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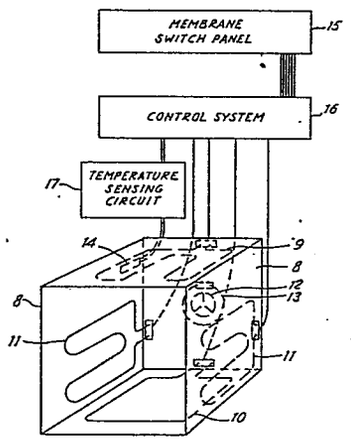
(54) **Electric cooking oven.**

(57) A multifunction cooking oven in which temperature and mode of operation are controlled by a data processor, for example a microprocessor. The sensor (14) temperature may be corrected by reference to stored calibration data and the corrected temperature may be displayed. The settings may be made by means of a membrane switch panel (15), and may include operating programs.

Fig. 3



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Description

ELECTRIC COOKING OVEN

This invention relates to a multiple function electric cooking oven. Such an oven may comprise a roof element, side heating elements, a floor element and a convector fan surrounded by a fan element. The oven may be operated in various modes in which different elements or combinations of elements are energised, and is controlled to run at pre-set temperature.

The present invention, which is defined in the claims appended hereto, has as its object an improvement in the control of such ovens.

The position of the temperature sensor used in controlling the oven temperature is chosen as a compromise between the requirements of the various modes so that, in any particular mode, its indication does not necessarily agree with the thermostat setting. In a preferred embodiment of the invention the oven control system stores calibration data for the sensor in each operating mode, and thereby obtains a corrected temperature for the current mode of operation, which preferably represents the temperature at the centre of the oven.

In order that the invention may be clearly understood and readily carried into effect, a specific embodiment of the invention will now be described by way of example only, with reference to the accompanying drawings, of which:

Figure 1 shows a schematic representation of a prior art oven;

Figure 2 shows a schematic representation of another prior art oven;

Figure 3 shows a schematic representation of an embodiment of the invention, and

Figure 4 shows typical calibration profiles for the temperature sensing device of the invention for the various operating modes of the multifunction oven of the invention.

The oven representated in Figure 1 is a conventional oven with an oven casing 1 and side heating elements 2. An oven of this kind has only one operating mode i.e. both side elements 2 on; the temperature of the oven being varied by varying the power supply to the elements 2 and the temperature being maintained at the desired level by a known type of thermostatic device (not shown); such an oven is necessarly limited in its applications.

Figure 2 shows a multifunction oven of a known kind, with a casing 3, roof heating element 4, base heating element 5, fan 6 and fan heating element 7. This oven provides a greater number of modes of operation than a conventional oven, but because of the kind of temperature sensing device traditionally used in such oven, the temperature dial setting may not give an accurate indication of the temperature at the centre of the oven for all the possible modes of operation.

Figure 3 shows a schematic representation of a preferred embodiment of the invention comprising; a casing 8, a roof heating element assembly 9, a base heating element 10, side elements 11, fan 12 and fan heating element 13. A temperature sensor 14 forms an integral part of an oven temperature control system which itself is part of an overall electronic control system which maintains the oven at the desired temperature and ensures that the displayed oven dial temperature is an accurate representation of the centre oven temperature.

The roof element assembly 9 comprises two elements (not shown), namely a centre element and a lower power outer element; these elements are operable individually or in combination.

The element configuration shown in Figure 3 thus provides eight modes of operation as follows: hot fan convection, with the fan 12 blowing air and the fan heating element on; side elements 11 only on; roof elements 9 and base element 10 on, the roof elements 9 being connected in series and in parallel with the base element; fan 12 only on (no elements); roof elements and fan on; hot fan convection (as indicated before) now with roof elements on; hot fan convection and base element on; and base element only on.

All the heating elements 9, 10, 11 and 13 when in operation are connected to the mains via a closed loop feed-back temperature control system incorporating the oven temperature sensor 14, which is of the platinum resistor type and positioned in the oven cavity to give the required operating characteristic. The energy is supplied to the elements via relays and the oven modes are selected by a microprocessor (not shown) which switches the elements in and out via the relays and the fan via the triac as required, the microprocessor being incorporated into the electronic control system.

A membrane switch panel 15 is connected to the electronic control system 16 which in turn is connected to the temperature sensor 14 via temperature sensing circuit 17 and also to the heating elements 9, 10, 11, 13. The temperature sensing circuit 17 calibrates measurements from the sensor 14 in accordance with one of a number of specified calibration profiles corresponding to any heating element energisation arrangement chosen. The membrane switch panel 15 incorporates most of the user operable control features of the oven and displays the selected oven mode and/or feature and the oven temperature.

Figure 4 shows typical calibration profiles for the temperature sensing device of this invention.

Curve 18 indicates the calibration characteristics for the base and hot fan mode; curve 19 indicates the calibration characteristics for the roof elements and cold fan mode; curves 20, 21, 22, 23 and 24 are the calibration characteristics for the mode utilizing, respectively, the roof/base, the side elements only, the base elements only and the roof element/hot fan.

Typically, in operation, the system functions as follows: the user selects the required mode of operation by activating the appropriate switch on the membrane switch panel 15; a signal to this effect is then relayed to the electronic control system 16 where a microprocessor (not shown) sends out

signals to energise the required heating elements and/or fan. The microprocessor simultaneously switches the temperature sensing circuit 17 to operate according to the calibration profile corresponding to the selected mode of operation, the necessary information on the calibration characteristics corresponding to the predetermined energisation arrangements being stored in the microprocessor of the electronic control system 16. For example if the mode utilising the roof elements and cold fan mode is selected, the temperature sensing circuit 17 is switched to operating according to curve 19 by the electronic control system 16 and thus measurements from the sensor are processed and adjusted so that the information finally sent to be displayed on the membrane switch panel 15 is a true representation of the centre oven temperature.

In addition to the various operation modes detailed above, the user also has a choice of six preset features. Each one of these features can be obtained by pressing a dedicated key pad on the membrane switch panel 15; the display area of this panel is provided with an LED for each of the features, the appropriate LED being illuminated when the feature is selected. The preset features include, for example, slow cook, defrost and bread proving. Thus, when a preset feature is selected by the user, the electronic control system automatically selects the appropriate oven mode and additionally runs the oven at a predetermined temperature for a predetermined period of time, corresponding to the feature chosen. So if, for example, 'slow cook boost' is chosen, the oven is operated in the 'hot fan convection mode', the temperature is automatically set to 200°C for 30 minutes, thereafter being re-set to 110° for the remainder of the cooking process.

A principal advantage of the invention is that, regardless of the mode of operation selected by the user and/or electronic control system, the displayed dual temperature is always an accurate representation of the actual centre oven temperature. This is done by calibrating the temperature sensor 14 and temperature control system for each operational mode, so that the temperature display dial does not simply show the temperature of the temperature sensor but shows instead a corrected temperature which takes into account the oven mode selected and is representative of the actual centre oven temperature.

Alternative embodiments of the invention are envisaged, all utilizing the unique electronic control system and calibrated sensing device. Thus, for example, there may be provided a small oven with a roof element assembly and base element only. In such an oven the roof element assembly may comprise three elements: one to be used in conjunction with the base element when operating as an oven. the other two being used when a grill is required. Indeed, a small oven of such a type may be considered with the oven of Figure 3 and a hob unit to provide an extremely flexible, multifunctional, cooking assembly.

Claims

1. An electric cooking oven comprising heating elements of at least two of the following types, that is to say:
a roof element,
side heating elements,
a floor element,
a fan element,
together with a temperature sensor, mode and temperature setting means, and a control system, and in which the control system includes data processing means responsive to inputs from the setting means and the temperature sensor to control the supply of power to the elements and cause the oven to operate in the mode and at the temperature for which it is set.

2. An electric oven according to claim 1 in which the control system includes a memory storing temperature calibration data for each operating mode and the data processing means is arranged to compute from the sensor input a corrected temperature for the current mode of operation and to control the element power supplies accordingly.

3. An electric oven according to claim 2 including display means for displaying the corrected temperature.

4. An electric oven according to any preceding claim in which the data processing means is a microprocessor.

5. An electric oven according to any preceding claim in which the control means is arranged to store oven operating programs and the setting means includes means for selecting a desired program.

6. An electric oven according to any preceding claim in which the setting means is a membrane switch panel.

7. An electric oven according to any preceding claim which includes a roof element having independently switchable centre and outer sections.

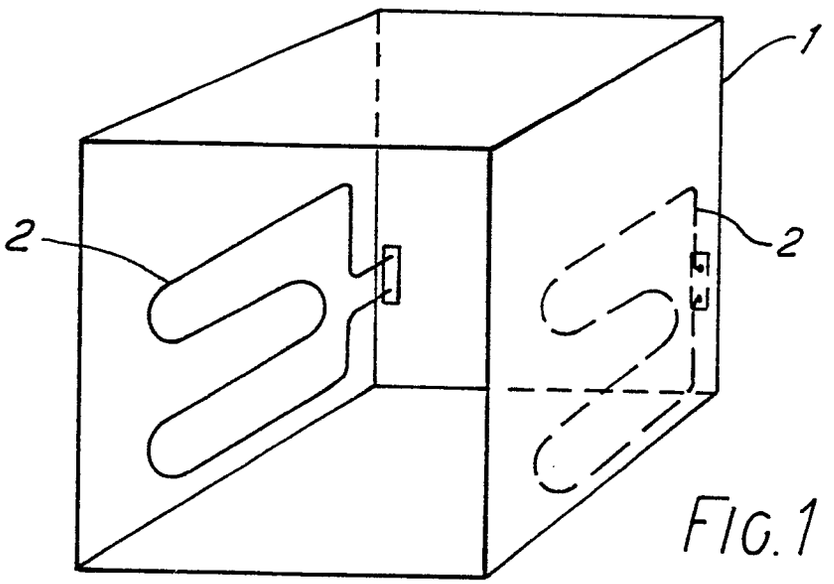


FIG. 1

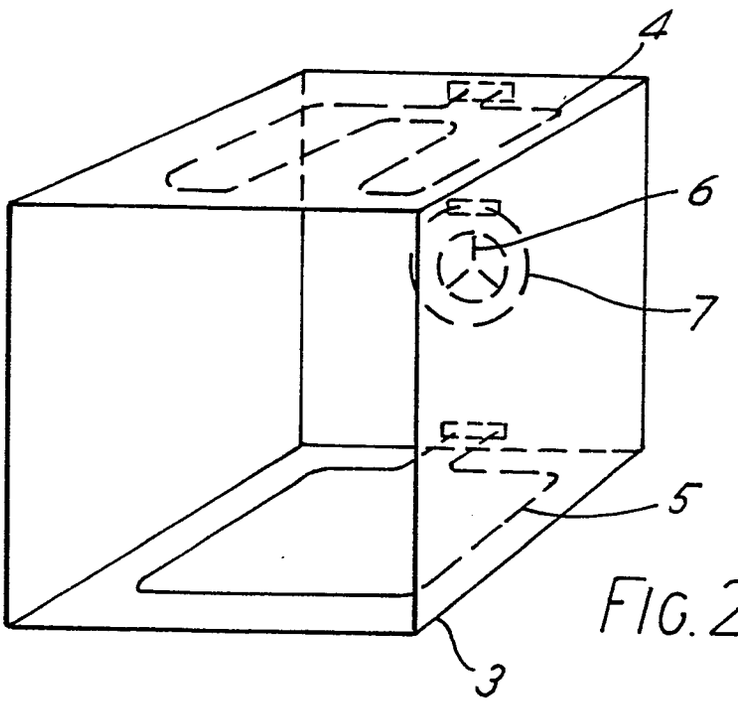


FIG. 2

FIG. 3

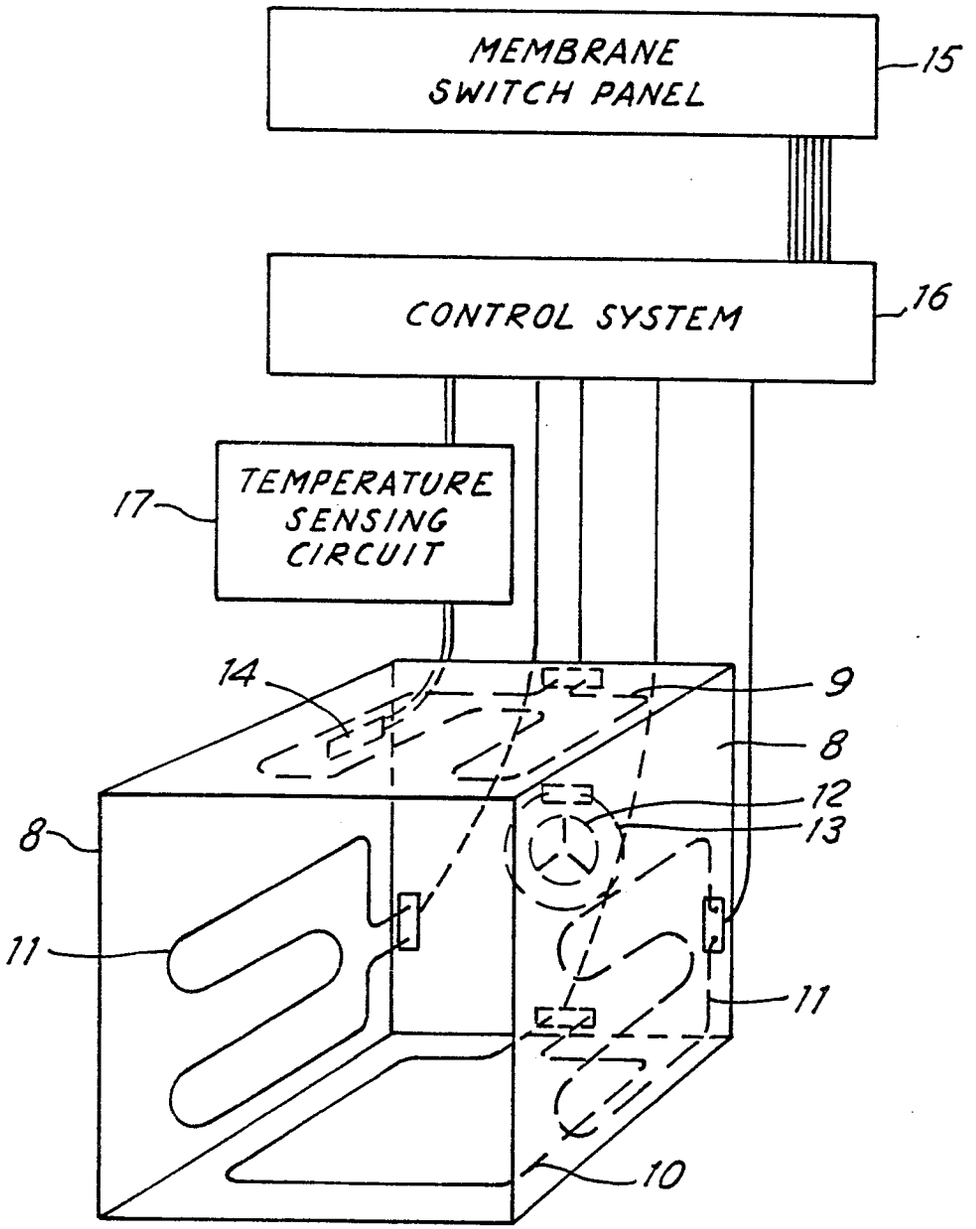
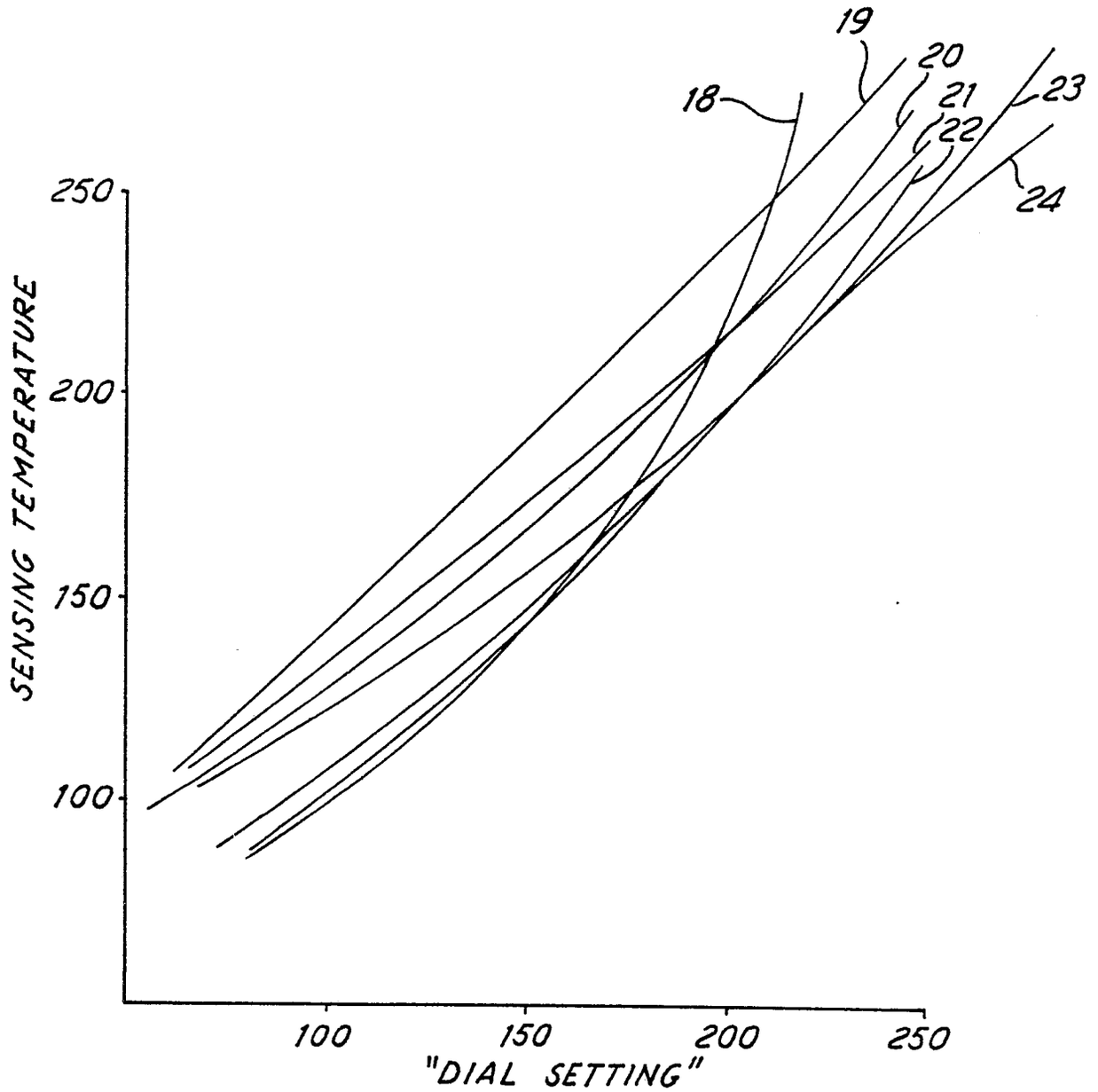

MEMBRANE SWITCH PANEL
15
CONTROL SYSTEM
16
TEMPERATURE SENSING CIRCUIT
17
14
9
8
12
13
8
11
11
10

FIG. 4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SENSING TEMPERATURE
100
150
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"DIAL SETTING"