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(54) **Baking and/or cooking oven and method for operating a baking and/or cooking oven**

(57) The invention relates to a backing oven comprising at least a first, a second and a third heating element for heating a cavity of the oven, wherein the third heating element is connected in series with the first and the second heating element.

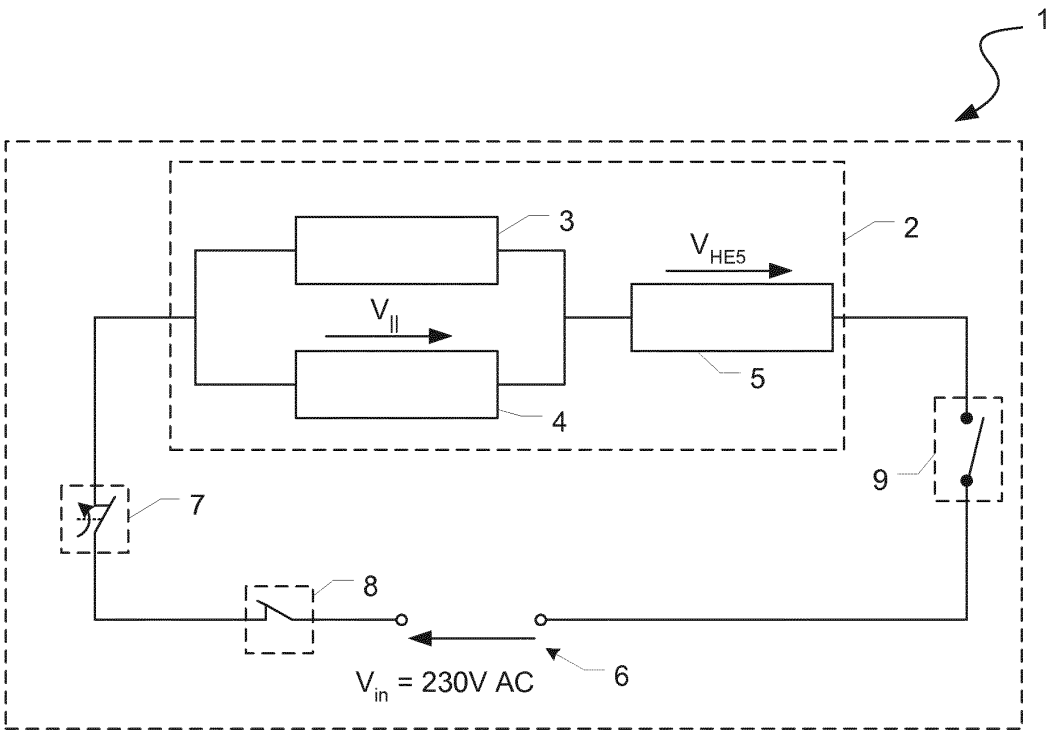

Fig. 1

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Description

[0001] The present invention relates generally to the field of baking and/or cooking ovens. More specifically, the present invention is related to a baking and/or cooking oven with reduced energy consumption.

BACKGROUND OF THE INVENTION

[0002] Baking and/or cooking ovens for preparing food are well known in prior art. Recent trends in developing baking and/or cooking ovens tend to reduce the energy consumption. There are different starting points for reducing the energy consumption of a baking and/or cooking oven, e.g. enhancing the thermal insulation of the oven cavity, using the residual heat of the heating elements etc..

[0003] A drawback of baking and/or cooking ovens with reduced energy consumption is that those baking and/or cooking ovens are quite expensive because of technical effort.

SUMMARY OF THE INVENTION

[0004] It is an objective of embodiments of the invention to provide for a technically simple and inexpensive baking and/or cooking oven with low energy consumption and a method for operating a baking and/or cooking oven with reduced energy consumption. The objective is solved by the features of the independent claims. Preferred embodiments are given in the dependent claims. If not explicitly indicated otherwise, embodiments of the invention can be freely combined with each other.

[0005] According to a first aspect of the invention, the invention relates to a baking and/or cooking oven comprising at least a first, a second and a third heating element for heating a cavity of the oven, wherein the third heating element is connected in series with the first and the second heating element.

[0006] The main advantage of the serial connection of the third heating element with the first and the second heating element is, that the heating elements are operated at a power lower than the nominal power of said heating elements because the input voltage of the oven is divided, wherein a first portion of the input voltage drops at the first and the second heating element and a second portion of the input voltage drops at the third heating element.

[0007] According to preferred embodiments, the first and the second heating elements are connected in parallel. Thereby, the voltage drop across the first and second heating element is equal and the first portion of the input voltage drops at the parallel connection and the remaining portion of the input voltage applies at the third heating element. Preferably, the portions of the input voltage applying at the respective heating elements are lower than the nominal voltage of said heating elements.

[0008] According to preferred embodiments, the first heating element is an upper heating element, i.e. the upper heating element is situated at the top of the oven cavity.

[0009] According to preferred embodiments, the second heating element is a lower heating element, i.e. the lower heating element is situated at the bottom of the oven cavity.

[0010] According to preferred embodiments, the third heating element is a grill heating element. Preferably, said grill heating element is also located at the top of the oven cavity.

[0011] According to preferred embodiments, the entire circuit comprising the parallel connection of the first and the second heating element in series with the third heating element is adapted to be supplied with a voltage of 230V AC. The nominal voltage of the first, second and third heating element may also be 230V AC. Due to the splitting of the input voltage at the series connection of the third heating element and the first and second heating elements, said heating elements are applied with a voltage below 230V AC and thereby operated below their nominal power.

[0012] According to preferred embodiments, the first heating element and/or the second heating element is located within the oven cavity. Thereby a direct heating of the oven cavity may be obtained which also enhances the power efficiency.

[0013] According to preferred embodiments, the first heating element is located next to the third heating element. For example, the first and the third heating element are located at the top of the oven cavity thereby providing an upper heat to the food to be baked.

[0014] According to preferred embodiments, the oven is adapted to operate the first and second heating elements below their nominal electrical power. Thereby, the energy loss due to heat radiation is reduced because the preheating of the baking and/or cooking oven takes a longer time in comparison to driving the first and the second heating elements at nominal power. Thus, the mean temperature during preheating is lowered resulting in a reduced energy loss, because that energy loss is directly proportional with the oven temperature. According to one embodiment, only during preheating, the first and second heating elements are operated in series to the third heating element. However, it is preferred to operate the backing oven during preheating as well as during the cooking period in said series connection.

[0015] According to preferred embodiments, the oven is adapted to operate the third heating element below its nominal electrical power. Thereby, the energy loss due to heat radiation is reduced because the preheating of the baking and/or cooking oven takes a longer time in comparison to driving the third heating element at nominal power. Thus, the mean temperature during preheating is lowered resulting in a reduced energy loss, because that energy loss is directly proportional with the oven temperature.

[0016] According to a further aspect, the invention re-

lates to a method for operating a baking and/or cooking oven comprising at least a first, a second and a third heating element for heating a cavity of the baking and/or cooking oven, wherein the third heating element is operated in series to the first and the second heating element.

[0017] The main advantage of operating the third heating element in series with the first and the second heating element is, that the heating elements are operated at a power lower than the nominal power of said heating elements because the input voltage of the oven is divided, wherein a first portion of the input voltage drops at the first and the second heating element and a second portion of the input voltage drops at the third heating element.

[0018] According to preferred embodiments, the first and the second heating element are operated in parallel.

[0019] According to preferred embodiments, the entire circuit comprising the parallel connection of the first and the second heating element in series with the third heating element is supplied with a voltage of 230V AC. Preferably, all heating elements comprise a nominal voltage of 230V AC. Due to the splitting of the input voltage, the heating elements are operated below their nominal voltage.

[0020] According to preferred embodiments, the first and second heating elements are operated below their nominal electrical power. Due to the splitting of the input voltage, the first and second heating elements are operated below their nominal voltage and therefore below their nominal power which leads to an enhanced energy efficiency.

[0021] According to preferred embodiments, the third heating element is operated below its nominal electrical power. Due to the splitting of the input voltage, the third heating element is operated below its nominal voltage and therefore below its nominal power which leads to an enhanced energy efficiency.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The various aspects of the invention, including its particular features and advantages, will be readily understood from the following detailed description and the accompanying drawing, in which:

Fig. 1 shows a schematic diagram of a baking and/or cooking oven according to the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0023] The present invention will now be described more fully with reference to the accompanying drawings, in which example embodiments are shown. However, this invention should not be construed as limited to the embodiments set forth herein. Throughout the following description similar reference numerals have been used to denote similar elements, parts, items or features, when applicable.

[0024] Fig. 1 illustrates a baking and/or cooking oven 1 by means of a schematic diagram. The baking and/or cooking oven 1 comprises on oven cavity 2 which is adapted to receive the food to be cooked and/or baked. The baking and/or cooking oven 1 comprises a first, a second and a third heating element 3, 4, 5 for heating the oven cavity 2. The first, second and third heating element 3, 4, 5 may be heating elements separated from each other, i.e. the heating elements may be situated at different locations within the oven cavity 2.

[0025] In preferred embodiments, the first heating element 3 is the upper heating element located at the top of the oven cavity 2, the second heating element 4 is the lower heating element located at the bottom of the oven cavity 2 and the third heating element 5 is a grill heating element which is preferably located also at the top of the oven cavity 2.

[0026] The heating elements 3, 4, 5 are electrically connected to an electrical input 6 for connecting the baking and/or cooking oven 1 via a thermostat 7 and a thermal cut out 8 with an electrical power source, e.g. the domestic mains supply. The baking and/or cooking oven 1 may also comprise an oven selector switch 9 for switching the baking and/or cooking oven 1 on/off and/or for operating the baking and/or cooking oven 1 at different programs. Preferably, the baking and/or cooking oven 1 may be adapted to be operated with an electric voltage of 230V AC.

[0027] In order to improve the energy consumption of the baking and/or cooking oven 1, the third heating element 5 is connected in series to the first heating element 3 and the second heating element 4. Thereby the input voltage of 230V AC drops along the series connection of the first heating element 3 and the third heating element 5, respectively, the second heating element 4 and the third heating element 5. The first, the second and the third heating element 3, 4, 5 may be adapted to be driven each at a nominal voltage of 230V AC in order to achieve their nominal power. Due to the series connection of the first heating element 3 and the third heating element 5, respectively, the second heating element 4 and the third heating element 5, each heating element is operated with a voltage below the nominal voltage, i.e. a voltage lower than 230V AC. Since the voltage dropped over the heating elements 3, 4, 5 is lower than the voltage necessary to achieve the nominal power of the heating elements, the heating elements 3, 4, 5 are driven below their nominal power.

[0028] In preferred embodiments, the voltage drop at the heating element 5 (grill element) may be between 100V and 120V, preferably ~110V. Thus, the voltage drop over the first and second heating element 3, 4 may be between 110V and 130V. As a result, none of the heating elements reaches the state of incandescence during heating the oven cavity 2.

[0029] Preferably, the first and the second heating element 3, 4 are interconnected in parallel and the third heating element 5 is interconnected in series with said

parallel connection. In other words, first electrical connectors of the first and second heating elements are coupled and second electrical connectors of the first and second heating element are coupled, wherein a first electrical connector of the third heating element is coupled with said second electrical connectors of the first and second heating element. So, the first and the second heating element 3, 4 are driven with the same voltage, namely the residual voltage $V_{||}$= Vin - V_{HE5}, wherein Vin is the input voltage and V_{HE5} is the voltage drop at the third heating element 5.

[0030] In preferred embodiments, the first heating element 3 may have a nominal power consumption of 800 W driven by a voltage of 230V AC, the second heating element 3 may have a nominal power consumption of 1000 W driven by a voltage of 230V AC and the third heating element 5 may have a nominal power consumption of 1650 W driven by a voltage of 230V AC. Due to connecting the third heating element 5 in series with the first and the second heating element 3, 4, the power consumption of the oven may be reduced significantly. Said reduced energy consumption leads on the one hand to an increased period of time for preheating the oven cavity 2 and an increased cooking time, but, on the other hand, to a reduced loss of heat (heating the environment of the baking and/or cooking oven 1). Experiments of the applicant show, that the percentage of heat inside the oven cavity 2 is increased from 45% (driving the heating elements 3, 4, 5 at their nominal power) to 73.4%, because the energy loss of the baking and/or cooking oven 1 is directly proportional with the oven cavity temperature and the mean value of the temperature within the oven cavity is lowered according to the invention.

List of reference numerals

[0031]

1	baking and/or cooking oven
2	oven cavity
3	first heating element
4	second heating element
5	third heating element
6	electrical input
7	thermostat
8	thermal cut out
9	oven selector switch

V_{in}	input voltage
$V_{||}$	voltage of parallel connection
V_{HE5}	voltage of third heating element

Claims

1. Baking and/or cooking oven comprising at least a first, a second and a third heating element (3, 4, 5) for heating a cavity (2) of the oven,
characterised in that,
the third heating element (5) is connected in series with the first and the second heating element (3, 4).

2. Baking and/or cooking oven according to claim 1, wherein the first and the second heating elements (3, 4) are connected in parallel.

3. Baking and/or cooking oven according to claim 1 or 2, wherein the first heating element (3) is an upper heating element.

4. Baking and/or cooking oven according to claim 1 or 2, wherein the second heating element (4) is a lower heating element.

5. Baking and/or cooking oven according to claim 1 or 2, wherein the third heating element (5) is a grill heating element.

6. Baking and/or cooking oven according to one of the preceding claims 2 to 5, wherein the entire circuit comprising the parallel connection of the first and the second heating element (3, 4) in series with the third heating element (5) is adapted to be supplied with a voltage of 230V AC.

7. Baking and/or cooking oven according to one of the preceding claims, wherein the first heating element (3) and/or the second heating element is located within the oven cavity (2).

8. Baking and/or cooking oven according to one of the preceding claims, wherein the first heating element (3) is located next to the third heating element (5).

9. Baking and/or cooking oven according to one of the preceding claims, wherein the oven (1) is adapted to operate the first and second heating elements (3, 4) below their nominal electrical power.

10. Baking and/or cooking oven according to one of the preceding claims, wherein the oven (1) is adapted to operate the third heating element (5) below its nominal electrical power.

11. Method for operating a baking and/or cooking oven (1) comprising at least a first, a second and a third heating element (3, 4, 5) for heating a cavity (2) of the baking and/or cooking oven (1),
characterised in that,
the third heating element (5) is operated in series to the first and the second heating element (3, 4).

12. Method according to claim 11, wherein the first and the second heating element (3, 4) are operated in parallel.

13. Method according to claim 12, wherein the entire circuit comprising the parallel connection of the first and the second heating element (3, 4) in series with the third heating element (5) is supplied with a voltage of 230V.

14. Method according to anyone of claims 11 to 13, wherein the first and second heating elements (3, 4) are operated below their nominal electrical power.

15. Method according to anyone of claims 11 to 14, wherein the third heating element (5) is operated below its nominal electrical power.

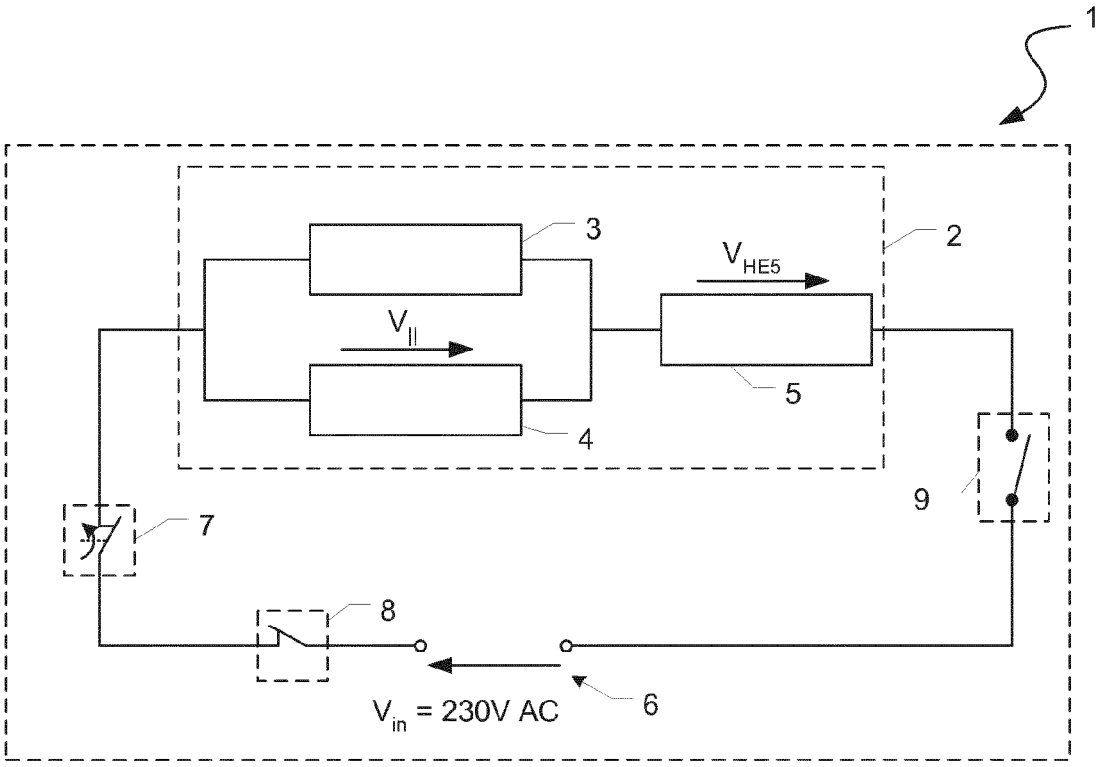

Fig. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 13 18 4801

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	AT 377 074 B (BURG KONRAD FA [AT]) 11 February 1985 (1985-02-11) * the whole document *	1-3,6-15	INV. F24C7/08 F24C7/06
X	EP 0 084 006 A1 (DIETRICH & CIE DE [FR]) 20 July 1983 (1983-07-20) * paragraph [0017]; figures 3,4 *	1-4, 6-12,14, 15	
X	JP 2009 287886 A (TIGER VACUUM BOTTLE CO LTD) 10 December 2009 (2009-12-10) * paragraph [0036]; figure 5a *	1,5	
X	EP 1 083 773 A2 (CERAMASPEED LTD [GB]) 14 March 2001 (2001-03-14) * paragraph [0003]; figure 5b *	1,11	

TECHNICAL FIELDS SEARCHED (IPC)

F24C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 March 2014	Rodriguez, Alexander

CATEGORY OF CITED DOCUMENTS

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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
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11-03-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
AT 377074 B	11-02-1985	NONE	
EP 0084006 A1	20-07-1983	DE 3362968 D1	22-05-1986
		EP 0084006 A1	20-07-1983
		FR 2519413 A1	08-07-1983
JP 2009287886 A	10-12-2009	JP 5169494 B2	27-03-2013
		JP 2009287886 A	10-12-2009
EP 1083773 A2	14-03-2001	CN 2454675 Y	17-10-2001
		EP 1083773 A2	14-03-2001
		GB 2354687 A	28-03-2001
		ID 27237 A	15-03-2001
		JP 2001090956 A	03-04-2001
		SG 86436 A1	19-02-2002
		TW 461673 U	21-10-2001
		US 6323472 B1	27-11-2001

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82