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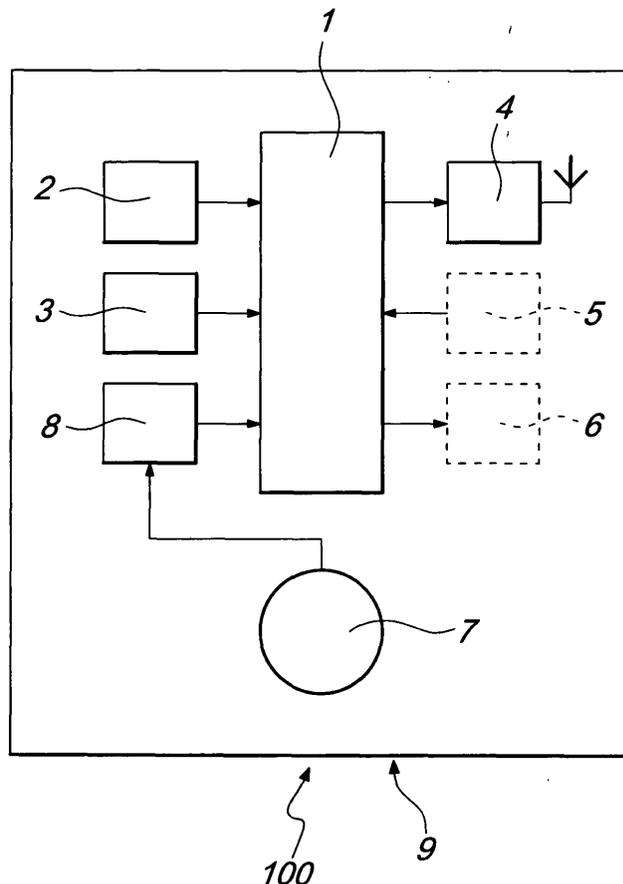
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(54) **Device for sensing ambient light intensity variation**

(57) A device (100) for sensing ambient light intensity variation, comprising processing and control means (1), light sensing means (3) connected to the processing and control means (1), and memory means (2) adapted

to store an identification code; its peculiarity consists in that it further comprises wireless transmission means (4) adapted to transmit the identification code following a variation in ambient light intensity sensed by the light sensing means (3).



## Description

**[0001]** The present invention relates to a device for sensing ambient light intensity variation. More particularly, the invention relates to a device for sensing ambient light intensity variation that can be used particularly in containers the internal space whereof is normally dark or has a light intensity that is lower than that in the space outside such container, for example refrigerators, safes, wardrobes, or other containment items.

**[0002]** Devices capable of sending an identification code when doors are opened are currently commercially known.

**[0003]** Some of these devices are integrated in the container whose opening is to be sensed, i.e., they require that the design of the container takes into account from the outset a mechanism that is capable of sensing the opening of the door of the container, accordingly with complex problems in terms of application in existing or already-installed containers, and with consequently significant costs.

**[0004]** Conventional devices can transmit an appropriate identification code by means of a cable and therefore require the laying of a dedicated system: in the presence of a plurality of devices, the complexity of the system obviously increases and so do the consequent installation costs.

**[0005]** Other devices provide transmission of the identification code by using an existing cable normally used for other purposes: for example, refrigerators in hotel rooms can be connected to a remote system over the cables of the telephone or television installed in the room. In such cases it is necessary to conduct a study of the compatibility among the systems that share the same cable, in order to avoid interference that would compromise operation of such systems.

**[0006]** These studies must be repeated for each different system in which one wishes to have multiple data items on the same cable. Even the solution described above suffers drawbacks caused by an outcome that is not always positive and by the significant cost.

**[0007]** Moreover, known types of device normally must be supplied with power and it is therefore necessary to provide an appropriate power supply cable, with the previously mentioned preparation and installation costs.

**[0008]** The aim of the present invention is to provide a device for sensing ambient light intensity variation that allows to remotely send an identification code without the need of dedicated or non-dedicated transmission cables.

**[0009]** Within this aim, an object of the present invention is to provide a device for sensing ambient light intensity variation that can be autonomously supplied with power, so as to not require the laying of power supply systems.

**[0010]** Another object of the present invention is to provide a device for sensing ambient light intensity var-

iation that can be arranged within the container for which door opening is to be checked.

**[0011]** Another object of the present invention is to provide a device for sensing ambient light intensity variation that is highly reliable, relatively simple to provide and at competitive costs.

**[0012]** This aim and these and other objects that will become better apparent hereinafter are achieved by a device for sensing variation in the light intensity of an enclosed space provided with at least one portion that is adapted to allow access to the inside of said enclosed space, comprising processing and control means, light sensing means connected to said processing and control means, and memory means adapted to store an identification code, characterized in that it further comprises wireless transmission means adapted to transmit said identification code following a variation in ambient light intensity sensed by said light sensing means.

**[0013]** Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of the device according to the invention, illustrated by way of non-limiting example in the accompanying drawing, wherein the only figure is a block diagram of the device according to the invention.

**[0014]** With reference to the only figure, the sensing device according to the present invention, generally designated by the reference numeral 100, comprises processing and control means 1, to which memory means 2, adapted to store an identification code and other data if necessary, are connected. A light sensing device 3, i.e., a device that is capable of sensing variation in the intensity of the light that is present in the enclosed space (the expression "enclosed space" designates here any closed space in which the device according to the invention can be accommodated, such as for example the inside of a refrigerator, of a safe, of a wardrobe or of other containment items), and data transmission means of the wireless type (such as for example radio transmission means 4, ultrasound transmission means and the like) are also connected to the processing and control means 1, which can be conveniently constituted for example by a microcontroller.

**[0015]** A switch 5 and a LED 6 can optionally be connected to the microcontroller 1. A battery 7 connected to a voltage measurement or comparison device 8 and to the microcontroller 1, supplies the energy required for operation of all the components of the device according to the invention.

**[0016]** Accordingly, the device is self-powered and therefore does not require the laying of dedicated power supply cables.

**[0017]** The components of the device may be enclosed in a hermetic enclosure made of plastics or other totally or partially transparent or translucent material. The enclosure or enclosed space is designated by the reference numeral 9. Since the enclosure can be of the hermetic type, it can be applied in any type of container,

such as for example refrigerators, safes, wardrobes, et cetera, without problems of environmental compatibility between the device and the enclosed space in which it is placed.

[0018] Operation of the device according to the invention is as follows.

[0019] When the light sensor 3 senses a positive light intensity variation, i.e., an increase in the intensity of the light inside the container, for example as a consequence of the opening of a door of the container in which the sensing device 100 is accommodated, the sensor 3 sends a signal to the microcontroller 1, which reads the identification code contained in the memory 2 and accordingly transmits the identification code being read over the wireless transmission means 4. The microcontroller 1 controls said wireless transmission (for example radio transmission) and repeats it for a predefined or programmable number of times, separating each radio transmission with a pseudorandom time interval generated by means of said controller 1 or by other functionally equivalent circuitry.

[0020] The microcontroller 1 can optionally also read the value of the voltage of the battery 7, measured by the voltage comparison and measurement device 8, compare the read value with the predefined threshold contained in the memory 2, and also associate with the transmission of the identification code the transmission of a code that corresponds to the charging state of the battery.

[0021] The microcontroller 1 can further receive signals also from the switch 5 and, as a consequence of this, can provide for example transmissions of the identification code or of the charging state of the battery or of the state of the switch 5, or allow maintenance of the device according to the invention and variation of constants or variables that affect its operation, such as for example the number of repetitions of the transmission to be performed, the identification code, et cetera.

[0022] The microcontroller 1 can also control the LED 6 in order to send a visual indication to the user, for example during radio transmissions or during maintenance operations.

[0023] In practice it has been observed that the device according to the invention fully achieves the intended aim and objects, since it can be self-powered and allows to send, without the aid of a data transmission cable (for example by radio) the identification code that is adapted to identify opening of the door of the container in which the device is accommodated, accordingly without requiring power supply cables and cables for carrying said identification code.

[0024] The device thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

[0025] In practice, the materials used, as well as the contingent shapes and dimensions, may be any accord-

ing to requirements and to the state of the art.

[0026] The disclosures in Italian Patent Application no. MI2003A002386, from which this application claims priority, are incorporated herein by reference.

[0027] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

## Claims

1. A device for sensing variation in the light intensity of an enclosed space provided with at least one portion that is adapted to allow access to the inside of said enclosed space, comprising processing and control means, light sensing means connected to said processing and control means, and memory means adapted to store an identification code, **characterized in that** it further comprises wireless transmission means adapted to transmit said identification code following a variation in ambient light intensity sensed by said light sensing means.
2. The device according to claim 1, **characterized in that** it comprises battery-based power supply means.
3. The device according to claim 1, **characterized in that** said wireless transmission means comprise radio transmission means.
4. The device according to claim 1, **characterized in that** said wireless transmission means comprise ultrasound transmission means.
5. The device according to claim 1, **characterized in that** said processing and control means are adapted to drive the transmission of said identification code for a predefined and/or programmable number of times.
6. The device according to one or more of the preceding claims, **characterized in that** said processing and control means are adapted to separate the repetition of the transmissions of said identification code with a pseudorandom time interval.
7. The device according to one or more of the preceding claims, **characterized in that** it comprises a switch and a LED, said switch being adapted to send a signal to said processing and control means.
8. The device according to one or more of the preceding claims, **characterized in that** it comprises volt-

age comparison and measurement means adapted to measure the voltage of said battery-based power supply means and to compare it with a predefined threshold stored in said memory means.

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9. The device according to one or more of the preceding claims, **characterized in that** it is inserted within a hermetic enclosure.

10. A container provided with at least one portion that is adapted to be opened in order to allow access to the inside of the container, **characterized in that** it comprises a device according to one or more of the preceding claims.

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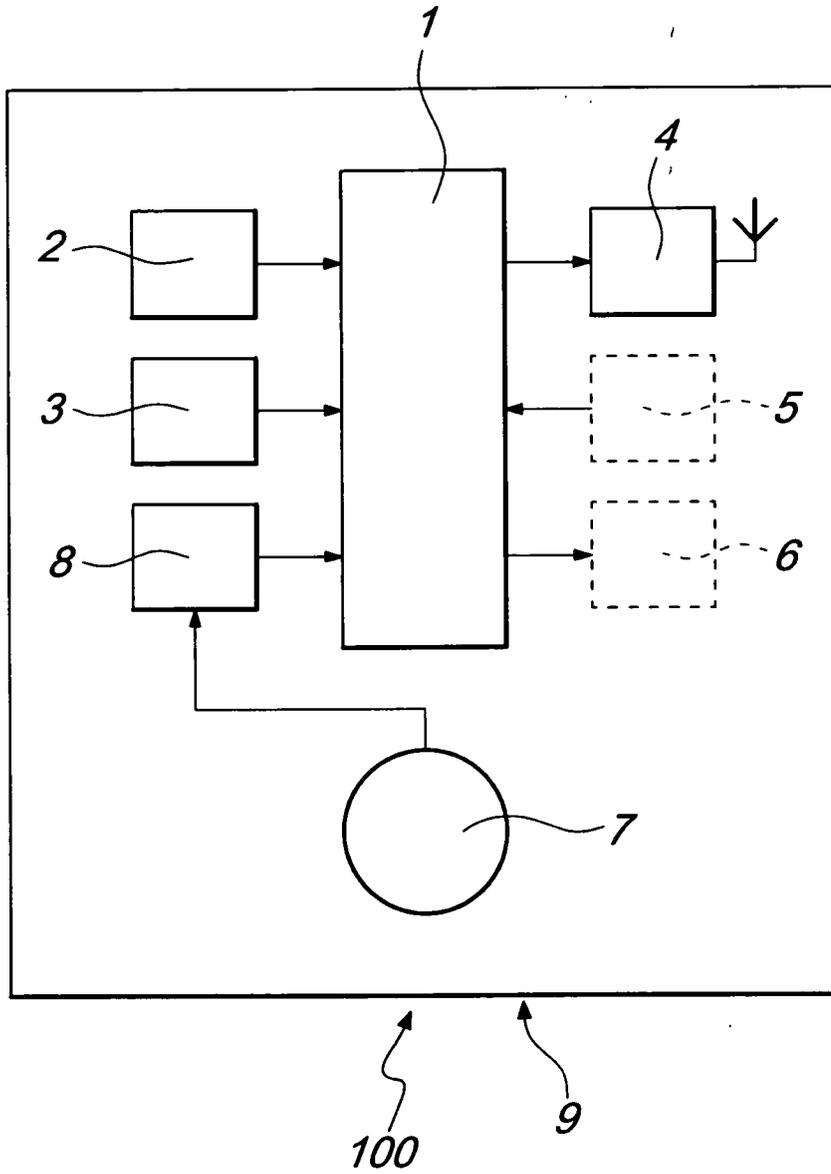
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European Patent  
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EUROPEAN SEARCH REPORT

Application Number  
EP 04 02 8609

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Y	* column 1, line 14 - column 1, line 28 * * column 2, line 66 - column 3, line 36 * * column 4, lines 40-55 * * column 5, lines 1-27 * * column 5, lines 59-62 * * column 8, lines 20-26 * * column 11, lines 20-22; figures 1-10 *	4,6,8,9	
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		4 March 2005	Wright, J
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	

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EPO FORM 1503 03.82 (P04001)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 04 02 8609

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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