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(54) **COOKING APPLIANCE AND METHOD OF OPERATING A COOKING APPLIANCE**

(57) A cooking appliance (2) has an oven (2) having a heating chamber (4) and an oven heater (7) for heating the heating chamber (4). The cooking appliance (2) further has a hob (3) having a hob heater (8) for heating a cooking vessel placed on the hob (3) in use. A hot air transfer arrangement (11) is operable to allow hot air to be selectively transferred from the oven heating chamber (3) to the hob (3) so as to heat a cooking vessel placed on the hob (3) in use.

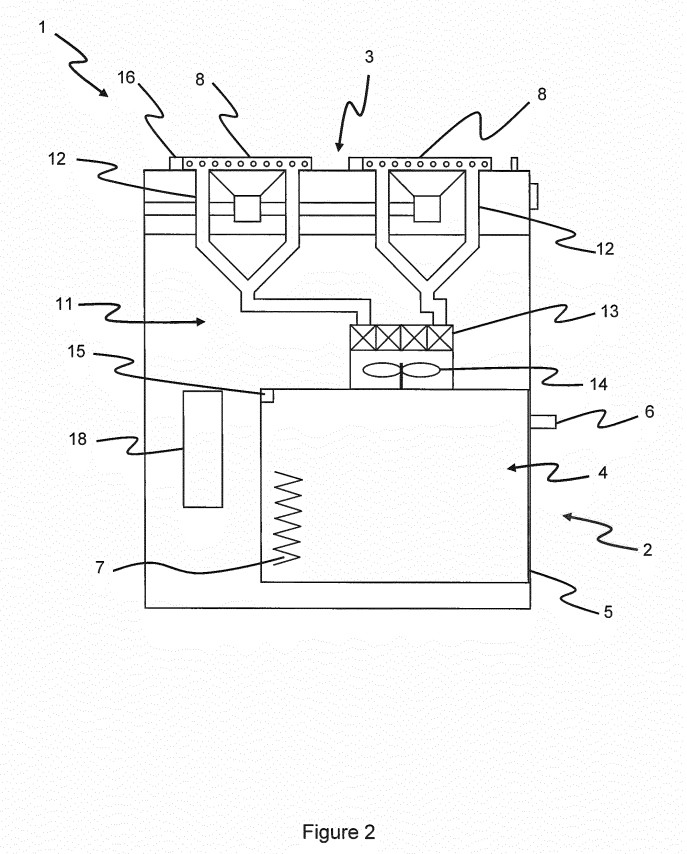

Figure 2

EP 3 742 054 A1

Description

Technical Field

[0001] The present disclosure relates to a cooking appliance and a method of operating a cooking appliance.

Background

[0002] A cooking appliance is an appliance that is used to cook or heat food, liquids, etc. Some cooking appliances include an oven having an oven heater and a hob having one or more (typically four) hob heaters or heating "rings". In some cooking appliances, the oven and the hob are integrated into a single unit but in other cooking appliances the oven and the hob are provided as separate components.

Summary

[0003] According to a first aspect disclosed herein, there is provided a cooking appliance comprising:

an oven having a heating chamber and an oven heater for heating the heating chamber;
a hob having a hob heater for heating a cooking vessel placed on the hob in use; and
a hot air transfer arrangement operable to allow hot air to be selectively transferred from the oven heating chamber to the hob so as to heat a cooking vessel placed on the hob in use.

[0004] In an example, the cooking appliance is arranged such that the hot air transfer arrangement is only operable to transfer hot air from the oven heating chamber to the region of the hob heater if the hob heater is switched off.

[0005] In an example, the hob comprises a hob temperature sensor for providing a measure of air temperature at the hob, and the hot air transfer arrangement is selectively operable based at least in part on the measured air temperature at the hob.

[0006] In an example, the cooking appliance comprises a user input device for a user to input a desired air temperature at the hob, wherein the hot air transfer arrangement is configured to control the air flow from the oven heating chamber to the hob based at least in part on the measured air temperature at the hob and the desired air temperature at the hob.

[0007] In an example, the oven comprises an oven temperature sensor for providing a measure of air temperature within the oven heating chamber, and wherein the hot air transfer arrangement is selectively operable based at least in part on the measured temperature of the air temperature within the oven heating chamber.

[0008] In an example, the hot air transfer arrangement comprises a pipe providing a conduit for air flow from the oven heating chamber to the hob.

[0009] In an example, the hot air transfer arrangement comprises a valve operable to control air flow through the pipe from the oven heating chamber to the hob.

[0010] In an example, the hot air transfer arrangement comprises a fan selectively operable to drive air flow from the oven heating chamber to the hob.

[0011] In an example, the cooking appliance comprises:

a controller, the controller being configured to cause operation of the hot air transfer arrangement to allow heat to be transferred from the oven heating chamber to the hob in accordance with a user input.

[0012] According to a second aspect disclosed herein, there is provided a method of operating a cooking appliance, the cooking appliance comprising an oven and a hob, the oven having a heating chamber and an oven heater for heating the heating chamber, the hob having a hob heater for heating a cooking vessel placed on the hob in use, the method comprising:

operating a hot air transfer arrangement to transfer hot air from the oven heating chamber to the hob so as to heat a cooking vessel placed on the hob in use.

Brief Description of the Drawings

[0013] To assist understanding of the present disclosure and to show how embodiments may be put into effect, reference is made by way of example to the accompanying drawings in which:

Figure 1 shows schematically a perspective view of a cooking appliance according to aspect described herein; and

Figure 2 shows schematically the interior of the cooking appliance shown in Figure 1.

Detailed Description

[0014] Referring to the drawings, Figure 1 shows schematically a perspective view and Figure 2 shows schematically the interior of an example of a cooking appliance 1 according to the present disclosure. The cooking appliance 1 includes an oven 2 and a hob 3. In this example, the oven 2 and the hob 3 are combined together into a single standalone "integrated" cooking appliance 1. In another example, the oven 2 may be provided separately of the hob 3 so that, for example, the oven 2 and the hob 3 can be positioned separately of one another in a kitchen.

[0015] The oven 2 has an interior heating chamber 4. The oven 2 also includes a door 5 which can be opened to permit access to the heating chamber 4 and closed to prevent access to the heating chamber 4. A handle 6 is attached to a front surface of the door 5 to make it easier for a user to open and close the door 5.

[0016] The oven 2 includes an oven heater 7 for heating the interior of the heating chamber 4. In this example,

the oven heater 7 is located inside the heating chamber 4. In one example, the oven 2 is an electric oven which has an oven heater 7 in the form of one or more electric heating coils, which convert electricity into heat using resistive heating. In another example, the oven 2 is a gas oven which has an oven heater 7 in the form of a gas burner, which converts gas fuel into heat.

[0017] The hob 3 includes at least one hob heater 8 or "cooking ring". The hob heater 8 in arranged for localised heating of pots and pans or other cooking vessels placed on the hob 3 over the hob heater 8 in use. The hob 3 may include a plurality of hob heaters 8, and it is common for such cooking appliances to have four hob heaters 8. Each hob heater 8 has a stand or support arrangement 9 on which a cooking vessel may be placed to support the cooking vessel over the hob heater 8 in use. In this example, each of the hob heaters 8 is a gas burner, which burns natural gas to generate heat. In another example, one or all of the hob heaters 8 may be another type of heater, such as for example an electrical resistive element or a magnetic induction element. The hob 3 has hob controls 10 for providing control of the hob heaters 8. In this example, the hob 3 has a plurality of hob controls 10. Each hob control 10 is associated with a respective one of the hobs heaters 8 and is operable to control the heat output by its associated hob heater 8.

[0018] As will be familiar, after use for heating items within the interior heating chamber 4 of the oven 2, the interior heating chamber 4 typically remains hot for some time after the oven heater 7 has been switched off. With conventional ovens, the heat within the interior heating chamber 4 is gradually lost to the environment over time. This represents a waste of energy as the heat is simply lost and is not recovered.

[0019] In accordance with examples of the present disclosure, instead of the heat from the interior heating chamber 4 of the oven 2 being lost to the environment, at least some of the heat may be directed so as to warm, or keep warm, one or more cooking vessels placed in use on the hob 3. This is achieved by transferring hot air from the interior heating chamber 4 of the oven 2 to the hob 3. More specifically, hot air from the interior heating chamber 4 of the oven 2 may selectively be transferred to the region of a hob heater 8 so that the hot air flows to the bottom of a cooking vessel or the like placed in use on the hob 3 over the hob heater 8. This allows the cooking vessel, and therefore any contents of the cooking vessel, to be warmed up if cold or to be kept warm if already warm. This is done in an efficient way by effectively recovering heat from the interior heating chamber 4 of the oven 2 which would otherwise simply be lost.

[0020] The cooking appliance 1 has a hot air transfer arrangement 11 which is operable to allow hot air to be selectively transferred from the interior heating chamber 4 of the oven 2 to the hob 3. In an example, the hot air transfer arrangement 11 is arranged to transfer hot air to just one of the hob heaters 8. In the example shown, the hot air transfer arrangement 11 is arranged to transfer hot air to plural ones of the hob heaters 8 and, in this example, to each of the hob heaters 8. The hot air transfer arrangement 11 may be such that hot air may be passed selectively to any one or more of the hob heaters 8.

[0021] The hot air transfer arrangement 11 includes one or more pipes 12 which provide a conduit for air flow from the oven 2 to the hob 3. In this example, the hot air transfer arrangement 11 has a plurality of pipes 12, each pipe 12 providing a conduit for air flow from the oven 2 to a respective one of the hob heaters 8. In Figure 2, only two of the pipes 12 to two of the hob heaters 8 are shown. Two other pipes 12 for the two other hob heaters 8 are hidden from view in Figure 2. Each pipe 12 may be arranged so as to spread hot air from the oven 2 generally evenly over the hob heater 8, in turn so as to spread the hot air generally evenly over the base of a cooking vessel placed in use over the hob heater 8. The pipes 12 may contain a filter (not shown) for filtering the air passing from the oven 2 to the hob 3. The filters may contain for example activated carbon to assist in removing contaminants from the air.

[0022] The hot air transfer arrangement 11 of this example has one or more valves 13 operable to control air flow through the one or more pipes 12 from the oven 2 to the hob 3. In this example, the hot air transfer arrangement 11 has at least one valve 13 for each pipe 12. Each valve 13 is operable to control air flow through its respective pipe 12 from the oven 2 to the respective hob heater 8. Each valve 13 is operable between an open position, in which the valve 13 permits air flow from the oven 2 to the hob 3, and a closed position, in which the valve blocks 13 air flow from the oven 2 to the hob 3. In this example, each valve 13 may also be partially opened to control at least in part the air flow rate.

[0023] In this example, the hot air transfer arrangement 11 includes at least one fan 14. The fan 14 is selectively operable to drive air flow from the oven 2 through the or each pipes 12 to the hob 3.

[0024] The pipes 12 in this example connect at one end to the top of the oven 2 to collect air from the top of the interior heating chamber 4 of the oven 2. The fan 14 is located at the entry to the pipes 12 from the interior heating chamber 4 of the oven 2. In this example, the fan 14 is located upstream of the valves 13 but may be located downstream of the valves 13 in other examples.

[0025] The oven 2 in this example has an temperature sensor 15 for providing a measure of the air temperature within the interior heating chamber 4 of the oven 2. The hot air transfer arrangement 11 may be selectively operable based on, at least in part, the temperature sensed by the oven temperature sensor 15. For example, the hot air transfer arrangement 11 may only operate when the air temperature within the interior heating chamber 4 of the oven 2 is above a predetermined threshold, such as for example 75°C or 100°C or so. Other examples that make use of the temperature within the interior heating chamber 4 of the oven 2 will be discussed further below.

[0026] The hob 3 in this example has one or more hob

temperature sensors 16 for providing a measure of the temperature of a surface of the hob 3. There may be a respective hob temperature sensor 16 for each hob heater 8. In an example, a hob temperature sensor 16 may provide a measure of the temperature of a surface on which a cooking vessel can be placed on the hob 3. This may be for example the temperature of the stand or support arrangement 9 on which a cooking vessel may be placed over a hob heater 8. Alternatively or additionally, a hob temperature sensor 16 may provide a measure of the temperature of the (hot) air that has passed through the hot air transfer arrangement 11 from the oven 2 to the hob 3 at the point where the air is exiting the pipe 15 under the cooking vessel or the like. The hot air transfer arrangement 11 may be selectively operable based on, at least in part, the temperature sensed by the or each hob temperature sensors 16. For example, a valve 13 which controls air flow to a hob heater 8 may be opened or closed depending, at least in part, on the temperature sensed by the hob temperature sensor 16 associated with the hob heater 8.

[0027] In this example, the cooking appliance 1 includes an input device 17 by which a user can input commands to control operation of the hot air transfer arrangement 11 as will be discussed further by way of example below. The input device 17 may have one or more switches or the like and may be for example a touch panel. The input device 17 may be at the front of the cooking appliance 1, near the other hob controls 10 that are conventionally provided on a cooking appliance. As an alternative, there may be one or more input devices 17 provided on the top surface of the hob 3 adjacent the or each hob heater 8 for controlling transfer of hot air to the respective hob heater 8 (one being shown by way of example in Figure 1).

[0028] In this example, the cooking appliance 1 includes a controller 18 (such as a processor, a microprocessor, or the like). The controller 18 is configured to control operation of the hot air transfer arrangement 11, specifically in this example to control operation of the valves 13 and fan 14. For a particular hob heater 8, the hot air transfer arrangement 11 may be selectively operated based on, for example, one or more of: user input, the temperature sensed by the oven temperature sensor 15, and the temperature sensed by the hob temperature sensor 16 associated with the relevant hob heater 8.

[0029] Examples of operation of the cooking appliance 1 shown in Figures 1 and 2 will now be described.

[0030] In one example, the hot air transfer arrangement 11 is operable to transfer hot air from the interior heating chamber 4 of the oven 2 to a particular a hob heater 8 (or at least to the region of the hob heater 8) if the hob heater 8 itself is off and is not actually being used to heat a cooking vessel. That is, a user can choose a hob heater 8 to receive hot air from the oven 2 and locate a cooking vessel over that hob heater 8. The user can select that hob heater 8 to receive hot air from the oven 2 by appropriate operation of the input device 17 (or the relevant input device 17 is plural input devices 17 are provided). In that case, the controller 18 can cause the relevant valve 13 to open and switch on the fan 14 so that air is drawn from the interior heating chamber 4 of the oven 2, passes up the relevant pipe 12, and passes to the selected hob heater 8. In an example, the controller 18 checks that the particular hob heater 8 is off and only operates the relevant valve 13 to open if the hob heater 8 is off. Otherwise, if the particular hob heater 8 is not off, a warning, such as by display of a message on some display panel or by flashing of a warning light, etc., may be provided by the cooking appliance 1 to notify the user.

[0031] In an example, the controller 18 may operate based on feedback from the temperature sensor 15 of the oven 2 and/or the one or more hob temperature sensors 16.

[0032] For example, if the oven 2 is on (for example, heating or cooking food within the oven 2), then the controller 18 may only operate to transfer hot air from the oven 2 to the hob 3 if the temperature within the interior heating chamber 4 of the oven 2 stays close to a temperature that has been set for the interior heating chamber 4 of the oven 2. As a particular example to illustrate this, the user may have set the cooking appliance 1 so that the temperature within the interior heating chamber 4 of the oven 2 is 180°C. Removing hot air from the oven 2 to heat a cooking vessel on the hob 3 will in general cause the temperature in the interior heating chamber 4 to fall. The controller 18 may respond to this by increasing the heat energy applied by the oven heater 7, which may be sufficient to keep the temperature within the interior heating chamber 4 close enough to the desired set temperature for the oven 2. However, if the temperature within the interior heating chamber 4 falls too far below the set temperature, then the controller 18 may operate the valve 13 to reduce the flow of air leaving the oven 2 or even to completely close the valve 13 to prevent the flow of air leaving the oven 2. Alternatively or additionally, the controller 18 may control the fan 14 to operate at a slower rate so as to reduce the air flow rate out of the oven 2. This mode of operation may occur if the temperature within the interior heating chamber 4 falls a preset amount below the set temperature (e.g. more than 5°C or more than 10°C or the like below) or falls below a certain percentage of the set temperature (e.g. less than 95% or 90% or the like of the set temperature).

[0033] As mentioned, in an example the controller 18 may only operate the hot air transfer arrangement 11 when the air temperature within the interior heating chamber 4 of the oven 2 is above a predetermined threshold, such as for example 75°C or 100°C or so. This prevents cold or cool air being blown over the cooking vessel.

[0034] In another example in the case that the hob 3 has one or more hob temperature sensors 16, the controller 18 may operate the hot air transfer arrangement 11 in accordance with the temperature measured. As mentioned, the hob temperature sensors 16 may measure the temperature of a surface on which a cooking ves-

sel can be placed on the hob 3 and/or the temperature of the (hot) air that has passed to the hob 3 at the point where the air is exiting the pipe 15 under the cooking vessel or the like. In an example, if this temperature falls too low, then the controller 18 may operate the valve 13 and/or fan 14 to reduce the flow of air or even to completely close the valve 13 to prevent the flow of air leaving the oven 2.

[0035] In a specific example of this, the input device 17 may enable the user to select a "warming" temperature that is to be applied to the cooking vessel by transferring hot air from the oven 2. If the controller 18 notes that the temperature measured by the relevant hob temperature sensor 16 is (significantly) below this selected temperature (such as more than 5% or 10%, etc below), then the air transfer arrangement 1 may be switched off and, optionally, a warning may again be provided by the cooking appliance 1 to notify the user. Conversely, if the temperature measured by the relevant hob temperature sensor 16 is (significantly) above (such as more than 5% or 10%, etc above) the selected temperature, then the controller 18 may operate to reduce the flow of hot air from the oven 2 or even to switch off the flow of hot air from the oven 2, at least temporarily.

[0036] In some examples, the temperature sensor 15 of the oven 2 and the one or more hob temperature sensors 16 can both be used by the controller 18 in a closed loop control system to control operation of the hot air transfer arrangement 11. The user may select a particular hob 8 to receive hot air from the oven 2 and the controller 18 operates and controls the hot air transfer arrangement 11 so that hot air is provided from the oven 2 at an appropriate rate.

[0037] Examples described herein enable hot air from an oven, which would otherwise normally be lost to the environment, to be used in heating cooking vessels on a hob. This can be used for example to keep the contents of the cooking vessels warm without requiring consumption of any further fuel.

[0038] It will be understood that the processor or processing system or circuitry referred to herein may in practice be provided by a single chip or integrated circuit or plural chips or integrated circuits, optionally provided as a chipset, an application-specific integrated circuit (ASIC), field-programmable gate array (FPGA), digital signal processor (DSP), graphics processing units (GPUs), etc. The chip or chips may comprise circuitry (as well as possibly firmware) for embodying at least one or more of a data processor or processors, a digital signal processor or processors, baseband circuitry and radio frequency circuitry, which are configurable so as to operate in accordance with the exemplary embodiments. In this regard, the exemplary embodiments may be implemented at least in part by computer software stored in (non-transitory) memory and executable by the processor, or by hardware, or by a combination of tangibly stored software and hardware (and tangibly stored firmware).

[0039] Although at least some aspects of the embodiments described herein with reference to the drawings comprise computer processes performed in processing systems or processors, the invention also extends to computer programs, particularly computer programs on or in a carrier, adapted for putting the invention into practice. The program may be in the form of non-transitory source code, object code, a code intermediate source and object code such as in partially compiled form, or in any other non-transitory form suitable for use in the implementation of processes according to the invention. The carrier may be any entity or device capable of carrying the program. For example, the carrier may comprise a storage medium, such as a solid-state drive (SSD) or other semiconductor-based RAM; a ROM, for example a CD ROM or a semiconductor ROM; a magnetic recording medium, for example a floppy disk or hard disk; optical memory devices in general; etc.

[0040] The examples described herein are to be understood as illustrative examples of embodiments of the invention. Further embodiments and examples are envisaged. Any feature described in relation to any one example or embodiment may be used alone or in combination with other features. In addition, any feature described in relation to any one example or embodiment may also be used in combination with one or more features of any other of the examples or embodiments, or any combination of any other of the examples or embodiments. Furthermore, equivalents and modifications not described herein may also be employed within the scope of the invention, which is defined in the claims.

Claims

1. A cooking appliance comprising:

   an oven having a heating chamber and an oven heater for heating the heating chamber;
   a hob having a hob heater for heating a cooking vessel placed on the hob in use; and
   a hot air transfer arrangement operable to allow hot air to be selectively transferred from the oven heating chamber to the hob so as to heat a cooking vessel placed on the hob in use.

2. A cooking appliance according to claim 1, arranged such that the hot air transfer arrangement is only operable to transfer hot air from the oven heating chamber to the region of the hob heater if the hob heater is switched off.

3. A cooking appliance according to claim 1 or claim 2, wherein the hob comprises a hob temperature sensor for providing a measure of air temperature at the hob, and wherein the hot air transfer arrangement is selectively operable based at least in part on the measured air temperature at the hob.

4. A cooking appliance according to claim 3, comprising a user input device for a user to input a desired air temperature at the hob, wherein the hot air transfer arrangement is configured to control the air flow from the oven heating chamber to the hob based at least in part on the measured air temperature at the hob and the desired air temperature at the hob.

5. A cooking appliance according to any of claims 1 to 4, wherein the oven comprises an oven temperature sensor for providing a measure of air temperature within the oven heating chamber, and wherein the hot air transfer arrangement is selectively operable based at least in part on the measured temperature of the air temperature within the oven heating chamber.

6. A cooking appliance according to any of claims 1 to 5, wherein the hot air transfer arrangement comprises a pipe providing a conduit for air flow from the oven heating chamber to the hob.

7. A cooking appliance according to claim 6, wherein the hot air transfer arrangement comprises a valve operable to control air flow through the pipe from the oven heating chamber to the hob.

8. A cooking appliance according to any of claims 1 to 7, wherein the hot air transfer arrangement comprises a fan selectively operable to drive air flow from the oven heating chamber to the hob.

9. A cooking appliance according to any of claims 1 to 8, comprising:
a controller, the controller being configured to cause operation of the hot air transfer arrangement to allow heat to be transferred from the oven heating chamber to the hob in accordance with a user input.

10. A method of operating a cooking appliance, the cooking appliance comprising an oven and a hob, the oven having a heating chamber and an oven heater for heating the heating chamber, the hob having a hob heater for heating a cooking vessel placed on the hob in use, the method comprising:
operating a hot air transfer arrangement to transfer hot air from the oven heating chamber to the hob so as to heat a cooking vessel placed on the hob in use.

11. A method according to claim 10, wherein the hot air transfer arrangement is only operable to transfer hot air from the oven heating chamber to the region of the hob heater if the hob heater is switched off.

12. A method according to claim 10 or claim 11, wherein the hob comprises a hob temperature sensor for providing a measure of air temperature at the hob, and wherein the hot air transfer arrangement is operable based at least in part on the measured air temperature at the hob.

13. A method according to claim 12, comprising a user input device for a user to input a desired air temperature at the hob, wherein the hot air transfer arrangement is configured to control the air flow from the oven heating chamber to the hob based at least in part on the measured air temperature at the hob and the desired air temperature at the hob.

14. A method according to any of claims 10 to 13, wherein the oven comprises an oven temperature sensor for providing a measure of air temperature within the oven heating chamber, and wherein the hot air transfer arrangement is selectively operable based at least in part on the measured temperature of the air temperature within the oven heating chamber.

15. A method according to any of claims 10 to 14, wherein the hot air transfer arrangement comprises at least one of: a valve operable to control air flow through the pipe from the oven heating chamber to the hob; and a fan selectively operable to drive air flow from the oven heating chamber to the hob.

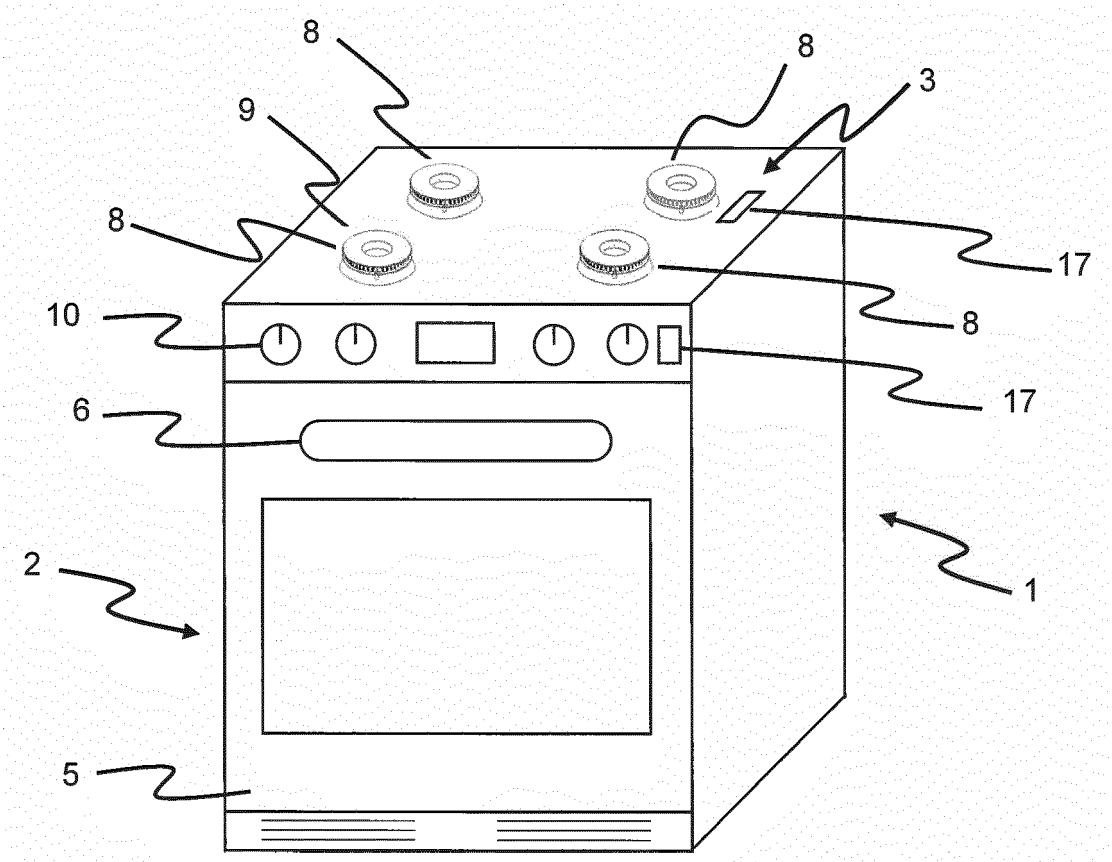

Figure 1

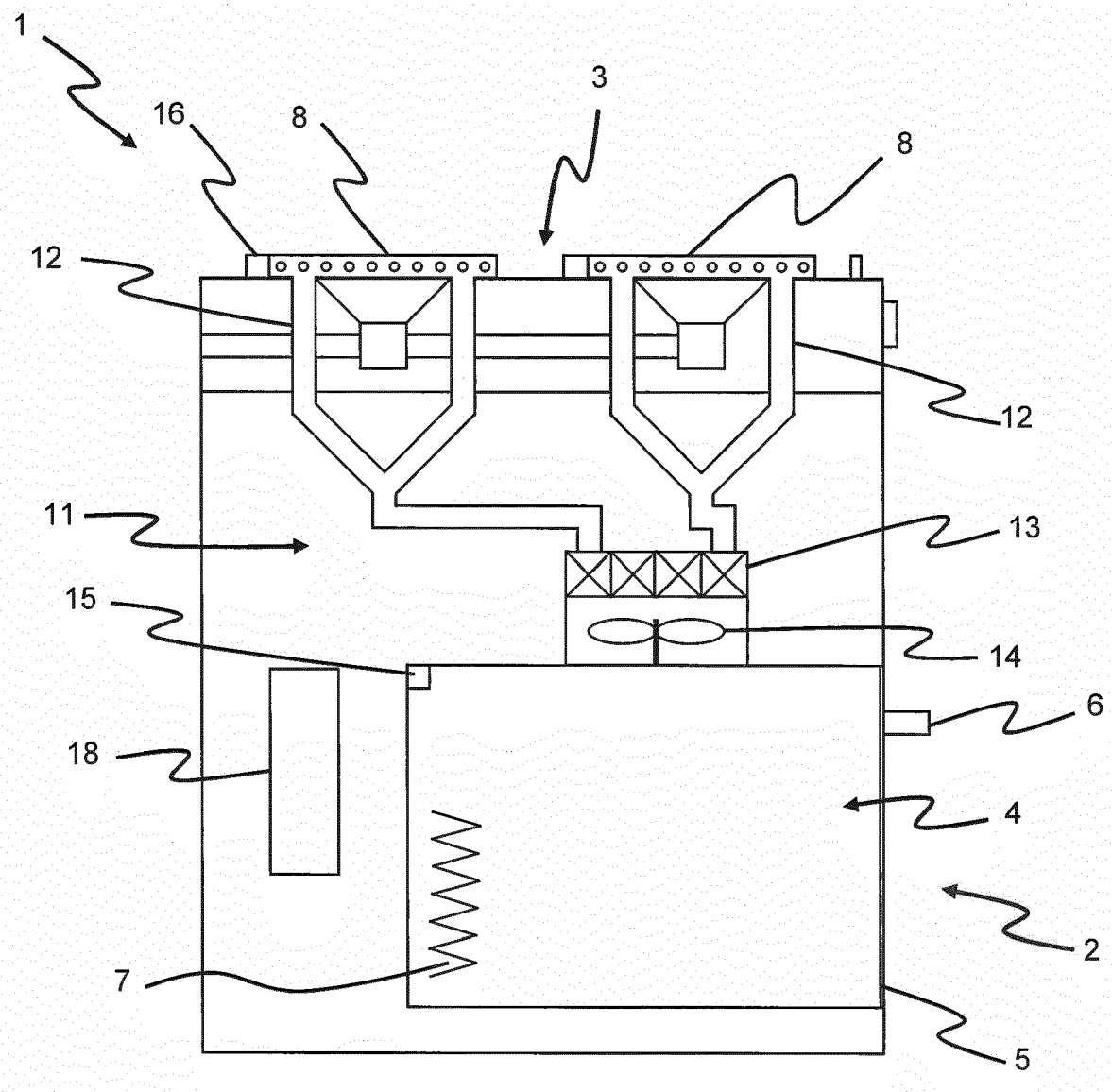

Figure 2

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EUROPEAN SEARCH REPORT

Application Number
EP 19 17 5896

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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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	7 November 2019	Verdoodt, Luk

CATEGORY OF CITED DOCUMENTS

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