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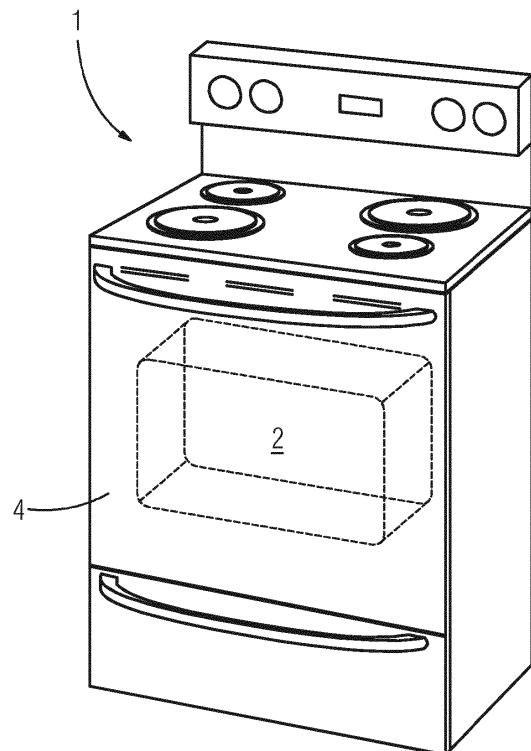
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(54) **Kitchen appliance with a heatable volume with an improved energy efficiency**

(57) Kitchen appliance 1, comprising
a heatable volume with an improved energy efficiency 2,
at least one heating device 3 that is arranged for heating
the heatable volume 2,
a door 4 arranged for opening and closing the heatable
volume 2 and
a compensation volume element 5 connected in fluidic
communication to the heatable volume 2,
wherein, in a state where the heatable volume 2 is closed
by the door 4, the heatable volume 2 and the compen-
sation volume element 5 are formed to be an essentially
fluid-tight, preferably essentially airtight, system, and
wherein the compensation volume element 5 is adapted
to essentially compensate a difference between a fluidic
pressure in the heatable volume 2 and a barometric pres-
sure of the atmosphere 6, wherein said difference results
from a temperature difference between the heatable vol-
ume 2 and the atmosphere 6.

FIG 1



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Description

[0001] The present invention relates to a kitchen appliance comprising a heatable volume with an improved energy efficiency.

[0002] In kitchen appliances of former, primary generations, and particularly baking and frying ovens, the heatable volume, for example the oven cavity did basically not form an isolated system, and particularly no essentially fluid-tight, preferably essentially airtight, system, with respect to the outside atmosphere in a kitchen.

[0003] The document US 2,339,398, for example, discloses such primary generation kitchen stove having a door construction that closes the front opening of the oven cavity during operation of the oven, and wherein a sealing is provided in between door and cavity. However, pressure differences that inevitably result from the heating of the oven cavity are compensated in that air or steam and, for example, unwanted humidity that liberates from water-rich foodstuff during the cooking or baking thereof, inside the cavity escapes to the surrounding atmosphere in the kitchen. Therefore, with regard to such primary generation kitchen stove air tightness of the cavity towards the atmosphere is neither achieved nor intended by such a seal. Moreover, the cavity as such was not constructed to be airtight in order to allow a compensation of over-pressure. In fact, some direct air exchange between the cavity and the atmosphere during the operation of the oven was allowed intentionally, in particular to balance the pressure differences that inevitably result from the heating of the oven cavity. Particularly, a closing pressure of the cavity door and the door sealing was basically insufficient to resist against air exchange between the cavity and the atmosphere. Consequently, a direct air leakage from the cavity to the atmosphere and a balance of pressure and the humidity between the cavity and atmosphere was allowed to some degree in an essentially uncontrolled way.

[0004] In that heated air or steam results from an energy input, particularly a heating energy input, and escapes essentially without being further usable, such stoves or ovens of primary generations, thus, however, exhibit very poor energy efficiency. In some cases such stoves or ovens of primary generations have an energy consumption of about 1000Wh. Moreover, such former stoves or ovens of primary generations did not comprise any optimization of the airflow through the oven or outlet control systems for vapors. However, in order to improve energy efficiency such measures were later implemented, also to improve user comfort. More recent and more advanced kitchen appliances with a heated volume, for example as disclosed in document DE 19738601 C1 comprise airflow systems with an active ventilation. Usually, such active ventilation is mediated by a motor driven fan wheel and a regulated vapor suction. Thereby, heated and polluted air from the cavity is sucked into an air duct and pushed towards the outside of the appliance. Thereby a special geometry facilitates the so called ven-

turi principle, i.e. cold air from the outside of the appliance is sucked into the door structure for cooling purpose. This airflow in the door is guided to the top of the door and lead to the outside as well. The vapor volume accordingly is adjustable directly by regulated openings or defined discharge openings. The venturi principle utilizes a direct exhaustion of cold air out of the device and a more passive suction of heated and polluted air into the air duct is realized as well as an active and direct suction using radial- or axial air systems.

[0005] Improved insulation, sealing, control and regulation, as well as improved door concepts allowed to achieve significantly improved energy consumption data, compared to appliances without ventilation and/or specific regulation. For example, such more recent and more advanced kitchen appliances with a heated volume exhibit an energy efficiency of about 700Wh at a cavity of more than 65 liter. Those more recent and more advanced ovens and stoves that are available today have an open cooling system that guides the air through door and/or inlet, passes the cooling channel and is blown out in particular areas. This airflow cools door and electronics and deals with the cavity's overpressure.

[0006] However, said oven cooling systems of more recent and more advanced ovens and stoves according to the prior art require lot of material. Such additional material in addition increases the energy consumption of a stove or oven by itself as it constitutes thermal mass that needs to be heated up and space inside a stove or oven, in particular considerably limiting the design freedom due to the necessary inlet and outlet openings for said forced airflow. Moreover, it has to be expected that government regulations with regard to the allowed limits of energy efficiency will become substantially stricter in the near future. Thus, the oven cooling systems known in the art will reach their limits. Presently, according to EU Directive 2010/30/EU the energy consumption labeling of class "A" allows, for example, for an oven or stove having a cavity volume of between 0 and 35 liters an energy consumption of less than 600Wh; for an oven or stove with a cavity volume of between 35 and 65 liters an energy consumption of less than 800Wh; and for an oven or stove with a cavity volume of more than 65 liters an energy consumption of less than 1000Wh. Moreover, at present it is being discussed to prohibit ovens or stoves having an energy consumption labeling of less than "A" according to EU Directive 2010/30/EU. This means that in order to be labeled with an energy consumption labeling of "A+" and thus being allowable in future, for example, ovens or stoves having a cavity volume of 35 liters have to have an energy consumption of less than 572Wh; ovens or stoves having a cavity volume of 65 liters have to have an energy consumption of less than 675Wh; and ovens or stoves having a cavity volume of 70 liters have to have an energy consumption of less than 692Wh. Particularly, ovens or stoves having an energy consumption labelling of "A+++" according to Directive 2010/30/EU have to have an energy consumption of about 380Wh at

a cavity volume of 70 liter.

[0007] It is thus an object of the present invention to provide an innovative concept for an air and pressure management system for a kitchen oven or a kitchen stove, having an improved energy efficiency. It is a further object of the present invention to provide an oven or stove having an improved energy efficiency, wherein the thermal mass of such stove or oven is reduced or at least not further increased compared to ovens or stoves of the prior art. Thereby, preferably such oven or stove comprises an energy consumption being capable of being labeled with an energy consumption labeling of "A+++", more preferably, better. It is a still further object of the present invention according to such innovative air and pressure management system and/or oven or stove to reduce the complexity of the oven and stove design. The above objects of the invention are achieved by a kitchen appliance according to claim 1. A kitchen appliance according to claim 1 comprises a heatable volume with an improved energy efficiency, at least one heating device that is arranged for heating the heatable volume, a door arranged for opening and closing the heatable volume and a compensation volume element connected in fluidic communication to the heatable volume, wherein, in a state where the heatable volume is closed by the door, the heatable volume and the compensation volume element are formed to be an essentially fluid-tight, preferably essentially airtight, system, and wherein the compensation volume element is adapted to essentially compensate a difference between a fluidic pressure in the heatable volume and a barometric pressure of the atmosphere, wherein said difference results from a temperature difference between the heatable volume and the atmosphere.

[0008] It is the merit of the present inventors having found that with the present inventive kitchen appliance the major constraint of the appliances of the prior art are overcome. Particularly, the present inventors realized that a majority of introduced energy, e.g. about 500Wh, corresponding to about 1800kJ, is lost in the appliances of the prior art in the form of heated air that leaves the kitchen oven or stove and is, particularly not used for the actual operation of the appliance, i.e. a cooking or baking process. By contrast, said energy used for heating is directly or indirectly blown out of the appliance in accordance with and by the cooling system of the device and/or its components. Thus, said energy is inefficiently wasted. In particular, the present invention provides an inventive concept for an air and pressure management system for a kitchen appliance, e.g. a kitchen oven or a kitchen stove, with an improved energy efficiency. Thereby, the thermal mass of a kitchen appliance according to the present invention, e.g. a stove or an oven, is reduced or at least not further increased compared to ovens or stoves of the prior art. This is basically achieved by a reduction of the complexity of the oven and stove design according to the present invention compared with solutions known in the prior art, which advantageously allows

savings in material, energy consumption and assembly costs and giving a wider freedom in the design of new ovens and stoves.

[0009] The present inventors have surprisingly found that heated fluid, and more particularly air or steam, within a heatable volume of a kitchen appliance, e.g. an oven cavity, which results from an energy input, particularly a heating energy input, not necessarily has to escape essentially without being further usable for a cooking process to the kitchen atmosphere. By contrast, the present inventors provide an innovative energy concept for an air and pressure management system for a kitchen appliance in that heated air or steam and, thus already invested energy is kept within an essentially fluid-tight, preferably essentially airtight system and, primarily not allowed to escape to the atmosphere outside of the kitchen appliance, e.g. the atmosphere of the kitchen. Thus, the invested energy resulting from the energy input, particularly heating energy input, is kept and not lost and wasted.

[0010] The present inventors realized that said potential energy may be saved and used in a purposeful manner in order to achieve a device exhibiting an improved energy efficiency. This, particularly is achieved by a kitchen appliance according to the present invention in that the heatable volume and the compensation volume element form an essentially fluid-tight, more particularly airtight system, wherein the compensation volume element is adapted to essentially compensate a difference between a fluidic pressure in the heatable volume and a barometric pressure of the atmosphere.

[0011] A kitchen appliance as used herein, preferably refers to a kitchen appliance in which food or food stuff is to be heated, but is not limited thereto. A kitchen appliance according to the present invention, preferably is selected from the group comprising kitchen oven, kitchen stove, steam oven, microwave, sterilizer, for example dish sterilizer, and heated warming drawer.

[0012] A heatable volume as used herein, preferably refers to a volume within a kitchen appliance according to the present invention which is to be heated. More preferably, such heatable volume of air or steam to be heated for a cooking or baking process, i.e. for heating food or food stuff. Accordingly, such heatable volume, most preferably refers to a volume, which is for being charged with food or food stuff to be heated. A heatable volume as used herein, preferably is selected from the group comprising muffle and cavity.

[0013] A heatable volume preferably is capable of being loaded with food or foodstuff. More preferably, said heatable volume comprises an opening through which food or foodstuff may be inserted into the heatable volume. Most preferably, a heatable volume is a closable heatable volume.

[0014] A kitchen appliance according to the present invention comprises a door arranged for opening and closing the heatable volume, preferably a closable heatable volume.

[0015] It will be immediately understood that such door in connection with the kitchen appliance according to the present invention is formed and/or configured such that it is suitable for closing an opening of the heatable volume and its configuration and/or form will thus, preferably depend on the kind of heatable volume. A door in connection with the kitchen appliance according to the present invention, preferably is selected from the group comprising door, flap or drawer, side swing door and butterfly door.

[0016] In connection with the kitchen appliance according to the present invention a heating device is arranged for heating the heatable volume, preferably is for heating a fluid to be inserted or present in the heatable volume, for example air which is contained in or to be inserted in and/or forms part of the heatable volume. It will be immediately understood that such heated fluid is heating the interior of the heatable volume, e.g. the heated air in an oven may be used to heat the oven cavity. According to the present invention and depending on the particularly chosen heating device, said heating device may be arranged and positioned in various ways within or attached to the kitchen appliance of the present invention. Such heating device may be positioned and arranged, for example, inside the heatable volume, e.g. a cavity, in a top area of said heatable volume, on a rear wall of said heatable volume, or in a bottom area of said heatable volume, and/or outside of said heatable volume, particularly in case of the kitchen appliance being a microwave. However, the heating device may also be positioned on at least one of the side walls of and within such heatable volume.

[0017] A heating device as used in connection with the kitchen appliance according to the present invention is preferably selected from the group comprising tubular heating element, comprising a top element and/or ring element and/or bottom element, thick film heater, halogen element, quartz grill, microwave, hot steam generating device. A heating device as used herein may employ various heating methods, for example, and not limited to gas, electric, steam, microwave, as well as combinations thereof, e.g. gas and electric, electric and steam or electric and microwave.

[0018] A heating device according to the kitchen appliance of the present invention is arranged for heating the heatable volume. It will be immediately understood that the arrangement of the heating device is thus possible in various ways and dependent on the selection of heating device type and/or fluid to be heated. Accordingly the arrangement of the heating device may comprise further elements such as pips, ducts, valves, nozzles or jets. For example, if the heating device is a steam generator and steam is used as a fluid to be inserted into the heatable volume, e.g. a cavity of a steam oven, for steam-cooking, the steam may be generated in a steam generator and may be introduced into the oven cavity via ducts and nozzles. If, for example, air is used as the fluid, wherein the kitchen appliance may be a kitchen stove, the air may be heated by tubular heating elements. It is

immediately clear to person skilled in the art, that the arrangement, and particularly the placement of the heating device is only limited by purpose-full considerations.

[0019] With a kitchen appliance according to the present invention an improved energy efficiency is realized. Thereby, preferably an energy consumption of the kitchen appliance according to the present invention is sufficient for an energy consumption labelling of "A+++" according to Directive 2010/30/EU. Preferably, the energy consumption of a kitchen appliance according to the present invention is of at least about 380Wh if referred to at a cavity volume of 70 liters.

[0020] An energy consumption as referred to herein, preferably is measured in a standard energy consumption test, more preferably according to EN50304 or EN60350.

[0021] It will be also understood by a person skilled in the art that when referring to energy consumption the unit "Wh" is preferably used. The unit "Wh" refers to a so called "Watt-hour" which as used herein, preferably corresponds to the energy input or output of a system, e.g. the kitchen appliance according to the present invention, having a power of 1W within 1 hour. Thereby, it is generally acknowledged that 1 Wh may be derived from the SI-unit Joule, in that 1 Wh corresponds to 3600 Ws (Watt seconds) corresponding to 3600 Joule corresponding to 3.6 Ki-lojoule, abbreviated as "kJ".

[0022] In connection with the kitchen appliance according to the present invention it is to be understood that a compensation volume element is arranged such that the compensation volume element is connected to the heatable volume. Such compensation volume element, preferably is a compensation compartment and/or a compensation volume and/or a membrane.

[0023] A compensation element as used herein, preferably refers to a volume capable of compensating a difference between a fluidic pressure in the heatable volume and a barometric pressure of the atmosphere in that such compensation element is connected in fluidic communication to the heatable volume and therefore allows a fluid to expand into or re-expand out of such compensation element from or into the heatable volume.

[0024] A connection of the compensation volume element to the heatable volume allows for fluidic communication between the heatable volume and the compensation volume element.

[0025] The term fluidic communication as used herein, preferably means that a fluid, preferably air or steam, may be exchanged and/or is allowed to flow, more preferably freely flow, from the compensation volume element to the heatable volume and vice versa.

[0026] A fluidic communication as used herein, preferably is essentially free of flow resistance.

[0027] A connection of or between a compensation volume element and a heatable volume, preferably is a direct connection to or via an opening and/or a duct or the like.

[0028] However, in each embodiment of the kitchen

appliance according to the present invention and in a state where the heatable volume is closed by the door, the heatable volume and the compensation volume element are formed to be an essentially fluid-tight, preferably essentially airtight, system.

[0029] It will be immediately understood that a temperature difference between the heatable volume and the atmospheres surrounding the essentially fluid-tight, preferably essentially airtight, system, preferably occurs during an operation of the kitchen, appliance, wherein said operation, more preferably comprises a heating and/or cooling step.

[0030] Closing the door and an accordingly impinged closing pressure, e.g. due to a hinge mechanism, preferably where a sealing element is present, leads to a closing of the heatable volume, and thus a closing of the then essentially fluid-tight, preferably essentially airtight, system.

[0031] Thereby, the fluidic communication of the outside of the appliance, e.g. an atmosphere having barometric pressure, and the interior of the heatable volume is prohibited. Thus, a difference in between a fluidic pressure in the heatable volume and a barometric pressure of the atmosphere which results from a temperature difference between the heatable volume and the atmosphere due to heating of the heatable volume, is not compensated in that fluid merely leaks out of the essentially fluid-tight, preferably essentially airtight, system formed by the heatable volume and the compensation volume element.

[0032] Preferably the closing pressure of a door, for example a closing pressure mediated by a hinge mechanism of a door, is adjusted to be higher than the pressure, particularly of a fluid, reached in the interior of the heatable volume and/or the compensation volume element and/or the essentially fluid-tight, preferably essentially airtight, system, respectively. The pressure reached in the interior of the heatable volume and/or the compensation volume element and/or the essentially fluid-tight, preferably essentially airtight, system, respectively, is preferably basically similar to the barometric pressure of the surrounding atmosphere.

[0033] In other words, it is preferred that an operation of the kitchen appliance which leads to a temperature difference between the heatable volume and the atmosphere surrounding the essentially fluid-tight, preferably essentially airtight, system, does preferably not lead to a significant overpressure in the heatable volume and the essentially fluid-tight, preferably essentially airtight, system, respectively.

[0034] It has to be understood that according to the inventive concept underlying the present invention, the fluid, particularly if said fluid is air, preferably is allowed to expand within the heatable volume and the essentially fluid-tight, preferably essentially airtight, system, respectively, in order to compensate temperature difference between the heatable volume and the atmosphere.

[0035] More particularly, in that the heatable volume

is connected to the compensation volume element in fluidic communication, the fluid is allowed to expand or de-expand into or out of the compensation volume element and a pressure difference between a fluidic pressure in the heatable volume and a barometric pressure of the atmosphere is thus compensated by the compensation volume element.

[0036] It has to be acknowledged that the present inventors thus turn away from the concepts known in the prior art and establish and develop an innovative energy concept allowing for energy saving, which may not be reached by appliances, and ovens or stoves in particular, according to the prior art, most probably even if the known concepts may be improved.

[0037] The essentially fluid-tight, preferably essentially airtight, system formed by the heatable volume and the compensation volume element, and thus the heatable volume itself is closed such, that no uncontrolled and/or unwanted fluidic communication and no exhaustion of fluid, respectively, is allowed, particularly not via openings or gaps, with the atmosphere outside of said essentially fluid-tight, preferably essentially airtight, system. The energy needed for the operation of the appliance, e.g. the heat for cooking or baking, is introduced into the essentially fluid-tight, preferably essentially airtight, system via at least one heating device. This leads to an increase in temperature in the essentially fluid-tight, preferably essentially airtight, system and thus to a temperature difference between the heatable volume and the atmosphere. Moreover, said increase in temperature leads to a volume expansion of the fluid contained in the essentially fluid-tight, preferably essentially airtight, system.

[0038] Due to the compensation volume element provided in the inventive kitchen appliance the formation of an overpressure is avoided in that the compensation volume element, and more particularly its volume and interior allows to compensate said volume expansion and increase in pressure compared to the atmosphere. The same applies vice versa if the fluid is cooled down and an under-pressure is avoided. In connection with the present invention the compensation volume element is for balancing and compensating the volume of the fluid contained in the essentially fluid-tight, preferably essentially airtight, system.

[0039] This means, preferably, that a pressure may not lead to fluid exhausting, or, at least not lead to fluid exhausting in an uncontrolled manner from the essentially fluid-tight, preferably essentially airtight, system. Such essentially fluid-tight, preferably essentially airtight, system is preferably isolated from the atmosphere. Said atmosphere preferably is the atmosphere at the outside of said essentially fluid-tight, preferably essentially airtight, system, more preferably outside of the kitchen appliance.

[0040] However, it will be immediately understood by a person skilled in the art that although a system is essentially fluid-tight, preferably essentially airtight, a balance of pressure within different compartments of said

system, e.g. within a compensation volume element and a heatable volume and/or a balance of pressure between an inside and an outside of said essentially fluid-tight, preferably essentially airtight, system is still possible. For example, a difference between a fluidic pressure in the heatable volume and a barometric pressure of the atmosphere is compensable by expansion of the fluid into or re-expansion out of the compensation volume element to a predetermined value of pressure difference. However, being an "essentially air-tight" or "essentially fluid-tight" system as used herein, preferably refers to an essentially fluidic isolated system, wherein fluidic communication of the essentially air-tight or essentially fluid-tight system, i.e. a fluid, and particularly air, within compensation volume element and heatable volume and the outside of said essentially air-tight or essentially fluid-tight system, e.g. the atmosphere, is not possible until to a predetermined cut-off value of a temperature difference and/or pressure difference, i.e. a predetermined over-and/or under-pressure, between the essentially fluid-tight, preferably essentially airtight, system and the outside, e.g. a barometric pressure of the atmosphere outside of said essentially fluid-tight, preferably essentially airtight, system, is reached. This is and will be immediately understood by a person skilled in the art, that reaching said cut-off value, e.g. a predetermined tolerable over-pressure, a balance between the essentially fluid-tight, preferably essentially airtight, system and the outside, needs still to be possible. The term "essentially air-tight" as used herein refers to the term "essentially fluid-tight", whereby the fluid is considered to be air. The term "essentially fluid-tight" as used herein, preferably refers to a state, wherein a heatable volume is closed by a door, and wherein fluid communication, particularly of energy-bearing fluid, e.g. heated air, between the "essentially fluid-tight, preferably essentially airtight system" and the outside of said system is not allowed, more preferably not allowed, wherein a value of a fluid parameter is less than a predetermined tolerable cut-off value of said fluid parameter, wherein the fluid parameter e.g. is a temperature and/or a pressure and/or a temperature and/or a pressure difference.

[0041] Preferably, a compensation volume element and a heatable volume are formed to be an essentially fluid-tight, preferably essentially airtight, system and, more preferably, said essentially fluid-tight, preferably essentially airtight, system does not comprise an opening or an open connection to the outside of said essentially fluid-tight, preferably essentially airtight, system, and particularly to the atmosphere. Preferably the essentially fluid-tight, preferably essentially airtight, system does not comprise an exhausting opening and/or an exhausting channel. However, it is to be understood that such essentially fluid-tight, preferably essentially airtight, system may comprise a valve, particularly a cut-off value, such as an overpressure valve, which allows exhaustion of fluid if a predetermined tolerable value of a fluid parameter is reached. Such valve, however, mainly serves se-

curity reasons, wherein the actual compensation of pressure arising in the heatable volume is primarily compensated by the compensation volume.

[0042] It will be understood that in embodiments where the compensation volume element is a membrane or where the compensation volume element is located in the interior of the heatable volume, the essentially fluid-tight, preferably essentially airtight, system is formed by the heatable volume itself.

[0043] By way of a non-limiting example, the kitchen appliance according to the present invention, e.g. an oven or stove, comprises a heatable volume, e.g. a cavity, for treating food or food stuff preferably via heating said food or food stuff. The heatable volume is a closable heatable volume, wherein a door is arranged for opening and closing the heatable volume by said door, and wherein in a state where the door is closed the heatable volume is separated from the atmosphere surrounding the kitchen appliance in an essentially fluid-tight, preferably airtight, manner. The heatable volume is connected to at least one compensation volume element, suitable to allow a fluidic communication, preferably essentially free of flow resistance, between the heatable volume and the compensation volume element.

[0044] The kitchen appliance according to the present invention comprises at least one compensation volume element, wherein said compensation volume element is configured such that it essentially allows a pressure compensation and/or pressure balance, preferably if the pressure of the fluid, e.g. the air, in the heatable volume is elevated or lowered compared to the barometric pressure of said atmosphere surrounding the kitchen appliance, particularly wherein said pressure difference results from a temperature difference between the heatable volume and said atmosphere due to and/or occurring during a heating or cooling process of the fluid, being preferably air, steam or a mixture thereof. Said pressure and/or temperature difference results primarily in the heatable volume during at least one step of heating or cooling. Preferably, the at least one compensation volume element is suitable to compensate a pressure difference between the heatable volume and the barometric pressure in said surrounding atmosphere during heating or cooling of the fluid within said heatable volume during at least one step of heating or cooling of an operation of said kitchen appliance. This advantageously allows for an essentially pressure-neutral treatment of the food or food stuff to be treated within the heatable volume.

[0045] Preferably, the at least one compensation volume element comprises a predetermined volume, wherein said predetermined volume more preferably, allows for compensating at least partially the compensation of a pressure difference, preferably during a heating or cooling step of the kitchen appliance.

[0046] In a further advantageous embodiment of the kitchen appliance according to the present invention said compensation volume element comprises a compensation tank.

[0047] In connection with the inventive appliance the compensation tank, preferably is connected, more preferably directly connected, to the heatable volume. Preferably, the compensation tank is arranged in fluidic communication with at least one opening in a wall of the heatable volume.

[0048] Preferably a compensation tank comprises a predetermined compensation volume, wherein said predetermined volume more preferably, allows for compensating at least partially the compensation of a pressure difference, preferably during a heating or cooling step of the kitchen appliance.

[0049] In a preferred embodiment the compensation volume element is connected to the heatable volume via at least one duct for allowing exchange of fluid heatable volume and compensation volume element, preferably via an inlet duct and/or an outlet duct. Preferably, an at least one duct comprises at least one first valve.

[0050] A valve as used herein, preferably a first valve and/or a second valve, is a controlled valve.

[0051] Preferably a valve as used herein is suitable for essentially sealing the surrounding barometric atmosphere against the heatable cavity in an essentially fluid-tight, preferably essentially airtight, manner and vice versa. More preferably, such valve is configured such that a pressure difference, e.g. an over-pressure and/or an under-pressure, between the essentially fluid-tight, preferably essentially airtight, system and the surrounding barometric atmosphere, is compensated in a predetermined quantity, wherein preferably such compensation essentially results in a reduced pressure difference, more preferably no pressure difference. It will be immediately understood that such pressure difference inevitably will occur due to the physical rules. However, it is immediately clear that the present invention is advantageously compensating such pressure difference.

[0052] Additionally and/or alternatively to a compensation volume element having a predetermined compensation volume and/or being a compensation tank, preferably comprising such predetermined compensation volume, the kitchen appliance according to the present invention comprises at least one compensation volume element comprised in a wall section of heatable volume and/or such compensation volume element having a predetermined volume, e.g. a compensation tank.

[0053] Preferably, a kitchen appliance according to the present invention, more particularly a heatable volume thereof and/or a compensation volume element, comprises a wall section, wherein said wall section is arranged such that it is in contact with the barometric atmosphere surrounding the essentially fluid-tight, preferably essentially airtight, system. Such compensation volume element comprised in said wall section, preferably comprises a predetermined area and/or a predetermined elasticity.

[0054] Said predetermined elasticity at least partially allows for compensating at least partially the compensation of a pressure difference, preferably during a heating

or cooling step of the kitchen appliance.

[0055] Preferably, said compensation volume element comprised in a wall section is a compensation membrane.

5 **[0056]** In a further advantageous embodiment of the kitchen appliance according to the present invention said compensation volume element comprises or is at least one compensation membrane.

10 **[0057]** Such compensation membrane could be adjustable and controllable according atmospheric pressure and height above sea level as well as the particular need for heating function selected.

[0058] Such compensation membrane preferably is for regulating a pressure of the fluid comprised in the essentially fluid-tight, preferably essentially airtight, system.

15 **[0059]** In connection with the appliance of the present invention preferably, the compensation membrane is arranged in fluidic communication with at least one opening in a wall of the heatable volume.

20 **[0060]** More preferably, the compensation membrane is a flexible compensation membrane.

25 **[0061]** Such compensation membrane, preferably is comprised in a wall section of the heatable volume and/or a compensation volume element, e.g. a compensation tank.

[0062] Preferably such compensation membrane comprises a predetermined area and/or a predetermined elasticity.

30 **[0063]** Said predetermined elasticity at least partially allows for compensating at least partially the compensation of a pressure difference, preferably during a heating or cooling step of the kitchen appliance.

35 **[0064]** Such membrane is particularly useful in that the compensation volume element may compensate an overpressure occurring or existing in the heatable volume.

40 **[0065]** Such membrane, preferably is a pretensioned membrane or diaphragm, which, more preferably is arranged in the interior and/or wall of the compensation volume element. The pretension pressure of such pretensioned membrane or diaphragm is, preferably adjusted to be only slightly higher than the atmospheric pressure of the surrounding atmosphere.

45 **[0066]** In a further advantageous embodiment of the kitchen appliance according to the present invention said compensation membrane is a counter pressure-providing compensation membrane.

50 **[0067]** In a further advantageous embodiment of the kitchen appliance according to the present invention said compensation membrane is arranged in fluidic communication with a compensation tank.

55 **[0068]** Preferably, said compensation membrane is arranged in fluidic communication with at least one opening in a wall of the tank. In a further advantageous embodiment of the kitchen appliance according to the present invention said compensation membrane forms at least part of at least one wall of the heatable volume and/or forms at least part of at least one wall of the compensation

tank.

[0069] A membrane, preferably a pretensioned membrane, is embedded and/or forms at least part of at least one wall in the wall of the compensation volume element. In such configuration the membrane is not located in the interior, but is directly embedded in and/or forms at least part of at least one wall of the compensation volume element.

[0070] As an alternative or additionally such membrane may be embedded and/or form at least part of at least one wall of a heatable volume.

[0071] In a preferred embodiment of the inventive kitchen appliance, the kitchen appliance comprises at least one membrane embedded and/or forming at least part of at least one wall of a heatable volume. In such case the compensation volume element may not comprise a compensation compartment, for example a tank or the like.

[0072] In a preferred embodiment the membrane preferably a pretensioned membrane and/or counter pressure membrane constitutes the or at least a part of at least one wall of the heatable volume.

[0073] It will be understood that in a particularly preferred embodiment an entire or nearly entire wall of the heatable volume may be formed by such membrane.

[0074] It will be understood that in a preferred embodiment a heatable volume may according to its geometry be manufactured at least parts thereof from an elastically deformable material. Such material and, more particularly, the parts of the heatable volume manufactured thereof allow for a direct balance of the pressure. In a particularly preferred embodiment the entire heatable volume is manufactured from such elastic material, which allows for a balance and compensation of pressure due to elastic deformation. In such case the compensation volume element is the heatable volume.

[0075] However, also a compensation volume element may be manufactured at least parts thereof from an elastically deformable material. For example, a compensation membrane may be manufactured from an elastically deformable material. However, also a compensation tank and/or any other compensation volume element, preferably is, at least parts thereof from an elastically deformable material. Particularly, where a compensation volume element is a compensation tank such compensation tank or at least parts thereof may be manufactured from an elastically deformable material. This is of particular advantage as such elastically deformable material allows for elastic deformation and further compensation of a pressure difference.

[0076] In a further advantageous embodiment of the kitchen appliance according to the present invention said kitchen appliance comprises a first controlled valve that is adapted to allow a fluid exchange, preferably a controlled fluid exchange, between at least one of the heatable volume and/or the compensation volume element, and the atmosphere.

[0077] Preferably, such first controlled valve is for con-

necting the essentially fluid-tight, preferably essentially airtight, system to the outside of said essentially fluid-tight, preferably essentially airtight, system and thus to the atmosphere, wherein more preferably said at least one first valve is an inlet valve for letting in fluid from the outside of said essentially fluid-tight, preferably essentially airtight, system, and/or an outlet valve for letting out fluid to the outside of said essentially fluid-tight, preferably essentially airtight, system.

[0078] Preferably, such first controlled valve is a security valve, which is configured such that a closing pressure exhibited by the door is higher than the triggering pressure of the security valve. Accordingly, if the pressure in the heatable volume increases the door will be kept close, and if the pressure exceeds the triggering pressure of the security valve the security valve will exhaust the fluid to the outside of the essentially fluid-tight, preferably essentially airtight, system.

[0079] In a preferred embodiment of the kitchen appliance according to the present invention said kitchen appliance, more preferably the compensation volume element and/or the heatable volume, comprises at least one regulated or unregulated pressure valve.

[0080] Such pressure valve preferably is a spring loaded and/or electromagnetically regulated valve, preferably a two-port valve, more preferably a two-port pressure valve. This is, particularly to allow for a pressure compensation in both ways, i.e. in case of under- and in case of over-pressure.

[0081] In connection with the appliance according to the present invention a valve may be arranged in a wall of the heatable volume or the compensation volume element.

[0082] Such valve may also improve the comfort for the user, in that in case of an under-pressure such valve allows a pressure compensation and thus an easier opening of the door.

[0083] In a further advantageous embodiment of the kitchen appliance according to the present invention said heatable volume is connected to the compensation tank via at least one duct.

[0084] Preferably, said duct is adapted to mediate fluidic communication between the heatable volume and the compensation tank, more preferably via a combined outlet and inlet duct, more preferably via an outlet duct and/or an inlet duct of the heatable volume.

[0085] In a further advantageous embodiment of the kitchen appliance according to the present invention said kitchen appliance comprises a heat exchange device.

[0086] Also with regard to kitchen ovens or stoves of the prior art which make use of a heat exchange device, the inventive concept and appliance is of advantage in that such ovens or stoves of the prior art still are in need of a complex cooling system, and, moreover, still exhaust air after merely exchanging some heat via such heat exchange device. However, in the kitchen appliance according to the present invention many components necessary in an ordinary cooling system may be saved.

Moreover, said innovative concept may be advantageously combined with elements of such ordinary cooling systems. Moreover, in the kitchen appliance according to the present invention, a heat exchange device may be advantageously employed.

[0087] Preferably such heat exchange device is functionally arranged between the heatable volume and the compensation volume element, in particular wherein the at least one heat exchange device is arranged inside at least one of the combined outlet and inlet duct, the outlet duct and/or the inlet duct.

[0088] Such heat exchange device, preferably is for regulating a temperature of a fluid.

[0089] In a configuration wherein the pressure compensation is not performed within the heatable volume, and wherein the compensation volume element is connected to the heatable volume, such connection, preferably constitutes a one or two way connection in its physical sense.

[0090] Within such connection preferably a heat exchange device may be arranged for enhancing efficiency and for optimizing energy consumption. Installation of such heat exchange device is carried out according to the optimal operating principle, which is known to the person skilled in the art.

[0091] In order to produce a directed air circulation, various parameters are to be considered, comprising size and/or dimensions of openings for air circulation, positioning depending on heating elements for generating a temperature difference, flow optimized configuration of the compensation volume element, and/or active and directed flow, respectively.

[0092] It will be understood that such heat exchanging device may support preheating of fluid which is introduced to balance the pressure. Furthermore, such heat exchange device may optimize the internal airstreams in terms of energy and time.

[0093] Such heat exchange device is of particular advantage in that heat from exhausted fluid may be reused and warm-up the supplied fluid.

[0094] Preferably, the heat exchange device is for heating, more preferably preheating, fluid, e.g. atmospheric air, from the outside of said essentially fluid-tight, preferably essentially air-tight, system and/or for transferring heat of fluid entering the compensation volume element, e.g. tank, from the heatable volume to fluid entering the heatable volume from the compensation volume element.

[0095] In a further advantageous embodiment of the kitchen appliance according to the present invention said at least one heat exchange device is adapted for cooling a fluid stream out of the heatable volume and/or for heating a fluid stream into the heatable volume.

[0096] In a further advantageous embodiment of the kitchen appliance according to the present invention said heat exchange device comprises a structured metal plate.

[0097] Preferably, said structured metal plate is pro-

vided inside the at least one combined outlet and inlet duct, outlet duct and/or inlet duct. More preferably, the heat exchange device comprises a cast part, preferably manufactured from synthetic material, for example plastic, in particular wherein the structured metal plate is molded-in the cast part.

[0098] A structured metal plate may be molded-in the cast part. In a further advantageous embodiment of the kitchen appliance according to the present invention said compensation tank and/or the outlet duct comprises a filter cartridge.

[0099] Preferably, the filter cartridge is adapted for removing humidity and/or soil, for example fat, from a fluid that streams out of the heatable volume, in particular wherein the filter cartridge is a removable filter cartridge, preferably removable for cleaning, more preferably removable for cleaning in a dish washer.

[0100] This is of particular advantage in that humidity and/or soil may not be removed from the essentially fluid-tight, preferably essentially airtight, system when the door is in a closed state. However, in order to remove humidity and/or soil in such state, and more particularly, during a cooking process, applying a filter cartridge is of advantage.

[0101] It is to be understood that vapor enriched with humidity and fat, or the like may be cleaned by using such filter cartridge. Such filter cartridge is advantageous in getting rid of humidity and soil like fat, such filter cartridge may be configured to be removable to be cleaned in a dish washer and, more particularly may be potentially combined with a smell filter.

[0102] Thus such the filter cartridge, preferably is for removing humidity and/or soil, for example fat, from the fluid. Preferably, such filter cartridge is a removable filter cartridge, more preferably removable for cleaning, most preferably removable for cleaning in a dish washer.

[0103] Preferably, the filter cartridge comprises a smell filter, wherein the smell filter, more preferably is for removing odor from the fluid.

[0104] In a further advantageous embodiment of the kitchen appliance according to the present invention said filter cartridge comprises a smell filter, wherein the smell filter preferably is for removing odor from a fluid that streams out of the heatable volume.

[0105] In a further advantageous embodiment of the kitchen appliance according to the present invention, the kitchen appliance comprises a sealing element.

[0106] In a preferred embodiment the heatable volume and/or the door for closing said heatable volume comprises such sealing element. A sealing element as used herein, preferably is an elastic sealing element, preferably an elastic door sealing.

[0107] Preferably such sealing element is part of a door of the kitchen appliance according to the present invention. Such sealing element, for example, may be a circumferential rubber seal of a door.

[0108] A sealing element as used herein, preferably is suitable for essentially sealing the surrounding baromet-

ric atmosphere against the heatable cavity and/or compensation volume element in an essentially fluid tight, preferably air tight, manner and vice versa. More preferably, such sealing is configured such that a pressure difference, e.g. an over-pressure and/or an under-pressure, between the essentially fluid-tight, preferably essentially airtight, system, the heatable cavity and/or the compensation volume element and the surrounding barometric atmosphere, is compensated in a predetermined quantity, wherein preferably such compensation essentially results in a reduced pressure difference, more preferably no pressure difference.

[0109] The present invention is of particular advantage in that the feature that a fluid, e.g. air, is essentially not allowed to escape the essentially fluid-tight, preferably essentially air-tight, is reached with relatively cheap measures.

[0110] Any sealing element comprised in the kitchen appliance according to the present invention is suitable for essentially sealing the surrounding barometric atmosphere against the heatable cavity and/or compensation volume element in an essentially fluid-tight, preferably air-tight manner and vice versa. Accordingly an escape of air is essentially prevented until to a predetermined cut-off value of a temperature difference and/or pressure difference, i.e. a predetermined over- and/or under-pressure, between the essentially fluid-tight, preferably essentially air-tight, system and the outside, e.g. a barometric pressure of the atmosphere outside of said essentially fluid-tight, preferably essentially airtight, system, is reached.

[0111] If, for example, a pressure within the essentially fluid-tight, preferably essentially airtight, system exceeds said cut-off value, reflecting a security high pressure, the fluid, e.g. air or steam, is capable of escaping though such sealing element.

[0112] Such cut-off value may be adjusted and thus predetermined for both a sealing element and a valve. It is also possible to adjust and predetermine the cut-off value to atmospheric barometric pressure. Accordingly, the essentially fluid-tight, preferably essentially airtight, system will have atmospheric barometric pressure as an increase or decrease of pressure within the heatable volume will, at first, result in an energy efficient pressure compensation by expansion or re-expansion of the fluid into or out of the compensation volume, whereas subsequently a further increase or decrease in fluid pressure within the essentially fluid-tight, preferably essentially airtight, system will immediately result in a compensation by exhaustion of fluid through such valve and/or sealing element having the atmospheric barometric pressure as a predetermined security pressure. Accordingly the heatable cavity will have essentially barometric atmospheric pressure in such configuration.

[0113] To further improve energy efficiency of the kitchen appliance according to the present invention a compensation volume element, and particularly a compensation tank, may comprise a sealing element. Preferably,

a compensation tank comprises a sealing element and/or is sealed against temperature loss.

[0114] A sealing element may also be advantageously applied to different parts of a kitchen appliance according to the present invention. In a preferred embodiment various parts of the kitchen appliance according to the present invention, preferably temperature-sensitive, particularly heat-sensitive, and/or pressure-sensitive parts, for example electric parts of an oven, may comprise and/or be sealed with a sealing element, and thus advantageously protected from temperature and/or pressure induced damage.

[0115] For example, the door, particularly an oven door may be sealed against heat loss in various ways.

[0116] It will be understood that a door for example a door of a baking oven may be closed and separate from the essentially fluid-tight, preferably essentially airtight, system and, more particularly, be an unventilated door, however, it is also possible, to ventilate the door via natural convection, the door being configured to be ventilated as part of the essentially fluid-tight, preferably essentially airtight, system. Such a door allows for a convectional flow of the fluid through the door. Preferably such door is open at top and bottom and, more preferably comprises one porter glass and two or three further glasses, wherein a distance between the glasses is optimized to support the energy relevant criteria and front temperature setting. Such configuration preferably supports the convectional flow of the fluid.

[0117] In a preferred embodiment of the kitchen appliance according to the present invention, a steam sealing that is provided between the heatable volume and the door and a closing mechanism that exerts a closing force that presses the door against the steam sealing in the closed state of the door, wherein the closing force is chosen to be equal to or higher than a capacity of the compensation volume element to compensate a predetermined minimum difference between a fluidic overpressure inside the oven cavity relative to the barometric pressure of the atmosphere. Accordingly a door and a door sealing, in particular, is provided which allows overpressure exceeding a predetermined cut-off value, to escape through said sealing and door. It is to be understood that in such configuration a sealing element exhibits essentially the function of a security valve.

[0118] In a further advantageous embodiment of the kitchen appliance according to the present invention said kitchen appliance comprises a steam generator for providing steam to the heatable volume, in particular wherein at least one of the heatable volume, the compensation tank or the at least one duct comprises at least one second controlled valve. Such second controlled valve is of particular advantage in a steam oven, wherein a relatively high amount of steam is generated. Such relatively high amount of steam may not be entirely compensated by a provided compensation volume element, such as a compensation tank. Moreover, such second valve is of particular advantage in a so called "desteaming" phase to

compensate relatively fast a pressure difference in that the steam is allowed to escape out of the cavity and the system quite quick.

[0119] Preferably a compensation tank comprises such at least one second valve, wherein said at least one second valve, more preferably is for connecting the essentially fluid-tight, preferably essentially airtight, system to the outside of said essentially fluid-tight, preferably essentially airtight, system, wherein most preferably said at least one second valve is an inlet valve for letting in fluid, e.g. atmospheric air, from the outside of said essentially fluid-tight, preferably essentially airtight, system, and/or an outlet valve for letting out fluid, e.g. air, to the outside of said essentially fluid-tight, preferably essentially airtight, system.

[0120] In a preferred embodiment parts of the kitchen appliance according to the present invention, preferably a compensation volume element or parts thereof are manufactured from shape memory alloy. Additionally or alternatively such shape memory alloy is preferably used to operate actuating elements, which can either be done in an indirect way by thermal energy or in a direct way by electrical energy.

[0121] Such shape memory alloy is of particular advantage in that very small component dimension is allowed and less thermal mass, very low energy consumption, very fast reaction time, no noise during operation and relatively long life time may be achieved.

[0122] All described embodiments of the invention have the advantage, that energy loss is advantageously reduced, as, for example, no active ventilation or cooling system is needed, no guided exhaustion of fluid, and particularly of air or vapor out of the appliance is performed, no active cooling of the cavity or parts thereof and no active cooling of the door is necessary, and particularly, no active cooling of the appliance beneath and/or surrounding the heatable volume is necessary. However, it is within the present invention that such active cooling may be additionally applied and/or provided. Further advantages of the present invention exist in the fact that the compensation volume element may be configured to take care of humidity removal and/or odor treatment. Moreover, the thermal mass is reduced. A still further advantage exist in the fact that the design of such oven or stove can be chosen free of inlet or outlet ducts of fluid, and particularly air. Thus, a complete esthetical design freedom for the complete appliance and particularly an oven front is possible. Still further, no active energy removal from this essentially fluid-tight, preferably essentially airtight, system is necessary, and such essentially fluid-tight, preferably essentially airtight, system allows the reuse of heat via a provided heat exchange system. Accordingly, less thermal mass results in reduced energy consumption and faster heat-up in both, boost mode and to reach the set temperature. In accordance therewith, various embodiments may be configured having different performance levels and functionalities, for example steam-, pyro- and microwave appliances including com-

binations of those, as well as systems for elimination of odor.

[0123] Furthermore, the pressure balance by a compensation volume element provides the advantages that high pressure and the resulting negative impacts like an unwanted door opening is avoided, no need exists to introduce fresh and cool air continuously into the system.

[0124] In a preferred embodiment, the kitchen appliance according to the present invention comprises a bleed over control, which advantageously serves the safety aspect as, for example, it may avoid the unintended opening of the door and the release of hot fluid under pressure.

[0125] The present invention provides a self-regulating system.

[0126] A counter pressure device may be applied which manages the air volume changes due to temperature and atmospheric pressure, providing a membrane or applying other known solutions.

[0127] In connection with the present invention an introduction of fluid, e.g. air, from the surroundings is only done in case of need.

[0128] By using the inventive system the introduced energy is used in the most efficient way for operation of a kitchen appliance, e.g. cooking, and energy loss is lowered down dramatically.

[0129] Moreover, too high humidity, which in general may depend on the food/cooking mode, may also be regulated by the system and may further contributes to the energy consumption reduction.

[0130] Without the need for an exhaust channel, less heat impact occurs. More particularly, the inventive appliance has a passive heat management which allows for better insulation towards the heatable volume, and if necessary by micro porous systems or similar materials. Alternatively or additionally, an active cooling system, i.e. an active heat management may be provided.

[0131] The present invention will be described in further detail with reference to the drawings from which further features, embodiments and advantages may be taken, and in which

FIG 1 illustrates a kitchen appliance of the prior art;

FIG 2 illustrates a schematic diagram of an air and pressure management system for a kitchen appliance according to the present invention showing a first inventive embodiment;

FIG 3 illustrates a schematic diagram of an air and pressure management system for a kitchen appliance according to the present invention showing a second inventive embodiment;

FIG 4 illustrates a schematic drawing of a kitchen appliance of the present invention showing a third inventive embodiment.

[0132] FIG 1 shows a kitchen appliance 1, here a cooking oven according to the prior art. Such cooking oven 1 usually comprises a heatable volume 2, here an oven cavity 2. The oven 1 further comprises a door 4, here being a horizontally hinged drop down door 4 arranged for opening and closing a central opening of the cavity 2. Such central opening usually is provided for loading the cavity 2 with food stuff to be cooked in the appliance 1. It can be immediately be seen that usually above and/or below such cavity 2, particularly above, there is space, which is available for positioning of further appliance elements. Thereby, it is common to position the or at least parts of the cooling system of the oven 1 within the space above the oven cavity 2. The space below the cavity 2 can, for example be used for positioning of heat elements 3.

[0133] In FIG 2 a schematic diagram is shown depicting an oven cavity 2 of a steam oven 1 as a heatable volume 2, and a heating device 3 arranged below said cavity 2, wherein said heating device 3 is arranged for heating the cavity 2 with heated fluid, here heated air. Said cavity is to be closed by a not shown door 4 arranged for opening and closing the cavity 2. The inventive device further comprises compensation volume elements 5, 5a, 5b, being a compensation tank 5a and flexible compensation membranes 5b, being arranged such that the tank 5a is connected to the cavity 2, wherein, in a state where the cavity 2 is closed by the door 4, the cavity 2 and the compensation tank 5a are formed to be an essentially fluid-tight, preferably essentially airtight, system. Also the flexible compensation membranes 5b are arranged such that the compensation membranes 5b are connected either to the cavity 2 or to the compensation tank 5a. It is to be understood that an appliance 1 according to the present invention may comprise at least one compensation tank 5a and/or at least one flexible compensation membrane 5b as a compensation volume element 5. However, it is also to be understood that an appliance 1 according to the present invention may comprise at least one compensation tank 5a and at least one flexible compensation membranes 5b, wherein said at least one flexible compensation membranes 5b may be arranged such that such compensation membrane 5b is connected either to the cavity 2 or to the compensation tank 5a, if present. The compensation tank 5a as well as the compensation membranes 5b are adapted to essentially compensate a difference between a fluidic pressure in the cavity 2 and an atmospheric pressure of an atmosphere 6, wherein said difference results from a temperature difference between the cavity 2 and the atmosphere 6. The compensation membranes 5b are a counter pressure-providing compensation membranes and are arranged in fluidic communication with the tank 5a or the cavity 2. Here the compensation membranes 5b form at least part of at least one wall 8 of the cavity 2 and forms at least part of at least one wall 10 of the compensation tank 5a. Moreover, here the tank 5a comprises a first controlled valve 11 that is adapted to allow a controlled

fluid exchange between the tank 5a and the atmosphere 6. It can be immediately seen that the cavity 2 is connected to the compensation tank 5a via a duct 12, particularly comprising an outlet duct 12a and an inlet duct 12b. The duct 12 further comprises a heat exchange device 13 which is adapted for cooling a fluid stream out 15 of the cavity 2 and for heating a fluid stream into 16 the cavity 2. Here the heat exchange device 13 comprises a structured metal plate 14. Moreover, the compensation tank 5a comprises a filter cartridge 18 which comprises a smell filter, wherein the smell filter is for removing odor from a fluid that streams out of the cavity 2. Moreover, the appliance 1 comprises a steam generator 19 for providing steam to the cavity 2, in particular wherein a second controlled valve 20 is arranged at the inlet duct 12b.

[0134] FIG 3 departs from FIG 2 in that in the embodiment shown in FIG 3 the duct 12 is a combined outlet and inlet duct, whereas according to the embodiment shown in FIG 2, the outlet duct 12a is separate from the inlet duct 12b. Moreover, as may be seen from FIG 3, the heat exchange device 13 comprises the structured metal plate 14.

[0135] FIG 4 shows a schematic drawing of an appliance 1 according to the present invention. A kitchen appliance according to the embodiment of the invention as shown in FIG 4 comprises a heatable volume 2 with an improved energy efficiency, here a not shown at least one heating device 3, for example a tubular heating element, preferably comprising a top element 3a and a bottom element 3b, that is arranged for heating the heatable volume 2. The oven 1 further comprises a door 4, here being a horizontally hinged drop down door 4 arranged for opening and closing a central opening of the cavity 2. An appliance 1 according to the present invention may comprise at least one compensation tank 5a and/or at least one flexible compensation membrane 5b as a compensation volume element 5. However, it is also to be understood that an appliance 1 according to the present invention may comprise at least one compensation tank 5a and at least one flexible compensation membranes 5b. In the embodiment shown in Fig 4, the oven 1 comprises a compensation tank 5a as a first compensation volume element 5 connected in fluidic communication to the cavity 2 via a short duct 12. According to the embodiment shown in Fig 4 the compensation tank 5a and/or the cavity 2 may comprise one or more than one compensation membranes 5b as a second compensation element 5. The inventive system, and particularly a compensation element 5, here a compensation tank 5a is located and implemented above the heatable volume 2, here an oven cavity 2. Preferably, the compensation volume element 5, more preferably the compensation tank 5a is arranged above the heatable volume, e.g. cavity 2. In connection therewith, it is to be understood that such compensation element 5, particularly a compensation tank 5a, may be located at different positions in the appliance 1 in general, e.g. above a heatable volume 2, particularly the cavity 2 or at a side wall thereof. Both

possibilities are shown in Fig.4 Preferably, a compensation tank 5a is arranged above the cavity 2. It is thereby preferred that an opening 7 in a wall of the oven cavity, is also arranged an upper part of the cavity 2, more preferably in an upper wall of said cavity 2. Such opening 7, which is not shown in Fig.4 is preferably connected with the duct 12, such that the compensation tank 5a and the heatable cavity 2 are in fluidic communication. This is of particular advantage. At first due to physical law hot air will accumulate in an upper part of said heatable volume 2 and thus the hot air may easier be introduced into the compensation volume 5, particularly the compensation tank 5a. At second, a kitchen appliance according to the prior art, e.g. as basically shown in Fig. 1 comprises a cooling duct, particularly positioned above the cavity 2, which is needless in connection with the present invention. Therefore, the space usually provided for such cooling system or cooling ducts can advantageously be used in that at the position where usually the cooling duct is arranged the compensation volume 5, particularly the compensation tank 5a, may be arranged. As can be immediately seen from Fig 4 also the at least one flexible compensation membrane 5b may be arranged and located at different positions in the appliance 1 in general. Such flexible compensation membrane 5b may be arranged such that the compensation membrane 5b is connected either to the cavity 2 or to the compensation tank 5a, if present. Preferably, the compensation membrane 5a is comprised in a wall section of the heatable volume 2 and/or of compensation tank 5a. Both possibilities are shown in Fig.4. More particularly, a first compensation tank 5a being connected to the cavity 2 via a first duct 12 may comprise such compensation membrane 5b, preferably in a wall section of said first compensation tank 5a and/or may comprise a further compensation tank 5a, particularly being smaller than the first compensation tank 5a and being connected to the first compensation tank 5a via a second duct 12. Such further compensation tank 5a may also comprise a compensation membrane 5b. This may also be taken from Fig.4.

[0136] In each and any configuration according to the present invention, in a state where the cavity 2 is closed by the door 4, the cavity 2 and the compensation volume element 5, more particularly the compensation tank 5a and/or the compensation membrane 5b, are formed to be an essentially fluid-tight, preferably essentially airtight, system, and the compensation volume elements 5, 5a and 5b are adapted to essentially compensate a difference between a fluidic pressure in the cavity 2, here the pressure of air expanding due to being heated, and the barometric pressure of the atmosphere outside of the oven 6. The pressure difference results from the temperature difference between the air in the cavity 2 and the room temperature of the atmosphere 6. As may be seen from FIG 4 the fluidic communication between the compensation tank 5a and/or the compensation membranes 5b and the heatable cavity 2 is essentially free of flow resistance and thus allows an ideal compensation.

[0137] The features of the present invention disclosed in the specification, the claims, and/or the figures may both separately and in any combination thereof be material for realizing the invention in various forms thereof.

List of reference numerals

[0138]

10	1	cooking oven
	2	oven cavity
	3	heating device
	4	oven door
	5	compensation volume element
15	5a	compensation tank
	5b	flexible compensation membrane
	6	atmosphere
	7	opening in a wall of the oven cavity
	8	wall of the oven cavity
20	9	opening in a wall of the compensation tank
	10	wall of the compensation tank
	11	first controlled valve
	12	combined outlet and inlet duct
	12a	outlet duct
25	12b	inlet duct
	13	heat exchange device
	14	structured metal plate
	15	fluid stream out of the oven cavity
	16	fluid stream into the oven cavity
30	17	cast part
	18	filter cartridge
	19	steam generator
	20	second controlled valve

Claims

1. Kitchen appliance (1), comprising a heatable volume with an improved energy efficiency (2), at least one heating device (3) that is arranged for heating the heatable volume (2), a door (4) arranged for opening and closing the heatable volume (2) and a compensation volume element (5) connected in fluidic communication to the heatable volume (2), wherein, in a state where the heatable volume (2) is closed by the door (4), the heatable volume (2) and the compensation volume element (5) are formed to be an essentially fluid-tight, preferably essentially airtight, system, and wherein the compensation volume element (5) is adapted to essentially compensate a difference between a fluidic pressure in the heatable volume (2) and a barometric pressure of the atmosphere (6), wherein said difference results from a temperature difference between the heatable volume (2) and the atmosphere (6).

2. The kitchen appliance (1) according to claim 1, wherein the compensation volume element (5) comprises a compensation tank (5a).
3. The kitchen appliance (1) according to any of the claims 1 to 2, wherein the compensation volume element (5) comprises at least one compensation membrane (5b).
4. The kitchen appliance (1) according to claim 3, wherein the compensation membrane (5b) is a counter pressure-providing compensation membrane (5b).
5. The kitchen appliance (1) according to claim 3 or 4, wherein the compensation membrane (5b) is arranged in fluidic communication with the compensation tank (5a).
6. The kitchen appliance (1) according to any of claims 3 to 5, wherein the compensation membrane (5b) forms at least part of at least one wall (8) of the heatable volume (2) and/or forms at least part of at least one wall (10) of the compensation tank (5a).
7. The kitchen appliance (1) according to any of claims 1 to 6 which comprises a first controlled valve (11) that is adapted to allow a controlled fluid exchange between at least one of the heatable volume (2) and/or the compensation volume element (5, 5a, 5b), and the atmosphere (6).
8. The kitchen appliance (1) according to any one of claims 1 to 7, wherein the heatable volume (2) is connected to the compensation tank (5a) via at least one duct (12, 12a, 12b).
9. The kitchen appliance (1) according to any one of claims 1 to 8, comprising a heat exchange device (13).
10. The kitchen appliance (1) according to claim 9, wherein the at least one heat exchange device (13) is adapted for cooling a fluid stream out (15) of the heatable volume (2) and/or for heating a fluid stream into (16) the heatable volume (2).
11. The kitchen appliance (1) according to claim 9 or 10, wherein the heat exchange device (13) comprises a structured metal plate (14).
12. The kitchen appliance (1) according to any of claims 1 to 11, wherein the compensation tank (5a) and/or the outlet duct (12a) comprises a filter cartridge (18).
13. The kitchen appliance (1) according to claim 12, wherein the filter cartridge (18) comprises a smell filter, wherein the smell filter preferably is for removing odor from a fluid that streams out of the heatable volume (2).
14. The kitchen appliance (1) according to any one of claims 1 to 13, comprising a sealing element.
15. The kitchen appliance (1) according to any of claims 1 to 14, that comprises a steam generator (19) for providing steam to the heatable volume (2), in particular wherein at least one of the heatable volume (2), the compensation tank (5a) or the at least one duct (12, 12a, 12b) comprises at least one second controlled valve.

FIG 1

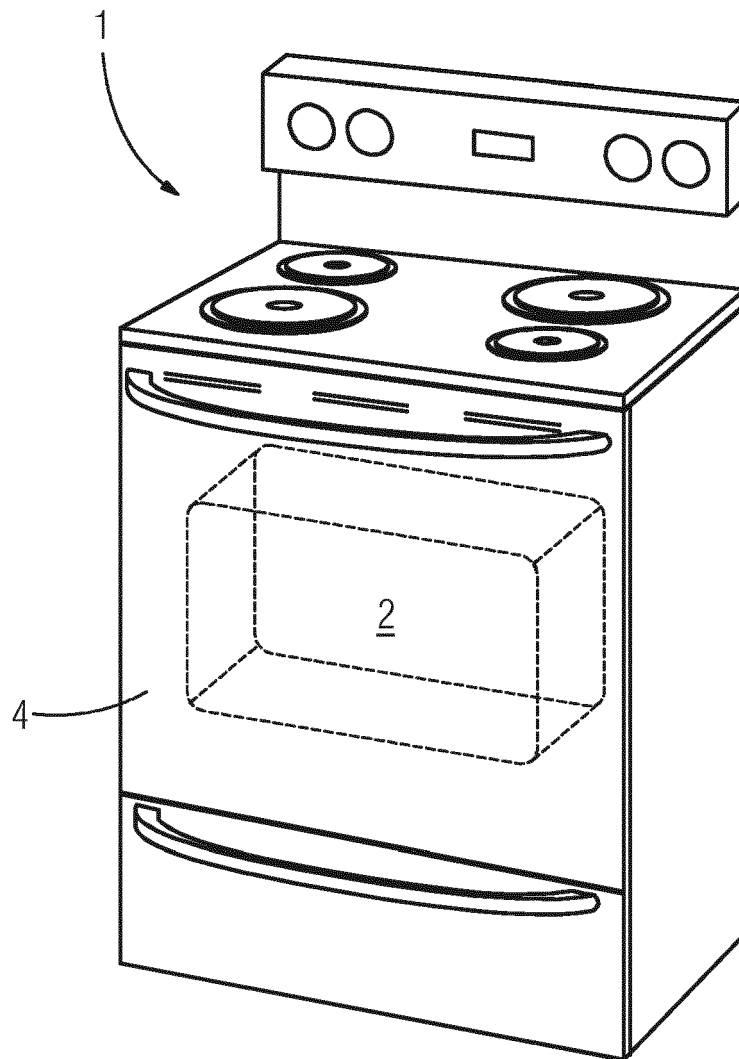


FIG 2

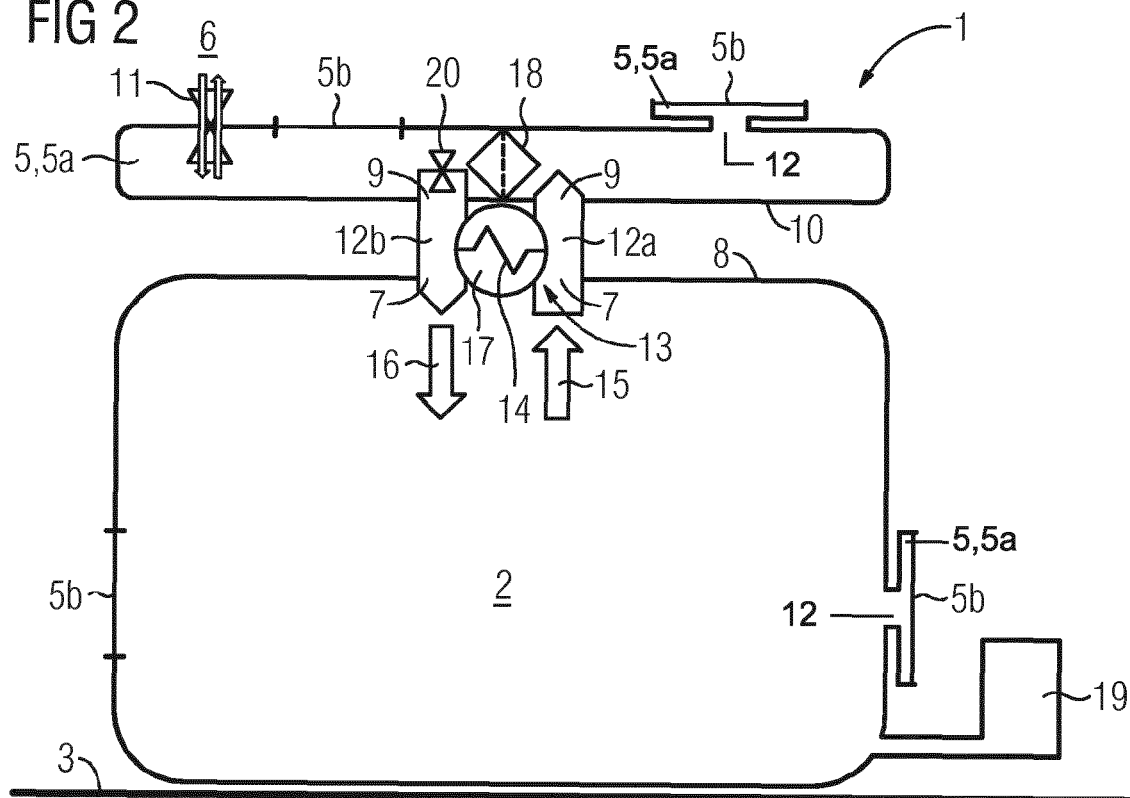


FIG 3

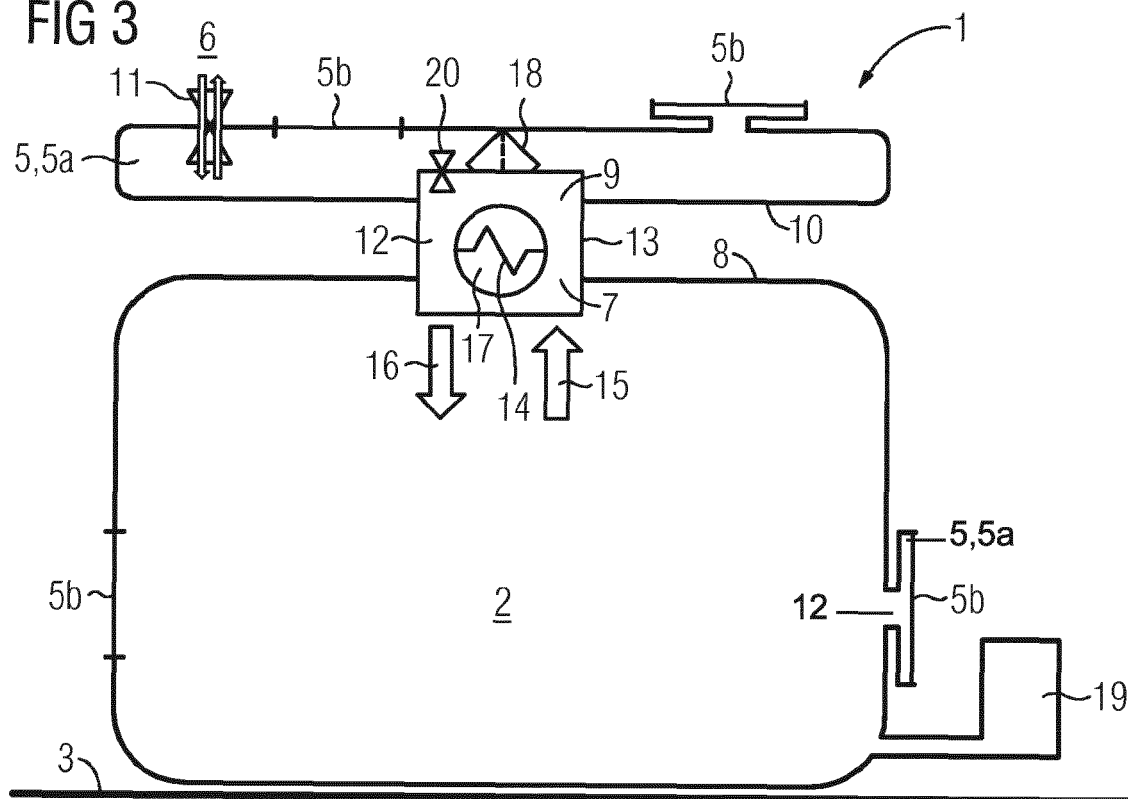
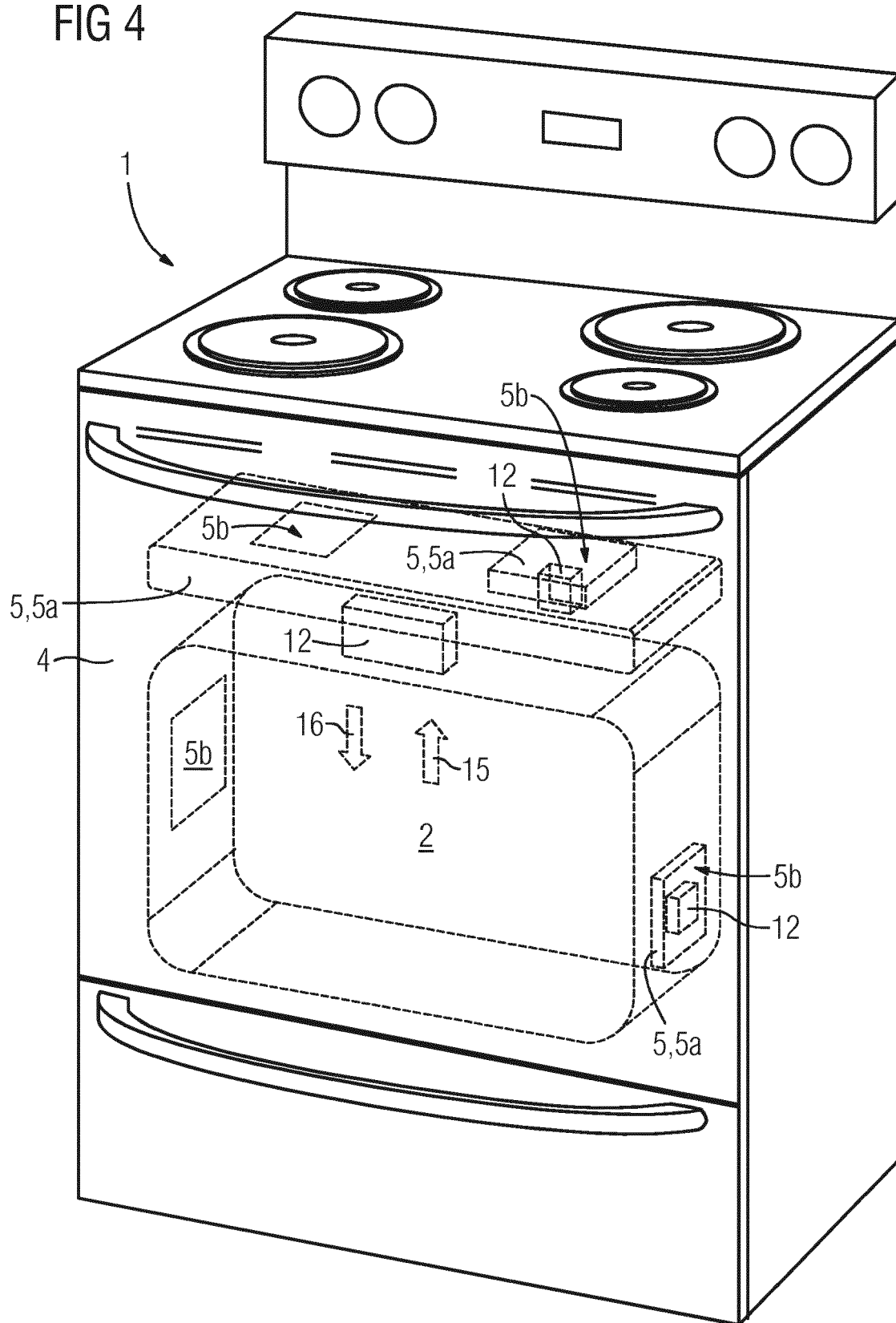


FIG 4





EUROPEAN SEARCH REPORT

 Application Number
EP 14 16 8640

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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	EP 1 314 387 A1 (RZEMIENIUK BERNHARD [DE]) 28 May 2003 (2003-05-28)	1-8,14, 15	INV. F24C15/20
Y	* figure 1 * * paragraphs [0013], [0014], [0020] - [0022] *	9-13	F24C15/32
X	WO 2012/140003 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]; HOFFMANN OLIVIER [FR]; OUMGHARI RA) 18 October 2012 (2012-10-18) * figures 1,2 * * page 8, line 28 - page 9, line 5 *	1,2	
X	EP 0 092 851 A2 (CONVOTHERM ELEKTROGERAETE) 2 November 1983 (1983-11-02) * figures 1,2 * * page 13, line 7 - page 14, line 24 *	1,2	
Y	EP 1 201 999 A2 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 2 May 2002 (2002-05-02) * figure 1 * * paragraphs [0011], [0012], [0020] *	9-13	TECHNICAL FIELDS SEARCHED (IPC)
A	EP 2 230 883 A1 (TOPINOX SARL [FR]) 22 September 2010 (2010-09-22) * paragraphs [0026], [0037] *	1-15	F24C A21B
A	EP 0 691 513 A2 (WIESHEU WIWA GMBH [DE]) 10 January 1996 (1996-01-10) * figures 1-3 *	1,9-13	
A	DE 10 2004 001221 A1 (RATIONAL AG [DE]) 4 August 2005 (2005-08-04) * figure 3 * * paragraphs [0055] - [0057] *	1-15	
		-/--	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 31 October 2014	Examiner Moreno Rey, Marcos
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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EUROPEAN SEARCH REPORT

Application Number
EP 14 16 8640

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 42 40 096 A1 (JUNO GROSKUECHEN GMBH [DE]) 1 June 1994 (1994-06-01) * paragraphs [0015] - [0017], [0032] - [0034] *	1-15	

			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 31 October 2014	Examiner Moreno Rey, Marcos
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)

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

EP 14 16 8640

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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31-10-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1314387 A1	28-05-2003	NONE	
WO 2012140003 A1	18-10-2012	CN 103492810 A EP 2697569 A1 US 2014013963 A1 WO 2012140003 A1	01-01-2014 19-02-2014 16-01-2014 18-10-2012
EP 0092851 A2	02-11-1983	DE 3215812 A1 EP 0092851 A2	03-11-1983 02-11-1983
EP 1201999 A2	02-05-2002	DE 10053412 A1 EP 1201999 A2	08-05-2002 02-05-2002
EP 2230883 A1	22-09-2010	NONE	
EP 0691513 A2	10-01-1996	DE 4423557 A1 EP 0691513 A2	25-01-1996 10-01-1996
DE 102004001221 A1	04-08-2005	NONE	
DE 4240096 A1	01-06-1994	NONE	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 2339398 A [0003]
- DE 19738601 C1 [0004]