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(71) Applicant: **Candy S.p.A.**
20900 Monza (MB) (IT)

(72) Inventor: **FUMAGALLI, Aldo**
I-20900 Monza, MONZA E BRIANZA (IT)

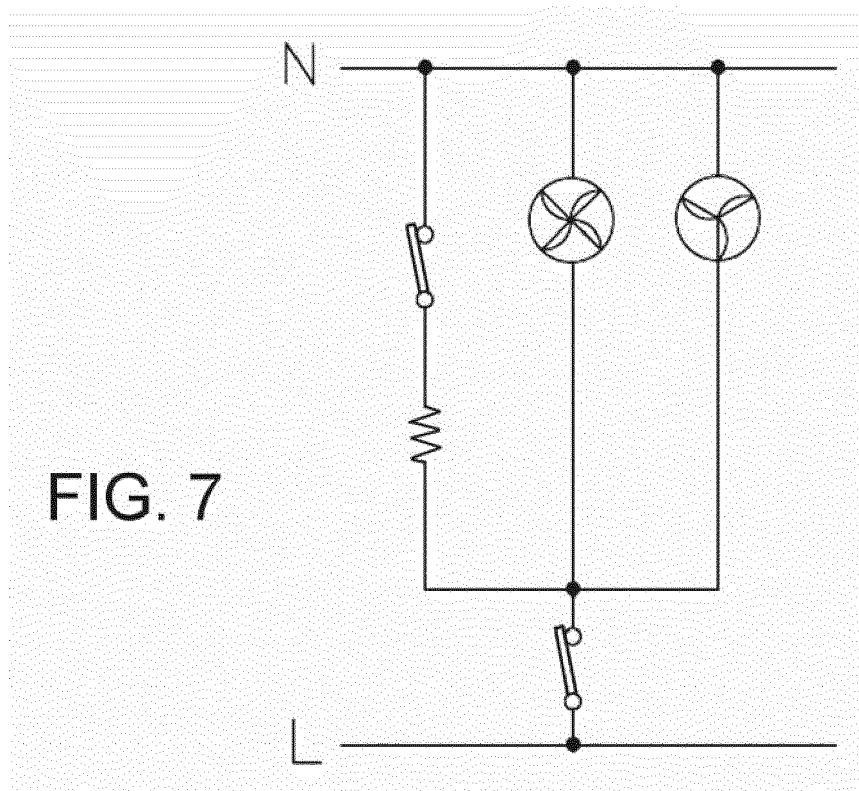
(74) Representative: **Leihkauf, Steffen Falk et al**
Jacobacci & Partners S.p.A.
Via Senato, 8
20121 Milano (IT)

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(54) **COOKING OVEN**

(57) A cooking oven (1), comprising a housing (2) which forms a cooking cavity (3), heating means (6, 6') of the cooking cavity (3), ventilating means (7, 8, 7', 8') with at least a first electrical fan (7', 8') adapted to generate a first air stream (14) in a thermally sensitive area

of the oven (1), as well as a control system (10) which automatically activates and deactivates the first fan (7', 8') together with the respective activation and deactivation of the heating means (6, 6').



Description

[0001] The present invention relates to a cooking oven, in particular a domestic electrical oven.

[0002] Domestic cooking ovens usually comprise a housing with a cooking cavity which delimits inside a cooking space for accommodating the food to be cooked. The cooking cavity has an access opening which can be closed by means of a door hinged to the housing.

[0003] In order to heat the cooking space, the cooking cavity is provided, at its lower and upper walls, with heating elements typically formed by electrical resistors.

[0004] In order to obtain a preferably uniform distribution of the heat in the cooking space, the electrical cooking ovens comprise an air circulation system in the cooking cavity. Typically, such an air circulation system comprises an impeller operated by an electrical motor in flow communication with the cooking cavity so as to be able to generate an air circulation in the cooking space.

[0005] In order to avoid the overheating of electrical or electronic components of the oven as well as burns to the user during use of the cooking oven, it is known to cool such thermally sensitive components and/or a grip zone of the door by means of a cooling air stream.

[0006] For such purpose, the ovens of the prior art may comprise a fan placed in a cooling compartment arranged over the cooking cavity and which can be operated to suck ambient air, e.g. through an intake opening formed in a rear wall of the housing, and to direct it towards the thermally sensitive components and/or through a horizontal slot of the front wall of the oven in the anterior front zone (grip zone) of the oven door.

[0007] Traditionally, the cooling of the thermally sensitive components of the oven is activated when the oven is switched on and remains on for the entire operating time of the oven until it is switched off. This ensures fully safe operation of the oven and avoids undesired overheating at the cost of a permanent consumption of electrical energy.

[0008] The ventilating of the cooking space may be turned on or off by the user as a function of the cooking recipe. Once on, the ventilating of the cooking space remains permanently on until it is switched off manually regardless of the operation of the heating resistors of the oven. Thereby, the ventilating of the cooking space also implies a permanent consumption of electrical energy.

[0009] More recently, intermittent cooling systems have been suggested provided with a sophisticated control to optimize the cooling of thermally sensitive components or cooking parameters of particular food.

[0010] Compared with the traditional ovens, the more sophisticated ventilating control systems also comply with the energy saving needs but require more complex electronic or electrical controllers which, in turn, are costly and subjected to fault and malfunctioning. Furthermore, even renouncing permanent ventilating of the oven the residual risk of overheating cannot be excluded.

[0011] It is the object of the present invention to sug-

gest a cooking oven, in particular of the domestic electrical type having features to better conciliate the needs of:

- reducing the energy consumption of the oven,
- simplifying and reducing the oven fan control system costs,
- maintaining or increasing the anti-overheating safety of the oven.

Such an object is reached by a cooking oven, in particular of the electrical household oven type, comprising a housing (2), a cooking cavity (3) formed in the housing (2) and closeable by a door (5), heating means (6, 6') placed in thermal exchange relationship with the cooking cavity (3), ventilating means placed in the housing (2) and having one or more electrical fans (7, 8; 7', 8') adapted to blow air on one or more thermally sensitive areas of the oven (1), a control system (10) connected to the heating means (6, 6') and to the ventilating means and having a temperature detector (12) associated with the cooking cavity (3), wherein the control system is configured to activate and deactivate the heating means (6, 6') depending on a temperature detected by the temperature detector (12), **characterized in that** the control system (10) automatically activates and deactivates at least one of said one or more fans (7, 8; 7', 8') while activating and deactivating the heating means (6, 6').

[0012] In other words, the control system automatically switches on the fan together with switching on the heating means and automatically switches the fan off together with switching off the heating means so that the fan is actuated intermittently in a synchronized manner with the actuation of the heating means.

[0013] Thereby, each step of heating of the cooking cavity is automatically and permanently accompanied by the ventilation of the thermally sensitive region of the oven (e.g. cooking cavity and/or thermally sensitive components, door) thus effectively avoiding the risk of overheating. Furthermore, during all periods in which the heating of the cooking cavity is deactivated and there can be no further increase of the thermal energy accumulated therein, the ventilation of the thermally sensitive region to which the fan is associated is deactivated and the respective consumption of electrical energy is canceled out.

[0014] Finally, the joint switching of the heating means and of the electrical fan makes the control system simpler and more robust because both functions can be managed with the same electrical control circuit.

[0015] In order to better understand the invention and appreciate its advantages, some non-limitative embodiments will be described below with reference to the figures, in which:

figures 1, 2, 3 show by way of example trends of temperature (Figure 1), electrical power absorption of the heating means (Figure 2) and electrical power

absorption of the ventilating means (Figure 3) in an oven of the prior art,
 figures 4, 5, 6 show by way of example trends of temperature (Figure 4), electrical power absorption of the heating means (Figure 5) and electrical power absorption of the ventilating means (Figure 6) in an oven according to the invention,
 figure 7 shows a circuit diagram of a heating and ventilating control system of an oven of the prior art, figures 8, 9, 10 show circuit diagrams of the heating and ventilating control system of an oven according to embodiments of the invention,
 figure 11 shows an oven according to an embodiment of the invention.

[0016] With reference to the figures, a cooking oven 1 comprises a housing 2, in which a cooking cavity 3 is formed intended to accommodate the food to be cooked. The cooking cavity 3 has an access opening 4 which can be closed by means of a door 5 hinged to the housing 2.

[0017] The oven 1 further comprises a heating system of the cooking cavity 3, e.g. one or more electrical resistors 6, 6' arranged outside and/or inside the cooking cavity 3.

[0018] A ventilating system with one or more recirculation and/or ventilating and/or cooling impellers 7, 7', which can be operated by electrical motors 8, 8' mixes the air inside the cooking cavity 3 to suck and exhaust cooking fumes and/or for cooling thermally sensitive components of the oven 1, such as for example the door 5 and/or the electrical or electronic components 9.

[0019] The oven 1 further comprises a control system 10 connected and configured to control the heating means 6, 6' and the ventilating means 7, 7' and having a user interface 11 for selecting operating parameters and for indicating operating conditions of the oven 1.

[0020] The control system 10 comprises a temperature detector 12 associated with the cooking cavity 3 and is configured to activate and deactivate the heating means 6, 6' according to a temperature detected by the temperature detector 12 and a desired temperature selected by means of the user interface 11.

[0021] The ventilating means comprise a first electrical fan 7', 8' positioned in a cooling compartment 13 formed, for example, over the cooking cavity 3 which can be operated to suck ambient air through an intake opening 14 in a wall of the housing 2, and to direct it as a first stream 14 (cooling stream) towards the heat sensitive components 9 placed inside the housing 2 and/or in a grip region 15 of the door 5 of the oven 1.

[0022] According to an aspect of the invention, the control system 10 automatically activates and deactivates the first electrical fans 7', 8' together with activating and deactivating the heating means 6, 6', regardless of the settings and/or cooking program selections made by the user.

[0023] Figure 8 shows a circuit diagram of the control system 10, in which the first fan 7', 8' and the heating

means (electrical resistor 6) are connected to one another in parallel to form a single heating and ventilating unit 17 which is connected in series both to an on-off switch 18 of the oven 1 and to a switch 19 controlled by the temperature detector 12 (thermostat 19, 12) or controlled as a function of the temperature detected by the temperature detector 12.

[0024] The ventilating means may comprise a second electrical fan 7, 8 in flow communication with the cooking cavity 3 so as to be able to generate a second air stream 16 (heat distribution stream) in the cooking cavity 3.

[0025] In an embodiment, the control system 10 allows the selection of a cooking program with air circulation in the cooking cavity 3, and when the cooking program with air circulation in the cooking cavity 3 is selected, the control system 10 automatically activates and deactivates the second electrical fan 7, 8 together with activating and deactivating the heating means 6, 6'.

[0026] Figure 9 shows a circuit diagram of the control system 10, in which the first fan 7', 8', the second fan 7, 8 and the heating means (electrical resistor 6) are connected to one another in parallel to form a single heating and ventilating unit 17 which is connected in series to an on-off switch 18 of the oven 1 and to a switch 19 controlled by the temperature detector 12 (thermostat 19 or 12) or controlled as a function of the temperature detected by the temperature detector 12.

[0027] The control system 10 may also allow the selection of a cooking program without air circulation in the cooking cavity 3, and, when the cooking program without air circulation in the cooking cavity 3 is selected, the control system 10 keeps the second electrical fan 7, 8 automatically deactivated, regardless of the operation of the heating means 6, 6'.

[0028] Figure 10 shows a circuit diagram of the control circuit 10 in which the first fan 7', 8', the second fan 7, 8 and the heating means (electrical resistor 6) are connected to each other in parallel to form a single heating and ventilating unit 17 which is connected in series both to an on-off switch 18 of the oven 1 and to a switch 19 controlled by the temperature detector 12 (thermostat 19, 12) or controlled as a function of the temperature detected by the temperature detector 12 and in which a circuit branch 21 of the second fan 7, 8 in the heating and ventilating unit 17 comprises a third switch 20 which allows the connection and disconnection of the second fan 7, 8 in the heating and ventilating unit 17.

[0029] In an embodiment, the heating means 6, 6', 6" can comprise one or more lower heating elements 6 arranged at a lower wall of the cooking cavity 3, one or more upper heating elements 6' arranged at an upper wall of the cooking cavity 3, as well as optionally one or more rear heating elements 6" arranged at the rear wall of the cooking cavity 3,

and the control system 10 is configured to allow the selection of programs or cooking modes and to set the cooking mode as a function of the cooking programs selected by the user, said cooking modes comprising one or more

of the following:

[0030] A) using only the rear heating element 6" (if provided), not using the lower 6 and upper 6' heating elements (if provided), with ventilating of the cooking cavity 3 by means of the second electrical fan 7, 8,

[0031] B) using only the upper heating element 6' (if provided), not using the lower 6 and rear 6" heating elements (if provided), without or with ventilating of the cooking cavity 3 by means of the second electrical fan 7, 8,

[0032] C) using only the lower heating element 6 (if provided), not using the upper 6' and rear 6" heating elements (if provided), without or with ventilating of the cooking cavity 3 by means of the second electrical fan 7, 8,

[0033] D) using the lower 6 and upper 6' heating elements (if provided), not using the rear heating element 6" (if provided), without or with ventilation of the cooking cavity 3 by means of the second electrical fan 7, 8.

[0034] In mode **A)** the control system 10 operates the second electrical fan 7, 8 in:

- energy saving mode, by automatically activating and deactivating the second electrical fan 7, 8 together with activating and deactivating the rear heating element 6", or
- standard mode, by activating the second electrical fan 7, 8 in a continuous manner.

[0035] In mode **B)** with ventilating of the cooking cavity 3, the control system 10 operates the second electrical fan 7, 8 in:

- energy saving mode, by automatically activating and deactivating the second electrical fan 7, 8 together with activating and deactivating the upper heating element 6", or
- standard mode, by operating the second electrical fan 7, 8 in a continuous manner.

[0036] In mode **C)** with ventilating of the cooking cavity 3, the control system 10 operates the second electrical fan 7, 8 in:

- energy saving mode, by automatically activating and deactivating the second electrical fan 7, 8 together with activating and deactivating the lower heating element 6", or
- standard mode, by operating the second electrical fan 7, 8 in a continuous manner.

[0037] In mode **D)** with ventilating of the cooking cavity 3, the control system 10 operates the second electrical fan 7, 8 in:

- energy saving mode, by activating and deactivating the second electrical fan 7, 8 together with activating and deactivating the upper lower 6 and upper 6" heating elements, or

- standard mode, by activating the second electrical fan 7, 8 in a continuous manner.

[0038] With reference to the aforesaid operating modes A), B), C), D), one criterion for choosing energy saving mode or standard mode is the necessary and/or predicted/estimated electrical power absorption to execute the cooking program or the cooking mode selected by the user.

[0039] In an advantageous embodiment, in energy saving mode, the control system 10 automatically activates and deactivates the first 7', 8' and second 7, 8 electrical fans together with activating and deactivating the heating means.

[0040] The oven according to the invention has many advantages. Each step of heating of the cooking cavity 3 is automatically and permanently accompanied by the ventilating of the thermally sensitive region of the oven 1, thus effectively avoiding the risk of overheating. Furthermore, during all periods in which the heating of the cooking cavity 3 is deactivated and there can be no further increase of the thermal energy accumulated therein, the ventilation of the thermally sensitive region is deactivated and the respective consumption of electrical energy is canceled out.

[0041] Finally, the joint switching of the heating means and of the ventilating means of the oven 1 makes the control system simpler and more robust because both functions can be managed with the same electrical control circuit.

[0042] Obviously, those skilled in art may make further changes and variants to the heating oven according to the present invention all without departing from the scope of protection of the invention, as defined in the following claims.

Claims

1. A cooking oven (1), comprising a housing (2), a cooking cavity (3) formed in the housing (2) and closable by a door (5), heating means (6, 6') placed in thermal exchange relationship with the cooking cavity (3), ventilating means placed in the housing (2) and having one or more electrical fans (7, 8; 7', 8') adapted to ventilate on one or more thermally sensitive areas of the oven (1), a control system (10) connected to the heating means (6, 6') and to the ventilating means and having a temperature detector (12) associated with the cooking cavity (3), wherein the control system is configured to activate and deactivate the heating means (6, 6') depending on a temperature detected by the temperature detector (12), **characterized in that** the control system (10) activates and deactivates at least one of said one or more fans (7, 8; 7', 8') automatically together with the respective activation and deactivation of the heating means (6, 6').

2. The cooking oven (1) according to claim 1, wherein the ventilating means comprise a first electrical fan (7', 8') which can be operated to suck ambient air through an intake opening (14) in a wall of the housing (2) and direct said ambient air as a first stream (14) towards thermally sensitive components (9) placed inside the housing (2) and/or into a grip region (15) of the door (5), wherein the control system (10) activates and deactivates the first electrical fan (7', 8') together with the respective activation and deactivation of the heating means (6,6'), independently from settings and selections of the cooking program made by the user.
3. The cooking oven (1) according to claim 2, wherein the first fan (7', 8') and the heating means (6) are connected to each other in parallel to form a single heating and ventilating unit (17) which is connected in series both to a switch (19) controlled depending on the temperature detected by the temperature detector (12) and to an on-off switch (18) of the oven (1).
4. The cooking oven (1) according to one of the preceding claims, wherein:
- the ventilating means comprise a second electrical fan (7, 8) in flow communication with the cooking cavity (3) such as to be able to generate a second air stream (16) in the cooking cavity (3),
 - the control system (10) allows the selection of a cooking program with air circulation in the cooking cavity (3), and
 - when the cooking program with air circulation in the cooking cavity (3) is selected, the control system (10) activates and deactivates the second electrical fan (7, 8) automatically together with the respective activation and deactivation of the heating means (6, 6').
5. The cooking oven (1) according to claim 4, wherein the first fan (7', 8'), second fan (7, 8) and heating means (6) are connected to each other in parallel to form a single heating and ventilating unit (17) which is connected in series both to a switch (19) controlled depending on the temperature detected by the temperature detector (12) and to an on-off switch (18) of the oven (1).
6. The cooking oven (1) according to claim 4 or 5, wherein:
- the control system (10) allows the selection of a cooking program without air circulation in the cooking cavity (3), and
 - when the cooking program without air circulation in the cooking cavity (3) is selected, the control system (10) keeps the second electrical fan (7, 8) automatically deactivated, regardless of the operation of the heating means (6, 6').
7. The cooking oven (1) according to claim 6, wherein the first fan (7', 8'), the second fan (7, 8) and the heating means (6) are connected to each other in parallel to form a single heating and ventilating unit (17) which is connected in series both to a switch (19) controlled depending on the temperature detected by the temperature detector (12) and to an on-off switch (18) of the oven (1), and wherein an electrical circuit branch (21) connecting the second fan (7, 8) in the heating and ventilating unit (17) comprises a third switch (20) allowing the connection and disconnection of the second fan (7, 8) in the heating and ventilating unit (17).
8. The cooking oven (1) according to claim 4, wherein the control system (10) is configured to establish different cooking modes depending on the cooking programs selected by the user, wherein:
- in a power saving mode, the control system (10) activates and deactivates the second electrical fan (7, 8) automatically together with the respective activation and deactivation of the heating means (6, 6', 6''), and
 - in a standard mode, the control system (10) activates the second electrical fan (7, 8) continuously without interruptions.
9. The cooking oven (1) according to claim 8, wherein the control system (10) selects between the power saving mode and the standard mode depending on a pre-set criterion of power consumption needed to perform the cooking program selected by the user.
10. The cooking oven (1) according to claim 8 or 9, wherein, in said power saving mode, the control system (10) activates and deactivates the first (7', 8') and second electrical fan (7, 8) automatically together with the respective activation and deactivation of the heating means.

FIG. 1

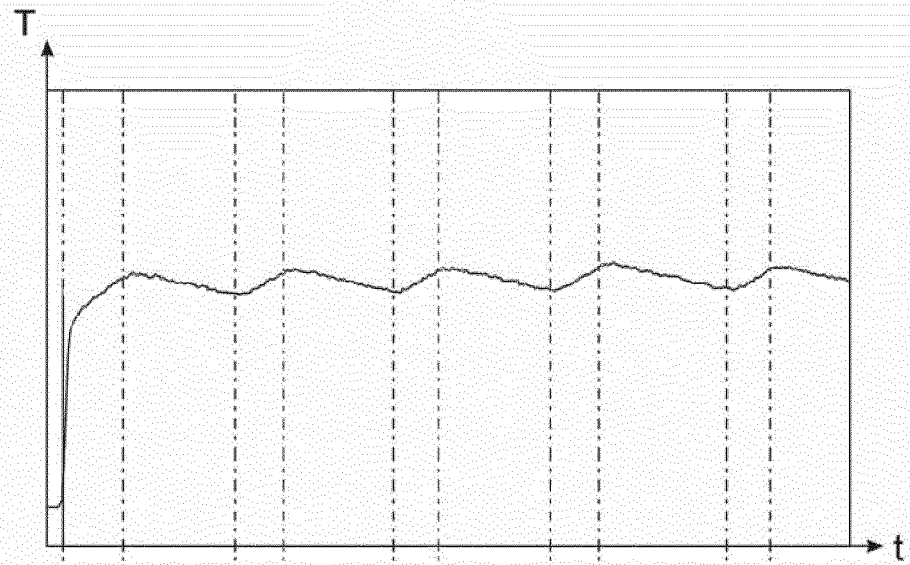


FIG. 2

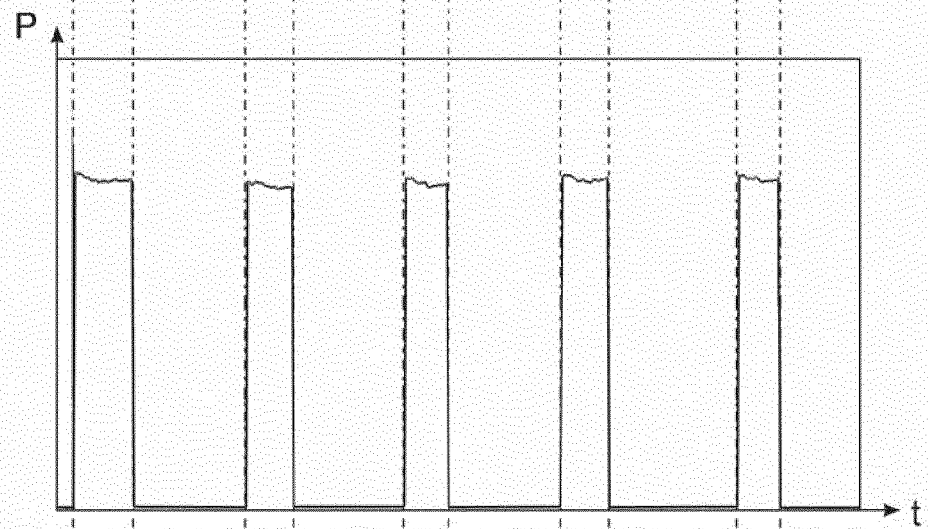


FIG. 3

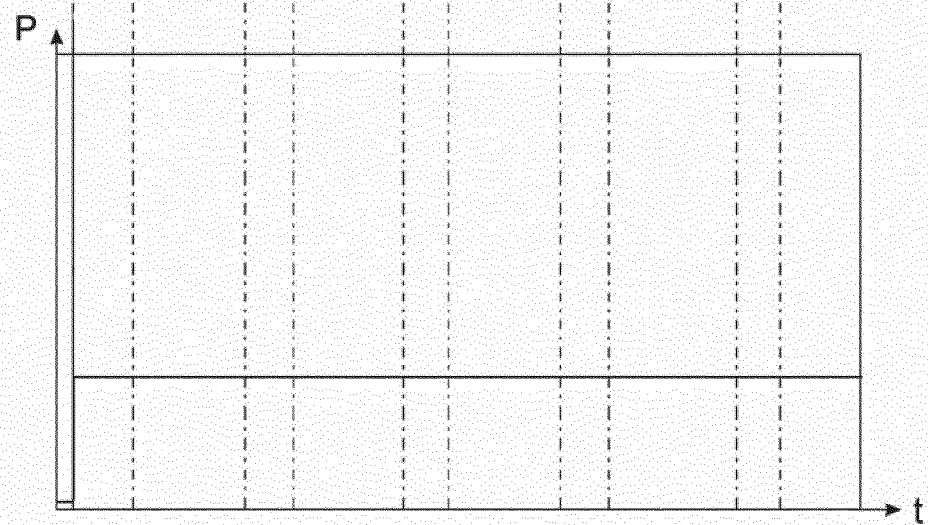


FIG. 4

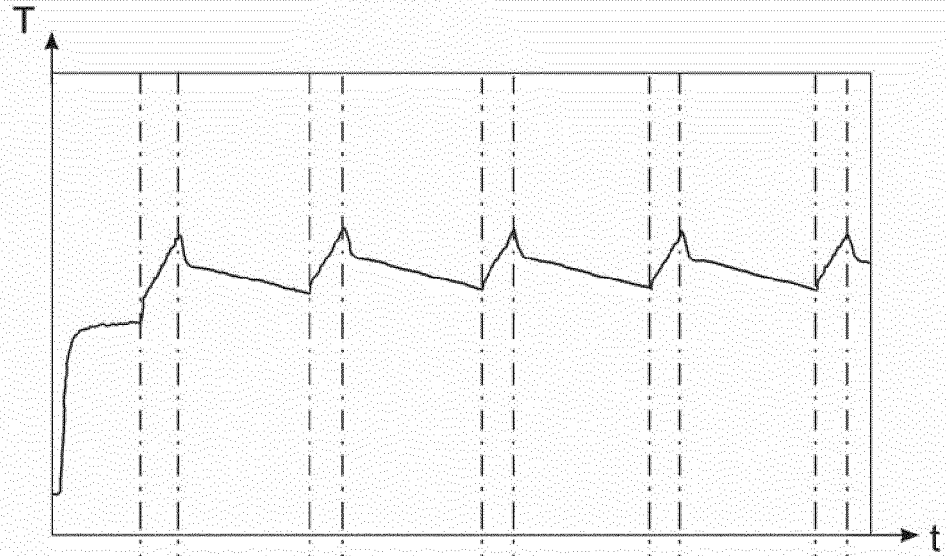


FIG. 5

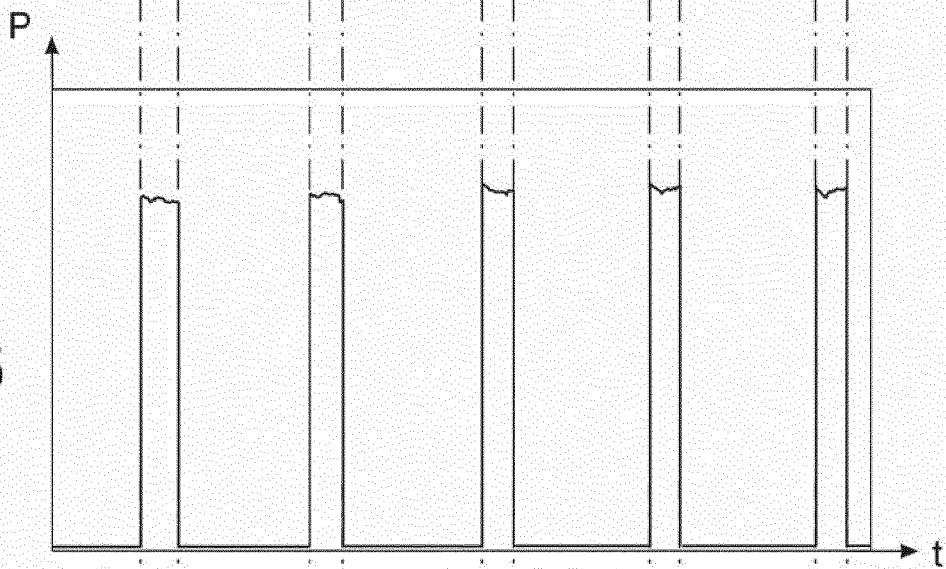


FIG. 6

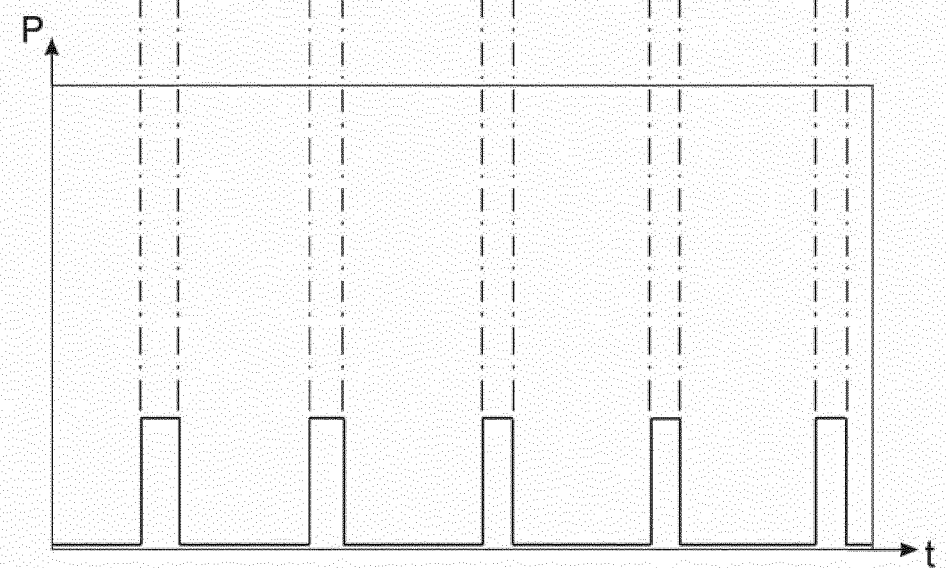


FIG. 7

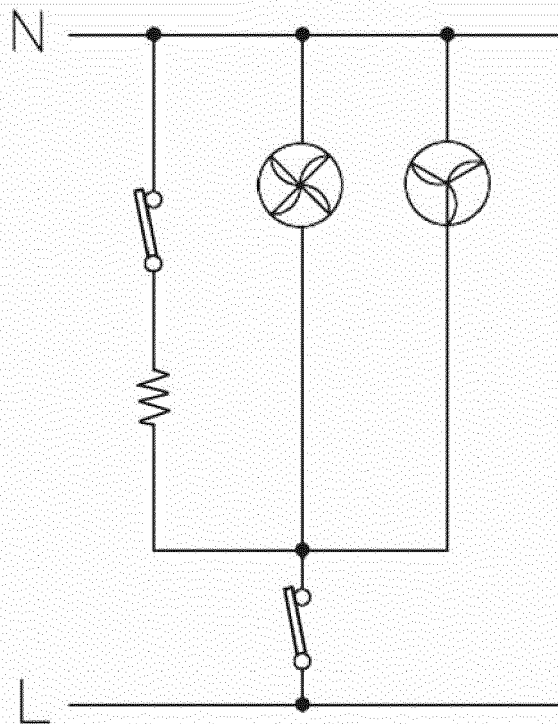


FIG. 8

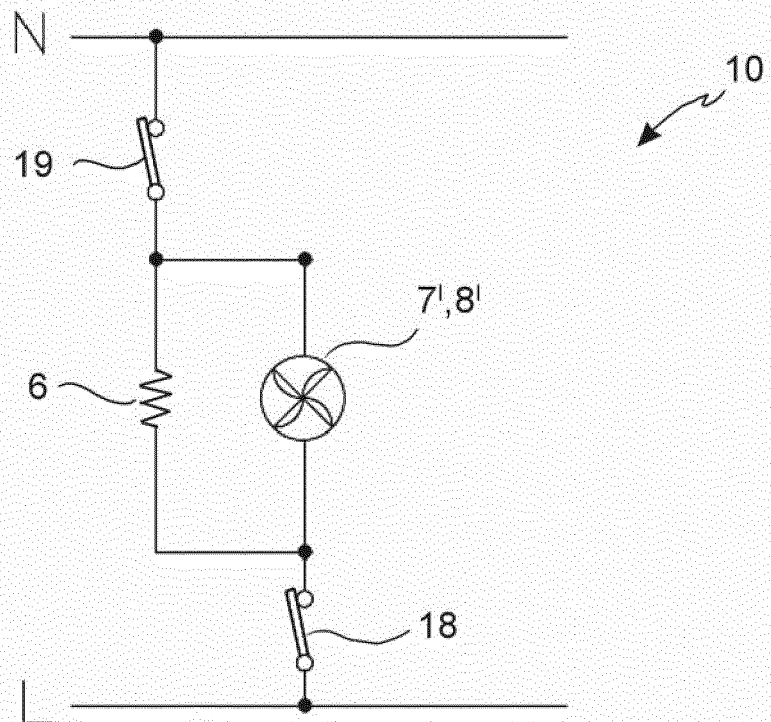


FIG. 9

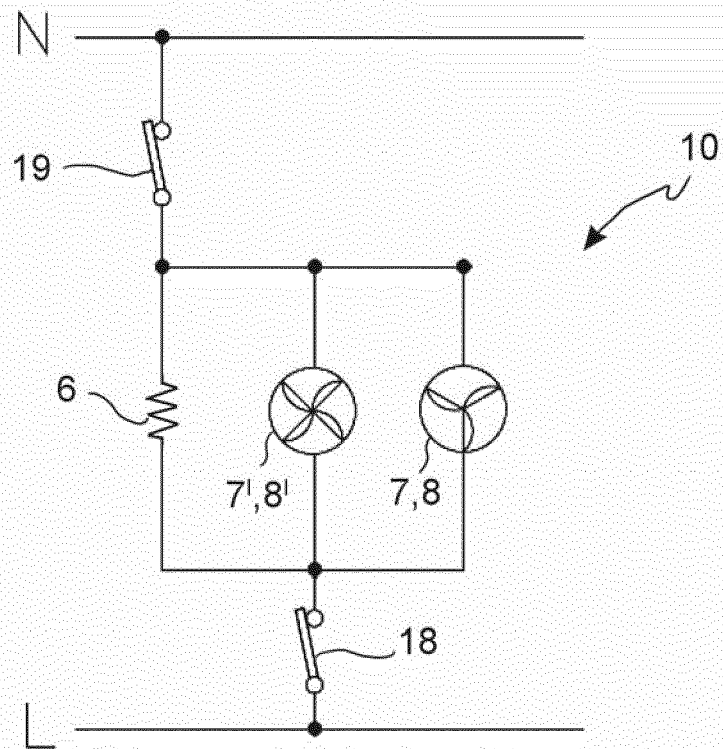
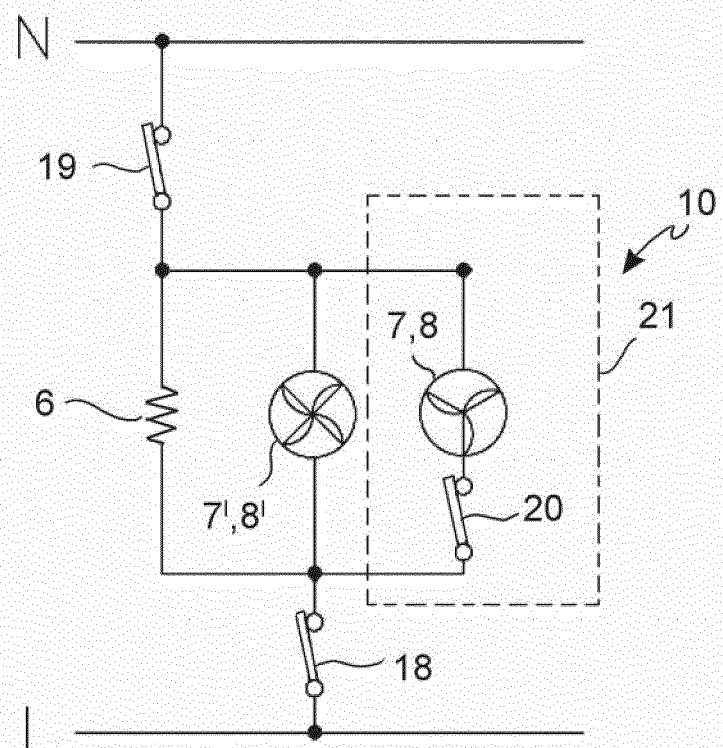


FIG. 10



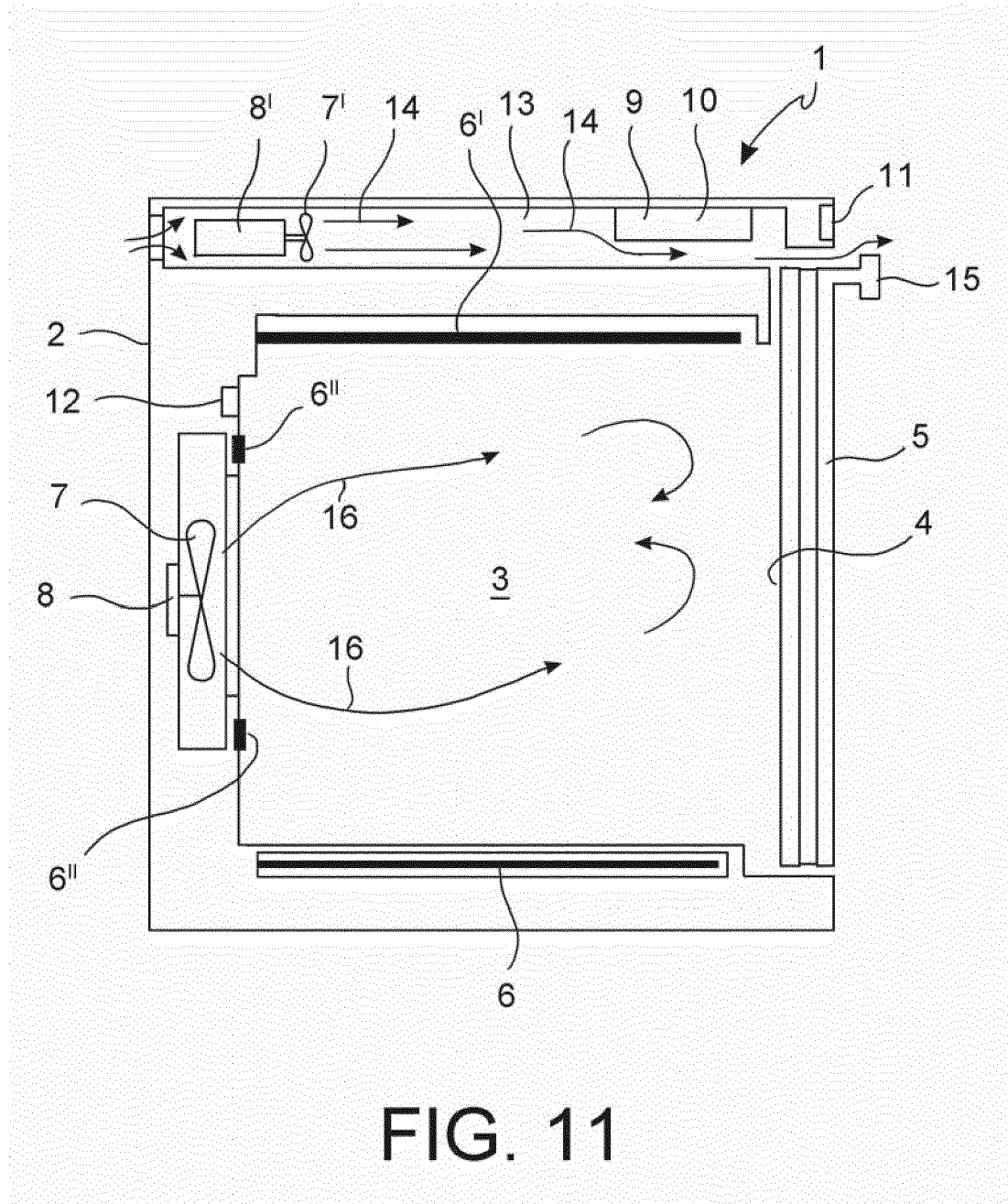


FIG. 11



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Application Number
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Place of search The Hague		Date of completion of the search 26 January 2016	Examiner Rodriguez, Alexander
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