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Cross References to Related Applications

This application claims the priority of Swiss patent application 00560/13, filed 7 March 2013, the disclosure of which is incorporated herein by reference in its entirety.

Technical Field

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The invention relates to an oven, in particular a baking oven with a cooking chamber and heating means according to the preamble of claim 1.

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Background Art

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CH 704 191 describes a baking oven according to the preamble of claim 1 with a hot air generator, a microwave heater and a steam generator. Further, a climate sensor comprising an opening in the cooking chamber and a temperature sensor outside the opening is provided. When the temperature at the temperature sensor exceeds a given threshold, the feeding of hot steam and the heating with microwaves are reduced, while the hot air generator continues to operate normally. Further relevant prior art is known from the documents WO 2009/049077 A1, EP 2 445 311 A2 and GB 2 142 714 A.

Disclosure of the Invention

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The problem to be solved by the present invention is to provide an oven of the type described above, which has a simple design and still is able to prepare foodstuff with low energy consumption.

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According to the invention, this problem is solved by providing an oven according to claim 1. According to it, the baking oven has a cooking chamber as well

as a heating arrangement consisting of a hot air heater and/or a top and bottom heater. Preferably, air from the cooking space can be supplied to the heating arrangement from the cooking space and back again into the cooking space by means of the fan. A first temperature sensor serves for measuring the temperature in the cooking chamber and a feedback loop for setting the heating power of the heating arrangement in a regulation circuit serving for maintaining the temperature in the cooking chamber, measured by the first temperature sensor, at a desired temperature.

A climate sensor comprising a first opening in the cooking chamber and a second temperature sensor arranged outside the first opening. In other words, the second temperature sensor is thus arranged in such a way that air exiting the cooking chamber first passes the first opening and only after that the second temperature sensor.

Furthermore, the oven comprises a thermostat, wherein the second temperature sensor forms a part of this thermostat. The thermostat allows to decrease the heating power of the heating arrangement to a value below the value given by the feedback loop if the temperature at the second temperature sensor exceeds a threshold temperature, such that the temperature in the cooking chamber falls below the desired temperature.

In this manner the signal of the climate sensor can be used in simple manner for controlling the device. When the temperature at the second temperature sensor rises above the threshold temperature, it must be assumed that a comparatively large amount of steam escapes from the foodstuff. In order to avoid an unnecessary loss of energy in this case, the heating power of the heating arrangement is reduced, advantageously until the temperature at the second temperature sensor falls back. In this manner, the foodstuff can be kept cooking or simmering with a small amount of energy.

In a particularly simple implementation, the thermostat comprises a switch adapted to interrupt the current from the feedback loop to the heating arrangement until the temperature at the second temperature sensor falls back below the threshold temperature.

Brief Description of the Drawing

The invention will be better understood and objects other than those set forth above will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawing, which shows a simplified sectional view of a baking oven.

Modes for Carrying Out the Invention

Overview:

Fig. 1 shows a sectional view of a baking oven. The device comprises the enclosure 1, forming the cooking chamber 2 for receiving the foodstuff. Cooking chamber 2 receives the foodstuff to be processed. Enclosure 1 is arranged in a housing 35. At its front side, cooking chamber 2 is closed by a door 3, through which the user can gain access to the cooking chamber. A heating arrangement with resistive heating elements is provided for heating cooking chamber 2, in the present embodiment a top and bottom heater 4a, 4b as well as a hot air heater 5. The hot air heater 5 is located in a heating chamber 6 at the backside of cooking chamber 2 and comprises a fan 7, which is designed as a radially blowing fan, as well as a resistive heater element designed as a heating coil 8. Openings 10a, 10b are arranged in a wall between the cooking chamber 2 and the heating chamber 6. Air can be sucked in from cooking chamber 2

through the openings 10a, which are arranged radially inside the fan 7. This air is then heated by heating coil 8 through the openings 10b, which are arranged radially outside fan 7, supplied back into heating chamber 2.

5 A first temperature sensor 12, by means of which the cooking chamber temperature, i.e. the temperature in the cooking chamber 2, is measured, is arranged in or at heating chamber 2. It is connected to a feedback loop 14 of the electronic and/or mechanical control unit
10 15 of the device, by means of which the temperature within cooking chamber 2 is maintained at a desired value - in a regulation circuit consisting of the first temperature sensor 12, the feedback loop 14 and the hot air heater. For this, the regulation circuit 14 controls the
15 heating power of hot air heater 5. Depending on a selected device program it is possible to also control the heating power of top heater 4a and bottom heater 4b by the feedback loop 14.

 A first opening 16 and a second opening 17
20 are arranged at the cooking chamber 2. First opening 16, which is - in the present embodiment - located in a side wall of cooking chamber 2, forms part of a climate sensor 18, which will be described in more detail below, while second opening 17, which is - in the present embodiment -
25 located at the ceiling of cooking chamber 2, is used to remove air from the cooking chamber 2 in certain operating programs.

 Second opening 17 can be partially closed by means of a closing mechanism 19 controlled by control
30 unit 15. Closing mechanism 19 can comprise e.g. a pivoting door or a sliding door 20, which can be guided over the second opening 17 by a drive 21. A small passage 20a, e.g. with a diameter of 8 mm, is arranged in pivoting door or the sliding door 20, such that second opening 17
35 is not fully blocked even if sliding door 20 is closed, thereby guaranteeing that the underpressure in cooking

chamber 2, as described below, can be maintained as long as the foodstuff is not outgassing.

A channel 22 for carrying off air is located above enclosure 1, which communicates with the environment via an exit opening 23, e.g. at the front side of the device. A blower 24 is located in channel 22, which in the present embodiment is a radial fan with two chamber 24a, 24b. Bottom chamber 24a sucks in air from cooking chamber 2, through passage 20a if closing mechanism 19 is closed. Upper chamber 24b sucks in air from a space 37, which is located between enclosure 1 and housing 35, through an opening 36 and in this way generates an air stream therein, in order to cool the walls of housing 35.

Blower 24 is dimensioned such that - without any potentially outgassing foodstuff - the pressure p_1 in cooking chamber 2 is lower than the pressure p_2 in space 37, even if door 20 is in its closed position.

The mentioned climate sensor 18 comprises a duct 26, which connects first opening 16 to space 37. A second temperature sensor 27 is arranged in or at duct 26 in order to measure the temperature at a location along duct 26.

Second temperature sensor 27 is part of a thermostat, by means of which the heating power of the heating arrangement 5 can be lowered below a value given by the feedback loop 14 if the temperature at the second temperature sensor 27 exceeds a threshold temperature T_s . In the shown embodiment, this thermostat comprises a switch 28, which is interrupted as soon as the temperature at the second temperature sensor 27 is above the given threshold temperature T_s .

The threshold temperature T_s is advantageously in a range between 60°C and 90°C, in particular between 65°C and 75°C, such that steam outgassing from the foodstuff can be detected and the heating power can be lowered early.

Switch 28 can also be implemented as part of feedback loop 14 or control unit 15, in which case second temperature sensor 27 is directly connected to feedback loop 14 or control unit 15.

5 The oven further comprises input controls 30, by means of which the user can select an operating program. Several such operating programs are provided, some of which are adapted to control the device in conventional manner.

10 Operation of the device:

At least one of the operating cooking programs that can be selected by the user through the input
15 controls 30 is a program for energy-efficient cooking under humid temperature. In the following, the steps executed by this program are described in more detail. These steps are controlled by control unit 15.

In a first step, cooking chamber 2 is heated
20 by means of hot air heater 5 (and, possibly, with the help of the top and bottom heaters 4a, 4b), and its temperature is then maintained at the desired temperature (which is e.g. specified by the user) by means of control loop 14. During this program, pivoting door or sliding
25 door 20 at second opening 17 is kept in its closed position, or it can potentially be opened in a time-regulating way after a certain time. Blower 24 is in operation.

The foodstuff in cooking chamber 2 heats up.
30 Once steam starts to escape from the foodstuff, the pressure p_1 in cooking chamber 2 increases. When pressure p_1 rises above pressure p_2 in space 37, hot, humid air starts flowing through duct 26, which causes the temperature at second temperature sensor 27 to raise above
35 threshold temperature T_s . As soon and as long as this is the case, the supply of heating power to heating arrangement 5 is interrupted and subsequently the temperature in

cooking chamber 2 starts to fall until the escape of steam from the foodstuff is so far reduced that the temperature at second temperature sensor 27 falls back below threshold temperature T_s , whereupon the temperature in
5 cooking chamber 2 can again be maintained at the desired temperature by control loop 14.

In this manner the foodstuff can be kept cooking or simmering with a minimum amount of energy.

10 Notes:

Second temperature sensor 27 is located at a duct that connects first opening 16 directly or indirectly with the environment.

In the embodiment of Fig. 1, duct 26 extends
15 from first opening 16 to space 37, such that the temperature at the second temperature sensor 27 rises only when the pressure in cooking chamber 2 is higher than the pressure in space 37. Duct 26 may, however, also communicate with another part of the device or with the environ-
20 ment, in which (without outgassing foodstuff) a slightly higher pressure is present than in the cooking chamber 2 in operation of the device, in particular by an amount of at least 0.1 Pa, in particular by at least 3 Pa.

As mentioned, pivoting door or sliding door
25 20 at second opening 17 is usually closed in the operating program described above, or it can be opened in time-controlled manner after a certain time. Such a time-controlled opening allows to make sure that steam is carried off cooking chamber 2 for removing humidity from the
30 latter, in case that the thermostat is not triggered correctly despite strong steam generation in the cooking chamber.

In the embodiment of Fig. 1, the supply of energy to heating arrangement 5 is interrupted completely
35 when the temperature at the second temperature sensor 27 rises above the threshold temperature T_s . Alternatively,

the energy supply can be reduced only, without being interrupted completely.

Further, control loop 14 can control the heating power of top heater 4a and/or bottom heater 4b, instead of, or in addition to, the heating power to hot
5 air heater 5. In this case, the heating power of top and/or bottom heater 4a, 4b is reduced when the temperature at second temperature sensor 27 rises above the threshold temperature T_s .

Patentkrav

1. Bageovn omfattende

et tilberedningsrum (2),

5 opvarmningsmidler (4a, 4b; 5) bestående af en varmluftvarmeindretning (5) og/eller en top- og bundvarmer (4a, 4b),

en første temperatursensor (12) til måling af en tilberedningsrumtemperatur,

en reguleringsindretning (14) til styring af en varmeeffekt af opvarmningsmid-

10 lerne (4a, 4b; 5) med henblik på en regulering af tilberedningsrumtemperatu-

ren til en indstillingstemperatur og

en klimasensor (18) omfattende en første åbning (16) i tilberedningsrummet (2) og en anden temperatursensor (27), der er anbragt uden for den første åbning (16),

kendetegnet ved, at bageovnen har en termostat (27, 28) omfattende den

15 anden temperatursensor (27), hvor bageovnen er udformet til med termosta-

ten at sænke opvarmningsmidlernes (4a, 4b; 5) varmeeffekt automatisk til

under en værdi, der er angivet på forhånd af reguleringsindretningen (14),

når temperaturen ved den anden temperatursensor (27) overstiger en tær-

20 skeltemperatur, således at tilberedningsrumtemperaturen falder til under ind-

stillingstemperaturen.

2. Bageovn ifølge krav 1, hvor opvarmningsmidlernes (4a, 4b; 5) varmeeffekt

kan sænkes automatisk med termostaten (27, 28) til under den værdi, der er

angivet på forhånd af reguleringsindretningen (14) i så lang tid, som tempera-

25 turen ved den anden temperatursensor (27) ligger over tærskeltemperaturen.

3. Bageovn ifølge et af de foregående krav, yderligere omfattende

en indkapsling (1), der indkapsler tilberedningsrummet (2),

et hus (35), i hvilket indkapslingen (1) er anbragt,

30 et mellemliggende rum (37) mellem indkapslingen (1) og huset (35),

en ventilationsindretning (24), med hvilken der kan suges luft ud af tilbered-

ningsrummet (2) og det mellemliggende rum (37), hvor ventilationsindretnin-

gen (24) er dimensioneret til, at den, uden tilberedningsmateriale i tilbered-

35 ningsrummet (2), genererer et lavere tryk i tilberedningsrummet (2) end i det

mellemliggende rum (37),

hvor den første åbning (16) er forbundet med det mellemliggende rum (37)

via en ledning (26), hvor den anden temperatursensor (27) er anbragt på ledningen (26).

- 5 **4.** Bageovn ifølge krav 3,
med en anden åbning (17), gennem hvilken der med ventilationsindretningen (24) kan suges luft ud af tilberedningsrummet (2) og med en lukkemekanisme (19), der styres af en indretningsstyreenhed (15), til delvis lukning og åbning af den anden åbning (17).
- 10 **5.** Bageovn ifølge krav 4, hvor der med ventilationsindretningen (24) også ved lukket lukkemekanisme (19) kan suges luft ud af tilberedningsrummet.
- 15 **6.** Bageovn ifølge et af kravene 4 eller 5, hvor lukkemekanismen (19) har en klap eller en skyder (20), hvor der i klappen eller skyderen (20) forefindes en gennemgang (20a), således at den anden åbning (17) heller ikke ved en lukket klap eller skyder (20) er fuldstændigt blokeret.
- 20 **7.** Bageovn ifølge et af de foregående krav, hvor termostaten (27, 28) har en omskifter (28), som afbryder en strøm fra reguleringsindretningen (14) til opvarmningsmidlerne (4a, 4b; 5), indtil temperaturen ved den anden temperatursensor (27) kommer under tærskeltemperaturen.
- 25 **8.** Bageovn ifølge et af de foregående krav, hvor tærskeltemperaturen ligger mellem 60 °C og 90 °C.
- 9.** Bageovn ifølge et af de foregående krav, hvor tærskeltemperaturen ligger mellem 65 °C og 75 °C.
- 30 **10.** Bageovn ifølge et af de foregående krav, hvor opvarmningsmidlerne har en varmluftvarmeindretning (5), hvor varmluftvarmeindretningen (5) har en ventilator (7) og et varmeelement (8) uden for tilberedningsrummet (2), hvor luft kan tilføres til varmeelementet (8) fra tilberedningsrummet (2) med ventilatoren (7) og transporteres tilbage til tilberedningsrummet (2).

