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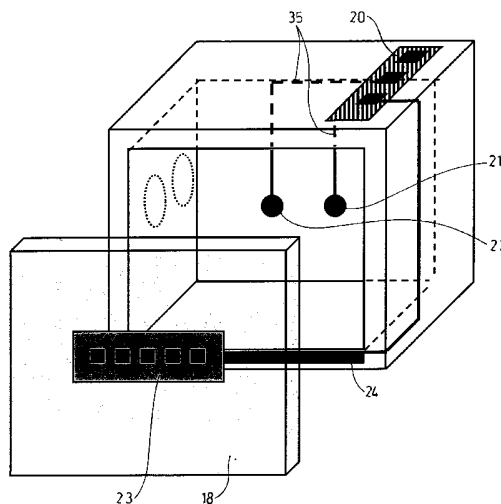
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(54) Title: FOOD TEMPERATURE SETTING USING WIRELESS TECHNOLOGY



(57) Abstract: The present invention relates to an appliance 10 having a storage compartment 11 with an opening 17 for access into the compartment 10. A cover 18 is being arranged for covering the opening 17 in order to enclose the compartment 11. The apparatus further comprising a climate control system being provided to control the climate inside the compartment 11, the system comprising a control unit 20 for control and adjustment of climate parameters of the compartment 11. The system further comprises means 21,22 to detect the parameters. Furthermore, the system comprises a user interface 23 enabling the user to select the operation mode of the system. The user interface is being arranged on the cover 18 and comprises a limited number of operation modes 25-29 for the selection. Each of the operation modes 25-29 corresponds to a defined set of values of the climate parameters and being indicated by a graphic symbol on the interface (23). At least one signal transmitting device is arranged on the user interface, said device communicating wirelessly with the control unit.

WO 2006/122783 A2

FOOD TEMPERATURE SETTING USING WIRELESS TECHNOLOGY

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TECHNICAL FIELD

The present invention relates to an appliance having a storage compartment with an opening for access into the compartment. A cover is being arranged for covering the opening in order to enclose the compartment. The apparatus further comprising a
10 climate control system being provided to control the climate inside the compartment, the system comprising a control unit for control and adjustment of climate parameters of the compartment. The system further comprises means to detect the parameters.

BACKGROUND

15 Systems to control the climate inside a compartment are well known. For instance in the area of cooling cabinets, for instance refrigerators or freezers, the cabinet comprises at least one compartment for which the temperature needs to be controlled. Most common is to control the temperature, but it might also happen that other climate parameters, such as air humidity, is controlled.

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US patent US6170276 from Maytag Corporation discloses a cooling cabinet wherein the cabinet comprises some compartment in which the climate is controlled. As shown there is at least one compartment 30 where the climate is specifically controlled. A climate device, indicated with a fan 71 and inlet/outlet 76/77, makes the adjustment of
25 the climate parameters based on information from a control unit 58. The control system further comprises means, such as temperature and humidity sensors connected to the control unit, to detect the climate inside the compartment.

As mentioned is said patent there is a great need by consumers to store fruit and
30 vegetables or other provisions in a separate storage compartment in order to be able to provide the most sufficient storage climate for this specific provisions. The compartment therefore comprises means to provide such a wishful storage. For instance should the walls be isolated from the rest of the compartment and the control system needs to be sufficient enough to enable the climate control.

One problem with the disclosed solution by Maytag and many other solutions is that the control unit is very complex to handle. The user is in most cases not aware of the proper settings for specific provisions and will have problems to handle the buttons of the disclosed user interface. Another problem is that the user interface is arranged in a very inconvenient position. It is difficult for the user to be able to bend down and try to read and understand the user interface when it is positioned like that at a small unit next to the drawer cover. Moreover, one problem with the Maytag solution is that the user interface demands space, which results in a decreased volume for the provisions compartment.

Therefore an object of the present invention is to provide a more consumer innovative solution, meaning a solution that understands the needs of the user. Moreover, an object of the present invention is to provide a solution that is cheaper and easier to industrialize.

SUMMARY OF THE PRESENT INVENTION

The present invention relates to an appliance having a storage compartment with a opening for access into the compartment. A cover is being arranged for covering the opening in order to enclose the compartment. The apparatus further comprising a climate control system being provided to control the climate inside the compartment, the system comprising a control unit for control and adjustment of climate parameters of the compartment. The system further comprises means to detect the parameters.

Furthermore, the system comprises a user interface enabling the user to select the operation of the system. The user interface is being arranged on the cover and comprises a limited number of operational modes to select from. Each of the operation modes corresponds to a defined set of values of the climate parameters.

DESCRIPTION OF THE DRAWINGS

The invention will now be described further with reference to the accompanying drawings, in which:

Fig. 1 shows a front perspective view of a cooling cabinet in which a compartment with a climate control system is integrated.

Fig. 2 shows a front perspective view of the compartment according to fig. 1 in which
5 the climate control system is further illustrated.

Fig. 3 shows a front perspective view of the cover of the compartment according to fig. 1 – 2 in which the user interface is further illustrated.

10 Fig. 4 shows in a front view the user interface of fig. 3 in a more detailed view.

Fig. 5 shows a front perspective view of the selection mechanism of the user interface.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

15 The figures show an illustrative embodiment of an appliance with a compartment having a climate control system in accordance with the invention. The illustrative embodiment shall not be interpreted as a limitation of the invention. Its purpose is to illustrate how the invention can be applied and to further illustrate the scope of the invention.

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Fig. 1 shows a front perspective view of a cooling cabinet 10 in which a compartment 11 with a climate control system is integrated. The figure only illustrates the basic concepts of the technical field, which is climate-controlled compartment. This means that the person skilled in the art should not read the specification and the
25 accompanying drawings as a strict limitation of the scope of the invention, which in fact relates to the features of the climate control system, see fig. 2 – 5.

Fig. 1 illustrates how the cooling cabinet 10, having a regular cooling system of some kind, and the compartment 11 could cooperate. In this embodiment it is illustrated that
30 air is provided to flow between the cooling compartment 12 of the cooling cabinet and the inside 13 of the compartment. The flow is illustrated with arrows, flow from the compartment 12 to the inside 13 by arrows 14 and flow from the inside to the compartment 12 by arrows 15. A climate device such as this is, as part of the climate control system, enables the airflow. Such as device preferably comprises at least one

fan and/or a damper (not shown). Moreover, in order to adjust humidity, means enabling the adjustment of humidity could be included. Since the features of the climate device is not essential, the device will not be further described. It should moreover be understood that the climate device as an alternative could comprise a
5 separate cooling system, such as by compressor or by Peltier element operated. This means that the compartment does not have to be arranged into a cooling cabinet as disclosed in the present embodiment.

The compartment 11 comprises surrounding walls 16 and an opening 17. Moreover, a
10 cover 18 is arranged for covering the opening in order to enclose the compartment.

The cover of the illustrative embodiment is preferably part of a receptacle that is slidably mounted at the compartment, in order to be able to slide as a drawer in and out of the compartment. The complete receptacle is not shown in the drawings, since it is not essential for the present invention and since it is part of common knowledge.
15 Arrow 19 illustrates how the cover of the illustrative embodiment can move during use. As an alternative the cover could be a door or lid hinged at the compartment. This means that the cover design is not essential for the present invention.

Fig. 2 shows a front perspective view of the compartment 11 in which the climate
20 control system is further illustrated. The surrounding walls 16 and the cover 17 are shown. Moreover, the climate control system is shown. The task for this system is to control the climate parameters, such as temperature and air humidity, inside the compartment. In order to enable this operation, the system comprises some parts. At first there is a control unit 20 preferable as a PCB board with a microcomputer. The
25 control unit could be separate and unique for this compartment or part of a larger control system for more compartments and/or the whole cooling cabinet.

The control unit 20 is connected to sensors or probes, in the illustrative embodiment one temperature sensor 21 and one air humidity sensor 22. These provide information
30 to the control unit about the values of the climate parameters inside the compartment 11. They are for instance connected to the control unit by wire connections 35 or wireless. The compartment further comprises a user interface 23 mounted on the cover 18 and an antenna 24 mounted at the lower part of the compartment. The antenna could as an alternative be arranged at the top of the compartment or

somewhere else preferable for the operations of the compartment or the whole cabinet.

The user interface is the most essential part of the present invention and will therefore
5 be described in detail in relation to fig. 3 – 5.

Fig. 3 shows a front perspective view of the cover 18 of the compartment in which the user interface is further illustrated, while fig. 4 shows in a front view the user interface in a more detailed view. The main idea having a user interface for this kind of climate
10 control system is to enable for the user to select the operation of the system. This means that the user can set the values of the climate parameters. For instance, if the user wishes to have a setting of 2 degree Celsius temperature and 70% air humidity inside the compartment 11 he/she selects the values on the interface and the control system will make sure to adjust the climate inside the compartment to enable the
15 selected parameter values. As mentioned above one of the problems with many now common user interfaces is that they are difficult for the user to handle. The user interface of the present invention intends to solve this problem.

As shown in fig. 3 – 4 of the illustrative embodiment, the user interface is provided
20 with five operation modes, illustrated by numbers 25 – 29, for user's selection. Each of these operation modes corresponds to a defined setting of values for the climate parameters. For instance one operation mode 25 corresponds to a setting of 2 degree Celsius temperature and 70% air humidity. Another operation mode 29 for instance corresponds to a setting of 0 degree Celsius temperature and 50% air humidity. This
25 means that the user does not need to know the actual settings. Instead he/she selects one of five operation modes and the climate control system does the rest. In order to communicate to the user what provisions the settings of a specific operation mode relates to, each operation mode has a symbol (printed or electronically displayed). The star of operation mode 27 illustrates such a symbol. Preferably, the picture of specific
30 provisions, such as a vegetable, is shown (see fig. 4).

As mentioned above, another problem with commonly known user interfaces in this technical field is that they are often small and positioned at the side of the cover. This often means that the interface has to be small and difficult to see and read. In order to

avoid this the user interface 23 of the present invention is arranged on the cover 18. This means that it can be larger and easier to handle. In order to provide a convenient technical solution to enable the user interface to be positioned on a movable part such as the cover, the present invention proposes an arrangement as described below.

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A newly introduced technology for radio frequency communication is Radio Frequency Identifiers, RFID. These small electronic circuits does not need any energy supply and can transmit a digital code to identify itself. Depending on the frequency in which the RFID works it can transmit more or less complex signals. In order to be able to transmit signals, the RFID also comprises some kind of antenna, such as a coil, which can receive magnetic or electrical field signals and use these to energize the RFID and thereby be able to transmit the digital code. In the future it is also expected that the energy RFID receives can be user to do more than transmit a digital code.

15 RFID is a very convenient technique to use in the present invention. The basic principle is to arrange one unique RFID 25 – 29 at each operation mode symbol of the cover. Each unique RFID has its own digital code. In fig. 4 one of the operation modes, 26, is illustrated with an RFID 30. The arrows 31 illustrate the radio frequency signal sent out when the RFID is energized while the symbol 35 illustrates the digital code carried by the frequency sent.

The idea is that the climate control system uses the antenna 24, see fig. 2, both to energize the RFID:s and to receive the radio frequency signals transmitted back. It will therefore either “see” the RFID continuously or on regular basis ask for (shake hand) with the RFID circuits by energizing them. Having the communication, it will be possible to communicate the operation mode selected by the user to the control unit. The present invention uses shielding to enable this, as illustrated in fig. 5.

Fig. 5 shows a front perspective view of the principle idea for the user interface of the illustrative embodiment. In the figure, two RFID:s 27 and 28 out of five is shown, one of them 28 shown by dotted line. The user interface further comprises a mechanism with a moving part 32 being able to indicate the operation mode 25 – 29 selected by the user. The figure also shows the symbol (the star) of number 27 operation mode. The mechanism of the embodiment comprises a sliding frame 33, see fig. 4, which

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supports the moving part. Of course a rotating or any other mechanism can be used instead to enable to same operation mode. The position of the moving part can be indicated in many ways, which is why the illustrative embodiment does not describe any particular indication. One way could be to have a frame indicating the symbol
5 selected. Another way could be to energize light means on the RFID lightning up or change color of the symbol selected.

The idea with a moving part 32 is that when it is positioned at an RFID, the signals to and from this RFID will be shielded off. This means that the climate control system
10 will no "see" this RFID. Still it sees the other four RFID:s. This means that the system will easily select which operation mode the user has selected and activate the adjustments needed to change the climate in accordance with the operation mode. The arrow 34 illustrates the selected operation mode.

15 A known technique, widely used, for detecting movements is Hall effect sensors. The basics is that a Hall effect sensor detects changes in the magnetic field. In cars a permanent magnet is attached to a rotating shaft. The sensor is positioned in vicinity of the shaft and senses the angle of the shaft. An ignition control system then uses this information to control the timing of the ignition.

20 Fig. 6 shows an embodiment of a Climate control system using Hall effect sensors 36 for the functionality of the User interface 23 on the cover 18. The sensors are mounted at the lower part of the compartment 11 and connected to the control unit 20. The arrangement is similar to the embodiment using RFID (fig. 2). There is one sensor
25 positioned below each of the five operation modes (fig. 2). As mentioned earlier each of these operation modes corresponds to a defined setting of values for the climate parameters. As also mentioned earlier, there is a mechanism comprises a sliding frame 33, see fig. 4, which supports a moving part 32 indicating the operation mode chosen. This is very suitable for a Hall effect based system. Attaching a permanent magnet 37
30 to the moving part will provide the option to detect the position of the moving part, using the Hall effect sensor. The control unit will then detect the operation mode chosen. It should be understood that it is also possible to use a fewer number of sensors.

Another known technique for detecting movement is capacitive sensor technology. The basics is that a sensor circuit detects changes is capacitance is a measurement circuit. The capacitance may be influence by many things, such as moving objects made in an electrically conductive material. An example is an opening mechanism for an elevator door. If a capacitive sensor circuit antenna is positioned at the edge of the door, the mechanism can detect (if the influence of surrounding metal parts is disregarded by the system) if a human body part is positioned next to the door. Thereby, it is possible to avoid that the door pinches a person.

Fig. 7 shows an embodiment of a climate control system using capacitive sensors for the functionality of the user interface 23 on the cover 18. There is one electrode 39 positioned at each of the five graphic symbols (fig. 2). As mentioned earlier each of these operation modes corresponds to a defined setting of values for the climate parameters. The electrodes extend from the cover 18 to the bottom of a drawer, which drawer said cover is part of. A capacitive sensor circuit 39 is arranged at the lower part of the compartment 11 and connected to the control unit 20 (not shown). The arrangement is similar to the embodiment using RFID (fig. 2). The capacitive sensor circuits will detect every change in capacitance, caused by influences on the electrodes. For instance, if the drawer is opened, that will be detected.

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The functionality will be like this. When the user puts his finger closed to one of the operation mode symbols on the cover 18, the sensor circuit will detect a significant change in capacitance for electrode arranged at this particular operation mode.

Probably the surrounding electrodes will also be influenced, but the influence is much less. This will indicate to the control unit 20 to operate the climate control system in way that corresponds to that specific operation mode. It is important that the control unit can discern the user's influence from other influences. Therefore, some algorithm and some work on mechanical details will be needed.

In relation to the above techniques for wireless control at a climate control system, it is highly relevant to monitor the compartment conditions on the user interface 23, corresponding to operation mode for the system. Since there is to power on the cover 18, there is a need to find a non-powered technology for this. A suitable technology found is thermochromic materials. A thermochromic material can be doped to change

colour at a certain temperature. For instance it turns red at a certain temperature interval. Outside this interval it is uncoloured.

The idea is to combine thermochromic materials and wireless climate control. At each graphic symbol (fig. 3) a piece of doped thermochromic material is applied. The pieces are doped differently (a,b,c,d) for instance in the following way (here four operation modes):

Temp. °C	-6°C	0-3°C	0+3°C	3+6°C
RH %	10	65-75	85-95	65-75
Food Type	a	b	c	d

a) Fresh Meat	c) Fresh vegetables
b) Fresh Fish	d) Milk, Dairy

10

When user selects a symbol of one of the operation modes (that correspond to a certain climate setting), the wireless climate control system can recognize the selection and consequently run the proper chilling cycle. When the compartment reaches the temperature range for that climate setting, the thermochromic label applied at that graphic symbol on the user interface changes colour. Preferably each doped piece of material will have a unique colour. The user will thereby get feedback that the climate inside the compartment 17 corresponds to the chosen operation mode.

There are obvious advantages to have a wireless connection between the user interface 23 and the control unit 20, especially if the user interface is positioned on a moving part, such as the cover. Having a wire connection will cause mechanical stress on wires. Moreover, the user will not be able to, in a convenient way, to remove the drawer from the compartment and clean it. Having a mainly mechanical solution also means that it will be easier to last the lifetime of the compartment.

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CLAIMS

1. An appliance (10) having a storage compartment (11) with an opening (17) for access into the compartment (11), a cover (18) being arranged for covering the opening (17) in order to enclose the compartment (11), a climate control system being provided to control the climate inside the compartment (11), the system comprising a control unit (20) for control and adjustment of climate parameters of the compartment (11), the system further comprising means (21,22) to detect the parameters and a climate device (14,15) enabling the adjustment, the system further comprising a user interface (23) enabling the user to select the operation mode for the system, the user interface being arranged on the cover (18) and having a limited number of operation modes (25-29) to choose from, each of the operation modes (25-29) corresponding to a defined set of values of the climate parameters and being indicated by a graphic symbol on the interface (23) **characterized in** that at least one signal transmitting device is arranged on the user interface, said device communicating wirelessly with the control unit.

2. An appliance according to claim 1 wherein said signal transmitting device consist in an electronic circuit which when being powered by the control unit (20), transmits a radio frequency signal (31) carrying a digital code (35) to be received by the control unit (20) via an antenna (24), the circuit being powered wirelessly by an electric and/or magnetic field.

3. An appliance according to claims 2, wherein each operation mode corresponds to a separate electronic circuit (25-29) arranged at the vicinity of each symbol and being able to transmit a unique digital code (35) via a radio frequency signals (31), wherein the control unit (20) detects the selected operation mode based on the received digital codes (35).

4. An appliance according to any of the claims 2 - 3 wherein the selection of operation mode is enabled by a mechanism having a movable (32) part being able to move to indicate the graphic symbol selected, the mechanism further comprises shielding means (32) arranged at the movable part (32) to shield off radio frequency signals (31) from the electronic circuit arranged at the vicinity of the selected symbol.

5. An appliance according to any claim 1 wherein said signal transmitting device consist in a movable, permanent magnet.
- 5 6. An appliance according to claim 5 wherein at least one Hall effect sensor (36) is arranged to wirelessly detect the movement of the permanent magnet.
7. An appliance according to claim 6 wherein each operation mode corresponds to a separate Hall effect sensor (36) arranged close to its corresponding graphic symbol,
10 the permanent magnet being arranged on a mechanism having a movable part (32) being able to move and indicate the symbol selected, the control unit (20) detecting the selected operation mode based on the position of the movable part (32).
8. An appliance according to claim 1 wherein said signal transmitting means consist
15 in an electrically conductive electrode (39).
9. An appliance according to claim 8 wherein a capacitive sensing circuit (38) is arranged to wirelessly detect the operation mode selected by the user.
- 20 10. An appliance according to any of the claims 8 - 9 wherein each operation mode corresponds to a separate electrode (39) arranged close to its corresponding graphic symbol, the capacitive sensing circuit and the control unit (20) detecting a change in capacitance when the user puts a body part close to said symbol and thereby detect the operation mode selected.
- 25 11. An appliance according to any of the preceding claims wherein a piece of substance or material is applied at each graphic symbol, said substance or material changing its properties when influenced by temperature variations, said properties being visually detectable by the user.
- 30 12. An appliance according to claim 11 wherein said substance or material is a thermocromic material, each applied piece having properties in that it indicates visually when the climate inside said compartment (11) corresponds one of the operation modes.

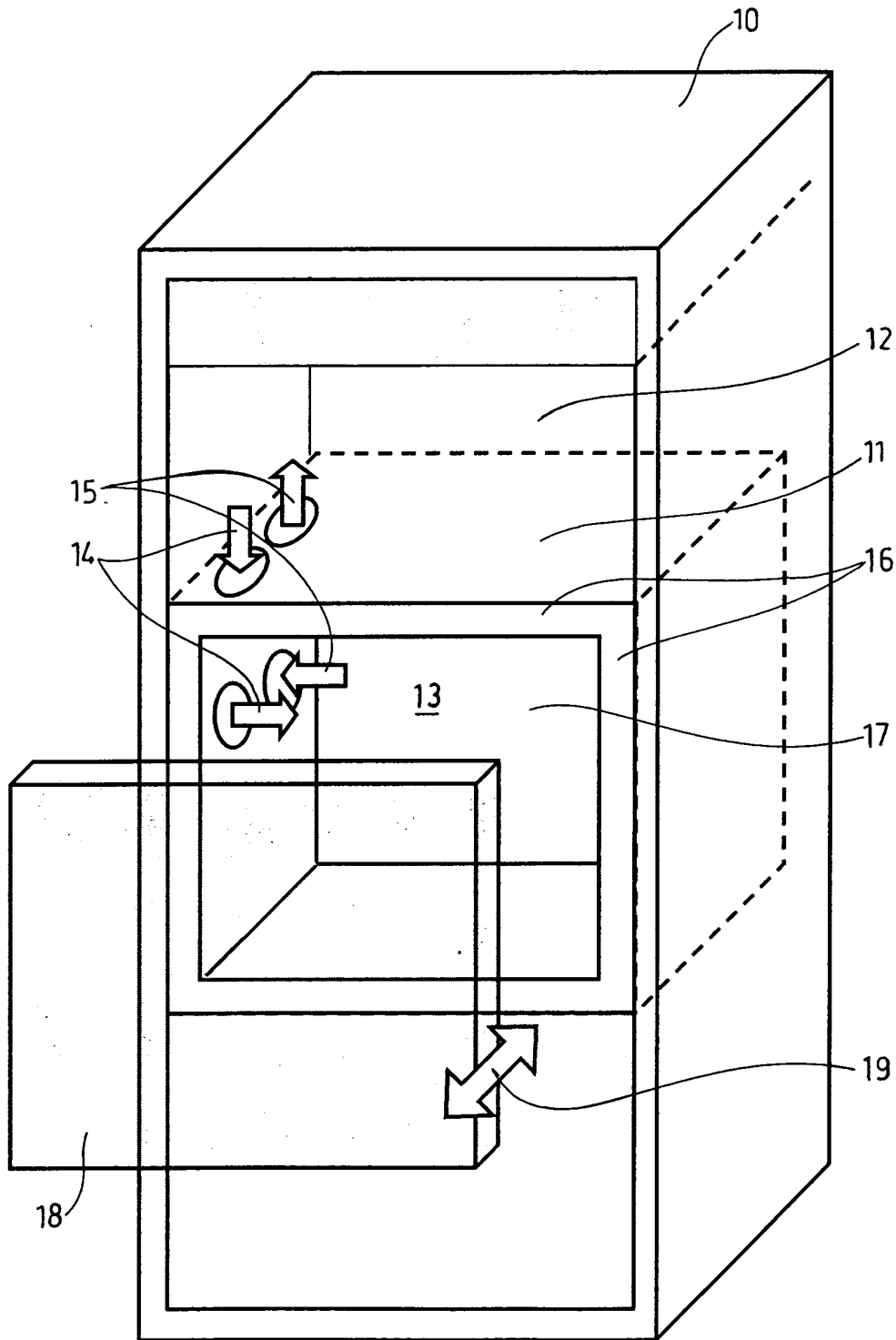


Fig.1

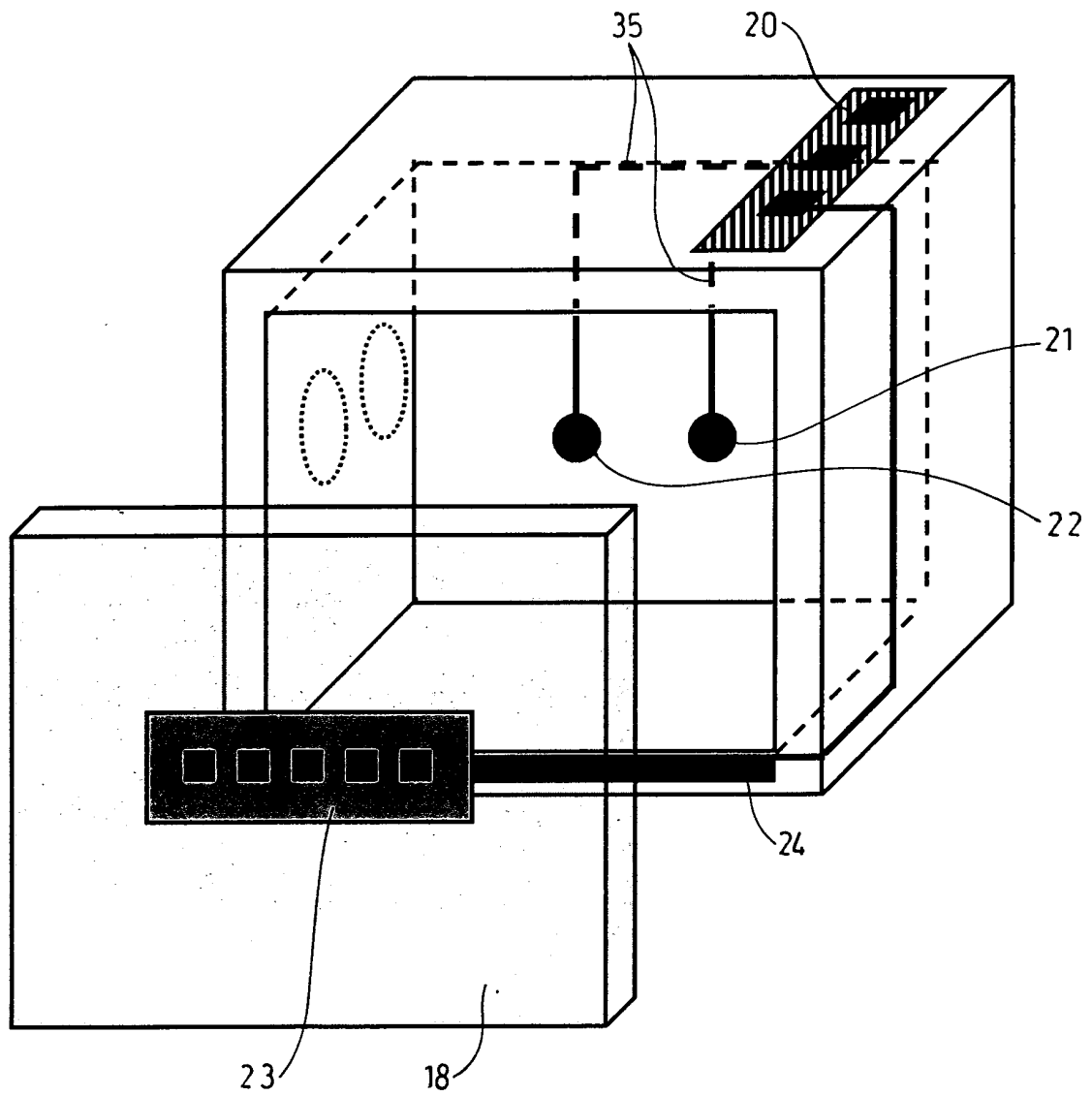


Fig.2

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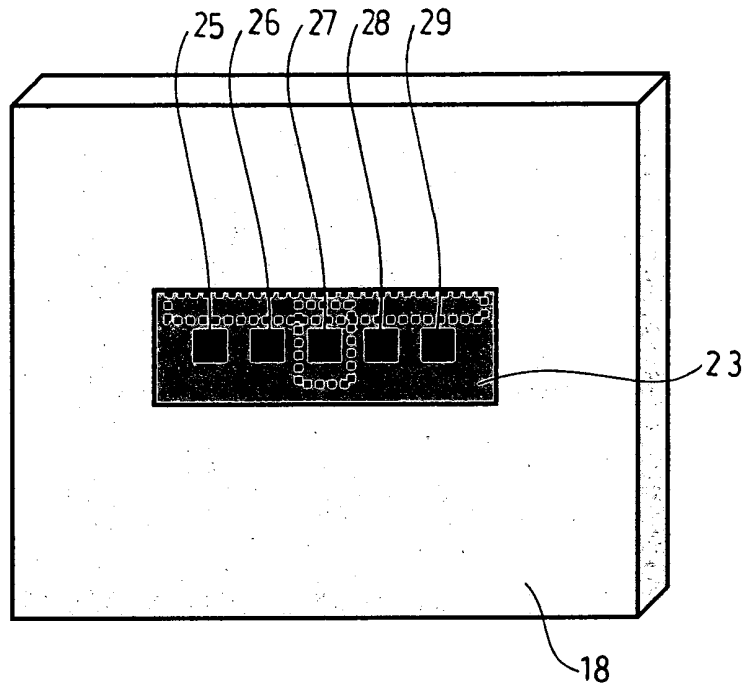


Fig. 3

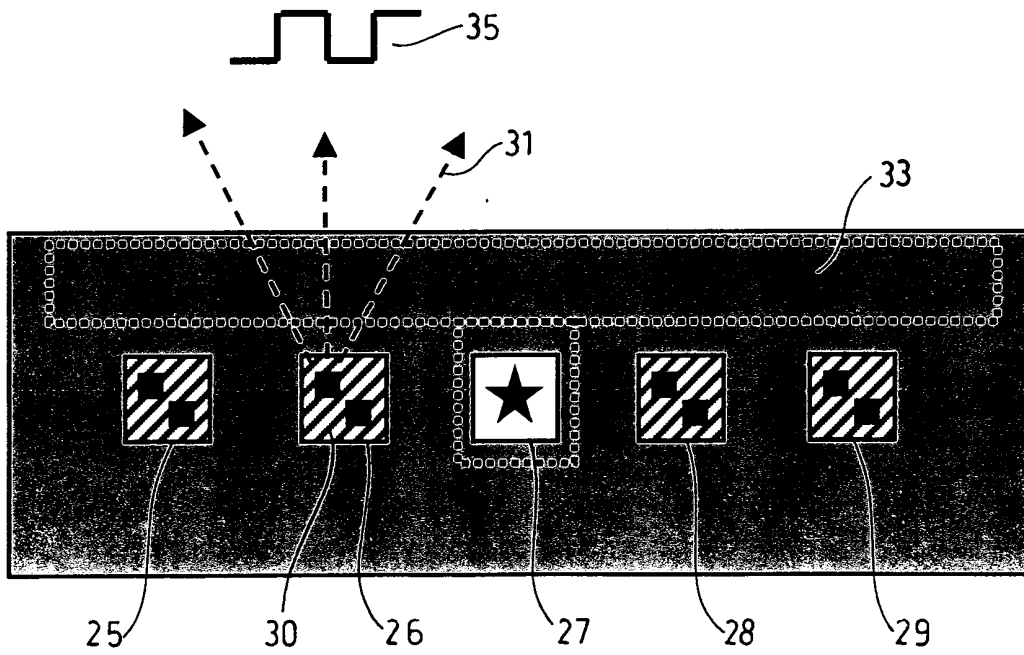


Fig. 4

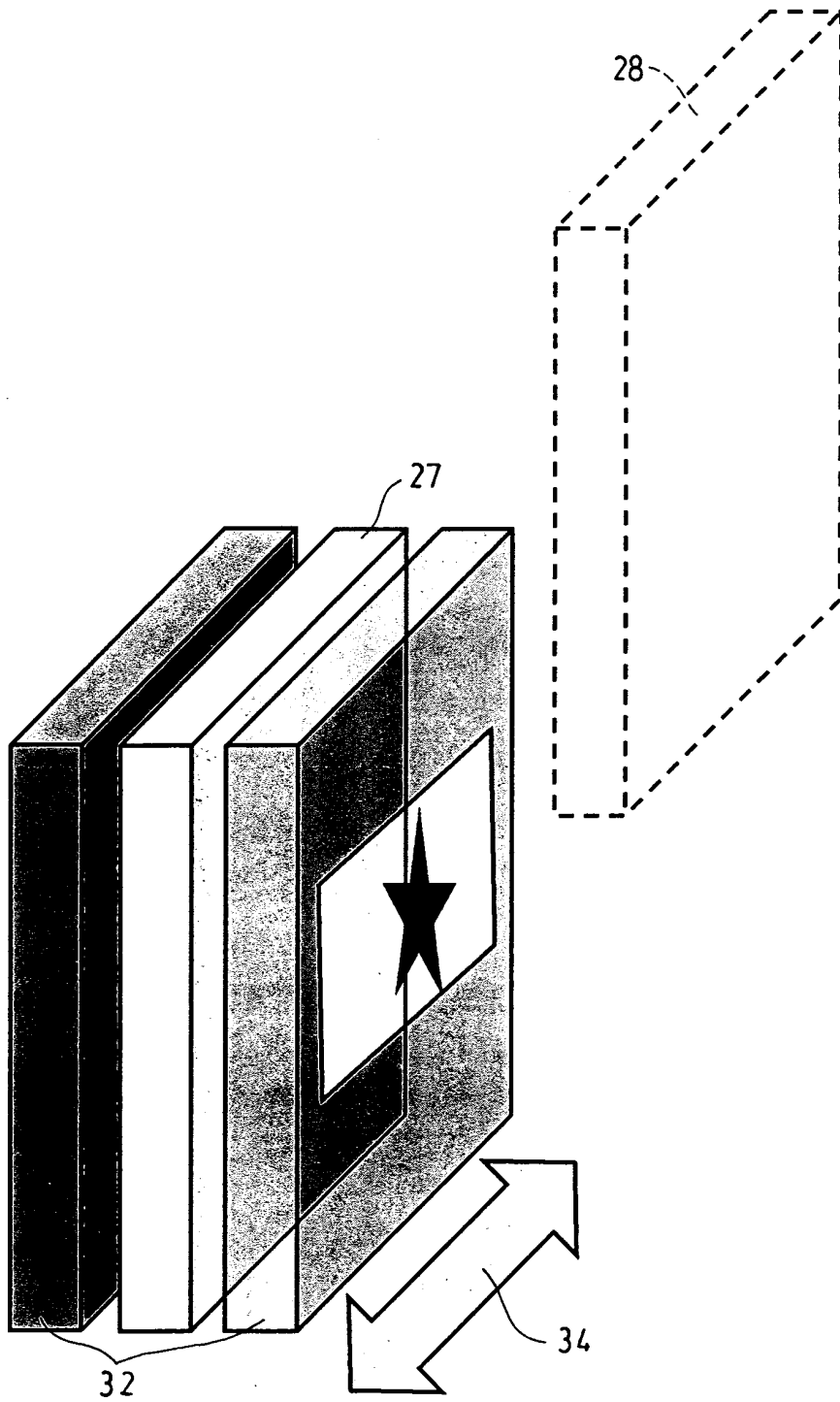


Fig. 5

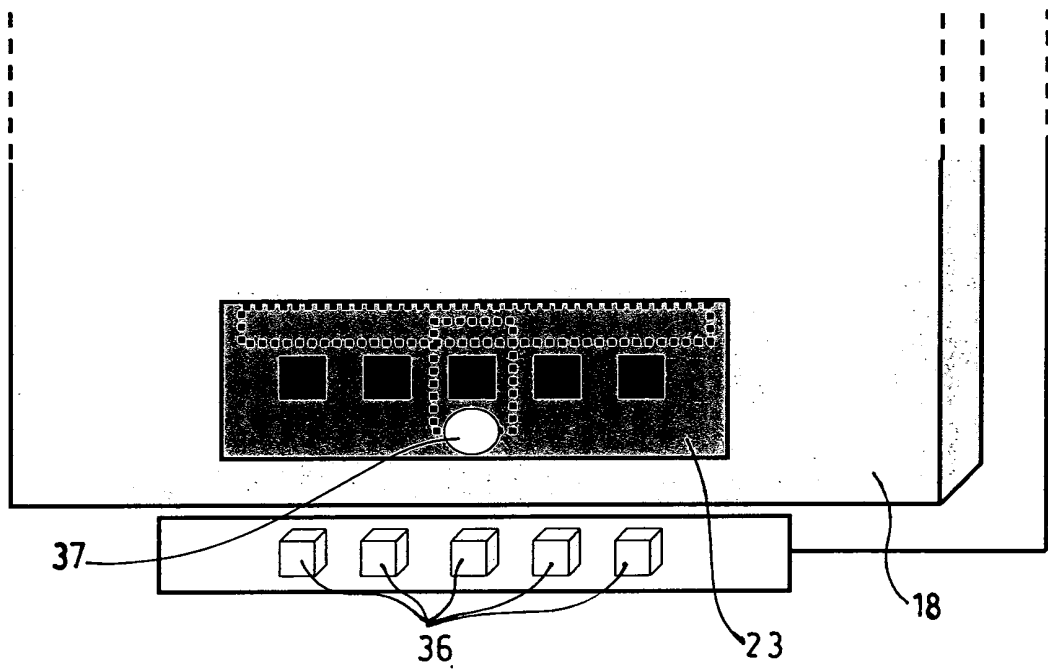


Fig. 6

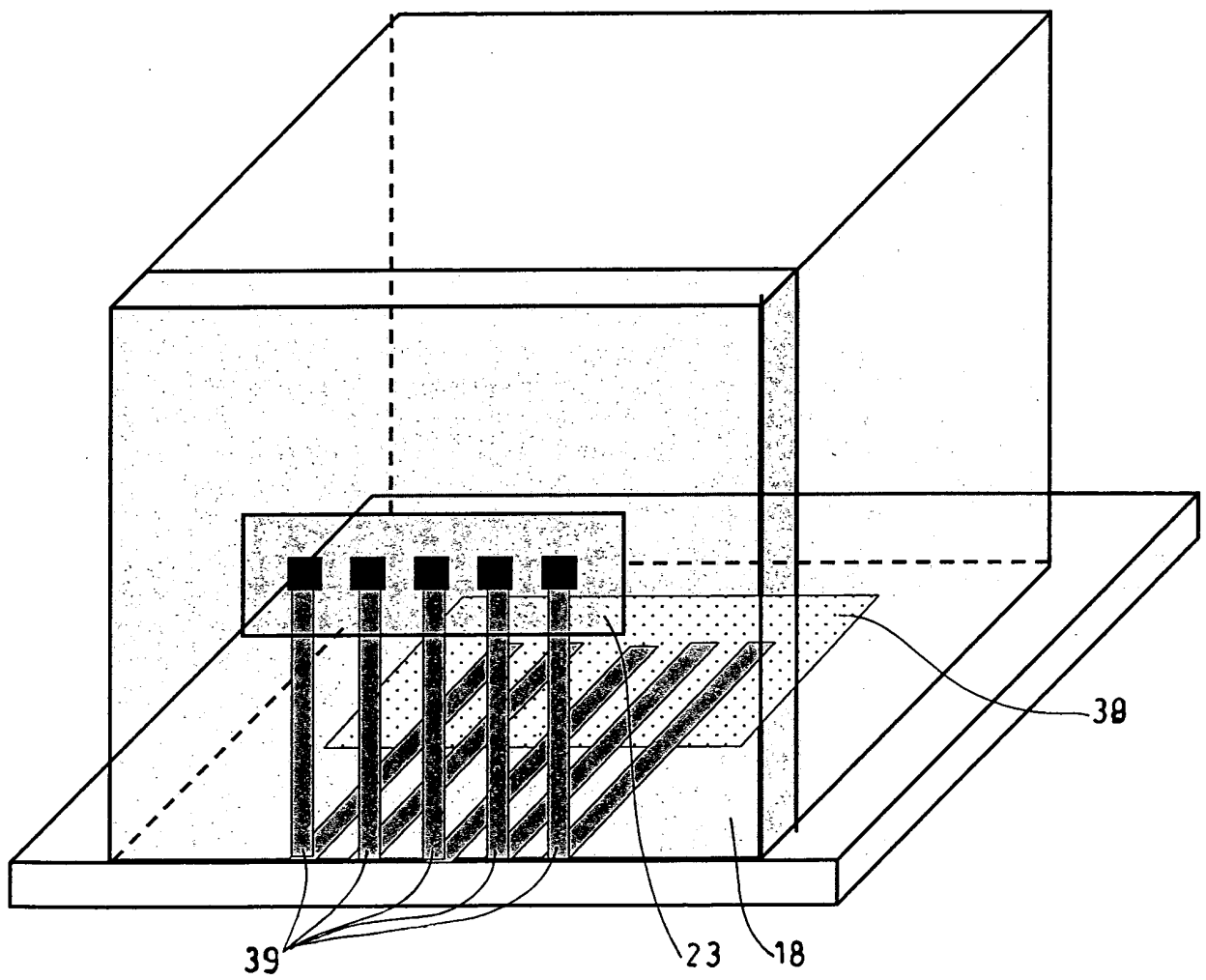


Fig. 7