(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 012 537 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.04.2016 Bulletin 2016/17

(51) Int Cl.:
F24C 15/20 *(2006.01)*

(21) Application number: **14190099.3**

(22) Date of filing: **23.10.2014**

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

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

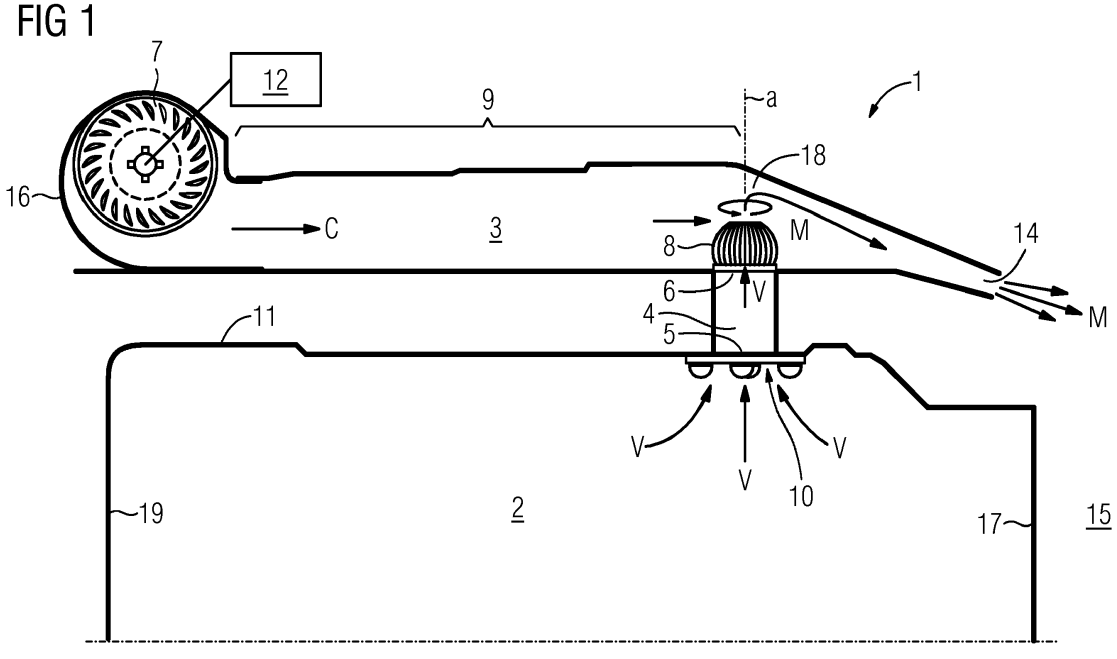
(72) Inventors:
- **Brenz, Reiner**
  91541 Rothenburg ob der Tauber (DE)
- **Weber, Mario**
  91541 Rothenburg ob der Tauber (DE)

(74) Representative: **Röder, Richard et al**
Electrolux Hausgeräte GmbH
Group Patents
90327 Nürnberg (DE)

(54) KITCHEN OVEN COMPRISING AN AIRFLOW PROPELLED FAN WHEEL

(57) A kitchen oven (1), comprising a cavity (2) and a cooling chamber (3) arranged outside of the cavity (2) and provided as a common duct for the joint discharge of cooling air and vapors, and
at least one vapor duct (4) for realizing a fluid communication between the cavity (2) and the cooling chamber (3), in that
said vapor duct (4) is arranged such that
its first end (5) is in fluid communication with the cavity (2), and
its second end (6) is in fluid communication with said cooling chamber (3),
said cooling chamber (3) further comprising a first fan wheel (7) generating a stream or flow of air (C) capable of blowing air and vapors out of the cooling chamber (3), and a second fan wheel (8) arranged at the second end (6) of said vapor duct (4)
characterized in that
said second fan wheel (8) is arranged such that it is drivable by the stream or flow of air (C) generated by the first fan wheel (7).

FIG 1



EP 3 012 537 A1

Description

[0001] The present invention relates to a kitchen oven, comprising a cavity and a cooling chamber arranged outside of the cavity and provided as a common duct for the joint discharge of cooling air and vapors.

[0002] Kitchen ovens and particularly, build-in kitchen ovens are heated according to their major purpose of heating or baking food products. Therefore, such kitchen ovens need a cooling and/or insulation system. A cooling system usually uses a pressure free air ventilation or a pressure forced ventilation.

[0003] In addition, with regard to vapor and moisture accumulating during a heating or baking process within an oven cavity, it is in general preferred to remove said vapor or moisture from the cavity and to release said vapor or moisture out of the kitchen oven.

[0004] For such purpose it is known to provide a vapor-duct which allows a fluid connection between the cavity and the cooling air system and through which vapor and moisture can be removed from the cavity and can be led to the outside of the kitchen oven, particularly combined with air from the cooling system. In connection with such solutions the use of fan wheels is known, on the one hand providing the cool air to cool the oven or, more particularly the oven housing, and on the other hand to promote the remove of moisture and vapor from the cavity.

[0005] The document EP 0 926 448 B1 describes an air channel arranged above an oven cavity, containing a motor. An air duct is provided for discharging cooling air and vapors, having at least a first flow connection for discharging a vapor airflow out of the baking muffle and at least a second flow connection for discharging a cooling airflow for the exterior of the baking muffle. The motor drives two different fan wheels arranged on a common shaft. The first fan wheel is arranged in the first flow connection for the cooling airflow and the second fan wheel is arranged in the flow connection for the vapor air. The first fan wheel leads cooling air from the ambience above into the air channel and the second fan wheel promotes the removal of vapor from the cavity through a hole provided in the cavity's top wall. In the air channel, cooling air and vapor are mixed and led to an exit in the front of the appliance. However, in such configuration, particularly if the second fan wheel is not rotating, cold air from the cooling air channel may be pressed into the cavity, disadvantageously leading to condensation.

[0006] With the increasing demands on reducing energy losses in the field of kitchen appliances, and particularly with regard to kitchen ovens, especially a more effective insulation is needed. Moreover, energy losses have to be further reduced and energy consumption has to be optimized.

[0007] It is an object of the present invention to provide a kitchen oven comprising a cost-, and/or purpose-effective and, particularly more simple, design that allows both an effective cooling and an effective vapor exhaustion.

[0008] It is a further object of the present invention to provide a kitchen oven that allows for an optimized energy consumption of a combined cooling and vapor exhaust system.

[0009] These and other problems are solved by the subject matter of the attached independent claims.

[0010] The above objects of the invention are achieved by a kitchen oven according to claim 1.

[0011] Preferred embodiments may be taken from the dependent claims.

[0012] A kitchen oven according to claim 1 comprises at least a cavity and a cooling chamber arranged outside of the cavity and provided as a common duct for the joint discharge of cooling air and vapors, and at least one vapor duct for realizing a fluid communication between the cavity and the cooling chamber, wherein said vapor duct is arranged such that its first end is in fluid communication with the cavity, and its second end is in fluid communication with said cooling chamber, said kitchen oven, particularly said cooling chamber, further comprising a first fan wheel for generating a stream or flow of air capable of blowing air and vapors out of the cooling chamber, and a second fan wheel arranged at the second end of said vapor duct.

[0013] Such kitchen oven is characterized in that said second fan wheel is arranged such that it is drivable and/or propelled by the stream of air generated by the first fan wheel. Particularly, it is preferred that a rotational movement of said second fan wheel may be substantially due to a stream or flow of air generated by the first fan wheel.

[0014] Such oven allows for an effective cooling by the air blown through the cooling chamber by the first fan wheel. Moreover, said cooling chamber serves as or comprises a mixing area in which vapors and cooling air are mixed together. This is possible as the cavity and the cooling chamber are in fluid connection, through the vapor duct. In that a second fan wheel is arranged such that it is drivable and propelled by the stream or flow of air generated by the first fan wheel, preferably on top of the vapor duct, the stream or flow of air generated by the first fan wheel propels the second fan wheel, which supports the generation of a negative pressure within said vapor duct and the cavity and thus sucks the vapor within the cavity out of said cavity and into the vapor duct. From the vapor duct, said vapor enters the cooling chamber and is mixed with the cooling air. The vapor, particularly the vapor mixed with cooling air, is than taken away by the cooling airflow. The mixture thereof may finally be released to the surrounding of the kitchen appliance.

[0015] However, an under pressure in the cavity is usually avoided, as the kitchen oven, particularly a cavity of such oven, is not designed as a completely closed system. Particularly, a cavity may comprise various further openings through which air may be passively sucked into the cavity, comprising screw holes, openings for heating elements, lamps, fan wheel motors, and the like. During a baking process, however, usually an overpressure due to vapor occurs

in the cavity.

[0016] It is to be understood that, an airflow generated by the first fan wheel may have a positive effect on sucking vapor out of the vapor duct. However, depending on the particular configuration, cooling air may also enter the vapor duct in an undesired manner. Particularly without a second fan wheel according to the present invention, cold cooling air may enter the vapor duct in an undesired manner and may, thus generate a counter-pressure against the vapor contained in the cavity. Accordingly, the vapor contained in said cavity may disadvantageously be cooled by said cooling air entering the vapor duct. This, particularly, may lead to an insufficient escape of vapor from the cavity through the vapor duct. The kitchen appliance according to the present invention preferably is configured such that the first fan wheel and the vapor duct are arranged such that such undesired entering of cooling air into the vapor duct is substantially prevented or kept substantially low.

[0017] In that a second fan wheel is arranged such that it is drivable and propelled by the stream or flow of air generated by the first fan wheel, preferably on top of the vapor duct, said second fan wheel advantageously supports an escape of vapor out of the cavity through the vapor duct. Moreover, an undesired entering of cooling air into the vapor duct, and particularly into the cavity, is substantially prevented and/or kept substantially low.

[0018] Thereby, the arrangement of the second fan and the vapor duct advantageously may prevent an unwanted condensation of vapor and moisture in the vapor duct and/or cavity.

[0019] The vapor is mixed with the cooling air, preferably immediately after being sucked out of the cavity, the vapor is cooled down and neither hot vapor is exhausted by the oven, nor unwanted condensation will occur or at least be reduced. This is of particular importance as the vapor contained within the cavity may probably comprise moisture to a certain extend.

[0020] In an advantageous embodiment of the inventive oven said second end of the vapor duct is arranged in an outlet area of the first fan wheel, preferably such, that an airflow generated by a rotating movement of said first fan wheel supports the sucking of the vapors out of the cavity.

[0021] The term "outlet area" as used herein, preferably refers to the positioning relative to a fan wheel; accordingly, an outlet area is an area located in a region where air is blown to, particularly an area of air overpressure generated by the rotational movement of a fan wheel, whereas an inlet area refers to a region where air is pulled from, particularly an area of air under pressure generated by the rotational movement of a fan wheel.

[0022] It is immediately understood, that in general the second end of the vapor duct may be arranged both, in an inlet and/or in an outlet area of the first fan wheel. Both is considered in connection with the present invention. However, if the second end is arranged in an inlet area of the fan, the vapor, probably hot and moist, which is sucked out of the cavity, has to pass the fan wheel, which might be of disadvantage.

[0023] In both settings, however, it is preferred that a rotating movement of said first fan wheel generates an airflow capable of supporting the sucking of the vapors out of the cavity. The airflow generated by the first fan wheel propels the second fan wheel. In connection therewith, it is to be understood that if the second end and the respective opening of the vapor duct is designed and arranged such that the airflow generated by the fan wheel strives said second end and respective opening of the vapor duct, an under pressure in the vapor duct particularly due to an injector effect, is achieved and/or strengthened, which supports the sucking of the vapors out of the cavity, and particularly out of the vapor duct. This particularly is of advantage in that the performance of the second fan wheel is supported. Accordingly the sucking is either more effective, or for having the same effect, the second fan wheel may have a reduced performance.

[0024] In a further advantageous embodiment of the inventive oven, said first fan wheel is a radial flow fan wheel or an axial flow fan wheel.

[0025] A radial flow fan wheel as used herein is a fan wheel designed and arranged such that, preferably an air influx is an axial air influx and air efflux is a radial air efflux.

[0026] Such radial flow fan wheel is, preferably arranged within a spiral housing, preferably of a cochlea-shape. A person skilled in the art knows various forms of such spiral housing, preferably cochlea, and may design such housing with regard to various needs and advantages, e.g. acceleration or deceleration of air speed, air streaming, guiding or redirection of airflow.

[0027] In an alternative embodiment of the inventive oven, said first fan wheel is an axial flow fan wheel.

[0028] In connection therewith, it will be immediately understood by a person skilled in the art that said first fan wheel might be arranged and/or configured as an axial flow fan wheel or a radial flow fan wheel, depending on the particular desired purpose and configuration. A radial flow fan wheel may have the advantage that a relatively high air mass and relatively low airflow velocity may be realized. An axial flow fan wheel may have the advantage that a relatively high air mass and relatively high airflow velocity may be realized.

[0029] In addition, a person skilled in the art with regard to various needs and advantages can design such fan wheel, particularly such first and/or second fan wheel, in various forms. For example, a fan wheel, particularly a radial flow fan wheel, may be designed to suck air on one, or on two sides of the wheel.

[0030] Such fan wheel, particularly a first and/or second fan wheel according to the present invention, may comprise impeller blades with either backward or forward-curved blade geometries. A person skilled in the art will be able to design

such first flow fan wheel and, particularly choose the design of the impeller blades, according to the particular intended purpose. Particularly, with regard to design and space, more particularly restricted space, a fan wheel comprising impeller blades with forward-curved blade geometries may be preferred.

[0031] In a further advantageous embodiment of the inventive oven, said second fan wheel is an axial flow fan wheel.

[0032] An axial flow fan wheel as used herein is a fan wheel designed and arranged such that, preferably an air influx is an axial air influx and air efflux is an axial air efflux.

[0033] A fan wheel, particularly an axial flow fan wheel, may be provided with or without fixed route cone or guide wheel.

[0034] Such axial flow fan wheel is of particular advantage as only low or moderate pressure differences are achieved according to the present invention, however, a rather high volume of air may be transported.

[0035] Dependent on the intended purpose, and particularly the design and/or arrangement of the oven, the cooling chamber, the first fan wheel, and/or the vapor duct, a person skilled in the art will be able to design and/or arrange the second fan wheel according to the various embodiments of the present invention. Particularly, a person skilled in the art when designing and/or arranging said second fan wheel, will be able to, for example, select an appropriate number and/or an appropriate configuration of impeller blades and/or lamellae of a second fan wheel according to the desired purpose and, particularly according to the air stream or flow velocity and/or the stream or flow volume generated by the first fan wheel, the vapor stream or flow out of the cavity and/or the configuration, performance and/or speed of the first driving means and/or the first fan wheel.

[0036] In a particular preferred embodiment of the inventive oven said first fan wheel is a radial flow or an axial fan wheel and said second fan wheel is an axial flow fan wheel.

[0037] It will be immediately understood that a second fan wheel, particularly an axial flow fan wheel, advantageously supports the sucking of vapor out of the cavity. Particularly, where the first fan wheel performs such sucking effect, e. g. by a herein described arrangement of the vapor duct, i.e. by an injector effect of the airflow generated by said first fan wheel, the second fan wheel will support said effect and add to the performance of the first fan wheel, while the first fan wheel propels the second fan wheel. In such configuration, both fan wheels act together and support the function of sucking the vapor out of the cavity.

[0038] In a further advantageous embodiment of the inventive oven, said second fan wheel is a dome-shaped fan wheel.

[0039] In a further advantageous embodiment of the inventive oven said vapor duct at its first end is connected to an opening in an upper wall of the cavity and/or the cooling chamber is arranged above said upper wall of the cavity.

[0040] Accordingly, said vapor duct at its first end being connected to an opening in an upper wall of the cavity, advantageously is arranged such that its first end is in fluid communication with the cavity, particularly through said opening in the upper wall of the cavity. As the second end of said vapor duct is in fluid communication with said cooling chamber, the cooling chamber being arranged above said upper wall of the cavity is in fluid communication with said cavity through said vapor duct.

[0041] As used herein terms such as "upper", or "above" or the like refer, preferably, to an arrangement and/or a location of the oven according to the present invention relative to the height of the kitchen oven according to the present invention, and particularly to a placement of said oven according to its intended purpose. Accordingly, and in way of an example, where said vapor duct at its first end is connected to an opening in an upper wall of the cavity and/or the cooling chamber is arranged above said upper wall of the cavity, it will be immediately understood that such upper wall is the wall of the cavity which is averted from a kitchen floor, when the oven is installed and mounted for its intended use. Where the cooling chamber is arranged above said upper wall it is to be understood that the cooling chamber is, preferably arranged on or adjacent to the top of the cavity.

[0042] In an embodiment of the oven according to the present invention, the second fan wheel is arranged within the cooling chamber.

[0043] In a preferred embodiment of the present invention, the second fan wheel is mounted on top of the vapor duct. It is thus immediately understood that in such embodiment, particularly if said vapor duct at its first end is connected to an opening in an upper wall of the cavity and its second end is connected to the cooling chamber, the second fan wheel is arranged within the cooling chamber.

[0044] In a further advantageous embodiment of the inventive oven said first fan wheel is driven by a first driving means, and the second fan wheel is an external driven fan wheel, preferably a driving means-less driven fan wheel and/or a self-rotating fan wheel.

[0045] In connection therewith, it is important to understand that preferably the second fan wheel and/or the vapor duct is configured and/or arranged such that to drive the second fan wheel no driving means, besides a stream or flow of air generated by the first fan wheel and/or a stream or flow of vapor through the vapor duct out of the cavity, for example, due to a chimney effect and/or an overpressure within the cavity, is necessary. It is to be understood that particularly if the second fan wheel is designed and/or configured as a driving means-less driven fan wheel and/or a self-rotating fan wheel, escape of vapor out of the cavity through the vapor duct, for example, due to a chimney effect and/or an overpressure within the cavity, particularly if said second fan wheel is arranged above said vapor duct, may generate a self-rotational movement of the second fan wheel. However, an airflow generated by said first fan wheel

generates a self-rotational movement of the second fan wheel. A self-rotational movement of said second fan wheel advantageously support and/or generates a sucking effect for sucking vapor out of the cavity, and particularly out of the vapor duct. Advantageously, the second fan wheel particularly if comprising a lamellar system, may be configured and arranged such, that an undesired entering of air from the cooling chamber, particularly of an airflow generated by the first fan, is advantageously prevented or at least substantially lowered. For example, a lamellar system may be configured such that said lamellar system upon rotation of the second fan wheel shovels vapor out of the vapor duct. This particularly is possible, as the second fan wheel may configured such that the airflow generated by the first fan wheel and/or a vapor stream or flow out of the vapor duct is sufficient for self-rotation of the second fan wheel.

[0046] It will also be understood by a person skilled in the art that a performance of such self-rotating second fan wheel may be depended on an/or adjustable depend on the airflow, particularly an air volume capacity, generated by said first fan wheel, which may particularly depend on the performance of a first driving means, preferably a motor, driving said first fan wheel. Such airflow, particularly an air volume capacity, generated by said first fan wheel accordingly may depend on the rotational speed, in rounds per minute, of the first fan wheel and/or of the first driving means, preferably the motor, driving such first fan wheel.

[0047] A second fan wheel according to the present invention, preferably a self-rotating second fan wheel, more preferably a second fan wheel, preferably comprising a lamellar system may be configured and/or arranged such that the rotational velocity, preferably self-rotational velocity, of said second fan wheel is dependent on the stream or flow velocity and/or the stream or flow volume capacity of the airflow generated by the first fan wheel and/or the vapor stream or flow out of the vapor duct. In other words, a second fan wheel according to the present invention, preferably comprising a lamellar system may, in an embodiment, configured and/or arranged such that the rotational velocity, preferably self-rotational velocity of a rotational movement of the second fan wheel increases with an increase of airflow generated by the first fan wheel and/or the vapor stream or flow out of the vapor duct. Such relationship advantageously allows an automatic adaptation of the second fan wheel, particularly of the rotational movement of such second fan wheel, to the stream or flow velocity and/or the stream or flow volume generated by the first fan wheel and/or the vapor stream or flow out of the vapor duct. In an embodiment of the second flow wheel according to the present invention said second flow wheel, preferably comprising a lamellar system, may be configured and/or arranged such that upon a relatively fast rotational movement of said second flow wheel, the sucking of vapor out of the vapor duct is regulated to a maximum air stream or air flow, preferably a constant maximum air stream or air flow, preferably due to a shutting off-effect by the relatively fast rotational movement, particularly of a lamellar system if present.

[0048] In a preferred embodiment the second fan wheel, said second fan wheel is configured as a self-rotating fan wheel. In an embodiment, such self-rotating fan wheel comprises a self-rotating lamellar system. The self-rotating fan wheel may therefore comprise lamellae, preferably configured such that a self-rotating movement of said second fan wheel is substantially caused by the airflow generated by the first fan, impinging on said lamellar system, particularly on said lamellae. It will, however, immediately be understood by a person skilled in the art, that in some configurations of said second fan wheel according to the present invention, a self-rotating movement of said second fan wheel may also be generated by vapor escaping the cavity through the vapor duct, particularly if said vapor impinges on a self-rotating lamellar system, particularly on lamellae, of said second fan wheel.

[0049] Accordingly, such self-rotating second fan wheel may rotate independent from an external energy source, despite the airflow generated by the first fan wheel and/or vapor escaping the oven cavity through the vapor duct.

[0050] It is considered herein, that in an embodiment a second fan wheel, particularly a self-rotating second fan wheel, may further comprise a second driving means, preferably in addition to its self-rotating configuration. Such second driving means may be an active driving means, e.g. a motor, for assisting and/or supporting the self-rotational movement of said second fan wheel. Such second driving means may also be configured as a further ventilation means, for example, a further fan or sucking means, preferably for supporting the vapor flow through the vapor duct out of the cavity.

[0051] It will be immediately understood that a self-rotating fan wheel according to the present invention, particularly if such self-rotating fan wheel comprises a lamellar system, may be configured such that also an undesired high sucking effect, e.g. by an injector effect, of the airflow generated by the first fan wheel, in the vapor duct is prevented or at least significantly counteracted. It will be, thus immediately understood by a person skilled in the art, that besides a positive effect on supporting suction and escape of vapor out of the cavity through the vapor duct, such self-rotating fan wheel may also be configured to exhibit a damping effect in that an undesired high sucking effect, e.g. by an injector effect, of the airflow generated by the first fan wheel, in the vapor duct is prevented or at least significantly counteracted.

[0052] Such self-rotating fan wheel according to the present invention advantageously prevents an undesired loss of energy in that the escape of an undesired high amount vapor and/or heat out of the cavity may be prevented.

[0053] The term "external driven" as used herein, preferably refers to an airflow as a passive driving means. Where the second fan wheel is substantially propelled by the airflow generated by the first fan wheel it is immediately clear that the second fan wheel is external driven passively by the airflow substantially generated by the first fan wheel. More preferably, the term "ex-ternal driven" as used herein refers to a situation where a fan is driven without an active driving means, e.g. a motor, compressor or the like. Although a compressor might also propel the second fan wheel by blowing

air, such compressor is to be understood as an active driving means.

[0054] In a further advantageous embodiment of the inventive oven said first and/or a second driving means is selected from the group comprising a motor, preferably an infinitely adjustable motor, more preferably selected from the group comprising AC motor and DC motor.

[0055] This advantageously allows for an infinite adjustability of the rotational movement speed of the first fan wheel and/or the second fan wheel, respectively, and thus an infinite adjustability of the airflows and pressures generated therewith.

[0056] A first fan wheel and/or a second fan wheel according to the present invention, and particularly the rotational movement of a first fan wheel and/or a second fan wheel according to the present invention may be controlled and/or regulated in various ways.

[0057] In an embodiment, wherein the first fan wheel is driven by a first driving means, particularly a motor, the performance of the first fan wheel, particularly the rotation velocity of said first fan wheel, may be regulated and/or controlled by regulation and/or control of the driving means. For example, in an embodiment wherein the first driving means is a motor, the motor speed, e.g. rounds per minute, may determine the rotation velocity of said first fan wheel. It will be immediately understood that the first fan wheel may rotate upon switch on of the first driving means and/or may stop its rotational movement directly or delayed to a switch-off of the driving means.

In an embodiment and, particularly in a state of operation of the oven according to the present invention, wherein a rotational movement of the second fan wheel is due to or substantially due to the stream or flow of air generated by the first ventilation means, also the rotational movement of the second fan wheel may be controlled and/or adjusted by controlling and/or adjusting the performance of the first driving means, particularly a motor.

[0058] In an embodiment of the second fan wheel according to the present invention, the second fan wheel comprises a breaking element, particularly a mechanical breaking element. Such breaking element may be designed as a brake, which allows reducing, stopping and/or adjusting the rotational velocity of a rotational movement of said second fan wheel. This advantageously allows reducing the contribution of said second fan wheel to a sucking effect of sucking out vapor from the cavity. Such breaking element, may for example, be arranged and/or designed such that such breaking element is capable of adjusting, reducing and/or stopping a rotational velocity of an axis element, for example, a central axis.

[0059] An oven according to the present invention may comprise a control unit and/or a sensor element, e.g. a humidity, pressure or temperature sensor, preferably connected to said control unit.

[0060] A breaking element according to the present invention may be configured to adjust, reduce and/or stop a rotational velocity of a second fan wheel.

[0061] For such purpose, a breaking element may be regulated by such control unit and/or sensor element. For example, a breaking element may be controlled or regulated by a program and/or dependent on sensor measurement, manually or electrically, automatically, e.g. turned to zero, particularly for avoiding an under pressure in the cavity.

[0062] A vapor duct according to the present invention may be designed and/or arranged in various ways depending on the intended purpose. A person skilled in the art will be able to design and/or arrange a vapor duct according to the present invention. For example, a diameter and/or geometry of such vapor duct may be adapted to the oven or parts thereof, for example, the geometry of the cooling chamber; and/or may be adapted to an appropriate maximum and/or minimum amount of vapor, which is to escape and/or sucked from the cavity through said vapor duct.

[0063] It will be immediately understood that also the particular design and/or arrangement of a second fan wheel according to the present invention may be varied and adapted to the oven or parts thereof, for example, the geometry of the cooling chamber, and particularly to the geometry of the vapor duct. A diameter of a second fan wheel , for example, may be configured dependent on a diameter of the vapor duct, particularly if the second fan wheel is positioned at a second end of said vapor duct, particularly if the vapor duct is a tube-shaped vapor duct.

[0064] In a further advantageous embodiment of the inventive oven said vapor duct has a tube-shape.

[0065] Such tube-shape advantageously allows for a chimney-effect, which further supports the sucking of vapor out of the cavity. This is particularly the case, if the vapor duct has is configured and/or arranged as an essentially upright and essentially straight tube-shaped duct, preferably having a cylindrical geometry.

[0066] As used herein, a kitchen oven preferably is selected from the group comprising steam oven, microwave oven, baking oven.

[0067] In an embodiment of the oven according to the present invention, the first fan wheel is configured as a lateral ventilator or cross flow ventilator or axial ventilator.

[0068] The particular design and configuration of such first fan wheel may be chosen by a person skilled in the art dependent on the desired purpose, and particularly with regard to desired oven and/or first fan wheel performance, and/or space available.

[0069] In a preferred embodiment, the oven according to the present invention does not comprise a lateral ventilator or cross flow ventilator.

In a further advantageous embodiment of the inventive oven said second fan wheel is rotatable about an axis element

corresponding to the main axis of the vapor duct, preferably wherein the vapor duct has a tube shape.

[0070] In an embodiment of the oven according to the present invention a second fan wheel, particularly if said second fan wheel is an axial flow fan wheel, may be provided with an axis element, preferably a central axis element, particularly with an axis, preferably a central axis, for rotating the fan wheel around said axis.

[0071] A second fan wheel according to the present invention, preferably an axial flow fan wheel, and particularly such axis element, preferably a central axis element, may be mounted and designed in various ways.

[0072] A second fan wheel according to the present invention may be rotatably mounted on and/or comprise a support structure for supporting said second fan wheel. For example, the cooling chamber and/or the vapor duct may comprise such support structure.

[0073] A central axis element, for example, may be non-rotatably mounted to a lamellar system or impeller blades of said second fan wheel, and may be rotatably mounted on such support structure for supporting said second fan wheel. Alternatively, a central axis element, for example, may be rotatably mounted to a lamellar system or impeller blades of said second fan wheel, and may be non-rotatably mounted on such support structure for supporting said second fan wheel.

[0074] Such support structure may be mounted and/or fixed to the cooling chamber and/or to the vapor duct, particularly to a first or second end, preferably second end, of said vapor duct.

[0075] A support structure may comprise strutting means, for example, selected from the group comprising strut and support; and/or fixation means, for example, selected from the group comprising screw, weld spot and pin; and/or bearing means, for example, selected from the group comprising bearing bushing and plug connection.

[0076] In a further advantageous embodiment of the inventive oven said oven comprises at least one outlet opening for blowing the air and vapors out of the oven, wherein, preferably said at least one outlet opening is arranged at a front side of the oven.

[0077] A front side, as used herein preferably refers to the side of the oven, in a stage where the oven is mounted in place for its intended use, facing a user of the oven.

[0078] Such outlet opening may be advantageously configured and/or arranged to be in fluid connection with the cooling chamber. Advantageously, the mixture of vapor and cooling air may exhaust out of said at least one outlet opening.

[0079] A person skilled in the art will know various designs and arrangements of such outlet opening. For example, the outlet opening may be arranged adjacent to or in a handle of an oven door, advantageously cooling said handle.

[0080] Preferably, such outlet opening is arranged essentially above the cavity, preferably in a horizontal arrangement.

[0081] In an embodiment of the oven according to the present invention, a first fan wheel is manufactured from a material selected from the group comprising plastic and metal, particularly galvanized or zinc-coated metal.

[0082] In an embodiment of the oven according to the present invention, a second fan wheel is manufactured from a heat-resistant material.

[0083] In an embodiment of the oven according to the present invention, a second fan wheel is manufactured from a material, preferably a metal, more preferably selected from the group comprising aluminum, stainless steel, and/or alloys thereof.

[0084] In an embodiment of the oven according to the present invention, a vapor duct is manufactured from a heat-resistant material.

[0085] In an embodiment of the oven according to the present invention, a vapor duct is manufactured from a material, preferably a metal, more preferably selected from the group comprising aluminum, stainless steel, and/or alloys thereof.

[0086] In an embodiment of the oven according to the present invention, a vapor duct comprises at least one filter element and/or catalytic element. Such filter and/or catalytic element may be selected from the group comprising odor filter, particle filter and charcoal filter. Such filter and/or catalytic element may be selected from the group comprising stainless-steel filter.

[0087] Such filter and/or catalytic element advantageously allows improving the vapor escaping the cavity through the vapor duct, and/or the air mixture leaving the oven. Accordingly, the pollution of the cooling chamber and/or the surrounding of the oven may be decreased.

[0088] All described embodiments of the invention have the advantage, that a kitchen oven is provided comprising a cost-, effective and simple, design that allows both an effective cooling and an effective vapor exhaustion. Moreover, a kitchen oven according to the present invention allows for an optimized energy consumption of a combined cooling and vapor exhaust system. Thereby, the condensation and vapors within the cavity of the oven are advantageously reduced.

[0089] 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 schematically side sectional view of a cavity and a cooling chamber showing a first inventive embodiment.

FIG 2A and FIG 2B illustrate a detailed view of a second fan wheel according to the present invention.

[0090] FIG 1 shows schematically side sectional view of the upper part of the cavity 2 of a kitchen oven 1 according to the present invention. The cavity 2 is defied and comprised by several walls, more precisely, a frontal wall 17, usually having a central opening for insertion of cooking products which is usually provided with a front door for opening and closing said central opening, a rear wall 18 and an upper cavity wall 11, as well as two not shown side walls and a bottom wall.

[0091] An oven 1 according to the embodiment shown in Fig. 1 allows for an effective cooling by the cooling air C blown through the cooling chamber 3 (see arrows marked with C in Fig. 1) by the first fan wheel 7. Moreover, said cooling chamber 3 here serves as or comprises a mixing area 18 in which vapors V and cooling air C are mixed together (the flow of the mixture of vapor and cooling air is depicted with arrows marked with "M" in Fig. 1).

[0092] In that the vapor V is mixed with the cooling air C to the mixture M, immediately after being sucked out of the cavity 2, the vapor V is cooled down and neither hot vapor is exhausted by the oven 1, nor unwanted condensation will occur or at least be reduced. This is of particular importance as the vapor V contained within the cavity 2 may probably comprise moisture to a certain extend and may be hot.

[0093] For this purpose, above the upper cavity wall 11 a first fan wheel 7 is arranged, preferably adjacent to a rear part of the upper cavity wall 11.

[0094] Said first fan wheel 7 is provided in a cooling chamber 3, both arranged outside, here above, of the cavity 2. Said cooling chamber 3 is provided as a common duct for the joint discharge of cooling air, the general flow direction of which is marked with arrows "C" and vapors, the general flow direction of which is marked with arrows "V". Here, one vapor duct 4 is provided for realizing a fluid communication between the cavity 2 and the cooling chamber 3, in that said vapor duct 4 is arranged such that its first end 5 is in fluid communication with the cavity 2, and its second end 6 is in fluid communication with said cooling chamber 3. The vapor duct 4 has a tube-shape allowing for a chimney-effect, which supports the sucking of vapor V out of the cavity 2. This is particularly the case, as can be seen from Fig. 1, as the vapor duct is configured and arranged as an essentially upright and straight tube-shaped duct. The second end 6 of the vapor duct 4 is arranged in an outlet area 9 of the first fan wheel 7 such, that a rotational movement of said first fan wheel 7 supports the sucking of the vapors out of the cavity 2.

[0095] Most importantly, however, a second fan wheel 8 is arranged at the second end 6 of said vapor duct 4, more precisely on top of the opening of said vapor duct 4 at the second end 6 of said vapor duct 4. Such kitchen oven 1 is characterized in that said second fan wheel 8 is arranged such that it may be propelled by the stream or flow of air C generated by the first fan wheel 7.

[0096] The first fan wheel 7 is blowing cooling air C along the cooling chamber 3 into the outlet area 9, i.e. the area where air is blown to; thereby a rotating movement of said first fan wheel 7 supports the sucking of the vapors V out of the cavity 2. Moreover, the second end 6 of the vapor duct 4, and thus the second fan wheel 8 is arranged, at least partially, in said outlet area 9. Accordingly, the second fan wheel 8 is propelled by the stream or flow of air C generated by the first fan wheel 7. Because of the advantageous design of the second fan wheel 8, the second fan wheel 8 rotates and provides a sucking effect, which sucks moisture and vapor V out of the vapor duct 4 and out of the cavity 2. This is further assisted by an injector effect, which is provided by the blowing air C striving the opening of the vapor duct 4 at its second end 6. This, preferably is the case as the second end 6 and the opening and the respective opening of the vapor duct 4 is designed and arranged such that the air blown or pulled by the fan wheel strives said second end 6 and respective opening and due to an injector effect an under pressure in the vapor duct 4 is achieved and/or strengthened which supports the sucking of the vapors out of the cavity 2. This particularly is of advantage in that the performance of the second fan wheel 8, here an axial flow fan wheel 8 having dome-shape, is supported. Accordingly, the sucking is either more effective, or having the same effect at a reduced performance.

[0097] As may be seen from Fig 1, the second end 6 of the vapor duct 4 may protrude into the cooling chamber 3, and/or the first end 5 of the vapor duct 4 may protrude into the cavity 2. Such protrusion may advantageously allow supporting and/or mounting the vapor duct 4, and/or the second fan wheel 8, particularly by supporting means, e.g. welding spots, or the like. Such support structures and/or protrusion is preferably designed and/or arranged such that the sucking of vapor V out of the cavity 2 and through the vapor duct 4 is not significantly influenced. Here, the vapor duct 4 is mounted and fixed to the upper cavity wall 11, by screws, surrounding the lower opening of said vapor duct 4 at its first end 5, said first end 5 forming a bend circulating edge.

[0098] The axial flow fan wheel 8 is of particular advantage as only low or moderate pressure differences are achieved according to the present inventions purpose, however a rather high volume is to be transported in order to remove vapors V from the cavity 2.

[0099] Here the first fan wheel 7 is a radial flow fan wheel designed and arranged such that, an air influx is an axial air influx and air efflux is a radial air efflux. However, a first fan wheel 7 may also be designed and/or arranged as an axial flow fan wheel, depending on the particular arrangement and space restriction. The radial flow fan wheel 7 is arranged within a spiral housing 16 and comprises several impeller blades with forward-curved blade geometry.

[0100] It will be immediately understood that the axial flow fan wheel 8 advantageously supports the sucking of vapor out of the cavity 2. This is, as the first fan wheel 7 performs such sucking effect by the arrangement of the vapor duct 4

as shown in Fig. 1, in that an injector effect of the first fan wheel 7 sucks vapor V out of the cavity 2 and through the vapor duct 4; Thereby, the axial flow fan wheel 8 supports said effect and adds to the performance of the first fan wheel 7 in that its rotational movement generates and strengthens an under pressure within the vapor duct 4 and within the cavity 2 and sucks out the vapor V. It is important to note that in such configuration, both fan wheels may act together and support the function of sucking the vapor V out of the cavity 2, whereas the second fan wheel 8 is substantially propelled and driven by the airflow C generated by the first fan wheel 7.

[0101] As may be taken from Fig. 1 the vapor duct 4 at its first end 5 is connected to an opening 10 in an upper wall 11 of the cavity 2 and the cooling chamber 3 is arranged above said upper wall 11 of the cavity 2.

[0102] In the embodiment shown in Fig. 1 the first fan wheel 7 is driven by a first driving means 12, here an infinitely adjustable AC motor and the axial flow fan wheel 8 is driven substantially by the airflow C generated by the first fan wheel 7. It will be understood by a person skilled in the art that providing an AC motor, particularly having 1 or 2 different rotational speeds, as a first driving means, may be advantageous with regard to cost-effectiveness. Alternatively, a DC motor may be applied, advantageously allowing a more precise regulation of the air streams and airflows.

[0103] In that no further driving means is needed for driving the second fan wheel 8, advantageously a more compact design of a combined cooling and vapor exhaust system is made possible and energy consumption is also reduced.

[0104] The oven 1 shown in Fig. 1 comprises at least one outlet opening 14 for blowing the mixture M of air and vapors out of the oven 1. It can be immediately seen that said outlet opening 14 is arranged at a front side 15 of the oven 1 essentially above the cavity 2 and is in fluid connection with the cooling chamber 3 and thus the mixture M of vapor V and cooling air C can exhaust out of said at least one outlet opening 14.

[0105] The vapor duct 4, here serves as a tube-shaped extension out of the cavity 2 and on top of the extension, a second fan wheel 8 is provided as a rotating mechanism. This mechanism is propelled by the cooling airflow C. The rotating movement of the mechanism supports the sucking of the vapors V out of the cavity 2.

[0106] The axial flow fan wheel 8 is arranged such that it is rotatable about an axis element 19 corresponding to the main axis "a" of the vapor duct 4, here being upright tube-shaped, such that it is capable of generating a negative pressure within the vapor duct 4 and the cavity 2 and thus sucking air and vapors V out of the cavity 2 and into the vapor duct 4, from where it enters the cooling chamber 3. The vapor V is than taken away by the cooling air flow C and is mixed with the cooling air C in the mixing area 18. This is particularly shown by the arrows marked with V, C and M in Fig. 1. Vapor V is sucked out of the cavity 2, when the second fan wheel 8 is performing its rotational movement.

[0107] The mixture M is finally released to the surrounding of the kitchen appliance 1.

[0108] Figs 2A and 2B illustrate more detailed views of said second fan wheel according to the first embodiment shown in Fig 1.

[0109] In Fig 2A, a part of the lamellar system 20 of said second fan wheel 8 is depicted as cut out for better understanding and to allow the view on the central axis element 19. In Fig 2B, the second fan is shown mounted on the second end of the vapor duct 4.

[0110] As may be best seen from Fig 2A, the axis element 19 is a central axis element 9 with an axis "a" for rotating the fan wheel 8 around said axis "a". The second fan wheel 8 is rotatably mounted on a support structure 21 for supporting said second fan wheel 8. As may be best seen from Fig 2B also the vapor duct 4 comprises such support structure 21.

[0111] In the shown embodiment, the central axis element 19is non-rotatably fixed to the lamellar system 20 of said second fan wheel 8, and rotatably mounted on the support structure 21 for supporting said second fan wheel 8. Accordingly, a rotational movement of the lamellar system with the second axis element 19 of said second fan wheel 8, around said central axis "a", is facilitated.

[0112] The support structure 21 may be mounted and/or fixed to the cooling chamber 3 and/or to the vapor duct 4, as may be seen, for example from Fig 2B, particularly to the second end 6 of the vapor duct 4.

[0113] Such support structure 21 may comprise strutting means 21a and supports 21b for stabilizing the lamellar system 20 and/or the axis element 19. Additionally or alternatively such support structure 21 may comprise fixation means, for example a screw, particularly a wing screw, and threaded rod, weld spots or clamping means, e.g. clamping protrusions, for mounting and/or assembling of a second fan wheel 8, as well as bearing means, for example a bearing bushing for rotational mounting of a central axis element 19. In the shown embodiment a second fan wheel 8 may be mounted directly to the vapor duct 4, e.g. by screws or weld spots.

[0114] In the shown embodiment the second fan wheel 8 is configured and/or arranged such that to drive the second fan wheel 8 no driving means, besides a stream or flow of air C generated by the first fan wheel 7 and/or a stream or flow of vapor V through the vapor duct 4 out of the cavity 2, for example, due to a chimney effect and/or an overpressure within the cavity 2, is necessary. It is to be understood that here the second fan wheel 8 is designed and/or configured as a driving means-less driven fan wheel and/or a self-rotating fan wheel. Accordingly, escape of vapor V out of the cavity 2 through the vapor duct 4 generates a self-rotational movement of the second fan wheel 8 around its central axis "a". However, an airflow C generated by said first fan wheel 7 generates a self-rotational movement of the second fan wheel 8. A self-rotational movement of said second fan wheel 8 advantageously support and/or generates a sucking effect for sucking vapor out of the cavity 2, and particularly out of the vapor duct 4. Advantageously, the second fan

wheel 8 comprising the lamellar system 20 is configured and arranged such, that an undesired entering of air C from the cooling chamber 3, particularly of an airflow C generated by the first fan 7, is advantageously prevented. The lamellar system 20 preferably is configured such that said lamellar system 20 upon rotation of the second fan wheel 8 shovels vapor V out of the vapor duct 4. This particularly is possible, as the second fan wheel 8 is configured such that the airflow C generated by the first fan wheel 7 and/or a vapor stream or flow V out of the vapor duct 4 is sufficient for self-rotation of the second fan wheel 8 around its central axis "a".

[0115] The second fan wheel 8 according to the shown embodiment comprises a lamellar system 20 and is configured and/or arranged such that the self-rotational velocity of a rotational movement of the second fan wheel 8 around its central axis "a" increases with an increase of airflow C generated by the first fan wheel 7 and/or the vapor stream or flow V out of the vapor duct 4. Accordingly, the second fan wheel 8 automatically adapts its rotational movement to the stream or flow velocity and/or the stream or flow volume generated by the first fan wheel 7 and/or the vapor stream or flow out of the vapor duct 4. The self-rotating fan wheel 8 as shown in the Figs 1, 2A and 2B, comprising lamellae 20is configured such that a self-rotating movement of said second fan wheel 8 around its central axis "a" is substantially caused by the airflow C generated by the first fan 7, impinging on the lamellae of the lamellar system 20.

[0116] Accordingly, such self-rotating second fan wheel 8 may rotate independent from an external energy source, despite the airflow C generated by the first fan wheel 7 and/or vapor V escaping the oven cavity 2 through the vapor duct 4.

[0117] Such self-rotating fan wheel according to the present invention advantageously prevents an undesired loss of energy in that the escape of an undesired high amount vapor and/or heat out of the cavity may be prevented.

[0118] 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

[0119]

1	kitchen oven
2	cavity
3	cooling chamber
4	vapor duct
5	first end of vapor duct
6	second end of vapor duct
7	first fan wheel
8	second fan wheel
9	outlet area
10	opening
11	upper cavity wall
12	first driving means
14	outlet opening
15	front side of the oven
16	spiral housing
17	frontal wall of cavity
18	mixing area
19	axis element
20	lamellae, lamellar system
21	support structure
21a	strut
21b	support
21f	bearing bushing

C	cooling airflow
V	Vapor and moisture stream
M	stream of mixture of vapor and moisture
a	axis of vapor duct

Claims

1. A kitchen oven (1), comprising a cavity (2) and a cooling chamber (3) arranged outside of the cavity (2) and provided

as a common duct for the joint discharge of cooling air and vapors, and
at least one vapor duct (4) for realizing a fluid communication between the cavity (2) and the cooling chamber (3), in that
said vapor duct (4) is arranged such that
its first end (5) is in fluid communication with the cavity (2), and
its second end (6) is in fluid communication with said cooling chamber (3),
said kitchen oven (1), particularly said cooling chamber (3), further comprising a first fan wheel (7) for generating a stream or flow of air (C) capable of blowing air and vapors out of the cooling chamber (3), and a second fan wheel (8) arranged at the second end (6) of said vapor duct (4)
characterized in that
said second fan wheel (8) is arranged such that it is drivable by the stream or flow of air (C) generated by the first fan wheel (7).

2. The oven (1) according to claim 1, wherein the second end (6) of the vapor duct (4) is arranged in an outlet area (9) of the first fan wheel (7), preferably such, that a rotating movement of said first fan wheel (7) supports the sucking of the vapors out of the cavity (2).

3. The oven (1) according to any one of claims 1 or 2, wherein the first fan wheel (7) is a radial flow fan wheel or an axial flow fan wheel.

4. The oven (1) according to any one of claims 1 to 3, wherein the second fan wheel (8) is an axial flow fan wheel.

5. The oven (1) according to any one of claims 1 to 4, wherein the second fan wheel (8) is a dome-shaped fan wheel.

6. The oven (1) according to any one of claims 1 to 5, wherein the vapor duct (4) at its first end (5) is connected to an opening (10) in an upper wall (11) of the cavity (2) and/or wherein the cooling chamber (3) is arranged above said upper wall (11) of the cavity (2).

7. The oven (1) according to any one of claims 1 to 6, wherein the first fan wheel (7) is driven by a first driving means (12), and the second fan wheel (8) is an external driven fan wheel (8), preferably a driving means-less driven and/or self-rotating fan wheel.

8. The oven (1) according to any one of claims 1 to 7, wherein the first driving means (12) is selected from the group comprising a motor, preferably an infinitely adjustable motor, more preferably selected from the group comprising AC motor and DC motor.

9. The oven (1) according to any one of claims 1 to 8, wherein the vapor duct (4) has a tube-shape.

10. The oven (1) according to any one of claims 1 to 9, wherein the second fan wheel (8) is rotatable about an axis element (19) corresponding to the main axis (a) of the vapor duct (8), preferably wherein the vapor duct (4) has a tube shape.

11. The oven (1) according to any one of claims 1 to 10 comprising at least one outlet opening (14) for blowing the air and vapors out of the oven (1), wherein, preferably said at least one outlet opening (14) is arranged at a front side (15) of the oven (1).

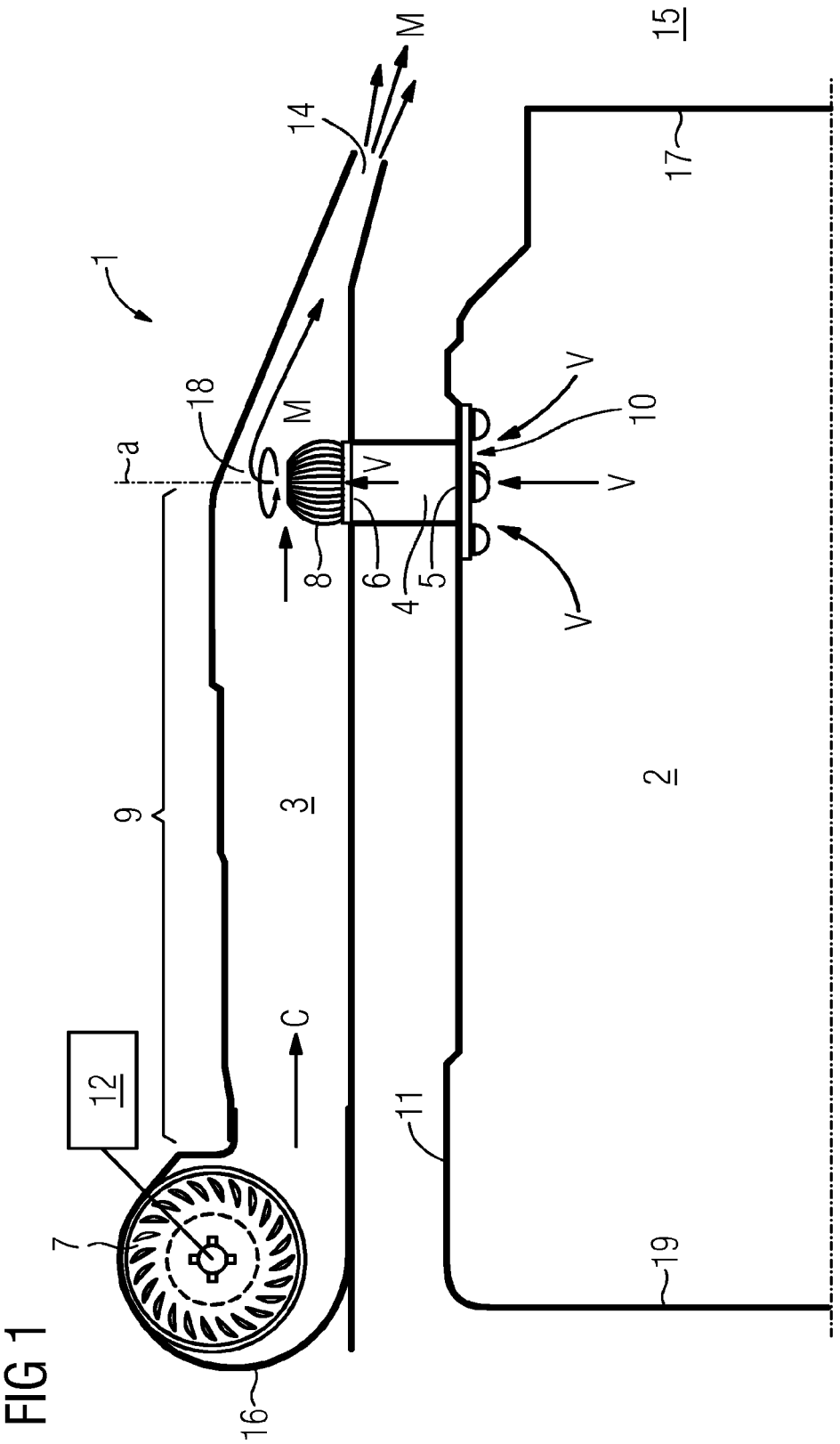


FIG 1

FIG 2A

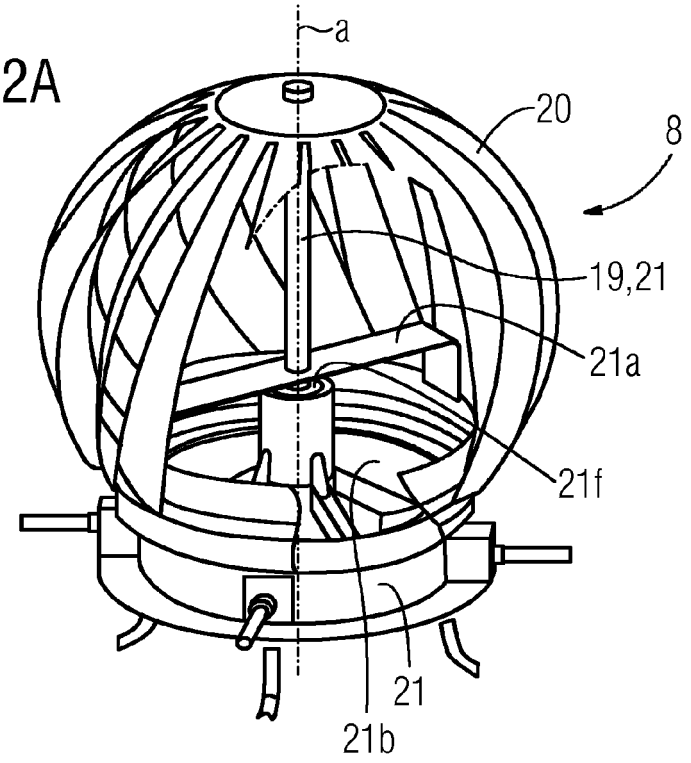
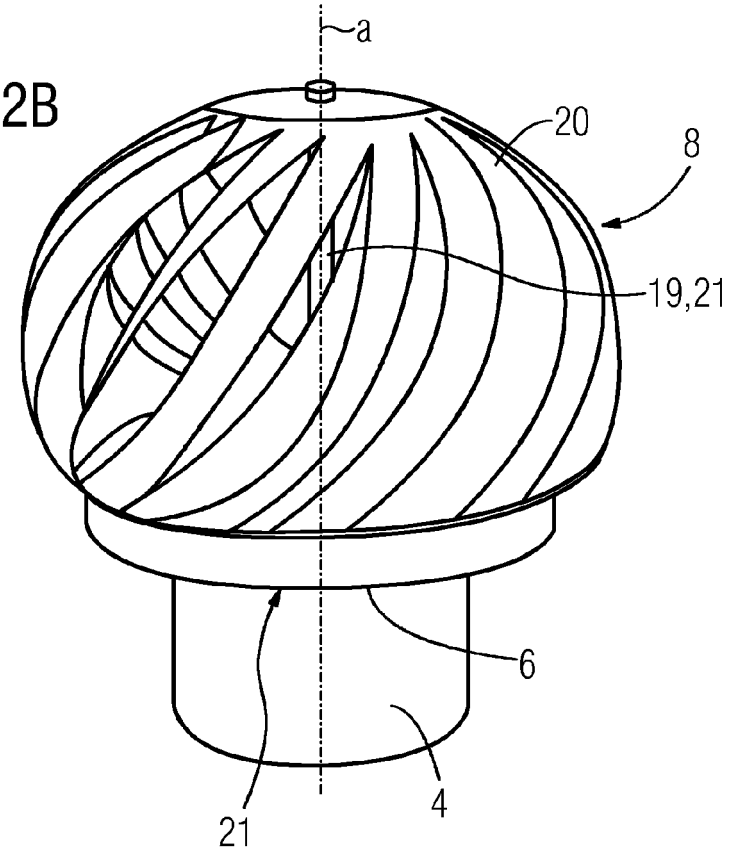


FIG 2B



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 14 19 0099

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 87 06 668 U1 (BOSCH SIEMENS HAUSGERAETE [DE]) 2 July 1987 (1987-07-02) * page 3, last paragraph - page 4, paragraph 1; figures *	1-11	INV. F24C15/20
A	DE 93 09 989 U1 (BOSCH SIEMENS HAUSGERAETE [DE]) 23 September 1993 (1993-09-23) * page 4, line 10 - line 18; figures *	1	
A	EP 0 942 235 A1 (BOSCH SIEMENS HAUSGERAETE [DE] BSH BOSCH SIEMENS HAUSGERAETE [DE]; MVL) 15 September 1999 (1999-09-15) * abstract; figure 1 *	1	
A	EP 1 041 346 A2 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 4 October 2000 (2000-10-04) * paragraphs [0011], [0012] *	1	
			TECHNICAL FIELDS SEARCHED (IPC) F24C H05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18 May 2015	Verdoodt, Luk

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 19 0099

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

18-05-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 8706668 U1	02-07-1987	NONE	
DE 9309989 U1	23-09-1993	NONE	
EP 0942235 A1	15-09-1999	EP 0942235 A1	15-09-1999
		EP 0949457 A1	13-10-1999
		ES 2184362 T3	01-04-2003
		ES 2210875 T3	01-07-2004
EP 1041346 A2	04-10-2000	AT 408098 T	15-09-2008
		DE 19915457 A1	12-10-2000
		EP 1041346 A2	04-10-2000

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 0926448 B1 **[0005]**