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(54) OVEN AND OVEN TRAY FOR SMOKING OR AROMATIC VAPOUR TREATMENT APPLICATIONS

(57) The invention relates to an oven for preparing food (60), the oven comprising: an oven chamber for receiving food to be prepared; an oven heater element or steam generator permanently mounted in or at the oven for supplying heat to the interior of the chamber; a guiding arrangement provided within the oven chamber or arranged at a drawer of the oven and designed for receiving and guiding an oven pan or a tray (30); a coupling element arranged at a wall of the oven chamber and being designed for receiving a mating coupling element (34, 36), wherein the coupling element comprises at least one electrical contact adapted to provide electrical power to a heater element (46) to be connected via a mating coupling element (34, 36) to the coupling element when a tray (30) having the mating coupling element (34, 36) is received in the guiding arrangement; and a control unit configured to control the supply of electrical power to the coupling element.

According to another aspect of the invention, an oven tray (30) is provided, in particular an oven tray configured to be used in the above oven. The oven tray comprises: a heater element (46) mounted at the oven tray; and a mating coupling element (34, 36) arranged at an outer wall of the oven tray (30) and being designed for coupling to a coupling element provided in an oven, wherein the mating coupling element (34, 36) comprises at least one electrical contact (38) adapted to provide electrical power to the heater element (46) when the mating coupling element (34, 36) is electrically coupled to the oven coupling element.

When the tray is inserted in the oven chamber and electrical coupling is provided, the heater element can be heated and a smoking or aromatic vapour treatment agent positioned over the heater element can be heated for generating smoke to be supplied to the food (60) stored in a container (52).

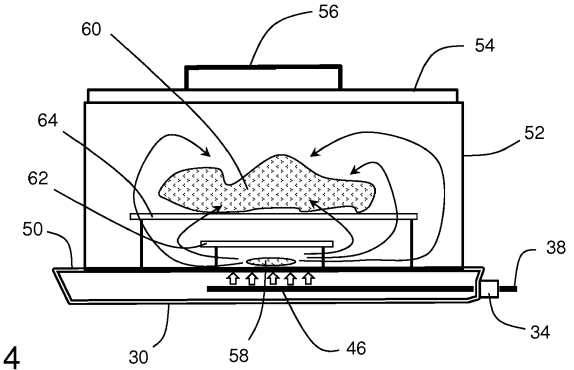

Fig. 4

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Description

[0001] The invention relates to an oven adapted for smoking or aromatic vapour treatment of food stored in the oven and a tray to be positioned in an oven chamber for smoking or aromatic vapour treatment of food.

[0002] Smoking or aromatic vapour treatment of of food is becoming more and more a trend not just with professional chefs, but also at home. Therefore, the customers usually go outside (balcony or garden), use either their BBQ grill or a smoker so as to keep the unwanted smoke, and smell out of their homes. For smoking or aromatic vapour treatment normally specific equipment or extended smoking/aromatization or preparation time is required. This is true also for the professional field of smoking or aromatic vapour treatment.

[0003] It is an object of the invention to provide an oven or a tray adapted for simplifying the smoking or aromatic vapour treatment of food preferably in the domestic field as well as in the professional field. The invention also provides arrangements using the oven and tray for facilitating the smoking or aromatic vapour treatment of food.

[0004] The invention is defined in claims 1, 7, 10 and 14. Particular embodiments are set out in the dependent claims.

[0005] In one aspect of the invention an oven for preparing food is provided. The oven comprises: an oven chamber for receiving food to be prepared; an oven heater element or steam generator permanently mounted in or at the oven for supplying heat to the interior of the cavity; a guiding arrangement provided within the oven chamber or arranged at a drawer of the oven and designed for receiving and guiding an oven tray; a coupling element arranged at a wall of the oven chamber and being designed for receiving a mating coupling element, wherein the coupling element comprises at least one electrical contact adapted to provide electrical power to a heater element to be connected via a mating coupling element to the coupling element when a tray having the mating coupling element is received in the guiding arrangement; and a control unit configured to control the supply of electrical power to the coupling element.

[0006] When a tray having the corresponding mating coupling element is placed in the oven at the guiding arrangement and when the tray is inserted such that the coupling element and mating coupling element are coupled to each other, electrical power can be supplied to a heater element of the tray and by the heater element of the tray a smoking agent or aromatic vapour treatment agent can be decomposed or gasified for generating smoke or aromatic vapours that is supplied to food stored in the oven chamber, preferably to food stored in a container placed on the tray.

[0007] The 'tray' may also be designated as pan or deep pan or the like. The heater element of the tray is no permanent part of the oven and is part of the tray that is removed out of the oven chamber when not in use.

[0008] The basis for the oven according to the invention is preferably a conventional oven having the modification as set out in claim 1. The oven may be for example a steamer oven, a combi-steamer oven, a baking oven, a convection oven, a grill (grilling oven), a multi-zones heating oven, an oven having a bottom heater and/or top heater and/or air heater and/or steam heater and/or radiation heater, or a microwave oven, or an oven having an arbitrary combination thereof. In an embodiment the oven may be a cook and chill device which is used for cooking the food at elevated temperatures and storing the food (before or after cooking) at lower temperatures, in particular at <= 7°C).. Herein, if the oven is a steamer having a steam unit or an oven having steam function, the steam supplied by the steam unit is considered to be the source for the heat, i.e. the steam generator is a heater element or one of the heater elements of the oven.

[0009] In one embodiment the oven may be a drawer-type oven, where a rack element is provided at the drawer for holding trays at predetermined positions. In this case the guiding arrangement is provided at the drawer. The tray is hooked or inserted in a predetermined position at the drawer rack element. The tray is guided into the chamber via the drawer and the coupling elements couple to each other.

[0010] Preferably the guiding arrangement is a tray shelf that is provided anyway as a standard configuration for an oven and/or the guiding arrangement is adapted to receive a tray, pan or grill of preferably standardized size. More preferably the guiding arrangement is a predetermined one or assigned one out of a plurality of guiding arrangements in the oven where each guiding arrangement is designed to receive a (standard sized) tray or pan or grill.

[0011] The present invention provides a solution that allows smoking or aromatic vapour treatment in the kitchen environment, using e.g. a household oven and neither contaminates the air inside the kitchen (and preferably in the oven chamber when using a container for receiving the food) nor harming the customer with gases from combustion.

[0012] In an embodiment the coupling element is or comprises a socket or a plug. Preferably the coupling element provided in the oven chamber is the socket due to safety considerations (e.g. hidden electrical contacts). Preferably a or the mating coupling element provided at the tray is a plug or socket, such that an electrical connection is provided by a socket/plug (preferred) or a plug/socket coupling.

[0013] Preferably the oven comprises a power supply switch or power supply circuit connected to the electrical power supply of the oven and to the at least one electrical contact of the coupling element. Thus when a tray having a heater element is positioned in the oven chamber and needs to be heated, the power supply switch (e.g. relay type) or power supply circuit (e.g. power controlled switching supply, pulse-width modulation power supply or zero-crossing switching supply) are switched on or activated.

[0014] Preferably the control unit is adapted to activate or deactivate the power supply switch to connect or disconnect

the heater element from power supply. By closing and opening the power supply switch, the time-averaged power supplied to the heater element can be controlled. Or the control unit is adapted to supply a heating power signal to the power supply circuit to supply the electrical power in dependency of the heating power signal.

[0015] In an embodiment the oven comprises a detector configured to detect connection of a mating coupling element of the tray to the coupling element of the oven and/or the oven comprises a detector to detect connection of the heater element and/or a temperature sensor to the coupling element. Thereby the security for the user is improved in that the power is supplied to the coupling element when actually a coupling to the heater element of the tray is provided or is reasonably provided. Alternatively or additionally insertion of the tray is detected via other or additional coupling detectors. For example a switch may be provided in or at the coupling element that is actuated when the mating coupling element is coupled to the coupling element. And/or a detector may sense whether the heater element and/or temperature sensor is connected via the coupling element, e.g. due to specific electrical properties of a connection/non-connection to the at least one electrical contact and/or temperature sensor. E.g. the resistance connected to one or to at least two of the electrical contacts can be monitored. In case of the heater element and/or temperature sensor being not connected, there is a high resistance and in case of the heater element being connected, there is a low resistance. Or a probe current and/or voltage can be applied to the electrical contact(s) of the coupling element and an induced current and/or voltage drop may be detected, when the heater element and/or temperature sensor is connected. Preferably the control unit executes a smoking or aromatic vapour treatment program and/or supplies power to the connector element only after detecting presence of the tray via the above detector(s).

[0016] Preferably the oven further comprises a second coupling element having at least one temperature sensor contact or the coupling element comprising at least one temperature sensor contact. The at least one temperature sensor contact is adapted to electrically connect a or the temperature sensor via the or a mating coupling element to the coupling element or the second coupling element. Preferably a temperature sensor is provided to sense the temperature at the heater element of the tray so that the temperature of the tray heater element can be controlled. The electrical contact to the temperature sensor arranged at the tray may be provided via an electrical coupling element that also couples to the heater element of the tray. Or a separate (second) coupling element may be provided so that the lines and contacts to and from the temperature sensor and the heater element are spatially separated.

[0017] In an embodiment the control unit is configured to execute a smoking or aromatic vapour treatment program for smoking or aromatic vapour treatment of food stored in the oven chamber and/or wherein the oven comprises an input panel for user input and wherein the input panel is adapted to receive a user selection for activating a smoking or aromatic vapour treatment program and/or wherein the input panel is adapted to receive parameter settings by the user for executing a smoking or aromatic vapour treatment program according to the input parameters. In the first case one or more predefined smoking or aromatic vapour treatment programs may be stored in a memory of the control unit and the user can select the smoking or aromatic vapour treatment program or one out of a plurality of smoking or aromatic vapour treatment programs which are differently adapted in dependency of one or more of the following program options: type of food, amount of food, type of smoking agent or aromatic vapour treatment agent, temperature for gasifying the smoking agent or aromatic vapour treatment agent, and duration for smoking or aromatic vapour treatment. Or one or more of these parameters are manually input by a user via an input panel of the oven so that the control unit controls execution of the manually configured smoking or aromatic vapour treatment program according to user settings.

[0018] According to another aspect of the invention, an oven tray is provided. Specifically the oven tray is configured to be used in an oven as described above or as described in the detailed embodiment. The oven tray comprises: a heater element mounted at the oven tray; and a mating coupling element arranged at an outer wall of the oven tray and being designed for coupling to a coupling element provided in an oven, wherein the mating coupling element comprises at least one electrical contact adapted to provide electrical power to the heater element when the mating coupling element is electrically coupled to the oven coupling element.

[0019] The 'mating' in the 'mating coupling element' is for differentiation between the 'coupling element' of the oven and the one of the tray. The 'mating' could be used instead of the coupling element of the tray for the coupling element of the oven as well. Preferably the tray has dimensions of a standard size for a tray or pan or grill to be inserted in a guiding arrangement of a (conventional) oven. The tray may be designed to be alternatively used in an oven having the guiding arrangement mounted at the lateral side wall of the oven chamber or at the inner side of a drawer in case of a drawer-type oven.

[0020] The mating (electrical) coupling element is designed to electrically and preferably mechanically couple to a or the counter-part coupling element arranged at the oven chamber. Preferably the outer dimension of the tray with the mating coupling element is such that the oven tray for smoking or aromatic vapour treatment appliances does not fit into the oven chamber when inserted at a position (level) of the guiding arrangement which is not dedicated or determined for the smoking or aromatic vapour treatment tray. Thereby the user notices when having selected a guiding arrangement (a tray or shelf holder) that is not dedicated for the smoking or aromatic vapour treatment tray in that she/he can not close the oven door or drawer.

[0021] In an embodiment the oven tray further comprises a temperature sensor mounted at the oven tray and designed

to detect the temperature at or of the heater element. Preferably the oven tray further comprises a second mating coupling element configured to be coupled with a second coupling element arranged at a wall of the oven. Thereby electrical connection to the heater supply (coupling arrangement) and the temperature signal line (second coupling arrangement) are spatially separated.

[0022] Preferably the oven tray further comprises an adapter element configured to be positioned at the top of the tray. Preferably the adapter element has a recess for exposing the heater element to the upper side. Alternatively or additionally the adapter element has a receptacle configured to receive and position a container over the heater element. In a modification the adapter element may be fixedly installed at the oven tray or may be removable from the oven tray (e.g. for cleaning purposes).

[0023] In an embodiment of the oven tray the heater element is mounted at the tray to be located in a cavity of the tray at a distance to the bottom wall of the tray and/or at a distance to the top level of the tray. Preferably a reflecting coating or a reflector element is provided on the surface of the bottom wall or between the heater element and the bottom wall. The reflector or reflecting surface reduces heating of the tray and reflects the heat towards the location where required, i.e. for gasifying the smoking agent or aromatic vapour treatment agent.

[0024] According to a further aspect of the invention a smoking or aromatic vapour treatment tray arrangement is provided for smoking or aromatic vapour treatment of food. The smoking or aromatic vapour treatment tray arrangement comprises: an oven tray as described above or below in connection with the detailed embodiment; and a container for storing food to be smoked or aromatized.

[0025] Preferably the container is a container having standard dimensions as for example defined in the Gastronomie Norm (see below). Preferably the tray has a or the adapter element for positioning the container thereon. Preferably the adapter element has a contoured receptacle where the contoured receptacle is designed to receive a standard container in a mating manner such that the container positioned on or at the receptacle is mechanically stably received. By such mating positioning of the container on the adapter element the tray with the container positioned thereon can be manipulated by the user during loading and unloading and during aligning and connecting the coupling elements in each other. Preferably the upper opening of the container is closed by a lid.

[0026] The smoking or aromatic vapour treatment tray arrangement may further comprise:

- A shielding element arranged within the container between a position at the container bottom where a smoking agent or aromatic vapour treatment agent is to be placed and a position in the container where food to be smoked is placed, wherein the shielding element is designed to shield the food against particles released from the smoking agent or aromatic vapour treatment agent at a direct path between smoking agent or aromatic vapour treatment agent and the food.
- Or a small tray positioned over the heater element and designed to receive a smoking agent or aromatic vapour treatment agent and preferably a shielding element arranged between the small tray and a position where the food to be smoked is received in the container. In the latter case, when providing a small tray positioned over the heater, the container has no bottom wall or has an opening in the bottom wall for allowing smoke generated in the small tray to enter into the container where the food is placed (preferably on a wire rack).

The shielding element prevents splashing of particles from the smoking agent or aromatic vapour treatment agent onto the food and/or minimizes smoke from arriving at the food in concentrated form. By the shielding element the homogeneity of smoking or aromatic vapour treatment of the food from all sides is improved.

[0027] In an embodiment of the smoking or aromatic vapour treatment tray arrangement the container has a closed bottom wall and the lower side of the bottom wall has a coating or a surface with a high absorption coefficient or which is black at least in a region of the container which is positioned over the heater element when the container is placed on the oven tray. This improves the absorption of heat at the container bottom and reduces the amount of heat required for producing the smoke from the smoking agent or aromatic vapour treatment agent. It also reduces the overall heat deposition and heat transfer to the food.

[0028] In another aspect of the invention a smoking or aromatic vapour treatment oven combination is provided which comprises: an oven having features as described above or below; and an oven tray having features as described above or below; or a smoking or aromatic vapour treatment tray arrangement having features as described above or below. Preferably the coupling element of the oven is electrically and preferably also mechanically connected to the mating coupling element of the tray. The mechanical connection provides preferably a positional alignment between tray and oven chamber and to a small extend a mechanical connection providing a mechanical resistance against (unintentional) decoupling (e.g. during the heating up of the heater element of the tray or a heater element of the oven).

[0029] Preferably the control unit of the oven is configured to one or more of the following: to detect the mating coupling element being coupled to the coupling element; to execute a smoking or aromatic vapour treatment program selected by a user; to control supply of power to the heater element; and to control the heater element to heat up to a predetermined temperature or predetermined temperature range.

[0030] The invention includes all combinations and sub-combinations of the features disclosed above and below in the detailed embodiment. Specifically the smoking or aromatic vapour treatment oven arrangement and the smoking or aromatic vapour treatment tray arrangement may be provided with any of the features disclosed above and/or below individually or in any sub-combination.

[0031] Reference is made in detail to preferred embodiments of the invention, examples of which are illustrated in the accompanying figures, which show:

Fig. 1 a lateral cross section through an oven with details of the arrangement of a smoker tray in the oven cavity,

Fig. 2 a front view of the oven of Fig. 1 with opened door and with the tray removed,

Fig. 3 a top view of the smoker tray with an adapter for placing a container,

Fig. 4 a cross-sectional side view of an arrangement with the smoker tray and a container positioned on the adapter, and

Fig. 5 a schematic block diagram of control elements of the oven for controlling the inter-cavity smoker arrangement.

[0032] The present invention relates to an oven having an oven-sided installation whereby the oven is designed for receiving a removable chamber-internal smoker arrangement (inter-cavity arrangement). When the smoker arrangement is positioned in the oven chamber a smoking or aromatic vapour treatment process for food can be performed by the oven. When the smoker arrangement is removed from the oven chamber, food can be prepared as in the conventional oven having no adaptations for smoking or aromatic vapour treatment processes. Limited electrical and structural adaptations are required for redesigning a conventional oven to be adapted for smoking or aromatic vapour treatment processes using the smoker arrangement. The basis for the modification is a conventional oven which may be for example a steamer oven, a combi-steamer oven, a baking oven, a convection oven, a grill (grilling oven), a multi-zones oven, an oven having a bottom heater and/or top heater and/or air heater and/or steam heater and/or radiation heater, or a microwave oven, or an oven having an arbitrary combination thereof. In an embodiment the oven may be a cook and chill device which is used for cooking the food at elevated temperatures and storing the food (before or after cooking) at lower temperatures, in particular at <= 7°C)..

[0033] By the above and below described arrangement and method a smoking or aromatic vapour treatment solution is applicable to household ovens. However the invention is not restricted to household oven, but is fully applicable to professional ovens. In a professional oven more than one of the oven levels may be provided with sockets 22 and/or 24 as described below for receiving a tray 30 with the smoking or aromatic vapour treatment arrangement.

[0034] The oven may be a front-loading type where the user places the containers or grills for receiving food directly within the cavity or may be a drawer-type oven where the user positions trays or grills on a rack-installation provided at the door forming the front panel of the drawer. In the front-loading type oven the door may be a pivotable door with hinges at the upper end or lower end or side edge of the door or the door may be a parallel-swing door.

[0035] In the following detailed embodiment the basic oven that is modified according to one example of the invention is a convection oven 2 having an air heater, a top heater and a bottom heater 14 (only one thereof shown in Fig. 1). As the representative basic oven is modified at the oven chamber 4 only in minor aspects that do not or do not essentially affect the function of the basic oven, it is understood that the invention is applicable to any type of oven, in particular the ovens listed above.

[0036] Fig. 1 shows a schematic representation of a lateral cross section through the oven 2 with details of the arrangement of a smoker tray 30 in the oven chamber 4. When a door 8 of the oven 2 is closed, the oven chamber 4 and door enclose an oven cavity 6. The oven has a bottom heater 14, a top heater (not shown) and an air heater (not shown). The air heater may be an electrical or resistor heater and/or may be arranged at a circulation fan 16 that together with the air heater is arranged behind a fan cover 17.

[0037] At the oven's front side an operation panel 12 is provided having user input buttons and/or knobs and/or a display for displaying e.g. operation state(s) of the oven (see schematic indication in Fig. 2). A handle 10 is provided for opening the door 8 which in this example is a swing-down door where the hinges are provided at the lower end of the door.

[0038] Above the upper wall of the chamber 4 an air exchange / cooling air fan 18 is arranged. At each side wall of the chamber 4 a rack element 20 is provided which serves as shelf support. The rack elements 20 are removable from the cavity 6 for cleaning purposes, in normal oven use the rack elements 20 are mounted stationary and in particular at a predetermined position or height level at the chamber 4. Alternatively the rack elements 20 may be non-removable mountings in the chamber 4. In embodiments as mentioned above, the rack elements are preferably provided at the side walls of the front-loading type oven and may be fixedly and non-removably installed or stationary but removably installed. The non-removable rack elements may be formed by guiding rails or notches or recesses at the side wall, for

example may be monolithic part of the sidewall material. In embodiments of the drawer-type ovens the rack elements or rack element is arranged at the drawer where the grills or trays are hooked into support elements arranged at the rack element(s).

[0039] At predefined height levels the rack elements 20 have shelf supports 20a to 20d which extent in the direction from front side to rear side of the chamber 4 in a horizontal plane. Two of the opposite sided shelf supports 20a to 20d are designed to receive and hold a tray or grill. The tray may be a pan, a backing tray or similar to be received by the shelf supports. In the lowest level (first level or level a) a smoker pan 30 (herein also denoted smoker tray) is inserted.

[0040] Fig. 2 shows a front view of the oven 2 where the door 8 is opened so that the back wall of the chamber 4 is exposed. The smoker pan 30 is removed but the contour of the inserted pan 30 is indicated by the dashed line. In the shown example the lowest level is the dedicated level for receiving the smoker pan 30 for performing the smoking or aromatic vapour treatment process. In other embodiments another level provided by a shelf support may be the dedicated level. Preferably the smoker pan 30 is inserted in the lowest shelf support 20a where, when the pan 30 is inserted, the air circulation by the circulation fan 16 is minimally disturbed.

[0041] As depicted in Fig. 2, at the height level of the dedicated level or shelf support 20a, a sensor socket 22 and a heater socket 24 are provided. The sensor socket 22 is designed to connect to a sensor plug 34 (Fig. 3) via the electrical contacts 26 and the heater socket 24 is designed to connect to a heater plug 36 via the electrical contacts 26. In the shown embodiment the connection between socket 22/24 and plug 34/36 is a mechanical and electrical connection, in other embodiments the connection may be an electrical connection only (e.g. an electrical contact connection and/or an inductive connection). In the shown embodiment the electrical connection is provided by electrical conductive pins 38 provided at the plugs 34, 36 and electrical contacts (not shown) in the sockets 22, 24.

[0042] Fig. 3 shows a top view of the smoker tray 30. The tray preferably has a standard size or has a size within a standardized range of sizes such that the tray 30 can be received between the dedicated shelf supports 20a. The 'standard size' normally refers to the standard width which is normally applied in front-loading type ovens and drawer-type ovens. The depth of the smoker tray 30 may be larger than the standard depth to facilitate the plugs 34, 36 reaching and sufficiently contacting the sockets 22, 24 when the tray 30 is fully inserted. Alternatively or additionally (and as shown in Fig. 3) the plugs 34, 36 have a depth extension such that when the tray is inserted the socket/plug connection is provided such that the electrical contacts sufficiently contact each other. In a preferred embodiment the tray 30 has - except the sensor and/or heater plugs 34, 36 extending from the backside - the dimensions of a deep tray or baking tray.

[0043] Inside the smoker tray 30 a mounting base 40 is provided where a heater 46 and a temperature sensor 48 are mounted at one end for providing mechanical stability. In embodiments the heater 46 and sensor 48 may be mounted without the mounting base 40 using other or separate mounting means for mounting the sensor and heater to the tray. In the depicted embodiment the electrical contacts 38 of the sensor plug 34 are connected by a sensor wire 42 to the mounting base 40 and there to the sensor 48. The electrical contacts 38 of the heater plug 38 are connected via heater wires 44 to the mounting base and there to the ends of heater 46. The sensor 48 may be a resistance sensor like a PT1000 or PT2000 or may be a thermo-element. Preferably the heater 46 is a radiation heater having a resistance that is resulting in heating up and emitting heat radiation. A typical heating power per surface area may be at 1000 W / 100 cm^2. Preferably the heating power is less than the heating power of conventional radiation heaters used for the other heating elements of the oven.

[0044] Between the heater 46 and a metal sheet 32 forming the body of smoker tray 30 a thermal insulator 47 is arranged which thermally shields the tray from the heat radiated from the heater 46. The insulator 47 may be an insulator with poor thermal conduction and/or preferably is a radiation reflector for reflecting the heater radiation away from the tray.

[0045] Further an adapter element 50 is provided which is placed at the upper region of the tray 30 for supporting a container 52 (Fig. 4) spaced from but in proximity to the heater 46. The adapter element 50 is shown partial-transparent for illustrative purposes and has a recess 51 or cutout that exposes the bottom of the container 52 to the heater 46 so that the heat radiation can directly impinge onto the container bottom. As shown and preferably the adapter 50 closes the upper side of the tray 50 which is not covered by the container 52. Preferably the shape of the recess 51 is such that it matches to a bottom profile of the container such that the container is reproducibly and stably positioned over the heater. In embodiments the adapter is mounted fixed to the tray 50 but preferably the adapter is removable from the tray 50 and preferably can be exchanged by other adapters that have a recess 51 that is designed to match with a container of another dimension and preferably has a recess mating to containers of another standard dimension.

[0046] Fig. 4 shows a cross-sectional side view of an arrangement with the smoker tray 30 and a container 52 positioned on the adapter element 50. The container 52 has closed side and bottom walls and the top opening is covered by a removable lid 54 having a handle 56. Preferably the container 52 is a standardized container, for example a container according to the GN standard (Gastronomie Norm, e.g. DIN EN 631), more specifically a container of GN 2/3 size. In the preferred embodiment the container 52 has a closed bottom, however it can also have an at least partially open bottom wall. In this case the container is supported by the partial bottom or the lower section of the sidewall on the adapter 50 (which may be removable from the tray 30 or not). In this case and in modification of the below, the smoking or aromatic vapour treatment agent 58 is not positioned on the bottom of the container, but on a plate that is placed

above the heater 46 - e.g. is placed on a small smoker agent tray.

[0047] In the embodiment shown in Fig. 4 the smoking or aromatic vapour treatment agent 58 is placed on the bottom of the container 52. For avoiding concentrated smoke delivery or agent particles or sparks splashing to a piece of food 60 placed in the container 52, preferably a shield element 62 is positioned over the smoking or aromatic vapour treatment agent 58. The shield element 62 has a closed surface (e.g. by a metal sheet or a fine mesh) and open sides so that the generated smoke can dissipate through the sides of the shield into the container interior towards the food 60. The food 60 is preferably placed on a wire rack or roast 64 positioned over the smoking or aromatic vapour treatment agent and/or shield element 62 so that there is no physical contact to the (hot) container bottom and the agent or shield element, while the smoke can freely diffuse to nearly all surface of the food 60. The fine arrows in Fig. 4 indicate the smoke diffusion to the food and the broad arrows indicate the heat dissipation from the heater to the bottom of the container. In an embodiment the surface of the container bottom may be darkened and/or may have a high heat radiation absorption coefficient such that heat absorption by the container bottom is improved. In an embodiment the bottom side of the shield element 62 may have a reflective coating or surface for shielding the food also against radiation from the container bottom.

[0048] Any element or any combination or sub-combination of elements of the following elements may be designed such that heat transfer is concentrated to take place between the heater 46 and the smoking or aromatic vapour treatment agent 58 and/or for reducing heat transfer from the heater 46 to the food 60 (to be compatible with the concept of e.g. sous vide cooking where the food temperature is to be kept low): the geometry and area of the heater 46, the bottom wall of the container 52, the shield element 62, the surface of the tray 30, the container walls.

[0049] Fig. 5 shows a schematic block diagram of control elements of the oven 2 including a power and control section 80 for controlling the inter-cavity smoker arrangement, wherein only elements relevant for understanding of the invention are shown (e.g. the power and control section 80 may be further designed to control activation/deactivation and temperature of cooking zones of a cooker combined with the oven - this preferable modification is not further described here).

[0050] The oven 2 has the elements of the power and control section 80, the elements of the oven chamber 4 and the elements of the smoker tray 30 which is removable from the oven cavity 6. The oven programs and/or user settings are controlled by a control unit 82 which preferably includes processor logic, but may also be formed of analog electronics only. The control unit 82 is adapted to independently control (but preferably in a coordinated manner) the electrical power supplied to oven heater 88 (which may be or may comprise as one heater element the bottom heater 14) and to the tray heater 46.

[0051] For controlling the temperature and activation/deactivation of the tray heater 46 the control unit 82 controls supply of power to the heater 46 via a heater power electronics 86 which in a simple modification may be a power relay for switching electrical voltage to the heater 46 on or off, or may be an electronics that is outputting the power dependent on a set value provided by the control unit 82. For controlling the temperature and activation/deactivation of one or more of the oven heaters 88, 14 (as mentioned above, a plurality and preferably independently controllable oven heaters are provided) the control unit 82 controls supply of power to the oven heater(s) 88, 14 via a heater power electronics 88 which in a simple modification may be a power relay for switching electrical voltage to the heater(s) on or off, or may be an electronics that is outputting the power dependent on a set value provided by the control unit 82. The oven temperature is detected using an oven temperature sensor 90 which supplies the temperature signal to the control unit 82. In case that the oven is a steamer oven the control unit 82 is correspondingly adapted to control activation/deactivation and power supply to the steam generator (in an embodiment in addition to the other radiation heater(s) mentioned above).

[0052] The control unit 82 receives the temperature signal from temperature sensor 48 of the tray 30 so that the control unit 82 can control the temperature of the heater 46 to a predetermined temperature in a closed control loop. Control of the temperature to a predetermined value is preferred so that the temperature by the heater 46 can be set to a value that is optimized in dependency of the type of the smoking or aromatic vapour treatment agent 58 and/or the type of food 60 to be smoked.

[0053] Preferably the control unit 82 is configured to detect whether the tray 30 has been inserted in the oven chamber 4 before activating supply of power to the heater 46. Detection of the presence/absence of the tray may be provided by one or more of:

- a switch provided at the socket 22 and/or 24 that is actuated only when the plug 34 and/or 36 is correctly inserted in the socket 22 and/or 24,
- the connection of the heater 46 and/or sensor 48 via the socket 22 and/or 24 is detected, for example by detecting a change of a resistor or sense current between the states of the heater and/or sensor being connected or not,
- a plausibility check when operating the heater 46 by supplying power which should result in increase of temperature within a given time period.

[0054] Via the input panel 12 the user can input at least one smoking or aromatic vapour treatment program to activate supply of power to the heater 46 during the smoking or aromatic vapour treatment program. Preferably at least one smoking or aromatic vapour treatment program has standard settings for temperature of the heater and duration. Alter-

natively or additionally the user can input parameters for the smoking or aromatic vapour treatment process, which are one or more of: a) the type of smoking or aromatic vapour treatment agent, b) the type of food to be smoked, c) the duration of smoking or aromatic vapour treatment, and d) the smoking or aromatic vapour treatment temperature (e.g. detected via sensor 48).

[0055] A typical smoking or aromatic vapour treatment process integrated in food preparation may for example be as follows. The food is pre-cooked, for example in the oven 2 which at that time does not have installed the tray 30 (and the smoking or aromatic vapour treatment arrangement). Pre-cooking may be performed by using steam (e.g. in case the oven 2 includes a steamer). After pre-cooking the tray 30 (with the adapter element 50) is inserted into the oven cavity 6 at the lowest level 20a (or the level where the sockets 22, 24 are provided for contacting), the food container 52 is positioned on the tray 30. Preferably the food container 52 the smoking or aromatic vapour treatment agent 58, the shield 62, the wire rack 64 and the food 60 are already positioned on the tray and the container 52 is closed by lid 54. The oven door 8 is closed and the smoking or aromatic vapour treatment process is started. Typically the smoking or aromatic vapour treatment process has a duration of 5 to 10 min. After smoking or aromatic vapour treatment the lid may be removed while the tray 30 keeps mounted in the oven cavity 6 and a final cooking is executed, e.g. at higher temperature for a short time. Alternatively the final cooking or the pre-cooking may be replaced or added by a short grilling of the food.

[0056] By using the arrangement of the invention the smoke and odors are kept inside the container. The temperature control allows specific temperature profiles for different woods, herbs, incents and spices, etc.. Due to the small size of the surface heated by the heater 46, the container 52 keeps cool to the touch. The surrounding temperatures inside the oven cavity 6 can be controlled independently from the smoking or aromatic vapour treatment container temperature (the temperature of the heater 46) using the oven heaters and sensors.

[0057] The smoking or aromatic vapour treatment process as such allows fast heat-up and fast cool-down. Therefore the smoking or aromatic vapour treatment needs less preparation and a short time. The temperature at the food or the heat transferred to the food is lower as compared to other processes. Avoidance of high temperatures allows producing of sour smoke aromas that would give negative taste results at higher temperature. According to heater temperature selection, the above solution gives the possibility to do both, hot and cold smoking or aromatic vapour treatment.

[0058] Due to the fast cool-down the smoke condensates at the surfaces so that less smoke escapes when the container is opened after a smoking or aromatic vapour treatment process. That results in low smell impact. Smoke has to stay inside the container in cavity to reduce smell in oven and to maximize flavor transfer to food in the container. After food smoking or aromatic vapour treatment a low amount of smoke or aromatic vapour should be escaping container when it is opened to avoid smell in kitchen and false alarms of smoke detectors. The smoke is condensed in the container (low temperatures after smoke development finishes).

[0059] The temperature range that can be set via the input panel 12 and the control unit 82 is for example in the range of 120°C to 400°C, which is convenient for most smoking or aromatic vapour treatment agents and processes.

[0060] The container 52 or a small tray arranged within the container or on a support over the heater 46 (when the container is without bottom wall as mentioned above) can receive for example an amount of wood dust as smoking or aromatic vapour treatment agent in the volume or liter range of 20 to 40 ml. The smoking or aromatic vapour treatment agent surface heated by the heater is for example about 200 cm^2 to 400 cm^2 - e.g. if wood dust is distributed 1 mm thin.

Reference Numeral List

2	oven	46	heater
4	oven chamber	47	reflector element
6	oven cavity	48	temperature sensor
8	door	50	adapter element
10	handle	51	recess
12	input panel	52	standardized food container / GN 2/3
14	bottom heater		
16	circulation fan	54	lid
17	fan cover	56	handle
18	exchange/cooling fan	58	smoking or aromatic vapour treatment agent
20	rack element / shelf support		
20a-d	shelf (grid) support	60	food
22	sensor socket	62	shield
24	heater socket	64	wire rack / roast
26	electrical contacts	80	power and control section
30	pan / (deep) tray	82	control unit

(continued)

32	tray sheet	84	heater power electronics (tray heater)
34	sensor plug		
36	heater plug	86	heater power electronics (oven heater)
38	electrical contact / pin		
40	mounting base	88	oven heater
42	sensor wire	90	oven temperature sensor
44	heater wire		

Claims

1. Oven (2) for preparing food (60), the oven comprising:

an oven chamber (4) for receiving food to be prepared,
an oven heater element (14, 88) or steam generator permanently mounted in or at the oven (2) for supplying heat to the interior of the chamber,
a guiding arrangement (20) provided within the oven chamber (4) or arranged at a drawer of the oven and designed for receiving and guiding an oven tray (30),
a coupling element (22, 24) arranged at a wall of the oven chamber (4) and being designed for receiving a mating coupling element (34, 36), wherein the coupling element (22, 24) comprises at least one electrical contact (26) adapted to provide electrical power to a heater element (46) to be connected via a mating coupling element (34, 36) to the coupling element (22, 24) when a tray (30) having the mating coupling element (34, 36) is received in the guiding arrangement (20), and
a control unit (82) configured to control the supply of electrical power to the coupling element (22, 24).

2. Oven according to claim 1, wherein the coupling element (22, 24) is or comprises a socket or a plug.

3. Oven according to claim 1 or 2, further comprising a power supply switch or power supply circuit (84) connected to the electrical power supply of the oven (2) and to the at least one electrical contact (26) of the coupling element (22, 24), wherein the control unit (82) is adapted to activate or deactivate the power supply switch to connect or disconnect the heater element from power supply, or wherein the control unit (82) is adapted to supply a heating power signal to the power supply circuit (84) to supply the electrical power in dependency of the heating power signal.

4. Oven according to claim 1, 2 or 3, further comprising a detector configured to detect connection of a mating coupling element (34, 36) to the coupling element (22, 24) and/or to detect connection of a or the heater element (46) of a tray (30) and/or a temperature sensor (48) of a tray (30) to the coupling element (22, 24).

5. Oven according to any of the previous claims, further comprising a second coupling element (22) having at least one temperature sensor contact (26) or the coupling element (24) comprising at least one temperature sensor contact, wherein the at least one temperature sensor contact (26) is adapted to electrically connect a or the temperature sensor (48) via the or a mating coupling element (34, 36) to the coupling element (22) or the second coupling element (24).

6. Oven according to any of the previous claims, wherein the control unit (82) is configured to execute a smoking or aromatic vapour treatment program for smoking or aromatic vapour treatment of food stored in the oven chamber (4) and/or wherein the oven comprises an input panel (12) for user input and wherein the input panel is adapted to receive a user selection for activating a smoking or armomatic vapour treatment program and/or wherein the input panel is adapted to receive parameter settings by the user for executing a smoking or aromatic vapour treatment program according to the input parameters.

7. Oven tray (30), in particular oven tray configured to be used in an oven (2) according to any of the previous claims, the oven tray comprising:

a heater element (46) mounted at the oven tray, and
a mating coupling element (34, 36) arranged at an outer wall of the oven tray (30) and being designed for

coupling to a coupling element (22, 24) provided in an oven (2), wherein the mating coupling element (34, 36) comprises at least one electrical contact (38) adapted to provide electrical power to the heater element (46) when the mating coupling element (34, 36) is electrically coupled to the oven coupling element (22, 24).

8. Oven tray according to claim 7, further comprising:

a temperature sensor (48) mounted at the oven tray and designed to detect the temperature at or of the heater element (46), and
a second mating coupling element (34) configured to be coupled with a second coupling element (22) arranged at a wall of the oven chamber (4).

9. Oven tray according to claim 7 or 8, further comprising an adapter element (50) configured to be positioned at the top of the tray (30), the adapter element having a recess (51) for exposing the heater element (46) to the upper side and/or the adapter element having a receptacle configured to receive and position a container (52) over the heater element (46).

10. Oven tray according to claim 7, 8 or 9, wherein the heater element (46) is mounted at the tray located in a cavity of the tray at a distance to the bottom wall (32) of the tray and/or at a distance to the top level of the tray, wherein preferably a reflecting coating or a reflector element (47) is provided on the surface of the bottom wall (32) or between the heater element (46) and the bottom wall (32).

11. Smoking or aromatic vapour treatment tray arrangement (30, 52) for smoking or aromatic vapour treatment of food, comprising:

an oven tray (30) according to any of claims 7 to 10, and
a container (52) for storing food (60) to be smoked or treated with aromatic vapours.

12. Smoking or aromatic vapour treatment tray arrangement according to claim 11, further comprising
a shielding element (62) arranged within the container (52) between a position at the container bottom where a smoking or aromatic vapour treatment agent (58) is to be placed and a position in the container where food (60) to be smoked or treated with aromatic vapours is placed, wherein the shielding element is designed to shield the food against particles released from the smoking or aromatic vapour treatment agent at a direct path between smoking or aromatic vapour treatment agent and the food, or
a small tray positioned over the heater element (46) and designed to receive a smoking or aromatic vapour treatment agent or an agent liberating aromatic vapours and preferably a shielding element arranged between the small tray and a position where the food to be smoked or to be treated with aromatic vapours is received in the container (52).

13. Smoking or aromatic vapour treatment tray arrangement according to claim 11 or 12, wherein the container (52) has a closed bottom wall and the lower side of the bottom wall has a coating or a surface with a high absorption coefficient or which is black at least in a region of the container which is positioned over the heater element (46) when the container is placed on the oven tray (30).

14. Smoking or aromatic vapour treatment oven combination (2, 30, 52) comprising:

an oven (2) according to any of the claims 1 to 6, and
an oven tray (30) according to any of the claims 7 to 10, or

a smoking or aromatic vapour treatment tray arrangement (30, 52) according to any of the claims 11 to 13.

15. Smoking or aromatic vapour treatment oven combination according to claim 14, wherein the coupling element (22, 24) of the oven (2) is electrically connected to the mating coupling element (34, 36) of the tray (30) and wherein the control unit (82) is configured to one or more of the following:

to detect the mating coupling element (34, 36) being coupled to the coupling element (22, 24),
to execute a smoking or aromatic vapour treatment program selected by a user, to control supply of power to the heater element (46), and
to control the heater element (46) to heat up to a predetermined temperature or predetermined temperature range.

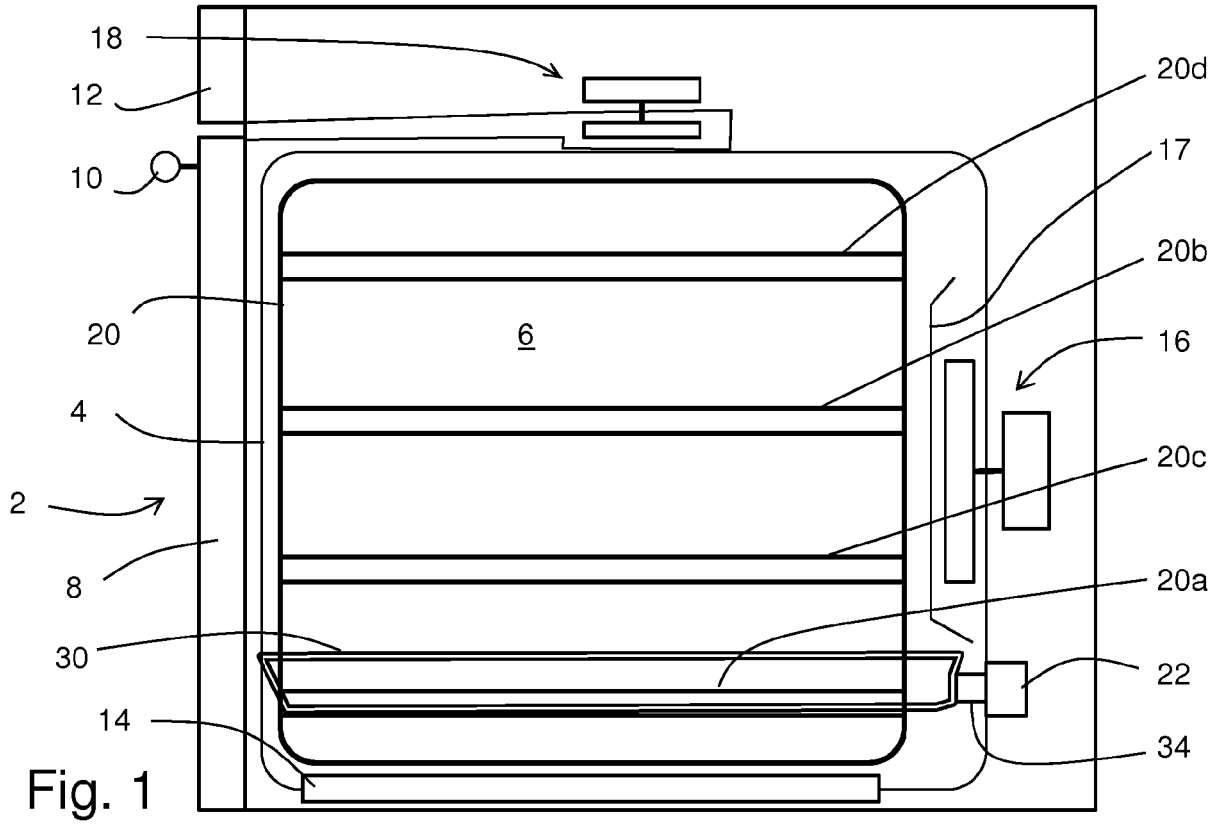
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Fig. 1

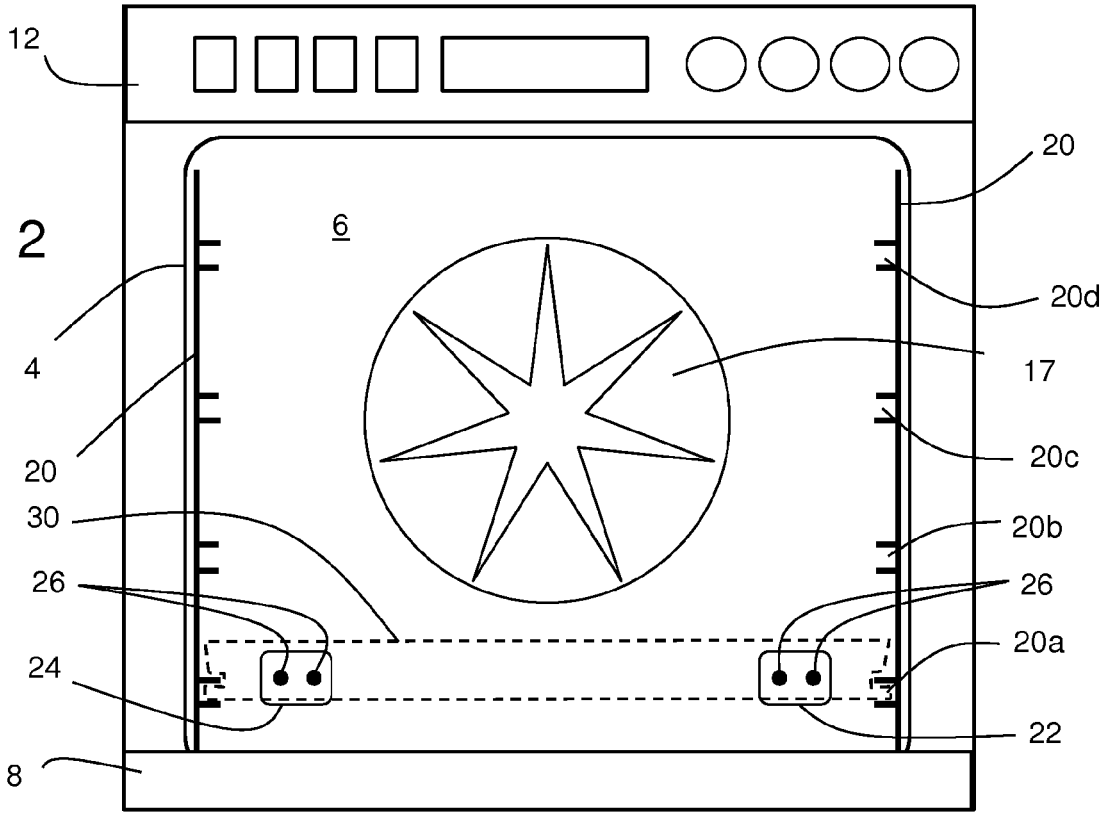
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Fig. 2

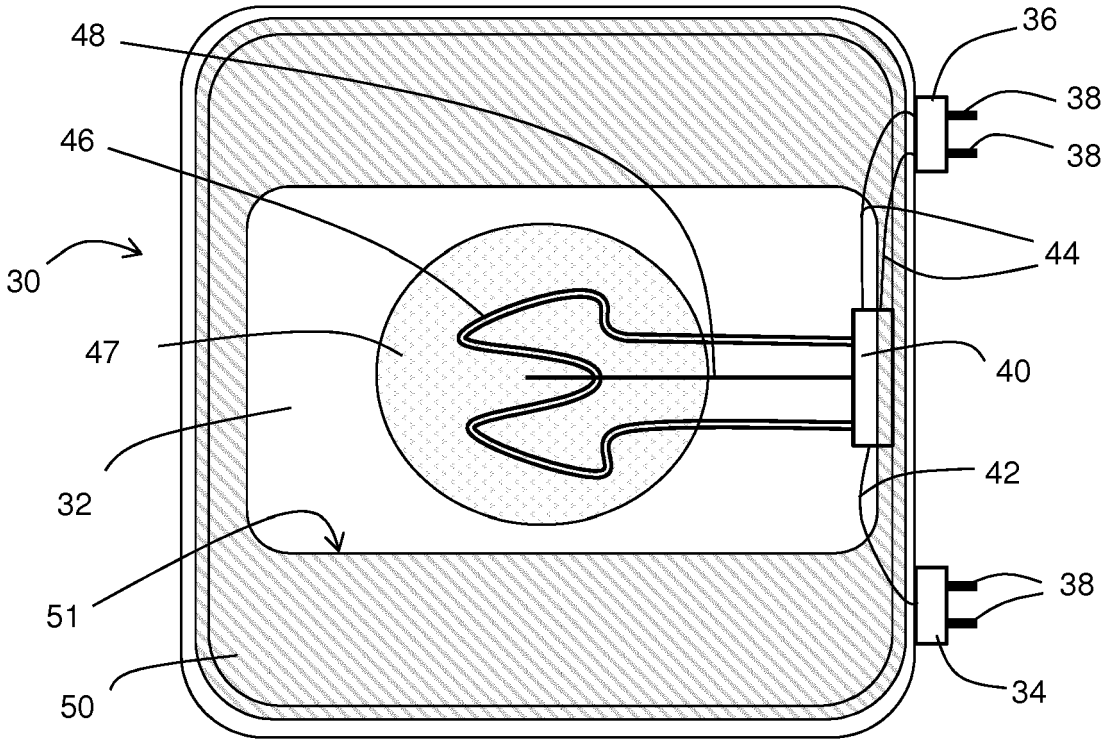
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Fig. 3

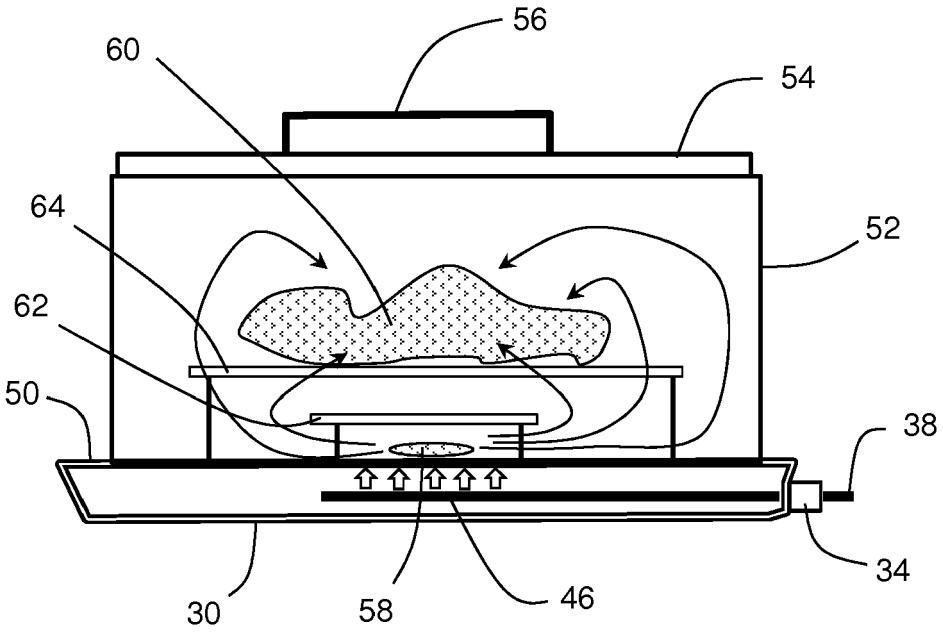
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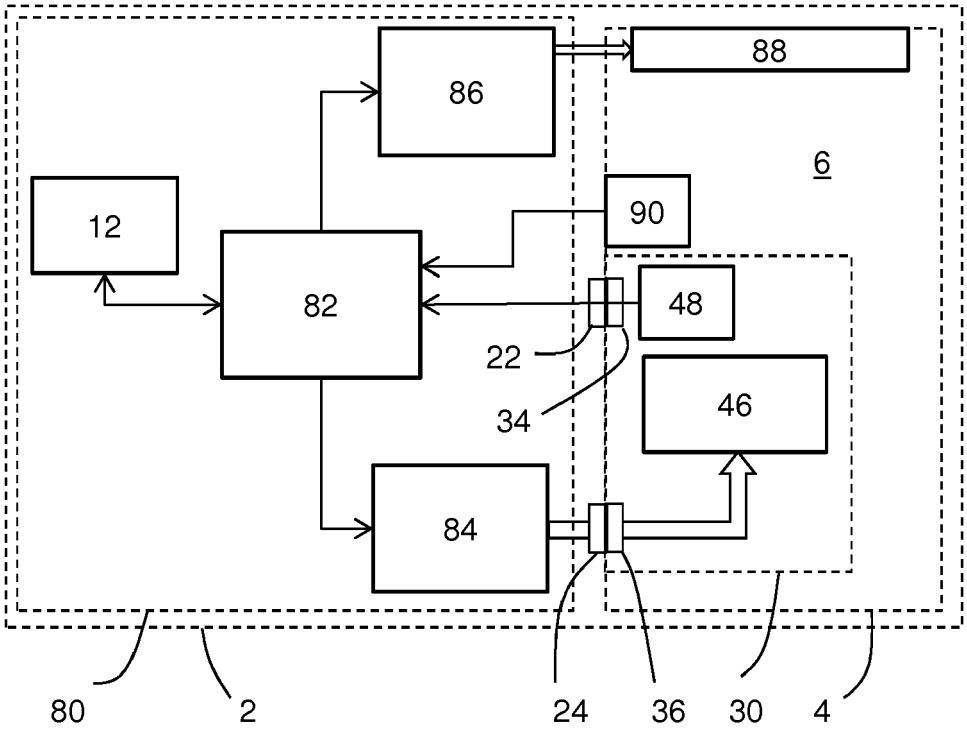
Fig. 4

Fig. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 16 18 5312

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 10 2010 062511 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 14 June 2012 (2012-06-14) * paragraphs [0011], [0012], [0026] - [0028], [0037]; figure 1 *	1-3,5,7, 8,10	INV. F24C15/16
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~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
The Hague	31 May 2017	Fest, Gilles

CATEGORY OF CITED DOCUMENTS

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& : member of the same patent family, corresponding document

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EUROPEAN SEARCH REPORT

Application Number
EP 16 18 5312

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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~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
The Hague	31 May 2017	Fest, Gilles

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Application Number
EP 16 18 5312

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☒ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

6, 11-15

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 16 18 5312

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-5, 7, 8, 10

a detector configured to detect connection of a mating coupling element (34, 36) to the coupling element (22, 24) and/or to detect connection of a or the heater element (46) of a tray (30) and/or a temperature sensor (48) of a tray (30) to the coupling element (22, 24)

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2. claims: 6, 11-15

the control unit (82) is configured to execute a smoking or aromatic vapour treatment program for smoking or aromatic vapour treatment of food stored in the oven chamber (4) and/or wherein the oven comprises an input panel (12) for user input and wherein the input panel is adapted to receive a user selection for activating a smoking or armomatic vapour treatment program and/or wherein the input panel is adapted to receive parameter settings by the user for executing a smoking or aromatic vapour treatment program according to the input parameters (to be taken from claim 6).
Smoking or aromatic vapour treatment tray arrangement (30, 52) for smoking or aromatic vapour treatment of food, comprising:an oven tray (30) according to any of claims 7 to 10, anda container (52) for storing food (60) to be smoked or treated with aromatic vapours (to be taken from claim 11).

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3. claim: 9

an adapter element (50) configured to be positioned at the top of the tray (30), the adapter element having a recess (51) for exposing the heater element (46) to the upper side and/or the adapter element having a receptacle configured to receive and position a container (52) over the heater element (46).

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