



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.08.2018 Bulletin 2018/34

(51) Int Cl.:
F24C 7/06 ^(2006.01) **F24C 7/08** ^(2006.01)
F24C 15/00 ^(2006.01)

(21) Application number: **17156686.2**

(22) Date of filing: **17.02.2017**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(72) Inventors:
• **VOGT, Tobias**
91541 Rothenburg ob der Tauber (DE)
• **ALTAMURA, Davide**
47100 Forlì (IT)
• **DE PETRIS, Gioacchino**
47100 Forlì (IT)

(71) Applicant: **Electrolux Appliances Aktiebolag**
105 45 Stockholm (SE)

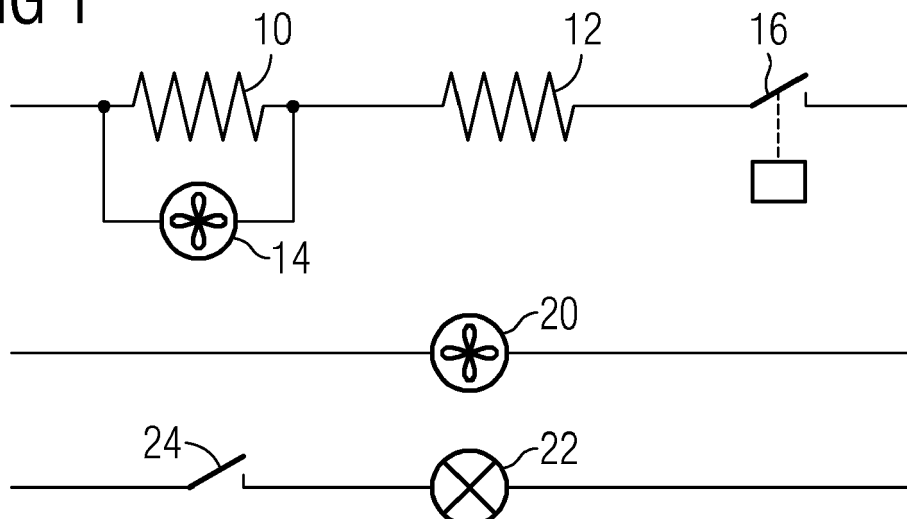
(74) Representative: **Electrolux Group Patents**
AB Electrolux
Group Patents
105 45 Stockholm (SE)

(54) **COOKING OVEN**

(57) The present invention relates to a cooking oven, in particular a domestic cooking oven. The cooking oven comprises at least one oven cavity and at least two resistive heating elements (10, 12, 18) for heating up said oven cavity. At least two of the resistive heating elements (10, 12, 18) are connected in series. The cooking oven

comprises at least one cooling fan (14) for cooling down the oven cavity. The cooling fan (14) is connected in parallel to at least one the resistive heating elements (10, 12, 18) connected in series, so that the resistive heating elements (10, 12, 18) connected in series form a voltage divider for the cooling fan (14).

FIG 1



Description

[0001] The present invention relates to a cooking oven. In particular, the present invention relates to a domestic cooking oven.

[0002] Energy efficiency is a very important property of a cooking oven. There are different methods for saving energy in a cooking oven. For example, a suitable thermal insulation of the oven cavity reduces losses of energy. Further, a selective control of the heating elements allows an efficient operation of the cooking oven. However, such cooking ovens require a complex control circuit.

[0003] It is an object of the present invention to provide a cooking oven, which allows an efficient operation by low complexity.

[0004] The object is achieved by the cooking oven according to claim 1.

[0005] According to the present invention a cooking oven, in particular a domestic cooking oven is provided, wherein:

- the cooking oven comprises at least one oven cavity,
- the cooking oven comprises at least two resistive heating elements for heating up the oven cavity,
- at least two of the resistive heating elements are connected in series,
- the cooking oven comprises at least one cooling fan for cooling down the oven cavity, and
- the cooling fan is connected in parallel to at least one of the resistive heating elements connected in series, so that
- the resistive heating elements connected in series form a voltage divider for the cooling fan.

[0006] The core of the present invention is that two or more heating elements form a voltage divider for the cooling fan. The voltage, power and fan speed of said cooling fan are reduced. This results in a reduced loss of energy. The voltage divider is formed by components, which are already present in the cooking oven. Thus, the cooking oven may be realised by low complexity.

[0007] In particular, the cooking oven comprises at least one top heating element, ring heating element, grill heating element and/or bottom heating element.

[0008] Further, the cooking oven may comprise at least one cooking fan for distributing hot air within the oven cavity, wherein said cooking fan is connected in parallel to the series of the resistive heating elements.

[0009] Moreover, the cooking oven may comprise at least one illumination unit, for illuminating the oven cavity, wherein said lamp is connected in parallel to the series of the resistive heating elements.

[0010] Preferably, a light switch is connected in series with the illumination unit, wherein said light switch and illumination unit are connected in parallel to the series of the resistive heating elements.

[0011] For example, the illumination unit includes at least one lamp.

[0012] In particular, the cooking oven comprises at least one thermostat connected in series with the resistive heating elements.

[0013] According to an embodiment of the present invention the cooling fan is connected in series with the thermostat and at least one resistive heating element.

[0014] According to another embodiment of the present invention the cooling fan is connected in parallel to the thermostat and at least one resistive heating element, so that the powers of the cooling fan and said resistive heating element are variable by the thermostat.

[0015] For example, the top heating element, the ring heating element and the thermostat may be connected in series, wherein the cooling fan is connected in parallel to the top heating element.

[0016] According to a further example, the top heating element, the ring heating element, the grill heating element and the thermostat are connected in series, wherein the cooling fan is connected in parallel to the top heating element and the ring heating element.

[0017] According to another example, the grill heating element, the top heating element and the thermostat are connected in series, wherein the cooling fan is connected in parallel to the top heating element and the thermostat. In this case, the powers of the cooling fan and the top heating element is variable by the thermostat.

[0018] Novel and inventive features of the present invention are set forth in the appended claims.

[0019] The present invention will be described in further detail with reference to the drawing, in which

FIG 1 illustrates a schematic circuit diagram of electric and electromechanical components of a cooking oven according to a first embodiment of the present invention,

FIG 2 illustrates a schematic circuit diagram of the electric and electromechanical components of the cooking oven according to a second embodiment of the present invention, and

FIG 3 illustrates a schematic circuit diagram of the electric and electromechanical components of the cooking oven according to a third embodiment of the present invention.

[0020] FIG 1 illustrates a schematic circuit diagram of electric and electromechanical components of a cooking oven according to a first embodiment of the present invention.

[0021] The cooking oven according to the first embodiment comprises a top heating element 10, a ring heating element 12, a cooling fan 14, a thermostat 16, a cooking fan 20, a lamp 22 and a light switch 24. The top heating element 10 and the cooling fan 18 are connected in parallel. Said parallel top heating element 10 and the cooling fan 14 are connected in series with the ring heating element 12 and the thermostat 16. In other words, the top

heating element 10 and the ring heating element 12 form a voltage divider for the cooling fan 14. The cooking fan 20 is connected in parallel to the top heating element 10, the cooling fan 14, the ring heating element 12 and the thermostat 16. The lamp 22 and the light switch 24 are connected in series, wherein said series is connected parallel to the cooking fan 20.

[0022] The top heating element 10 and the ring heating element 12 are provided for heating up an oven cavity of the cooking oven. The cooling fan 14 is provided for cooling down the oven cavity of the cooking oven. The thermostat 16 is provided for activating and deactivating the top heating element 10, the ring heating element 12 and the cooling fan 14. The lamp 22 is provided for illuminating the oven cavity of the cooking oven. The light switch 24 is provided for activating and deactivating the lamp 22. The cooking fan 20 is provided for distributing hot air within the oven cavity of the cooking oven.

[0023] The voltage divider formed by the top heating element 10 and the ring heating element 12 causes that the voltage at the cooling fan 14 is reduced. The reduced voltage at the cooling fan 14 results in a reduced fan speed of said cooling fan 14 and a reduced cooling of the oven cavity. In turn, the reduced cooling down of the oven cavity results in a reduced loss of energy.

[0024] For example, the rated power of the top heating element 10 is about 1000 W, while the rated power of the ring heating element 12 is about 2400 W. Since the top heating element 10 and the ring heating element 12 are connected in series, the total power of the top heating element 10 and the ring heating element 12 is about 706 W. The voltage divider causes, that the voltage at the top heating element 10 is about 162 V, while the voltage at the ring heating element 12 is about 68 V. The voltage at the cooling fan 14 is also about 162 V and results in a fan speed of about 600 rpm. The deactivation of the lamp 22 by the light switch 24 results in a further energy reduction of about 40 W.

[0025] FIG 2 illustrates a schematic circuit diagram of the electric and electromechanical components of the cooking oven according to a second embodiment of the present invention.

[0026] The cooking oven according to the second embodiment comprises the top heating element 10, the ring heating element 12, the cooling fan 14, the thermostat 16, a grill heating element 18, the cooking fan 20, the lamp 22 and the light switch 24. The top heating element 10 and the ring heating element 12 are connected in series. Said series of the top heating element 10 and the ring heating element 12 are connected in parallel to the cooling fan 14. In turn, said parallel group is connected in series with the grill heating element 18 and the thermostat 16. In other words, the top heating element 10, the ring heating element 12 and the grill heating element 18 form a voltage divider for the cooling fan 14. The cooking fan 20 is connected in parallel to the top heating element 10, the ring heating element 12, the cooling fan 14, the grill heating element 18 and the thermostat 16.

The lamp 22 and the light switch 24 are connected in series, wherein said series is connected parallel to the cooking fan 20.

[0027] The top heating element 10, the ring heating element 12 and the grill heating element 18 are provided for heating up the oven cavity of the cooking oven. The cooling fan 14 cools down the oven cavity of the cooking oven. The thermostat 16 activates and deactivates the top heating element 10, the ring heating element 12, the grill heating element 18 and the cooling fan 14. The lamp 22 illuminates the oven cavity of the cooking oven. The light switch 24 activates and deactivates the lamp 22. The cooking fan 20 distributes hot air within the oven cavity of the cooking oven.

[0028] The voltage divider formed by the top heating element 10, the ring heating element 12 and the grill heating element 18 causes that the voltage at the cooling fan 14 is reduced. The reduced voltage at the cooling fan 14 reduces also the fan speed of said cooling fan 14 and the cooling down of the oven cavity. In turn, the reduced cooling down of the oven cavity results in the reduced loss of energy.

[0029] In this example, the rated power of the top heating element 10 is about 1000 W, the rated power of the ring heating element 12 is about 2400 W and the rated power of the grill heating element 18 is about 1900 W. Since the top heating element 10, the ring heating element 12 and the grill heating element 18 are connected in series, the total power of the top heating element 10, the ring heating element 12 and the grill heating element 18 is about 515 W. The voltage divider causes, that the voltage at the top heating element 10 is about 118 V, the voltage at the ring heating element 12 is about 49 V and the voltage at the grill heating element 18 is about 63 V. The voltage at the cooling fan 14 is also about 167 V and result in a fan speed of about 700 rpm. The deactivation of the lamp 22 by the light switch 24 results in a further energy reduction of about 40 W.

[0030] FIG 3 illustrates a schematic circuit diagram of the electric and electromechanical components of the cooking oven according to a third embodiment of the present invention.

[0031] The cooking oven according to the third embodiment comprises the grill heating element 18, the top heating element 10, the cooling fan 14, the thermostat 16, the cooking fan 20, the lamp 22 and the light switch 24. The grill heating element 18, the top heating element 10 and thermostat 16 are connected in series. The cooling fan 14 is connected in parallel to the series of the top heating element 10 and the thermostat 16. In other words, the top heating element 10 and the grill heating element 18 form a voltage divider for the cooling fan 14, if the thermostat 16 is activated. The cooking fan 20 is connected in parallel to the top heating element 10, the ring heating element 12, the cooling fan 14, the grill heating element 18 and the thermostat 16. The lamp 22 and the light switch 24 are connected in series, wherein said series is connected parallel to the cooking fan 20.

[0032] The top heating element 10 and the grill heating element 18 are provided for heating up the oven cavity of the cooking oven. The cooling fan 14 cools down the oven cavity of the cooking oven.

[0033] The thermostat 16 activates and deactivates the top heating element 10, while the powers of the grill heating element 18 and the cooling fan 14 are variable by the thermostat 16. The lamp 22 illuminates the oven cavity of the cooking oven. The light switch 24 activates and deactivates the lamp 22. The cooking fan 20 distributes hot air within the oven cavity of the cooking oven.

[0034] The voltage divider formed by the top heating element 10 and the grill heating element 18 causes that the voltage at the cooling fan 14 is reduced. The reduced voltage at the cooling fan 14 reduces also the fan speed of said cooling fan 14 and the cooling down of the oven cavity. In turn, the reduced cooling down of the oven cavity results in the reduced loss of energy.

[0035] In this example, the rated power of the top heating element 10 is about 1000 W, while the rated power of the grill heating element 18 is about 1700 W. Since the top heating element 10 and the grill heating element 18 are connected in series, the total power of the top heating element 10 and the grill heating element 18 is about 630 W. The voltage divider causes, that the voltage at the top heating element 10 is about 145 V, while the voltage at the grill heating element 18 is about 85 V. The voltage at the cooling fan 14 is also about 145 V. The deactivation of the lamp 22 by the light switch 24 results in a further energy reduction of about 40 W. If the thermostat 16 is deactivated, then the grill heating element 18 and the cooling fan 14 remain in series, wherein a high voltage of almost 230 V is applied to the cooling fan 14, while a low voltage of about 3 V to 4 V is applied to the grill heating element 18. Thus, the cooling fan 14 provides a proper cooling, while the power of the grill heating element 18 is less than 1 W.

[0036] The three embodiments mentioned above may relate to three different cooking ovens. Moreover, two or three of said embodiments may relate to one cooking oven, wherein the connections between the heating elements 10, 12 and/or 18 and the cooling fan 14 may be changed by one or more changeover switches. In the latter case, the connections between the heating elements 10, 12 and/or 18 and the cooling fan 14 may relate to different operation modes.

[0037] The cooking oven according to the present invention allows a reduction of the complexity and production costs, since the voltage divider is formed by those heating elements 10, 12 and/or 18, which are already present in the cooking oven.

[0038] Although illustrative embodiments of the present invention have been described herein with reference to the accompanying drawings, it is to be understood that the present invention is not limited to those precise embodiments, and that various other changes and modifications may be affected therein by one skilled in the art without departing from the scope or spirit of the

invention. All such changes and modifications are intended to be included within the scope of the invention as defined by the appended claims.

5 List of reference numerals

[0039]

10	top heating element
12	ring heating element
14	cooling fan
16	thermostat
18	grill heating element
20	cooking fan
22	lamp
24	light switch

Claims

1. A cooking oven, in particular a domestic cooking oven, wherein:

- the cooking oven comprises at least one oven cavity,
- the cooking oven comprises at least two resistive heating elements (10, 12, 18) for heating up the oven cavity,
- at least two of the resistive heating elements (10, 12, 18) are connected in series,
- the cooking oven comprises at least one cooling fan (14) for cooling down the oven cavity, and
- the cooling fan (14) is connected in parallel to at least one of the resistive heating elements (10, 12, 18) connected in series, so that
- the resistive heating elements (10, 12, 18) connected in series form a voltage divider for the cooling fan (14).

2. The cooking oven according to claim 1, **characterised in that** the cooking oven comprises at least one top heating element (10), ring heating element (12), grill heating element (18) and/or bottom heating element.

3. The cooking oven according to claim 1 or 2, **characterised in that** the cooking oven comprises at least one cooking fan (20) for distributing hot air within the oven cavity, wherein said cooking fan (20) is connected in parallel to the series of the resistive heating elements (10, 12, 18).

4. The cooking oven according to any one of the preceding claims, **characterised in that** the cooking oven comprises at least one illumination unit (22), for illuminating the oven cavity, wherein

said lamp (22) is connected in parallel to the series of the resistive heating elements (10, 12, 18).

parallel to the top heating element (10) and the thermostat (16).

5. The cooking oven according to claim 4,
characterised in that 5
a light switch (24) is connected in series with the illumination unit (22), wherein said light switch (24) and illumination unit (22) are connected in parallel to the series of the resistive heating elements (10, 12, 18). 10
6. The cooking oven according to claim 4 or 5,
characterised in that
the illumination unit (22) includes at least one lamp (22). 15
7. The cooking oven according to any one of the preceding claims,
characterised in that
the cooking oven comprises at least one thermostat (16) connected in series with the resistive heating elements (10, 12, 18). 20
8. The cooking oven according to claim 7,
characterised in that 25
the cooling fan (14) is connected in series with the thermostat (16) and at least one resistive heating element (10, 12, 18).
9. The cooking oven according to claim 7, 30
characterised in that
the cooling fan (14) is connected in parallel to the thermostat (16) and at least one resistive heating element (10), so that the powers of the cooling fan (14) and said resistive heating element (10) are variable by the thermostat (16). 35
10. The cooking oven according to claim 7 or 8,
characterised in that
the top heating element (10), the ring heating element (12) and the thermostat (16) are connected in series, wherein the cooling fan (14) is connected in parallel to the top heating element (10). 40
11. The cooking oven according to claim 7 or 8, 45
characterised in that
the top heating element (10), the ring heating element (12), the grill heating element (18) and the thermostat (16) are connected in series, wherein the cooling fan (14) is connected in parallel to the top heating element (10) and the ring heating element (12). 50
12. The cooking oven according to claim 9, 55
characterised in that
the grill heating element (18), the top heating element (10) and the thermostat (16) are connected in series, wherein the cooling fan (14) is connected in

FIG 1

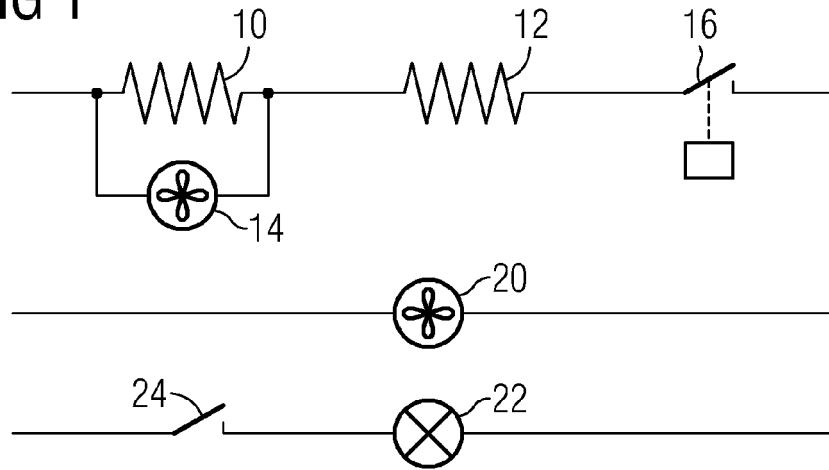


FIG 2

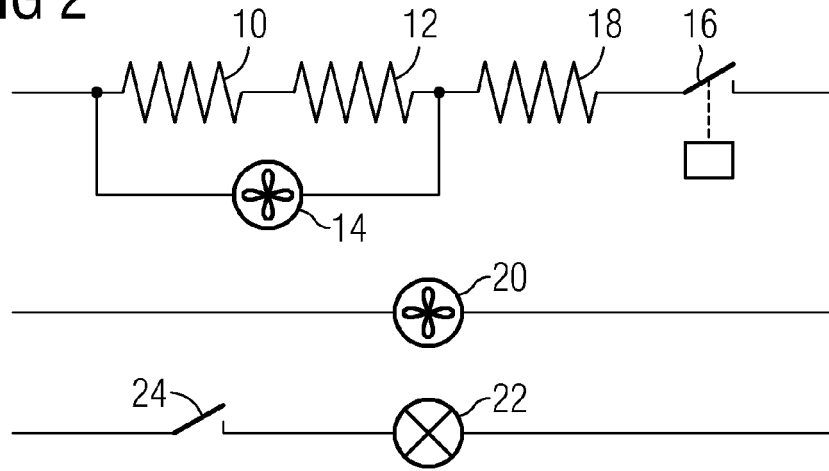
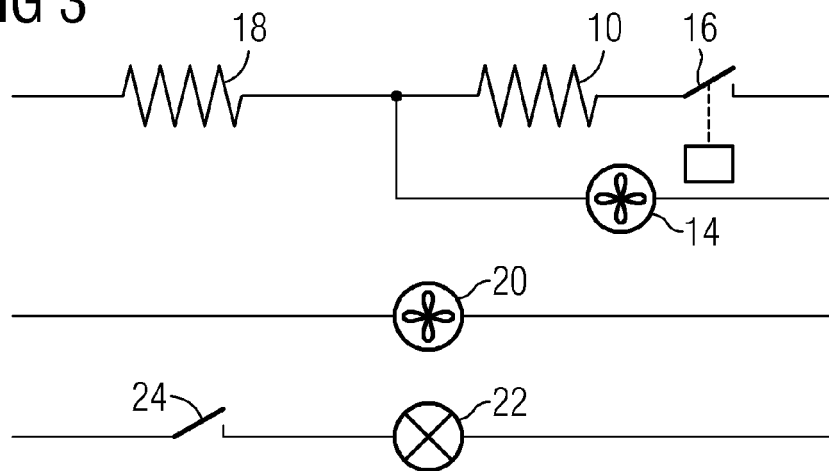


FIG 3





EUROPEAN SEARCH REPORT

Application Number
EP 17 15 6686

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 3 484 858 A (JORDAN SAMUEL C ET AL) 16 December 1969 (1969-12-16) * column 7, lines 1-2; figures 1,2,4 *	1-12	INV. F24C7/06 F24C7/08 F24C15/00
A	CA 1 196 968 A (WHIRLPOOL CO) 19 November 1985 (1985-11-19) * figure 3 *	1-12	
A	JP 2009 287886 A (TIGER VACUUM BOTTLE CO LTD) 10 December 2009 (2009-12-10) * figure 1 *	1-12	
A	DE 21 59 285 A1 (MIELE & CIE) 7 June 1973 (1973-06-07) * figure 1 *	1-12	
A	EP 2 848 866 A1 (ELECTROLUX APPLIANCES AB [SE]) 18 March 2015 (2015-03-18) * figure 5A *	1-12	
			TECHNICAL FIELDS SEARCHED (IPC)
			F24C H05B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 18 July 2017	Examiner Adant, Vincent
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 15 6686

5

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

18-07-2017

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3484858 A	16-12-1969	NONE	
CA 1196968 A	19-11-1985	NONE	
JP 2009287886 A	10-12-2009	JP 5169494 B2 JP 2009287886 A	27-03-2013 10-12-2009
DE 2159285 A1	07-06-1973	NONE	
EP 2848866 A1	18-03-2015	NONE	

15

20

25

30

35

40

45

50

55

EPO FORM P0459

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