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(54) A controller for the energy uptake fo an oven

(57) In conventional ovens the heating elements are controlled by a thermostat which cycles the temperature between a minimum and maximum cavity temperature. The cycling is constant over the whole cooking time. According to the invention the energy supply is controlled by the obtaining of a stable cycling, subsequent to which the temperature drops a predetermined amount, followed by renewed feeding of energy until stable conditions again prevail, and the process repeats itself. This type of control permits considerable energy savings.

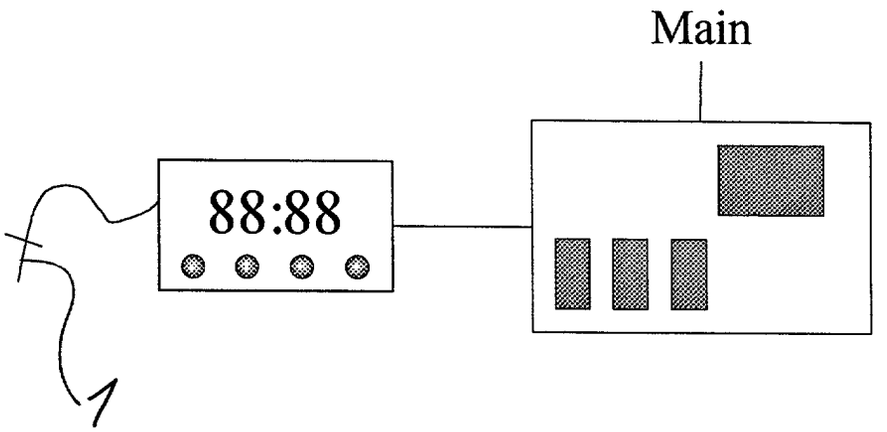

Fig. 1

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Description

[0001] The present invention relates to a controller for controlling the amount of energy supplied to an oven cavity for cooking food and comprising temperature measuring means, energy control means, and means for maintaining a set temperature in the cavity, and timer means.

[0002] Conventional ovens are fitted with a thermostat, i.e. a device which connects the energy supply when the temperature in the oven cavity is below a set value and switches it off when the set temperature has been reached. When a stable temperature has been reached there is a regular cycling between on and off in order to compensate for heat losses to the environment. There is frequently a hystereris involved in that there is a difference in temperature between switching-on and switching off for a given temperature setting. During the cycling the temperature hence fluctuates slightly. When the cooking is finished, either programmed or upon evaluation of the result by the user, the power is switched off, for instance by turning the thermostat setting to 0. The food is removed, and the oven is left to cool off, sometimes assisted by a built-in blower. The energy stored in the cavity, in particular in its metal parts, is lost to the room and has not contributed to the cooking, although it would be measured as being consumed in the cooking process. There is hence a need for energy saving. It is known to save energy by switching-offthe oven before the cooking has finished in order to use the "residual heat", however this requires a large experience in the user and for that reason it is only undertaken with well-known recipes. There is hence a need for a more efficient way of saving energy when using an oven.

[0003] According to the invention this is obtained in that the energy control means create a cyclic energy supply, in that when stable temperature conditions have been obtained in the cavity, the energy control means switch off the energy supply until a pre-determined lower temperature has been reached, subsequent to which the energy control means switch on the energy supply for obtaining and maintaining the set temperature until stable temperature conditions have again been obtained. In this way, the energy stored in the oven cavity is used until the lower temperature has been reached. It may then be determined if the food has been cooked to satisfaction, in which case the oven is switched off (manually) and the food removed. If this is not the case the cycle in the energy supply is repeated, until the cooking is finished. The set temperature may be made automatically lower for the later part of the cooking in order to finish the cooking.

[0004] In an advantageous embodiment the lower temperature is in the neighbourhood of 100 °C. This means that cooking can usefully take place until this temperature is reached. The reason that 100 °C is chosen as the lower temperature is that much cooking, in particular towards the end of the preparation, consists in heating and evaporating water.

[0005] The time and temperature defined process is in practice electronically controlled. The time from start of the cooking to the first change to the second cycle (the first "first cycle") is dependent on the temperature setting, in that a higher setting makes a shorter first cycle.

[0006] The advantage of the new combined temperature and time controlled switching of the heating elements in an oven cavity is firstly the saving in energy during each use of the cavity in all cooking functions without any intervention or program from the users side. The user prepares the food and sets the oven as usual. The cooking result is not changed, only the energy consumption is reduced significantly. Energy is saved due to better exploitation of energy introduced into the system. The heat transfer during the "second cycle" occurs mainly by radiation. This type of transfer in general distributes the energy evenly.

[0007] The invention will be described in greater detail with reference to the drawing, in which

Fig. 1 shows a block diagram for an energy supply control according to the invention, and

Fig. 2 shows temperature and power on/off functions over time in an oven control according to the invention.

[0008] In Fig. 1 is seen a temperature sensor 1 which is fitted in a conventional manner inside the cavity of an oven. The temperature sensor provides the input to means for maintaining a set temperature in the cavity, in other words a controller which functions like a thermostat. The temperature sensor also provides the input for energy control means which serve to cut the power supply to the oven cavity for a period when stable temperature conditions have been determined by regular swiching-on and switching-off in the thermostat circuit. The time constants for heating an oven cavity may be individually calibrated for each cavity, and more sophisticated controllers will take into account the load of food inside the cavity for cooking.

[0009] In Fig. 2 is seen the action of the energy control means for an oven cavity according to the invention. The temperature function is shown in dependence of time. It will be observed that the temperature increases steeply until a first region of maintenance by means of the thermostat circuit is reached. At this stage the power is switched off, either until a pre-determined lower temperature has been reached, or for a pre-determined time. From that time or from the lower temperature the energy control means switch the power on again, and the temperature increases steeply until the set temperature has been reached and has stabilised, upon which the cycle repeats. Each cycle contains a Maintenance phase, a Residual phase, and a Heat-up (reheat) phase. The thin temperature curve shows the temperature in a conven-

tional oven controlled only by thermostat circuit means.

[0010] The energy saving is shown by the curves representing the power averages for each of the phases. The curve at (a) shows the initial full power supplied for the first heating up of the cavity, after which it falls to a maintenance value (b). When the Residual phase is entered, the power falls to that consumed by ancillary equipment, such as the electronics, lamps, etc. During the Heat-up phase the initial value of power consumption occurs briefly, upon which it again falls to the maintenance value. A traditional power controller for an oven cavity would have the same initial full power and a continuous maintenance power, but this would mean an overall higher energy consumption as compared to the controller according to the invention. This is demonstrated graphically by the drop in power during the Residual phase, from which has been subtracted the full power surge required in the Heat-up phase.

[0011] The rectangles Energy Saving represent an energy saving in each cycle according to the invention.

[0012] This process which is defined by time and temperature is controlled electronically. In one embodiment the variable time (start of the Residual phase) varies depending on the oven set temperature. The higher the set temperature, the earlier the first Residual phase starts. The correlation between the cavity centre temperature and cooking time is negative. This embodiment secures good cooking results and to optimise the energy consumption for each cooking process.

[0013] The advantage of the new controlled switching of the heating elements in an oven cavity is that it saves energy during each use of the cavity for all cooking functions without any special instruction of program from the user's side. The customer prepares the food and sets the oven as usual. The cooking result is not changed, only there is a significant reduction of the energy consumed.

Claims

1. A controller for controlling the amount of energy supplied to an oven cavity for cooking food and comprising temperature measuring means, energy control means, and means for maintaining a set temperature in the cavity, and timer means, **characterised in that** the energy control means create a cyclic energy supply, **in that** when stable temperature conditions have been obtained in the cavity, the energy control means switch off the energy supply until a pre-determined lower temperature has been reached, subsequent to which the energy control means switch on the energy supply for obtaining and maintaining the set temperature until stable temperature conditions have again been obtained.

2. A controller according to claim 1, **characterised in that** the timer means delay the start of the cyclic energy supply when the set temperature has been reached.

3. A controller according to claim 1, **characterised in that** the pre-determined lower temperature is in the neighbourhood of 100 °C.

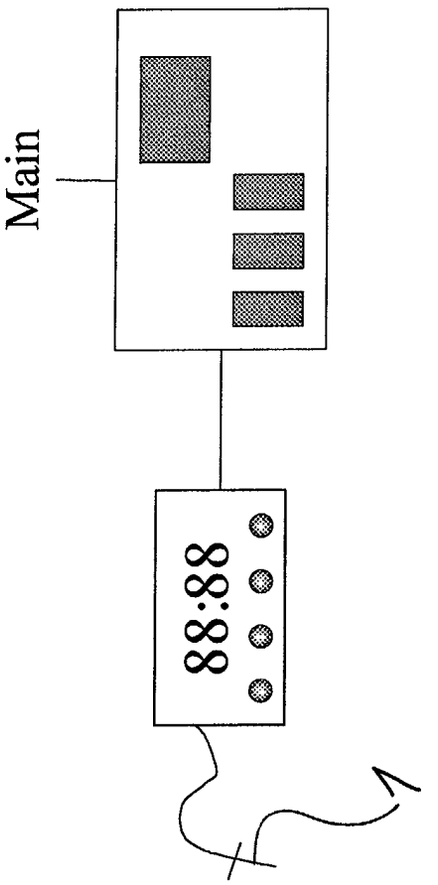
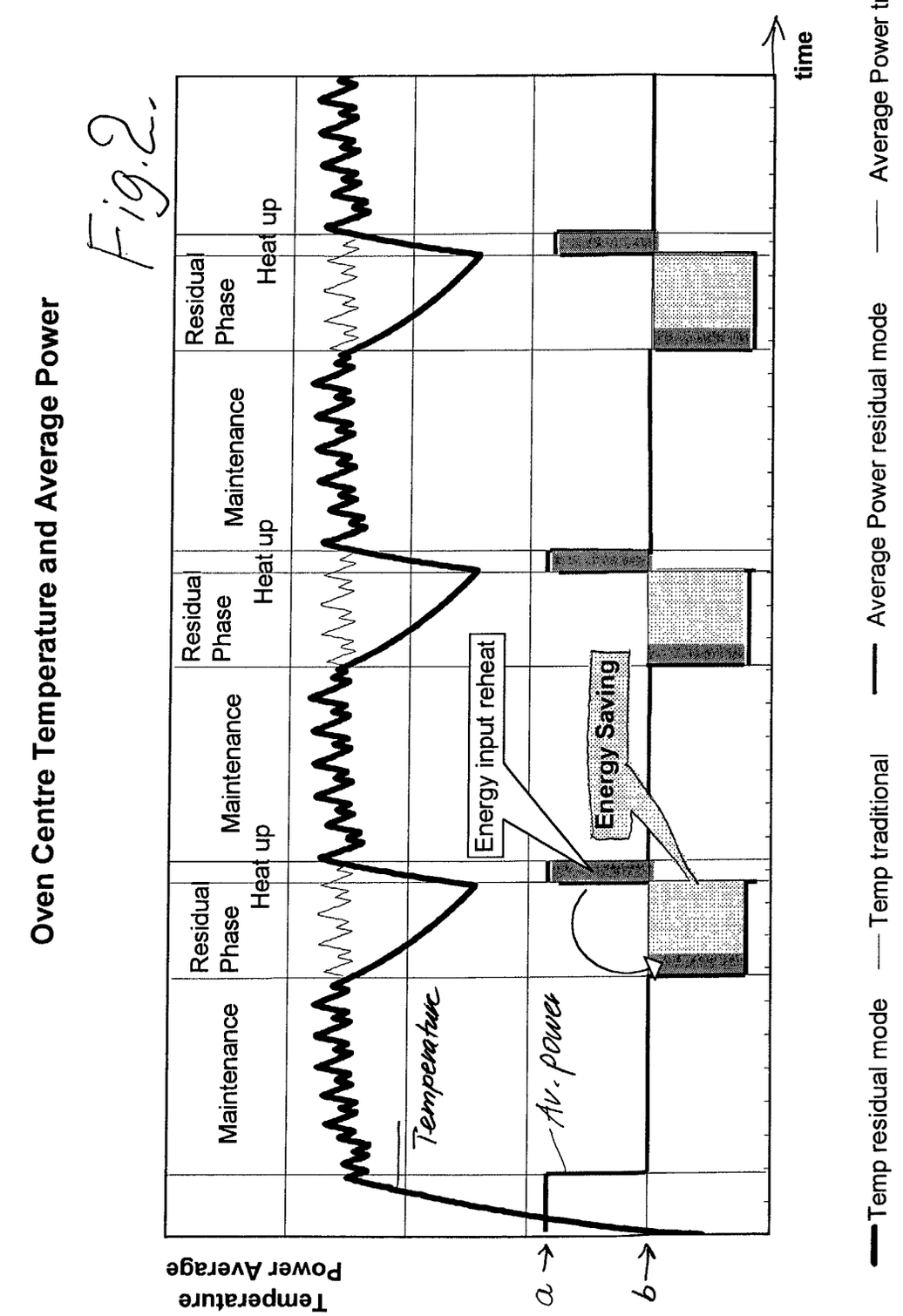


Fig. 1

Fig.2.


Oven Centre Temperature and Average Power
Temperature
Power Average
time
Maintenance
Residual Phase
Heat up
Maintenance
Residual Phase
Heat up
Maintenance
Residual Phase
Heat up
Temperature
Av. power
Energy input reheat
Energy Saving
a
b
Temp residual mode
Temp traditional
Average Power residual mode
Average Power traditional