally or accidentally (such as lighting or bell switches), to result in considerable damage.

In addition to the danger of explosion there is also the danger of poisoning to persons present in the environment in which the gas leak occurs, especially if said leak occurs during normal sleeping periods.

The apparatus according to the present invention provides a totally satisfactory solution to said explosion problem and the problem of indicating gas presence in a closed environment, by immediately switching off the electricity supply to any appliance present in said environment while at the same time activating an optical and acoustic warning system making timely intervention possible for correcting the dangerous situation.

According to one of its basic characteristics, the apparatus of the present invention is provided with a self-contained power supply system in the form of a rechargeable battery which operates every time the mains electricity fails, either because of power failure deriving from the electricity supply company or because said apparatus according to the invention has operated to switch off the electricity supply to the environment in which it is situated and in which gas has been found to be present.

The apparatus according to the invention therefore consists essentially of a control unit with an incorporated power supply battery, said unit being connected to a gas sensor sensitive to the presence of gas, in particular of the hydrogen, carbon monoxide, hydrocarbon and combustible organic compound type, and further connected to an optical and acoustic alarm system and to a switch for switching off the electricity supply to the environment in which the gas presence has been detected.

According to a further characteristic of the invention, the control unit can be connected to other apparatus, such as servo mechanisms or electronic processing or remote transmission systems, in order to provide other types of intervention or indication even at large distances from the place in which said control unit or gas sensor is present.

Other characteristics of the invention will be apparent from the present description.

One embodiment of the present invention is described hereinafter with particular reference to the accompanying drawings in which:

Figure 1 shows the electrical circuit diagram of the apparatus control unit;

Figure 2 is a block diagram of the apparatus;

Figure 3 shows the electrical circuit diagram of the gas sensor.

The terminals 101, 102 and 103 of the control unit 100 are connected to the gas sensor 200. The terminals 104 and 105 are connected to the control unit power supply battery 130, which operates should the mains supply fail.

The terminals 109, 110, 111 and 112 are connected to the acoustic alarms 201 and/or optical alarms 202 which indicate the gas presence detected by the sensor 200.

The terminal 106 is free, and the terminals 107 and 108 are available for feeding control signals to other types of servo mechanisms or systems to be connected to the control unit.

The control unit is normally fed with 220 V alternating current which, by means of a power circuit 204 comprising a transformer and rectifier - (not shown in the figures), is converted into 24 V direct current and enters the control unit circuit through the terminal 113, the terminal 115 being connected to earth.

By means of the voltage regulator 120, the capacitors 121 and 122 and the diodes 123, 124, 125, 126, 127, the voltage of the supply current is regulated to the optimum value for charging the battery 130.

The LED 131 indicates the presence of power in the control unit circuit, and the zener 132 further reduces the current voltage to 6 V for feeding the electronic circuit.

The switch 133 is used for switching off the power to the circuit of the control unit during lengthy periods of system inactivity, such as during storage or transportation.

The gas sensor 200 is fed by the timer circuit formed from the oscillators 140, 141, 142, 143 and the counter 144.

As soon as current is fed to the control unit, the counter is reset by the circuit comprising the capacitor 150 and resistor 151, and with the counter at zero the sensor 200 is fed by way of the transistors 145 and 146.

The circuit formed from the oscillators 160 and 161 forms a bistable multivibrator which memorises the alarm state.

When an alarm state occurs, the oscillator 162 activates the oscillators 163, 164, 165 and 166, which by way of the transistor 167 feed the optical alarms 202 and acoustic alarms 201 connected to the terminals 109, 110, 111, 112.

The transistor 170 operates a system comprising one or more relays (not shown in the figures) which are connected to the terminal 114 and operate the switch 203 to switch off the mains supply to the environment in which the gas presence has been detected.

Should the 220 V current fail, the continued operation of the control unit is ensured by the battery 130, which is always kept fully charged both in terms of voltage and capacity by the circuit heretofore described.

By memorising the alarm state, the circuit formed by the oscillators 160 and 161 enables the sensor 200 to be fed only intermittently, by way of the counter 144 and oscillator 143, for example for only two minutes in every ten minutes, or for shorter times or with longer intervals, to thus prevent useless energy consumption.

This ensures a longer life for the battery charge, and thus a more prolonged operation of the gas presence indicating system, even during a lengthy failure of the mains electricity supply.

Thus, should the mains supply fail, the alarm cycle continues in accordance with the predetermined time interval, for example ten minutes, by feeding current to the sensor 200 for two minutes - (or less), memorising any alarm state and then remaining inactive until the end of the interval, ie from the second to the tenth minute.

In order to obtain further battery energy saving, the alarm could be made to operate only on opening the entrance door to the environment in which the gas is present, by fitting a sealed magnetic switch to the door and connecting it to the control unit 100 by the terminals 107 and 108.

The sensor 200, which is of TGS type, ie a sintered gas-sensitive semiconductor, is fed at 5 volts by the stabiliser 300.

The transistor 301 ensures that current is always present in the sensor 200. If the supply to the heating resistor of the sensor 200 becomes interrupted or if the gas-sensitive resistor breaks down, the current which keeps the transistor 301 in its conducting state either disappears or decreases with the result that this transistor becomes inhibited, to inhibit the transistor 302, which puts the two transistors 303 and 304 into the conducting state to generate the alarm signal.

Normally, when the sensor 200 is intact, the sensor resistance decreases if gas is present, to operate the trigger circuit formed by the circuit containing the transistors 303 and 305.

In this case, the transistor 305 conducts current to put the transistor 303 into the conducting state, which causes the transistor 304 to conduct so generating the alarm signal.

The diode 306 protects the circuit against current polarity reversal.

The purpose of the resistor 307 is to discharge the power dissipated by the regulator 300.

The LED 308, which is of the green light type, indicates the presence of current in the circuit, whereas the LED 309, which is of the red light type, lights when the alarm operates either due to the presence of gas or due to a fault in the sensor.

The purpose of the trimmer 310 is to adjust the sensitivity of the sensor 200.

Claims

1. An apparatus for detecting the presence in a closed environment of gases which form explosive mixtures with air, for indicating said presence and for switching off the electricity supply to any appliance present in said environment, comprising an electronic control unit with an incorporated power supply battery and connected to an optical and acoustic alarm system, to a gas sensor and to a switch for switching off the electricity supply to the environment in which the gas presence has been detected.

2. An apparatus as claimed in claim 1, characterised in that the control unit contains a circuit comprising an oscillator 143 and a counter 144 which enable current to be fed to the gas sensor 200 for a predetermined time and with predetermined time intervals between one feed and the next.

3. An apparatus as claimed in claim 2, characterised in that the control unit contains a circuit comprising two oscillators 160 and 161 which

memorise any alarm states detected during the period in which current is fed to the sensor 200.

4. An apparatus as claimed in claim 1, characterised in that the control unit is connected to a sealed magnetic switch fitted to the entrance door of the environment in which the gas presence has been detected, said switch causing the alarm signal to be emitted on opening the door.

FIG 1

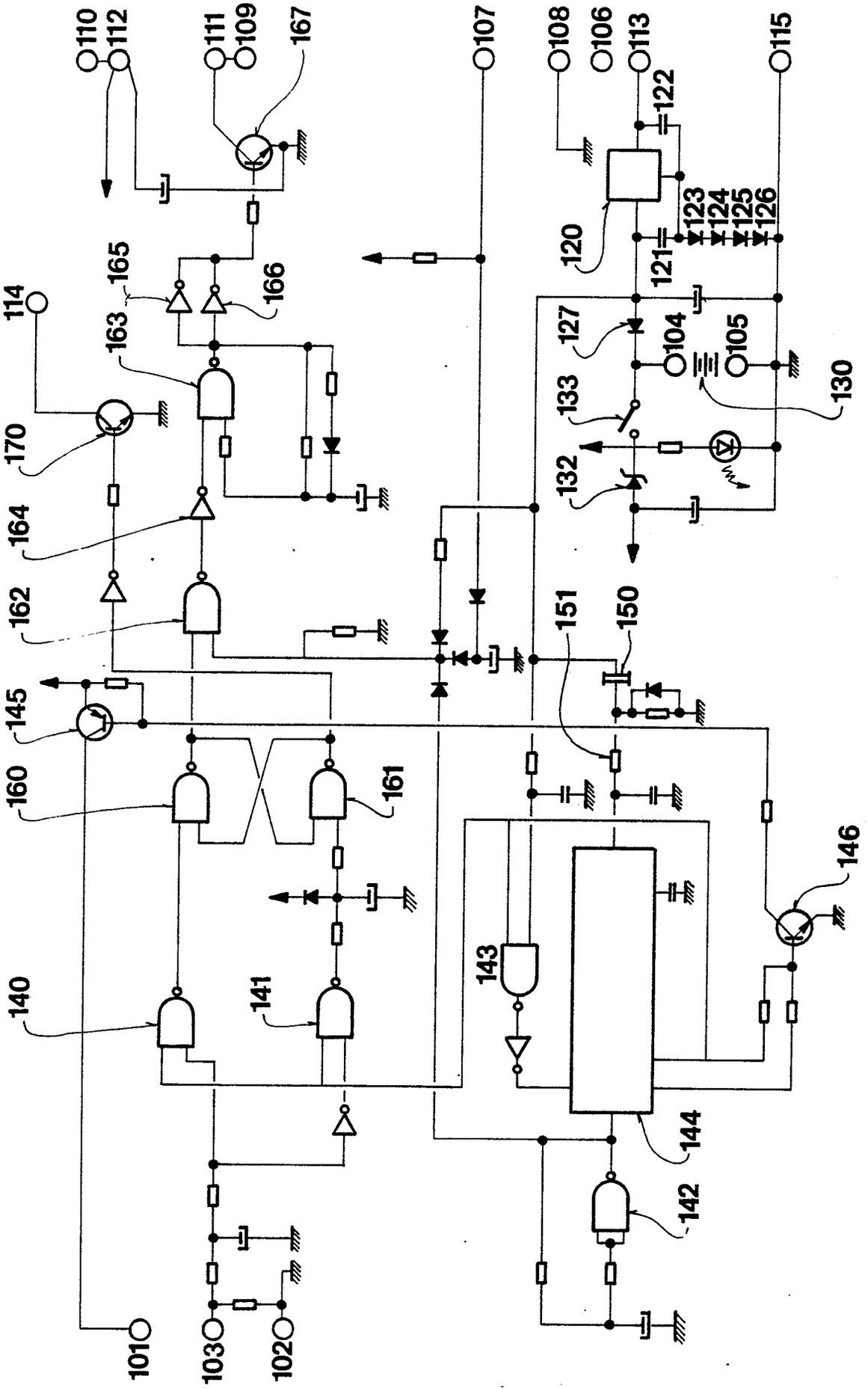

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FIG 2

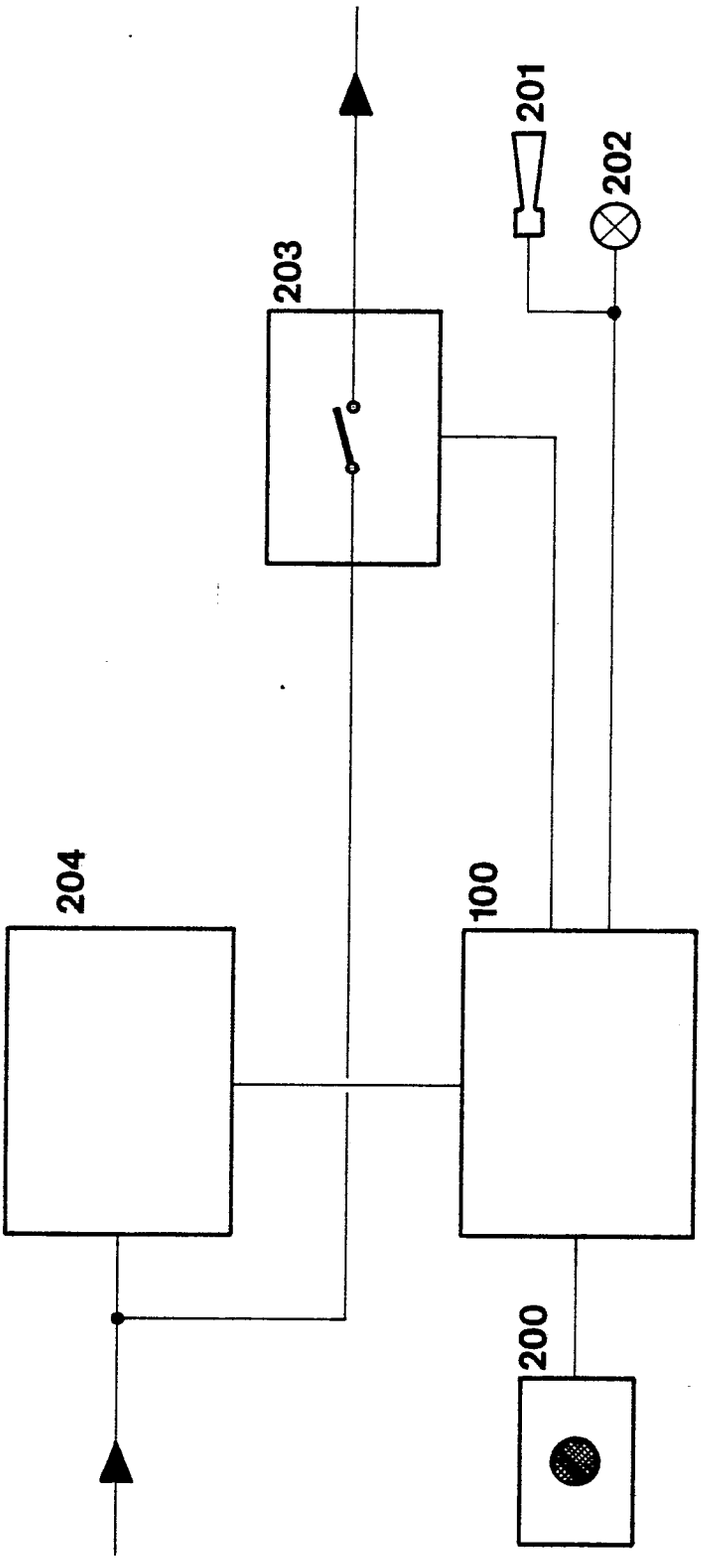
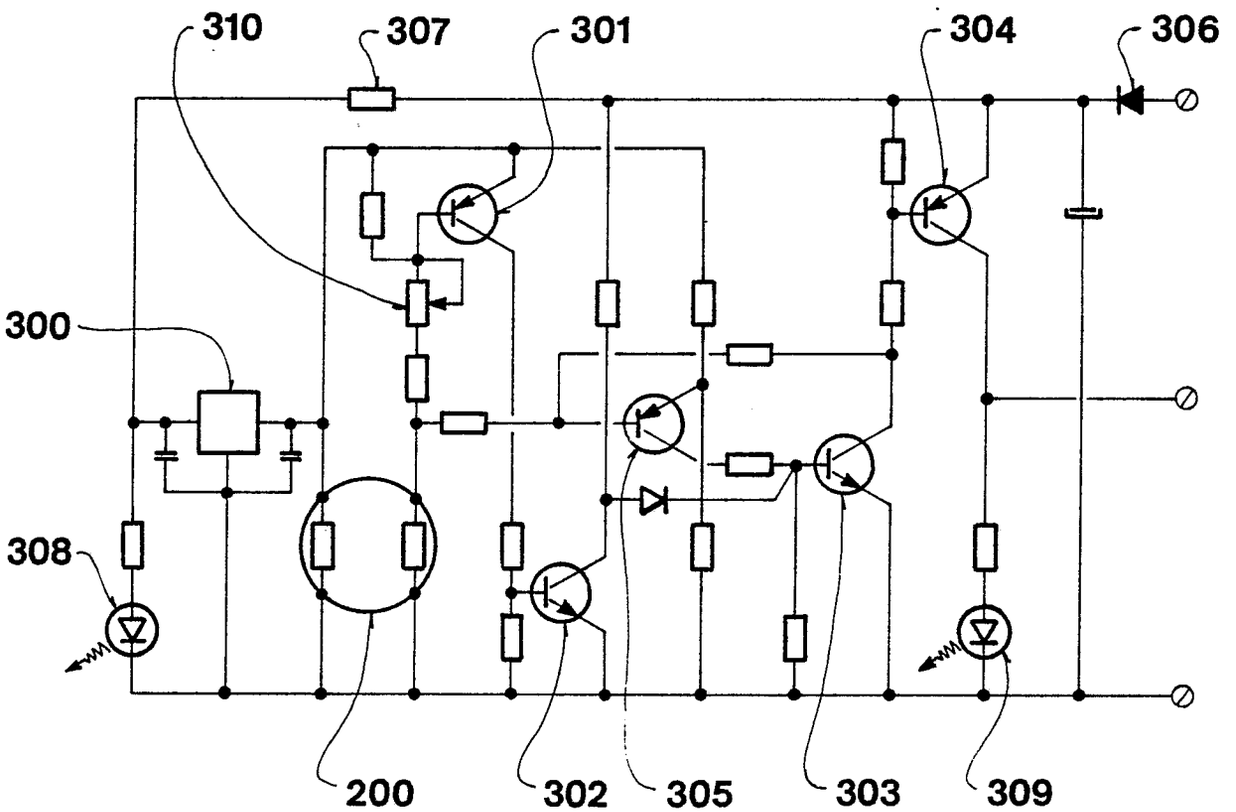


FIG 3



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EUROPEAN SEARCH REPORT

Application number

EP 86 10 1572

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y	FR-A-2 543 839 (SOCIETE PGEP) * figure 1, abstract *	1	G 08 B 17/10
Y	DE-A-2 319 476 (SECURITEX S.A.R.L.) * figure 1; page 2, lines 10-26 *	1	
A	US-A-4 126 790 (E.E. SOLOMON) * figure 3, abstract *	2	
A	DE-A-2 402 493 (VISSER, ROBERTUS GERARDUS) * figure 2; page 8, line 26 - page 9, line 11 *	3	
A	DE-A-3 102 924 (J. GRANEK) * figure 1, abstract *		TECHNICAL FIELDS SEARCHED (Int. Cl.4) G 08 B 17/10
A	US-A-4 007 456 (R.C. PAIGE et al.) * figue 2, abstract *		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	12-06-1986	BREUSING J

CATEGORY OF CITED DOCUMENTS

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