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(54) Cooking oven

(57) A cooking oven comprises a cavity (12) and a separating and insulating plate (18) which can be inserted horizontally in the cavity (12) in order to split it in two sub-cavities (12b, 12c), each sub-cavity having at least a heating element (14, 40, 50) attached to the external face (K) of the cavity side wall (12a).

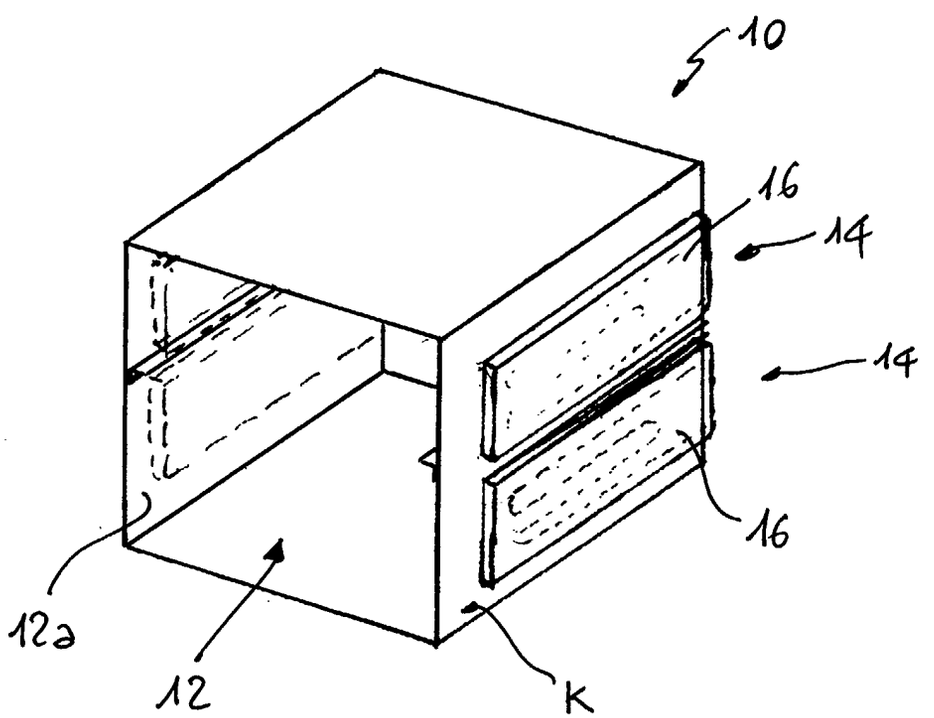

Fig. 1

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Description

[0001] The present invention relates to a cooking oven comprising a cavity and a separating and insulating plate which can be inserted horizontally in the cavity in order to split it in two sub-cavities, each sub-cavity having at least a heating element on its side wall.

[0002] Such kind of cooking oven is disclosed in the European Patent Application 123206.5.

[0003] According to the present invention, an oven of the above type is provided which has a reduced cost, while maintaining the same flexibility in use, improved quality of cooking, better cleanability by means of a flexible heating system using heating elements placed either horizontally (top and bottom walls) and/or vertically (side walls).

[0004] The above object is reached thanks to the features reported in the appended claims.

[0005] According to the invention, the oven comprises heating elements placed vertically on side walls of the cavity and attached to the external face of the cavity wall, in addition to traditional heating elements placed horizontally on top, bottom and rear walls. The concept is applicable to pyrolitic and non-pyrolitic ovens, and includes also the solution according to which the oven cavity does not have the traditional heating elements placed horizontally on top and/or bottom walls, and/or the solution according to which the oven cavity is provided, on back wall thereof, with a traditional central forced air fan and a heater, which can be a circular or non circular tubular heater or a quartz lamp.

[0006] According to a first embodiment of the invention, four tubular heating elements, two for each side of the oven cavity, are housed in suitable metal casings or 'pockets' that are attached to the external face of the cavity wall.

[0007] According to a second embodiment of the invention, four radiant heating elements are mounted directly behind the metallic walls of the oven cavity. In both the above embodiments, the cavity (when the separating plate is removed) does not distinguish, in a visual inspection, from a cavity of a traditional oven. As an alternative solution of the second embodiment, the oven cavity can be provided with openings closed by metal plates that cover the heater elements. In this case it is preferred to use for such plates a material different from the material of the oven walls, in order to improve and optimise heat transfer from the heating elements to the oven cavity.

[0008] According to a third embodiment of the invention, a twin radiant heating element is mounted behind the metal side wall or behind a metallic or ceramic glass plate and is located at the centre of each side wall of the oven. In this case the heaters are aligned so as to transfer heat also to the separating and insulating plate faces, underneath the food tray or container as well as to the cavity. The scope here is to improve baking performance especially in terms of browning, crisping etc through the use of appropriate reflection.

[0009] According to a fourth embodiment four radiant heating elements in the form of quartz lamps, two for each side of the oven cavity are used. These are housed in suitable metal reflectors that are attached to the external face of the cavity wall and covered either by a metal plate (which can be integral with the oven wall) or ceramic glass.

[0010] According to a fifth embodiment of the present invention, the oven comprises a forced air fan and a heater for the main cavity and upper sub-cavity and two quartz lamps for the lower sub-cavity only. The heater can be a circular or non circular tubular heater or a quartz lamp.

[0011] The walls of the oven cavity, of the oven door or accessories thereof (e.g. baking tray) are preferably coated with coatings including fluoropolymers with or without PTFE additives and fillers, Sol-Gel generated films and PECVD (Plasma Enhanced Chemical Vapour Deposition) generated films. All the above coatings have the specific intent to create an abrasive-corrosive resistant and non-stick surface applied to metallic (e.g. stainless steel) or non metallic (e.g. enamel) substrate. These coatings can be applied to all or part of the cavity or oven accessories or parts e.g. baking trays, oven door, racks etc. The coatings can be applied to sheet, pre-formed sheet or ready-to-use parts.

[0012] The separating and insulating plate may be made of a material different from metal, i.e. polymeric material (preferably silicone resin type), tempered glass and Pyrex™ glass. The separating and insulating plate may also include a series of indications and/or guides (e.g. pressed/moulded directly in the plate material) to help the consumer position the food tray or container correctly. Further indications such as "Danger hot surface" or "Danger heavy weight" can also be added.

[0013] When installed, the separating plate sits on side supports that also act as heat and odour barriers around the perimeter of the cavity.

[0014] When tempered or Pyrex™ type glass is used for the separating plate, visibility inside the cavity is greatly improved, although in this case thermal insulation is reduced. In order to improve thermal insulation, the glass separating plate may have an interspace in which vacuum is created. Visibility is further improved by using low voltage (24V) or high (220V) voltage, low (10-50W) wattage, halogen illumination devices in both sub-cavities. These can be positioned on any of the cavity walls although the preferred position is either at the rear of the cavity or on the side walls.

[0015] High temperature silicone resin plastic may also be used to realise all or part of the separator; in this particular case the plastic is suitable up to 500°C continuous use i.e. also for pyrolitic ovens.

[0016] The present invention will be disclosed in detail with reference to the accompanying drawings, which illustrate preferred embodiments of the invention by way of example and in which:

- Figure 1 is a schematic perspective view of a built-in oven according to a first embodiment of the invention, in which the door oven, the insulating panels and the separating plate have been removed for sake of clarity,
- Figure 2 is a detailed view of a portion of the back side of the oven of figure 1, in which the back wall has been removed,
- Figure 3 is a side view of a heating element according to a further embodiment of the invention,
- Figure 4 is a cross-section of an oven provided with the heating element of figure 3, and
- Figures 5-8 are schematic front views of the oven showing the different embodiments of the invention.

[0017] With reference to the drawings, an oven 10 comprises a cavity 12 having four heating elements 14, two for each side 12a of the oven cavity, which are housed in flat metal housings or "pockets" 16. Two flat housings 16 are located on the external face K of the cavity 12 at each side 12a of the cavity and connected electrically through the back plate of the oven. The flat housings 16 are vertically separated in order to provide a thermal insulation between them. In the oven cavity 12 a shelf-shaped separating plate 18 can be inserted (figures 4-8) that splits the cavity 12 in two sub-cavities 12b and 12c. The separating plate 18 has thermal insulating properties and is provided with a silicone seal (not shown) in the front portion thereof in order to seal the front wall of the cavity i.e. the oven door.

[0018] According to a first embodiment of the invention (figures 1,2,5), each flat housing 16 contains a tubular heating element 13 which faces directly the external face K of the side wall of the oven cavity. Each heating element 13 has electrical connections 13a linked to the electrical circuit of the oven 10.

[0019] According to a further embodiment of the invention (figures 3-4) each heating element is a twin radiant heating element 40 comprising a metal flat housing 42 containing two dickey bow shaped heating elements 44 each having electrical connections 44a on the rear wall of the oven. Each twin radiant element 40 is attached to the centre of the oven side wall, which can be provided with a longitudinal slot 46 in order to improve the heat transfer to the separating plate 18. A metallic or a ceramic glass plate 42a can close the face of the housing 42 towards the external face K of the side wall. In the second case (not shown), the slot 46 is an opening having the same dimension of the ceramic glass plate.

[0020] According to a further embodiment of the invention (figure 7), the oven comprises four radiant heating elements in the form of quartz lamps 50, two for each side of the oven cavity 12. These are housed in suitable metal reflectors 52 that are attached to the external face K of the cavity wall and covered either by a metal or ceramic glass 54.

[0021] According to a further embodiment of the invention (figure 8), the oven 10 comprises a forced air fan 56 and circular heater 58 for the main cavity 12 and upper sub-cavity 12b and two quartz lamps 50 for the lower sub-cavity 12c only. Instead of or in addition to the circular heater 58, a quartz lamp 59 can be used (shown in the same figure 8).

[0022] In the standard mode of operation the oven can be used as a standard oven (static and/or lower element) or together with the four side heating elements. In this latter case performance (e.g. cooking results) is comparable or better than the standard radial heater configuration (circular heater around fan).

[0023] In the 'flexible cavity' mode the separating plate 18 is used to split the oven cavity thus providing three further modes of operation:

- a first mode in which the upper sub-cavity 12b only is used. In this case the heaters used are the two upper side wall heaters plus the grill element. The grill element may also be used separately such as for grilling or browning. In such mode the sub-cavity temperature is set and controlled by the same control used for the standard mode. The first cavity mode is particularly suited for meat, poultry, grilling etc.
- a second mode in which the lower sub-cavity 12c only is used. In this case the heaters used are the two lower side wall radiant heaters plus the lower heating element. The lower heating element may also be used separately such as for warming or crisping. In the second mode the lower sub-cavity temperature is set and controlled by a sensor positioned in the lower sub-cavity. The second cavity mode is particularly suited for pasta, cakes, baking, pizza etc.
- a third mode in which the sub-cavities 12b and 12c can be set at 2 different temperatures up to a maximum temperature difference of 100°C e.g. 250°C for the upper sub-cavity and 150°C for the lower sub-cavity.

[0024] In all of the above three mentioned modes the separating plate 18 is provided so as to isolate and insulate the two sub-cavities. This is done by carefully sizing the separator to match the cavity interior profile (incl. oven door) and using a silicone rubber seal fitted on the front of the separator. When in use it sits on a suitable ledge attached to the cavity wall.

[0025] When the separating plate 18 is installed the temperature control and sensor of the lower sub-cavity is enabled e.g. through a micro-switch fitted at the rear of the oven cavity.

[0026] In all the disclosed embodiments the installed power for each side wall heater is preferably between 250W to 1500 Watts. Where the heater on the rear wall is used (figure 8), its power is preferably 500 Watts or higher.

Claims

1. Cooking oven comprising a cavity (12), a separating and insulating plate (18) which can be inserted horizontally in the cavity (12) in order to split it in two sub-cavities (12b, 12c), each sub-cavity having at least a heating element (14, 40, 50) on its side wall (12a), **characterised in that** said heating element (14, 40, 50) is attached to the external face (K) of the cavity wall (12a).

2. Cooking oven according to claim 1, **characterised in that** each side wall (12a) of the cavity (12), on the external face (K) thereof, is provided with a twin radiant heating element (40) located approximately at the centre of the oven side wall (12a).

3. Cooking oven according to claim 2, **characterised in that** each twin radiant heating element (40) is aligned so as to transfer heat also to the separating and insulating plate (18).

4. Cooking oven according to claim 1, **characterised in that** it comprises four tubular heating elements (13), two for each side of the oven cavity (12), housed in a metal casing (16) attached to the external face (K) of the cavity wall (12a).

5. Cooking oven according to any of the preceding claims, **characterised in that** each heating element (14, 40, 50) comprises a metal plate (42a, 54) mounted in a corresponding opening of the oven cavity (12), such metal plate being of different material than the cavity wall.

6. Cooking oven according to claim 1, **characterised in that** it comprises radiant heating elements in the form of IR lamps (50), preferably quartz lamps.

7. Cooking oven according to claim 6, **characterised in that** it comprises four IR lamps (50), preferably quartz lamps, two for each side of the oven cavity (12).

8. Cooking oven according to any of the preceding claims, **characterised in that** it comprises, on a rear wall of one of its two sub-cavities (12b), a forced air fan (56) and a heater (58, 59), the other sub-cavity (12c) being provided with two heating elements (50), one for each side of said sub-cavity.

9. Cooking oven according to any of the preceding claims, **characterised in that** the separating and insulating plate (18) is made of a material selected in the group consisting of polymeric material, tempered glass and Pyrex glass.

10. Cooking oven according to any of the preceding claims, **characterised in that** the oven wall (12a) and/or the oven door is coated with a material selected in the group consisting of fluoropolymers, sol-gel generated films and plasma enhanced chemical vapour deposition generated films.

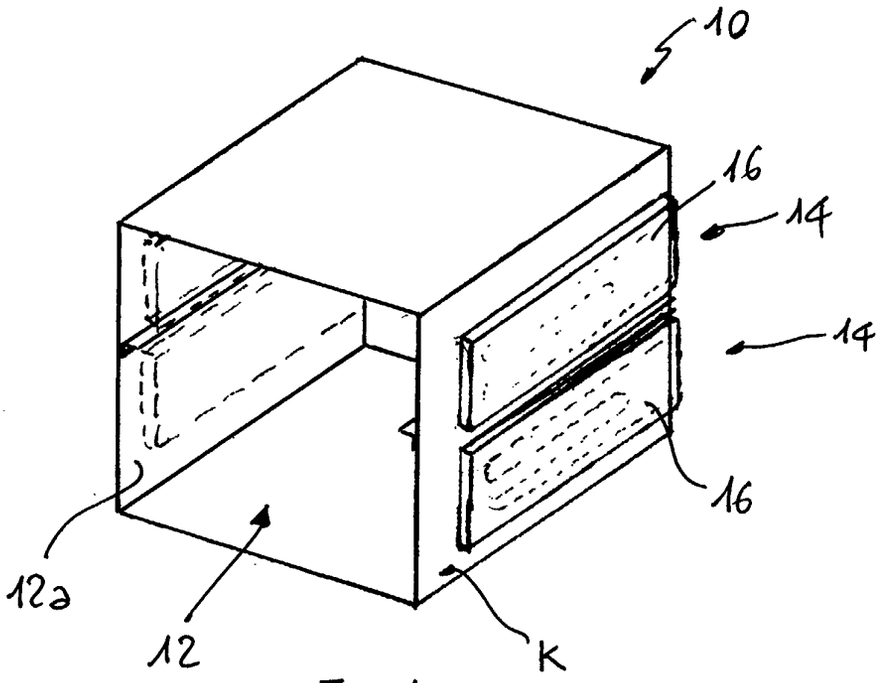

Fig. 1

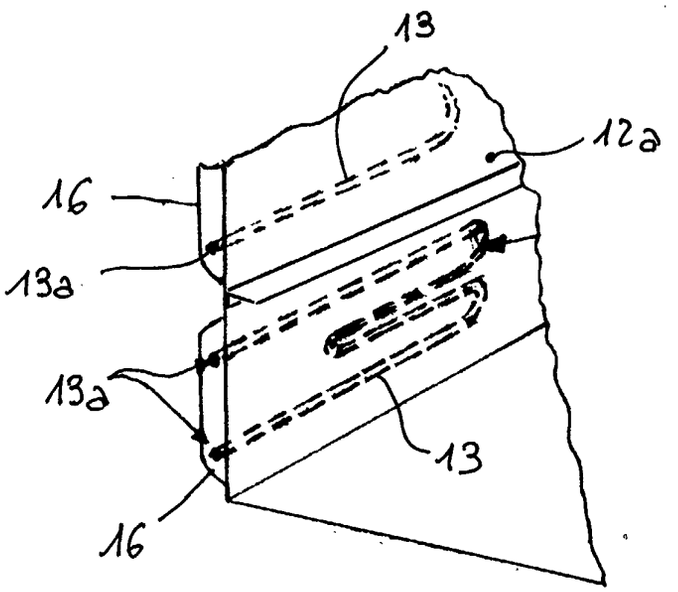

Fig. 2

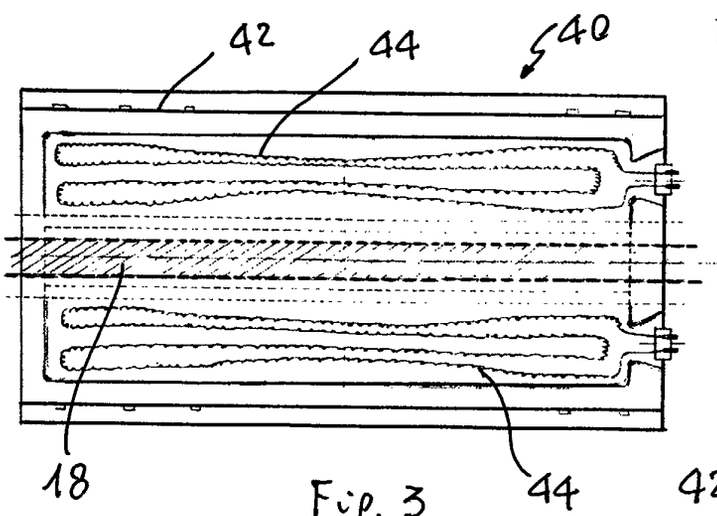

Fig. 3

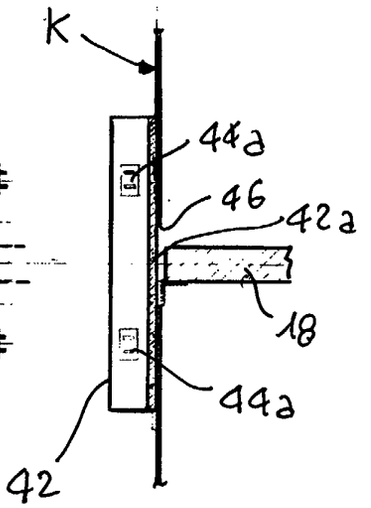

Fig. 4

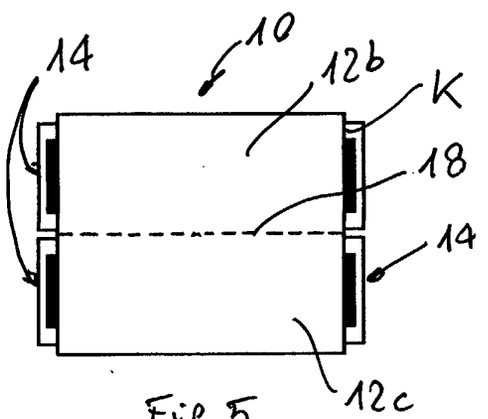

Fig. 5

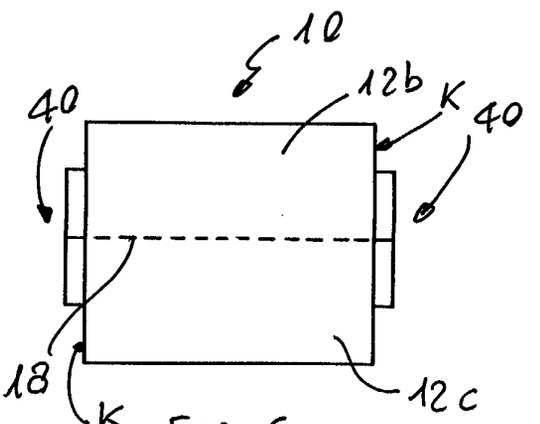

Fig. 6

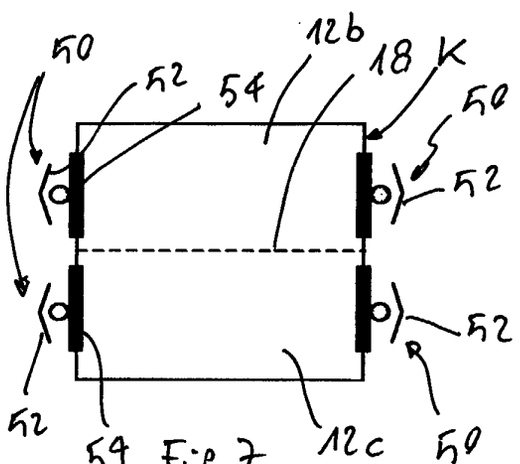

Fig. 7

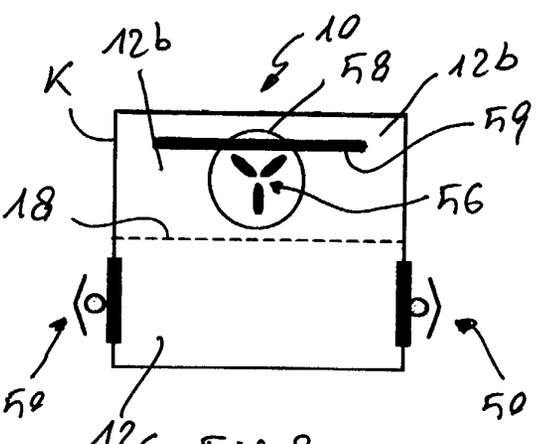

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 01 12 0603

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	NL 8 104 739 A (ATAG BV APPARATENFAB) 16 May 1983 (1983-05-16) * the whole document *	1	F24C15/16 F24C7/06
A	EP 0 253 278 A (LICENTIA GMBH) 20 January 1988 (1988-01-20) * abstract *	1	
A	DE 85 08 617 U (ROSS, ECKHARDT) 9 May 1985 (1985-05-09) * the whole document *	1,9	
A	GB 2 152 790 A (THORN EMI DOMESTIC APPLIANCES) 7 August 1985 (1985-08-07) * the whole document *	1-6	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F24C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	12 October 2001	Filtri, G

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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12-10-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
NL 8104739 A	16-05-1983	NONE	
EP 0253278 A	20-01-1988	DE 3624426 A1	28-01-1988
		AT 72380 T	15-02-1992
		DE 3776600 D1	19-03-1992
		DK 207287 A	19-01-1988
		EP 0253278 A2	20-01-1988
		ES 2030021 T3	16-10-1992
		FI 872925 A ,B,	19-01-1988
		JP 63029120 A	06-02-1988
		NO 873022 A ,B,	19-01-1988
		US 4780597 A	25-10-1988
		YU 81087 A1	31-10-1989
DE 8508617 U	09-05-1985	DE 8508617 U1	09-05-1985
GB 2152790 A	07-08-1985	GB 2150681 A ,B	03-07-1985

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