

EXHAUST APPARATUS FOR COOKING APPLIANCE AND COOKING METHOD

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The present invention relates to an exhaust apparatus for a cooking appliance and a cooking method.

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In recent years, in convenience stores, supermarkets, department stores, and the like, a cooking appliance is installed in a floor inside a store or the like, and freshly cooked food is served (or sold) to a customer.

Such cooking inside a store may require preventing an odor or the like generated during cooking from wafting inside the store.

As a conventional technique, JP 6-74507 A proposes a cooking apparatus which covers the periphery of a cooking appliance and exhausts air inside a space (cooking chamber) including an open part closed with a door. In the cooking apparatus, after the door is closed, no odor leaks to the outside through the open part, and an odor generated inside is discharged to the outside.

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However, in the conventional technique, the fan is

continuously operated. Thus, the conventional technique does not take into consideration energy saving which has been strongly demanded in recent years.

[0006]

5 Thus, it is an object of the present invention to provide an exhaust apparatus for a cooking appliance that is capable of reducing wafting of an odor inside a room where a cooking appliance is installed and also responding to the demand for energy saving, and a
10 cooking method using the exhaust apparatus for a cooking appliance.

[0007]

 The inventors of the present invention have made earnest studies to solve the above problem, and have
15 found out that an energy saving effect can be obtained by controlling a fan corresponding to an open/closed state of a door which is disposed on a cooking chamber and made the present invention.

[0008]

20 Specifically, the present invention provides an exhaust apparatus for a cooking appliance including: a cooking chamber which houses a cooking appliance inside; a door installed in or on the cooking chamber; a fan connected to an exhaust duct for exhausting air inside
25 the cooking chamber to inside or outside of a room in which the cooking chamber is placed; and a control unit that changes an operation of the fan corresponding to an open/closed state of the door.

[0009]

30 According to the present invention, it is possible to prevent an odor from wafting from the cooking chamber while the door is in a closed state. Further, the

operation of the fan is changed corresponding to the open/closed state of the door. Thus, it is possible to reduce power consumption compared to the case where the fan is continuously operated with a constant air volume
5 in order to exhaust the odor.

BRIEF DESCRIPTION OF DRAWINGS

[0010]

Fig. 1 is a front view of an exhaust apparatus for cooking appliance of a first embodiment.
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Fig. 2 is a perspective view of the exhaust apparatus for cooking appliance of the first embodiment.

Fig. 3 is a sectional view of the exhaust apparatus for cooking appliance of the first embodiment.

Fig. 4 is a sectional view illustrating an example in which the exhaust apparatus for cooking appliance is disposed for indoor circulation.
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Fig. 5 is a sectional view illustrating an example in which the exhaust apparatus for cooking appliance is disposed for outdoor exhaust.
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Fig. 6 is a circuit diagram for performing control in a first control example.

Fig. 7 is a circuit diagram for performing control in a second control example.

Fig. 8 is a circuit diagram for performing control in a third control example.
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Fig. 9 is a front view of an exhaust apparatus for cooking appliance of a second embodiment.

Fig. 10 is a sectional view of the exhaust apparatus for cooking appliance of the second embodiment.
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Fig. 11 is a circuit diagram for performing control in a fourth control example.

Fig. 12 is a sectional view of an exhaust apparatus for cooking appliance of a third embodiment.

Fig. 13 is a block diagram for describing control in a fifth control example.

5 Fig. 14 is a front view of an exhaust apparatus for cooking appliance of a fourth embodiment.

Fig. 15 is a sectional view of the exhaust apparatus for cooking appliance of the fourth embodiment.

10 Fig. 16 is a block diagram for describing a control system in a sixth control example.

Fig. 17 is a flowchart illustrating a control procedure in the sixth control example.

Fig. 18 is a block diagram for describing a control system in a seventh control example.

15 Fig. 19 is a flowchart illustrating a control procedure.

Fig. 20 is a sectional view of an exhaust apparatus for cooking appliance of a sixth embodiment.

20 Fig. 21 is a sectional view of an exhaust apparatus for cooking appliance of a seventh embodiment.

Fig. 22 is a sectional view of an exhaust apparatus for cooking appliance of an eighth embodiment.

DESCRIPTION OF EMBODIMENTS

25 [0011]

Hereinbelow, embodiments of the present invention will be described in detail with reference to the drawings. However, the present invention is not limited only to the following embodiments. Note that each
30 drawing is exaggerated for convenience of description, and dimensional ratios of elements in each drawing may differ from actual ratios. Further, in description of

the embodiments of the present invention with reference to the drawings, identical elements are designated by identical reference numerals, and redundant description is omitted.

5 [0012]

[First Embodiment]

<Exhaust apparatus for cooking appliance>

Fig. 1 is a front view of an exhaust apparatus for a cooking appliance of a first embodiment. Fig. 2 is a perspective view of the exhaust apparatus for the cooking appliance of the first embodiment. Fig. 3 is a sectional view of the exhaust apparatus for the cooking appliance of the first embodiment.

[0013]

15 An exhaust apparatus for a cooking appliance 101 of the first embodiment includes a base 11, a cooking chamber 12, which is disposed on the base 11, and a fan 20, which is disposed in an upper part of the cooking chamber 12.

20 [0014]

The cooking chamber 12 is a space which is covered with a front panel 13a with a door 14, side panels 13b (both sides), a back panel 13c, and a ceiling board 13d. The front panel 13a covers only a part in which the fan 20 is disposed, and a lower part is open. The door 14 is openably/closably attached to the open part. Each of the side panel 13b, the back panel 13c, and the ceiling board 13d is connected to a housing (described later) of the fan 20 with no gap therebetween. An indicator lamp 18, which indicates an operating state of the fan 20, is disposed on the front panel 13a. Further, an alarm lamp 18e, which indicates a malfunction of the exhaust

apparatus for cooking appliance 101, is also disposed on the front panel 13a (the same applies to the other embodiments). A case example in which the alarm lamp 18e is turned on includes a case where an operation different from control details has been detected, such as a case where the fan 20 is not brought into operation even though the door 14 has been opened, a case where the fan 20 does not come to a stop even though the door 14 has been closed, or the like.

10 [0015]

The door 14 slides up and down inside the front panel 13a. The door 14 is opened by being manually lifted with a handle 15 and closed by being manually lowered with the handle 15. A gasket 16 is disposed on the lower end of the door 14. The gasket 16 increases airtightness inside the cooking chamber 12 when the door 14 is closed and lessens an impact caused by closing the door 14. For example, an elastic member, such as rubber, resin, or the like, can be used as the gasket 16, and the gasket 16 is preferably heat resistant and fire resistant.

[0016]

The fan 20 is disposed in the upper part the cooking chamber 12. The fan 20 exhausts air inside the cooking chamber 12. The illustrated fan 20 includes a motor 21, a sirocco fan 22, and a housing 35 in which the motor 21 and the sirocco fan 22 are housed. In the fan 20, the sirocco fan 22 is attached to a shaft of the motor 21, and the sirocco fan 22 is rotated by the rotation of the motor 21, thereby drawing in air inside the cooking chamber 12 and exhausting the air through an exhaust port 23. The fan 20 is not limited to such a

structure. For example, a propeller fan may be used in the fan. Further, the housing 35 may not be dedicated to the fan, and may serve as a part of the side panel 13b, the back panel 13c, the ceiling board 13d inside the cooking chamber 12, or the like.

[0017]

The fan 20 generates an air current for exhausting air inside the cooking chamber 12. A grease filter 30 is disposed on the upstream side in the air current relative to the fan 20 in the upper part of the cooking chamber 12, and covers an intake port of the fan 20. The grease filter 30 roughly removes oils and fats in air drawn in by the fan 20 and also prevents the fan 20 from drawing in large dirt or the like.

[0018]

Various filters are attached to the exhaust port 23 on the downstream side of the fan 20 to cover the exhaust port 23. An air filter 31, which removes fine dust or dirt, a deodorization filter 32, which removes an odor, a smoke removal filter 33, which removes smoke, and an oil adsorption filter 34, which removes oil, are disposed in this order from the top. Although all the four filters are preferably attached, all the four filters are not necessarily required. For example, in order to prevent an odor from a food material or the like during, before, or after cooking from being discharged into exhausted air, only the deodorization filter 32 is required.

[0019]

Although these filters are disposed on the downstream side of the fan 20, the position of these filters is not limited to this position. The various

filters may be disposed, for example, on the upstream side of the fan 20 (e.g., the part in which the grease filter is disposed).

[0020]

5 A shutter 25, which closes the exhaust side, is disposed on the downstream side of the various filters. The exhaust side inside the cooking chamber 12 is closed by closing the shutter 25. The shutter 25 may be an electric shutter, or may be opened and closed by an air
10 current. In the case where the shutter 25 is an electric shutter, the shutter 25 is opened and closed in response to a signal from a control unit 50 (described later). In the case where the shutter 25 is a shutter opened and closed by an air current, the shutter 25 is opened by
15 the pressure of the air current when the fan 20 is started and closed by the own weight of the shutter 25 when the fan 20 comes to a stop and the air current becomes nonexistent. Thus, the shutter 25 which is opened and closed by the air current is opened when the
20 fan 20 is started and closed when the fan comes to a stop.

[0021]

 A fire alarm 41 and a fire extinguisher 42 are disposed on the ceiling board 13d of the cooking chamber
25 12 at the side facing the cooking chamber 12. The fire alarm 41 detects fire and issues an alarm. The fire extinguisher 42 operates in conjunction with the fire alarm 41, and a fire extinguishing agent is sprayed at the instant when the fire alarm 41 issues an alarm. The
30 fire extinguisher 42 is connected to a fire extinguishing agent tank 43, which is disposed on the back side of the ceiling board 13d when viewed from the

cooking chamber 12 (above the ceiling), and sprays the fire extinguishing agent toward the inside of the cooking chamber 12. Since the door 14 is attached to the exhaust apparatus for cooking appliance 101, the inside
5 of the cooking chamber 12 is out of sight when the door 14 is in a closed state. Thus, the fire alarm 41 and the fire extinguisher 42 are provided in preparation for the event of fire inside the cooking chamber 12.

[0022]

10 Further, the fan 20 may be stopped, for example, at the instant when the fire alarm 41 issues an alarm. For example, the fan 20 is forcibly stopped by, for example, turning off a main switch or a breaker included in the exhaust apparatus for cooking appliance 101. Further,
15 when an electric shutter is used as the shutter 25, the control unit 50 stops the fan 20 and also closes the shutter 25. The electric shutter is biased in the closing direction by a biasing force, and the shutter is electrically brought into an open state against the
20 biasing force when the fan is started. In this case, the shutter is brought into a closed state by the biasing force when power is lost. Further, a backup battery for operating the electric shutter when power is lost may be provided. Accordingly, if a fire breaks out inside the
25 cooking chamber 12, it is possible to prevent or reduce leakage of fire and smoke to the outside of the cooking chamber 12 through an exhaust duct.

[0023]

30 The fire alarm 41 and the fire extinguisher 42 may not be provided. However, as described above, due to the structure in which the inside of the cooking chamber 12 is out of sight, at least the fire alarm 41 is

preferably provided.

[0024]

The control unit 50 is disposed on the top of the housing 35, which covers the fan 20, in a part above the ceiling when viewed from the cooking chamber 12. An open/close sensor 51 is attached to a part where the door 14 and the base 11 come into contact with each other. The open/close sensor 51 is connected to the control unit 50 through a signal line.

10 [0025]

The control unit 50 operates the fan 20 in accordance with a signal of the open/close sensor 51. Control details will be described later. A circuit board and the like of the control unit 50 are preferably housed in a control box and fixed to the top of the housing 35. The control unit 50 (or the control box) is disposed at this position in order to facilitate wiring between the control unit 50 and the fan 20 at the time of construction by placing the control unit 50 near the fan 20. Further, for example, the fan 20 can use, for example, an existing range hood as the housing 35 in its entirety. In this case, since the control unit 50 is present inside the housing 35 of the existing range hood, such a position is achieved. It is needless to say that the position of the control unit 50 is not limited to such a position, and the control unit 50 may be disposed at any position.

25 [0026]

The open/close sensor 51 detects an open/closed state of the door 14. The door 14 is opened and closed by moving up and down. Thus, the open/close sensor 51 detects that the door 14 is in a closed state when the

lower end of the door 14 is in contact with the base 11 and detects that the door 14 is in an open state when the lower end of the door 14 is not in contact with the base 11. At the point in time when a signal from the open/close sensor 51 transitions from "closed" to "open" is defined as the point in time when the door 14 starts to open. However, not limited thereto, when the door in a completely closed state moves in the opening direction, the point in time when the open/close sensor first detects the action of the door may be defined as the start of opening of the door.

[0027]

Although, in the drawings, the open/close sensor 51 is disposed at the position easy to understand for description, the open/close sensor 51 may be located at any position where the open/close sensor 51 can detect the opening and closing of the door 14 in actuality. In particular, the open/close sensor 51 can be disposed in a part above the ceiling of the cooking chamber 12 depending on the structure or the like of the open/close sensor 51 to be used, which facilitates wiring with the control unit 50.

[0028]

For example, a switch which is turned off (or on) when the lower end of the door 14 comes into contact with the base 11 and turned on (or off) when the lower end of the door 14 is separated from the base 11 can be used as the open/close sensor 51.

[0029]

Although details will be described later, a full-open sensor 52, which detects that the door 14 has become fully open, may be provided depending on the

control details.

[0030]

For example, a switch which is turned on (or off) when the upper end of the door 14 comes into contact with a position with which the upper end of the door 14 should come into contact when the door 14 is fully open and turned off (or on) when the upper end of the door 14 is separated from the position can be used as the full-open sensor 52.

10 [0031]

In addition to the switches as described above, for example, an optical sensor, a magnetic sensor, a proximity sensor, and the like can be used as the open/close sensor 51 and the full-open sensor 52.

15 Further, a roller or a gear may move following the movement of the door 14, and the open/closed state of the door 14 may be detected from the amount of movement of the roller and the gear or the like. In the case of such an open/close sensor (opening degree sensor) using
20 the roller, gear, or the like, the opening degree of the door 14 (the open amount of the door) can also be obtained. Control details using the opening degree will be described later.

[0032]

25 A cooking appliance 200 is housed inside the cooking chamber 12. As the cooking appliance 200, for example, an automatic fryer, a roaster, a rice cooker, a cooking pot for boiled dishes, or various cooking robots may be housed. In each drawing, an example of the
30 automatic fryer is illustrated.

[0033]

Although the first embodiment describes the

structure in which the cooking appliance 200 (the automatic fryer) is placed on the base 11, the structure is not limited to such a mode. For example, in the case of the automatic fryer, a structure in which an oil pan part is embedded inside the base 11(lower side) may be employed. Also in the case of another cooking appliance 200, a structure in which the whole or a part thereof is embedded inside the base 11 may be employed.

[0034]

Further, although not illustrated, a main switch, a breaker, or the like for turning on and off power to the exhaust apparatus for cooking appliance 101 may be provided (the same applies to the other embodiments).

[0035] <Installation Example>

The exhaust apparatus for cooking appliance 101 can be provided for both indoor circulation which circulates air exhausted from the cooking chamber 12 into a room and outdoor exhaust which exhausts air exhausted from the cooking chamber 12 to the outside of the room. The exhaust apparatus for cooking appliance 101 is installed inside the room where cooking is performed using the cooking appliance 200 inside the cooking chamber 12. The room to be an installation place is, for example, a store, such as a convenience store, a supermarket, a drug store, a restaurant or a department store, an exhibition hall, or the like.

[0036] (Indoor Circulation Example)

Fig. 4 is a sectional view illustrating an example in which the exhaust apparatus for cooking appliance is disposed for indoor circulation.

[0037]

As illustrated in Fig. 4, when the exhaust

apparatus for cooking appliance 101 is disposed for indoor circulation, an exhaust duct 501 for indoor circulation is connected to the exhaust port 23 of the fan 20. The exhaust duct 501 for indoor circulation is disposed in a part above the ceiling of the cooking chamber 12, and air is exhausted into the room from the upper part of the front panel 13a. Thus, an exhaust port 502 to which the exhaust duct 501 is connected is disposed in the upper part of the front panel 13a.

10 [0038]

In the case of indoor circulation, air from the cooking chamber 12 is exhausted into the room where the exhaust apparatus for cooking appliance 101 in which the cooking appliance 200 is housed is installed. An odor from the cooking chamber 12 is removed by the deodorization filter 32. Thus, in the indoor circulation, it is possible to prevent or reduce wafting of an odor from the cooking chamber 12 into the room.

[0039]

20 Further, in the case of indoor circulation, air cooled or heated inside the room where the exhaust apparatus for cooking appliance 101 is installed is not released to the outside of the room, but returns into the room as it is. In this manner, in the case of indoor circulation, an air conditioning energy loss can be reduced. Thus, energy saving can be achieved as the entire room where the cooking chamber 12 is placed.

[0040]

30 Although, in this example, the exhaust apparatus for cooking appliance 101 is placed along a wall 500, the exhaust apparatus for cooking appliance 101 may be placed away from the wall 500. Further, the exhaust duct

501 may exhaust air not from the front face, but from the side face or the back face, or may exhaust air upward.

[0041] (Outdoor Exhaust Example)

5 Fig. 5 is a sectional view illustrating an example in which the exhaust apparatus for cooking appliance is disposed for outdoor exhaust.

[0042]

10 As illustrated in Fig. 5, when the exhaust apparatus for cooking appliance 101 or the like is disposed for outdoor exhaust, an exhaust duct 503 for outdoor exhaust is connected to the exhaust port 23 of the fan 20. In order to directly exhaust air to the outside of the room, the exhaust duct 503 extends to the
15 outside through a facility port or the like which is disposed on the wall 500 or the like in the room where the exhaust apparatus for cooking appliance 101 is installed.

[0043]

20 In the case of outdoor exhaust, air from the cooking chamber 12 is exhausted to the outside of the room where the exhaust apparatus for cooking appliance 101 in which the cooking appliance 200 is housed is installed. Thus, in the case of outdoor exhaust, it is
25 possible to prevent or reduce wafting of an odor from the cooking chamber 12 into the room.

[0044]

30 In the case of outdoor exhaust, although the various filters including the lock unit 32 may not be provided, in particular, when air is exhausted to the outside of the room, these filters are preferably provided for consideration for neighbors.

[0045]

Further, also in the outdoor exhaust, the exhaust apparatus for cooking appliance 101 may be placed away from the wall 500. However, in the outdoor exhaust, it is necessary for the exhaust duct 501 to be connected to the facility port or the like on the wall surface so that exhausted air is released to the outside of the room.

[0046]

10 <Control Examples>

As control examples, the open/closed state of the door 14 and control of the fan 20 corresponding to the open/closed state of the door 14 will be described.

[0047]

15 (First Control Example)

A first control example is a control example in which the fan 20 is kept stopped when the door 14 is in a closed state and operated with a certain air volume after the door 14 starts to open.

20 [0048]

Fig. 6 is a circuit diagram for performing the control in the first control example.

[0049]

The first control example has a simple configuration in which a single-phase AC motor M (AC) is used as the motor 21 of the fan 20, and, for example, a b-contact push button switch is used as the open/close sensor 51. Thus, in the first control example, the switch of the open/close sensor 51 also serves as the control unit 50. A capacitor C for determining a rotation direction is connected to the single-phase AC motor. In the first control example, the full-open

sensor 52 may not be provided.

[0050]

In the first control example, the b-contact push button switch is connected to one of wires which connect
5 the motor 21 and an AC power supply AC (e.g., a 100 V commercial power supply). Further, an indicator lamp 18 is connected between the motor 21 and the AC power supply AC. The indicator lamp 18 is turned on when electricity flows through the wires between the motor 21
10 and the AC power supply.

[0051]

The b-contact push button switch is disposed at a position interposed between the lower end of the door 14 and the base 11. When the door 14 is closed, a button of
15 the push button switch is pressed, and the push button switch is thereby turned off. When the door 14 is slightly opened, and the lower end of the door 14 is separated from the base 11, the button returns to its original position, and the push button switch is thereby
20 turned on. At the point in time when the switch (a signal from the open/close sensor 51) transitions from "off" to "on" is the start of opening of the door 14.

[0052]

The switch of the open/close sensor 51 is turned on
25 when the door 14 is opened. The motor 21 starts to rotate at the instant when the switch is turned on, and the exhaust of air by the fan 20 is started. At this time, the air volume of the fan 20 is set so that an air velocity in an open part formed by the door 14 is 0.2
30 m/s or higher when the door 14 is fully open. For example, the air velocity in the open part is preferably 0.2 m/s or higher at all measurement points on a plane

in the open part (the same applies to the other following examples). With such an air velocity, when the door 14 is in an open state (after the door 14 starts to open), it is possible to prevent or reduce odor leakage
5 caused by opening the door 14.

[0053]

In the first control example, when the door 14 is in a closed state, the motor 21 does not operate. That is, when the door 14 is in a closed state, the operation
10 of the fan 20 is stopped. Thus, when it is not necessary to touch a food material and the cooking appliance 200 inside the cooking chamber 12 during cooking or the like, power supply to the fan 20 can be stopped by keeping the door 14 closed. Accordingly, it is possible to reduce
15 power consumption compared to a conventional apparatus that continuously operates a fan.

[0054]

In the first control example, the motor 21 is started at the instant when the door 14 is opened. Thus,
20 there is a possibility that slight odor leakage occurs between when the motor 21 is started and when the rotation speed of the motor 21 reaches a predetermined rotation speed (the air velocity in the open part in a full-open state reaches 0.2 m/s or higher). However, the
25 amount of leaked odor is small, and the odor does not waft inside the room. Thus, a sufficient odor reducing effect can be obtained.

[0055]

Further, when the door 14 is in a closed state,
30 odor leakage does not occur by increasing airtightness inside the cooking chamber 12 with the gasket 16.

[0056]

The energy saving effect will be described with a concrete example.

[0057]

For example, in a case where the door 14, a panel
5 which covers the periphery of the cooking appliance 200,
or the like are not provided, an odor is prevented from
wafting inside the room by continuously exhausting air.
An exhaust air volume required in such a cooking
appliance is 600 m³/h. In a case where fried food is
10 cooked twenty-five times at 16 h/one day (24 h), a total
exhaust amount is 8000 m³/day.

[0058]

On the other hand, in the first control example in
the first embodiment, the time of exhausting air with
15 the door 14 open is the time for taking out cooked fried
food and setting the next fried food and five minutes.
In the case where fried food is cooked twenty-five times,
the total time of exhausting air is 5 min × 25 times =
125 min (2.1 h). When the exhaust air volume is 100 m³/h,
20 the total exhaust amount is 210 m³/day.

[0059]

In this manner, in the first embodiment, the
exhaust air volume can be reduced to $210/8000 \times 100 =$
2.6%. Thus, the exhaust apparatus for cooking appliance
25 101 can also reduce power consumption for exhausting air.

[0060]

Further, since the cooking appliance 200 is present
inside the cooking chamber 12 covered with the panel,
even though the exhaust apparatus for cooking appliance
30 101 exhausts air with the door open, the exhaust air
volume can be reduced compared to the case where the
cooking appliance 200 is in an open space. Thus, in the

exhaust apparatus for cooking appliance 101, the fan 20 can be downsized, and the power consumption of devices can also be reduced accordingly.

[0061]

5 Further, in the exhaust apparatus for cooking appliance 101, since the exhaust air volume is reduced, contamination of the filters is reduced, and the frequency of replacing the filters becomes long. Further, the life of the filters is increased. Thus, the exhaust
10 apparatus for cooking appliance 101 can contribute also to reducing running costs.

[0062]

Although not illustrated in the circuit diagram, in the case where an electric shutter is used as the
15 shutter 25, wiring is preferably performed in such a manner that the electric shutter can be opened and closed in synchronization with on and off of the motor 21 of the fan 20 (the same applies to the other embodiments).

20 [0063]

(Second Control Example)

A second control example is a control example in which the fan 20 is operated with a first air volume when the door 14 is in a closed state and operated with
25 a second air volume after the door 14 starts to open. The first air volume < the second air volume is satisfied. The second air volume is an air volume with which the air velocity in the open part formed by the door 14 becomes 0.2 m/s or higher when the door 14 is
30 fully open. The first air volume is preferably an air volume with which the inside of the cooking chamber 12 is kept at negative pressure by exhausting air inside

the cooking chamber 12.

[0064]

Fig. 7 is a circuit diagram for performing control in the second control example.

5 [0065]

The second control example has a simple configuration in which a single-phase AC motor M (AC) is used as the motor 21 of the fan 20, and, for example, a double-contact push button switch is used as the
10 open/close sensor 51. Thus, in the second control example, the switch of the open/close sensor 51 also serves as the control unit 50. The single-phase AC motor M (AC) is capable of changing the rotation speed of the motor 21 by supplying power to wires having different
15 numbers of motor coil windings.

[0066]

The second control example includes a motor wire Lo for the first air volume and a motor wire Mi for the second air volume.

20 [0067]

The double-contact push button switch as the open/close sensor 51 is disposed at a position interposed between the lower end of the door 14 and the base 11. When the door 14 is closed, a button of the
25 push button switch is pressed, and the wire Lo side is thereby turned on. On the other hand, when the door 14 is opened, the wire Mi side is turned on.

[0068]

Further, indicator lamps 18a and 18b are connected
30 to the wires Lo and Mi, respectively. The indicator lamps 18a and 18b are lamps having different colors. Instead of the indicator lamps, a display panel which

displays an air volume "standard", an air volume "strong", and the like may be provided, and the display may be switched in accordance with the operation of each switch.

5 [0069]

In the second control example, even when the door 14 is in a closed state, the motor 21 operates with the first air volume. Further, the air volume becomes the second air volume, which is larger than the first air
10 volume, at the point in time when the switch is switched. Thus, even when the door 14 is in a closed state, air inside the cooking chamber 12 is exhausted. After the door 14 starts to open, the speed of the motor 21 increases so that the air volume becomes the second air
15 volume corresponding to the full-open state of the door 14.

[0070]

For example, the difference between the first air volume and the second air volume is set in such a manner
20 that, when the second air volume is defined as 100%, the first air volume is approximately 1 to 60%. When the ratio of the first air volume to the second air volume is more than 60%, the difference is small, and the energy saving effect is small. On the other hand, when
25 the ratio of the first air volume to the second air volume is 1% or less, the inside of the cooking chamber 12 cannot be continuously kept at negative pressure with the door 14 closed.

[0071]

30 In this manner, in the second control example, air inside the cooking chamber 12 is continuously exhausted with a small air volume. Thus, even at the instant when

the door 14 starts to open, odor leakage does not occur. On the other hand, the motor rotates at a lower speed with the first air volume than with the second air volume, and the power consumption can be reduced
5 accordingly.

[0072]

Further, in the second control example, the inside of the cooking chamber 12 is kept at negative pressure even when the door is closed. Thus, even when the gasket
10 16 is not provided, and a tiny gap is formed when the door 14 is closed, odor leakage can be prevented.

[0073]

(Third Control Example)

A third control example is a control example in
15 which the full-open sensor 52 of the door 14 is used. In the third control example, the fan 20 is kept stopped when the door 14 is in a closed state, and the fan 20 is operated with a third air volume between when the door 14 starts to open and when the door 14 becomes fully
20 open, and operated with the second air volume after the door 14 becomes fully open. The second air volume < the third air volume is satisfied. The second air volume is an air volume with which the air velocity in the open part formed by the door 14 becomes 0.2 m/s or higher
25 when the door 14 is fully open.

[0074]

Fig. 8 is a circuit diagram for performing control in the third control example.

[0075]

30 The third control example has a simple configuration in which a single-phase AC motor M (AC) is used as the motor 21 of the fan 20, for example, a b-

contact push button switch is used as the open/close sensor 51, and a double-contact switch is used as the full-open sensor 52. Thus, in the third control example, the switches of the open/close sensor 51 and the full-open sensor 52 also serve as the control unit 50. The single-phase AC motor M (AC) is capable of changing the rotation speed of the motor 21 by supplying power to wires having different numbers of motor coil windings.

[0076]

10 The third control example includes a motor wire Mi for the second air volume and a motor wire Hi for the third air volume. For example, the difference between the second air volume and the third air volume may be set in such a manner that, when the second air volume is defined as 100%, the third volume is approximately 120 to 160%. It is only required that the third air volume be larger than the air volume when the door is fully open. However, in a case where the third air volume is less than 120% of the second air volume, even when the air volume is increased, the amount of air to be actually drawn in does not largely change. Thus, this is meaningless. On the other hand, when the air volume is increased to more than 160%, the amount of air to be drawn in is increased. However, air can be sufficiently drawn in with a lower air volume. Thus, such an air volume merely increases the power consumption and is thus excessive.

[0077]

30 The b-contact push button switch as the open/close sensor 51 is disposed at a position interposed between the lower end of the door 14 and the base 11. When the door 14 is slightly opened, and the lower end of the

door 14 is separated from the base 11, the button of the push button switch returns to its original position, and the push button switch is thereby turned on. At this time, the double-contact switch of the full-open sensor 52 has been switched to the wire Hi side. Thus, the control is performed in such a manner that, when the switch of the open/close sensor 51 is turned on, the air volume becomes the third air volume at the instant when electricity flows to the wire Hi side of the motor 21 and the motor 21 is started.

[0078]

Then, the switch of the full-open sensor 52 is switched to the wire Mi side when the door 14 becomes fully open. At this time, the switch of the open/close sensor 51 remains on. Accordingly, the control is performed in such a manner that electricity flows to the wire Mi side of the motor 21, and the air volume becomes the second air volume after the door becomes fully open.

[0079]

Further, indicator lamps 18b and 18c are connected to the wires Mi and Hi, respectively. The indicator lamps 18b and 18c are lamps having different colors. Instead of the indicator lamps, a display panel which displays an air volume "standard", an air volume "strong", and the like may be provided, and the display may be switched in accordance with the operation of each switch.

[0080]

In the third control example, the motor 21 is at a stop when the door 14 is in a closed state. Thus, there is a possibility that an odor is accumulated inside the cooking chamber 12. When the door 14 starts to open, the

odor inside the cooking chamber 12 is exhausted at a stroke with the third air volume to prevent odor leakage. Even when the air volume is changed to the second air volume after the door 14 becomes fully open, odor leakage does not occur because most of the odor inside the cooking chamber 12 has been exhausted.

[0081]

Also in the third control example, air may be continuously exhausted with the first air volume, which is smaller than the second air volume, with the door 14 closed in a manner similar the second control example. In this case, the wire Lo of the motor 21 is used. The ratio between the first air volume, the second air volume, and the third air volume is preferably set in such a manner that, when the third air volume is defined as 100%, the first air volume is 10 to 30% and the second air volume is 50 to 60%.

[0082]

In the first to third control examples described above, instead of the AC motor, for example, software control using a DC motor, a converter, and a control computer (a CPU (Central Processing Unit)) or an MPU (Micro Processor Unit)) may be performed. The power consumption can be further reduced by using the DC motor.

[0083]

Further, although not illustrated, the exhaust apparatus for cooking appliance 101 may be provided with an opening degree sensor which detects the degree of opening of the door 14, and the air volume of the fan 20 may be changed according to the opening degree of the door 14. In this case, when the air volume of the fan 20 is changed in stages, for example, current may be passed

to the motor wires Lo, Mi, and Hi every time the opening of the door 14 increases in stages. Further, when the air volume of the fan 20 is continuously changed according to the opening of the door 14, for example, voltage may be changed from the converter according to the opening degree of the door 14 and supplied to the DC motor.

[0084]

[Second Embodiment]

10 In a second embodiment, although the opening and closing of a door 14 are manually performed, a lock unit which locks the door 14 is provided to limit the opening and closing of the door 14, and the operation of a fan 20 is controlled corresponding to the open/closed state of the door 14.

[0085]

<Exhaust apparatus for cooking appliance>

Fig. 9 is a front view of an exhaust apparatus for cooking appliance of the second embodiment. Fig. 10 is a sectional view of the exhaust apparatus for cooking appliance of the second embodiment.

[0086]

An exhaust apparatus for cooking appliance 102 of the second embodiment is provided with a lock unit 55, which maintains the closed state of the door 14, and an open button 17, which issues an instruction to open the door 14. The other configuration is similar to that of the first embodiment. Further, an installation example for indoor circulation or outdoor exhaust is also similar to that of the first embodiment. Thus, description thereof will be omitted. Further, a cooking method is also similar to that of the first embodiment.

Thus, description thereof will be omitted.

[0087]

In the second embodiment, the lock unit 55 enables the door 14, which is manually opened, to be opened only
5 when a predetermined condition is satisfied by control of a control unit 50 when an opening command is given from the open button 17. The lock unit 55, for example, has a structure in which a locking bar is inserted in a hole (including a recess) which is disposed on the door
10 14 with the door 14 closed. The locking bar is operated, for example, by an electromagnetic solenoid or the like, and the electromagnetic solenoid is operated in accordance with a command from the control unit 50. The mode of the lock unit 55 is not limited to such a mode
15 using the locking bar and the electromagnetic solenoid.

[0088]

The open button 17 is, for example, a push button switch, a touch sensor switch, or the like, and disposed on a front panel 13a. The opening and closing of the
20 door 14 are only manually performed. Thus, in other words, the open button 17 is a switch which requests permission to open the door 14 to the control unit 50.

[0089]

Further, in order to indicate whether the door 14
25 can be opened and closed, indicator lamps 19a and 19b are disposed on the front panel 13a. For example, the indicator lamp 19a illuminating blue indicates that the door 14 can be opened, and the indicator lamp 19b illuminating red indicates that the door 14 cannot be
30 opened. Instead of the indicator lamps, a display panel which displays that the opening of the door 14 is "allowed" or "not allowed" may be provided.

[0090]

<Control Example>

(Fourth Control Example)

In a control example (referred to as a fourth
5 control example) of the second embodiment, the fan 20 is
started at the instant when an opening instruction is
given from the open button 17, and a lock is unlocked to
bring the door 14 into an openable state after an elapse
of a certain time.

10 [0091]

Fig. 11 is a circuit diagram for performing control
in the fourth control example.

[0092]

In the fourth control example, a single-phase AC
15 motor M (AC) is used as a motor 21 of the fan 20. A
switch of the open button 17 and a switch of an
open/close sensor 51 operate in conjunction with each
other, and the open button 17 and the open/close sensor
51 are disposed on a wire Mi from an AC power supply
20 (AC) to the motor 21. The switch of the open button 17
and the switch of the open/close sensor 51 are both
turned on when the opening instruction is given from the
open button 17. On the other hand, when the open/close
sensor 51 is turned from on to off, the open button 17
25 is also turned off.

[0093]

Further, a wire which branches from the wire Mi is
introduced into a timer (TM) 57 and further connected to
an electromagnetic solenoid 58 of the lock unit 55.
30 Further, an output from the timer 57 is also connected
to the indicator lamp 19a.

[0094]

The timer 57 is previously set to count a certain time when power is supplied thereto, and power is supplied to the electromagnetic solenoid 58 after an elapse of the certain time. The timer 57 is not limited
5 to one which counts time, and may be a current delay circuit. The time set on the timer 57 is approximately a time within which the fan 20 is started, and the odor inside the cooking chamber 12 can be exhausted. The time set on the timer 57 is preferably approximately a time
10 within which air corresponding to a capacity inside the cooking chamber 12 can be exhausted. Specifically, although depending on the capacity inside the cooking chamber 12 and the performance of the fan 20, 1 to 60 seconds are sufficient.

15 [0095]

The electromagnetic solenoid 58 is, for example, an AC type electromagnetic solenoid 58 and a normally open spring return type (a valve element is separated with current cut off (here, the locking bar of the lock unit
20 55 projects to lock the door 14) and the valve element is closed when current flows (here, the locking bar of the lock unit 55 retracts to unlock the door 14)).

[0096]

In the fourth control example, the open/close
25 sensor 51 and the timer 57 serve as the control unit 50.

[0097]

In the fourth control example, the switch of the open button 17 and the switch of the open/close sensor 51 are both in an off state (the illustrated state) when
30 the door 14 is in a closed state. In this state, when the open button 17 is pressed to give an opening instruction, the switch of the open button 17 and the

switch of the open/close sensor 51 are both turned on to bring the motor 21 into operation. The air volume at this time is the second air volume described in the first embodiment (an air velocity of 0.2 m/s or higher
5 when the door 14 is fully open). Simultaneously, current also flows to the timer 57, and the certain time is counted. After counting the certain time, current flows from the timer 57 to the electromagnetic solenoid 58 to unlock the lock unit 55. Simultaneously, the indicator
10 lamp 19a is energized and turned on, which allows the door 14 to be opened.

[0098]

After that, the door 14 is manually opened. Also after opening the door 14, air is continuously exhausted
15 with the second air volume.

[0099]

When the open door 14 is closed, the switch of the open/close sensor 51 is turned off by the closing of the door 14, and the open button 17, which operates in
20 conjunction with the open/close sensor 51, is also turned off. Accordingly, the current to the electromagnetic solenoid 58 is also cut off. Thus, the locking bar is returned by the spring, and the door 14 is locked with the lock unit 55. Simultaneously, power
25 to the motor 21 is also cut off. Thus, the fan 20 comes to a stop. Further, the indicator lamp 19b is energized and turned on, and indicates that the door 14 has been locked.

[0100]

30 In this manner, according to the fourth control example, in order to open the door 14, the open button 17 is first pressed, and air inside the cooking chamber

12 is thereby exhausted. At this time, since the lock unit 55 is not unlocked, the door 14 cannot be opened. Then, after air inside the cooking chamber 12 is exhausted, the door 14 can be opened. Thus, at the point
5 in time when the door 14 is actually opened, most of the odor inside the cooking chamber 12 has been exhausted. Thus, no odor leaks out when the door 14 is opened. On the other hand, when the door 14 is closed, the fan 20 comes to a stop. Thus, in the exhaust apparatus for
10 cooking appliance 102, the fan 20 does not consume power when the door 14 is in a closed state.

[0101]

Also in the fourth control example, instead of the AC motor, for example, software control using a DC motor,
15 a converter, and a control computer (a CPU or an MPU) may be performed. The power consumption can be further reduced by using the DC motor.

[0102]

Further, in the second embodiment, the second
20 control example of the first embodiment may be combined with the fourth control example so that air is continuously exhausted with the first air volume when the door is in a closed state. Further, the third control example may be combined with the fourth control
25 example so that control is performed in such a manner that air is exhausted with the third air volume between when a door opening instruction is given and when the lock unit 55 is unlocked, and the third air volume is changed to the second air volume after the lock unit 55
30 is unlocked (or after the opening of the door 14 is detected by the open/close sensor 51).

[0103]

Further, in the second embodiment, air inside the cooking chamber 12 is exhausted between when the door opening instruction is given and when the lock unit 55 is unlocked. Thus, at the point in time when opening the door 14 becomes possible, the odor inside the cooking chamber 12 has substantially disappeared depending on a food material or cooking details. Assuming such a case, the control is, for example, performed in such a manner that air is exhausted with the third air volume (or with the second air volume for a time longer than that in the case of the third air volume or the like) between when the door opening instruction is given and when the lock unit 55 is unlocked, and the lock unit 55 is unlocked and the fan 20 is stopped after an elapse of a predetermined time. At this time, although the door 14 is open, the fan 20 is at a stop. However, as described above, the odor inside the cooking chamber 12 has substantially disappeared depending on a food material or cooking details. Thus, the odor hardly wafts. Accordingly, in the second embodiment, the power consumption can be further reduced.

[0104]

[Third Embodiment]

In a third embodiment, in a manner similar to the second embodiment, although the opening and closing of a door 14 are manually performed, a lock unit 55, which locks the door 14, is provided to limit the opening and closing of the door 14, and the operation of a fan 20 is controlled corresponding to the open/closed state of the door 14.

[0105]

<Exhaust apparatus for cooking appliance>

Fig. 12 is a sectional view of an exhaust apparatus for cooking appliance of the third embodiment.

[0106]

In an exhaust apparatus for cooking appliance 103 of the third embodiment, a cooking chamber internal state detection sensor (hereinbelow, referred to as a state sensor 61), which detects the state inside a cooking chamber 12, is disposed inside the cooking chamber 12. The other configuration is similar to that of the second embodiment. Further, an installation example for indoor circulation or outdoor exhaust is also similar to that of the first embodiment. Thus, description thereof will be omitted. Further, a cooking method is also similar to that of the first embodiment. Thus, description thereof will be omitted.

[0107]

The state sensor 61 detects, as the state inside the cooking chamber 12, at least any one of an odor inside the cooking chamber 12, a temperature inside the cooking chamber 12, an oil content in air, smoke, and a pressure inside the cooking chamber 12.

[0108]

In the third embodiment, when a detected value detected by the state sensor 61 becomes equal to or less than a predetermined reference value, a control unit 50 unlocks the lock unit 55.

[0109]

The odor is detected by a so-called odor sensor. Various types of commercially available sensors, such as a semiconductor sensor, a quartz crystal sensor, an FET biosensor (Field Effect Transistor Biosensor), and a membrane-type surface stress sensor, can be used as the

odor sensor. The control unit 50 compares a value of the odor sensor with the reference value, and unlocks the lock unit 55 when the odor becomes equal to or less than the reference value.

5 [0110]

The temperature is detected by a temperature sensor. A known (commercially available) analog or digital temperature sensor or the like may be used as the temperature sensor. The control unit 50 compares a value
10 of the temperature sensor with the reference value, and unlocks the lock unit 55 when the temperature becomes equal to or less than the reference value. When the fan 20 is operated, the temperature inside the cooking chamber 12 drops. Thus, it is determined that the odor
15 inside the cooking chamber 12 has been exhausted using the temperature drop as an index, and the lock unit 55 is unlocked.

[0111]

As the oil content in air, for example, an oil
20 component which is called oil mist and contained in air is detected. When the fan 20 is operated, the oil content in air inside the cooking chamber 12 is also exhausted. Thus, when the oil content has been reduced, it is determined that the odor has also disappeared, and
25 the lock unit 55 is unlocked.

[0112]

Smoke is detected by a smoke sensor. A commercially available optical smoke sensor or the like may be used as the smoke sensor. When the fan 20 is operated, smoke
30 inside the cooking chamber 12 is also exhausted. Thus, when the smoke has been reduced, it is determined that the odor has also disappeared, and the lock unit 55 is

unlocked.

[0113]

The pressure is detected by a pressure sensor. A commercially available optical pressure sensor or the like may be used as the pressure sensor. When the fan 20 is operated with the door 14 closed, the pressure inside the cooking chamber 12 drops. When the pressure becomes equal to or less than the reference value, it is determined that the odor has also been exhausted, and the lock unit 55 is unlocked. For example, a low value in normal atmospheric pressure may be set as the reference value of the pressure. Alternatively, an additional pressure sensor which measures the pressure outside the cooking chamber 12 or a sensor which detects a pressure difference between the inside and outside of the cooking chamber 12 may be provided to compare the pressure inside the cooking chamber 12 and the pressure outside the cooking chamber 12, and the lock unit 55 may be unlocked at the point in time when the pressure inside the cooking chamber 12 drops (or the point in time when the pressure difference becomes a certain ratio or more).

[0114]

<Control Example>

(Fifth Control Example)

In a control example (referred to as a fifth control example) of the third embodiment, the fan 20 is started at the instant when an opening instruction is given from the open button 17, and a lock is unlocked to bring the door 14 into an openable state after an elapse of a certain time.

[0115]

Fig. 13 is a block diagram for describing control in the fifth control example.

[0116]

In the fifth control example, a signal from the state sensor 61 is introduced into a control IC 62, and a value detected by the state sensor (Sen) 61 is compared with the predetermined reference value in the control IC 62. When the detected value becomes equal to or less than the reference value, the control IC 62 passes current to an electromagnetic solenoid 58. The control IC 62, for example, compares a voltage from the state sensor 61 with a reference voltage. The control IC 62, for example, compares a current with a reference current. In the case of a digital signal, a DSP (Digital Signal Processor) is used as the control IC 62 to compare digital values. Although not illustrated, the control IC 62 and the state sensor 61 use power converted from AC to DC. The other circuit configuration is similar to that in the fourth control example. Thus, description thereof will be omitted.

[0117]

In the fifth control example, the control IC 62 serves as the control unit 50.

[0118]

In the fifth control example, the switch of the open button 17 and the switch of the open/close sensor 51 are both in an off state (the illustrated state) when the door 14 is in a closed state. In this state, when the open button 17 is pressed to give an opening instruction, the switch of the open button 17 and the switch of the open/close sensor 51 are both turned on to bring the motor 21 into operation. The air volume at

this time is the second air volume described in the first embodiment (an air velocity of 0.2 m/s or higher when the door 14 is fully open).

[0119]

5 Then, the control IC 62 compares the detected value with the reference value, and passes current to the electromagnetic solenoid 58 when the detected value becomes equal to or less than the reference value. The current flows to the electromagnetic solenoid 58, and
10 the lock unit 55 is thereby unlocked. Simultaneously, the indicator lamp 19a is energized and turned on, which allows the door 14 to be opened.

[0120]

15 After that, the door 14 is manually opened. Also after opening the door 14, air is continuously exhausted with the second air volume.

[0121]

20 When the open door 14 is closed, the switch of the open/close sensor 51 is turned off by the closing of the door 14, and the open button 17, which operates in conjunction with the open/close sensor 51, is also turned off. Accordingly, the current to the electromagnetic solenoid 58 is also cut off. Thus, the locking bar is returned by the spring, and the door 14
25 is locked with the lock unit 55. Simultaneously, power to the motor 21 is also cut off. Thus, the fan 20 comes to a stop. Further, the indicator lamp 19b is energized and turned on, and indicates that the door 14 has been locked.

30 [0122]

 In this manner, according to the fifth control example, in order to open the door 14, the open button

17 is first pressed, and air inside the cooking chamber 12 is thereby exhausted. Then, after it is confirmed, by the state sensor 61, that air inside the cooking chamber 12 has been reliably exhausted, the door 14 can be
5 opened. Thus, at the point in time when the door 14 is actually opened, most of the odor inside the cooking chamber 12 has been exhausted. Thus, no odor leaks out when the door 14 is opened. On the other hand, when the door 14 is closed, the fan 20 comes to a stop. Thus, the
10 fan 20 does not consume power when the door 14 is in a closed state.

[0123]

Also in the fifth control example, instead of the AC motor, for example, software control using a DC motor,
15 a converter, and a control computer (a CPU or an MPU) may be performed. The power consumption can be further reduced by using the DC motor.

[0124]

Further, in the third embodiment, the second
20 control example of the first embodiment may be combined with the fifth control example so that air is continuously exhausted with the first air volume when the door is in a closed state. Further, the third control example may be combined with the fifth control
25 example so that control is performed in such a manner that air is exhausted with the third air volume between when a door opening instruction is given and when the lock unit 55 is unlocked, and the third air volume is changed to the second air volume after the lock unit 55
30 is unlocked (or after the opening of the door 14 is detected by the open/close sensor 51).

[0125]

Further, in the third embodiment, the inside of the cooking chamber 12 is monitored by the state sensor 61 between when the door opening instruction is given and when the lock unit 55 is unlocked, and the lock unit 55 is unlocked after confirming that no odor is present (or a small amount of odor is present). Thus, also in the third embodiment, depending on a food material or cooking details, air may be exhausted with the third air volume (or with the second air volume for a time longer than that in the case of the third air volume or the like) between when the door opening instruction is given and when the lock unit 55 is unlocked, and the fan 20 may come to a stop simultaneously with the unlocking of the lock unit 55 after the odor disappears. As described above, the odor inside the cooking chamber 12 has substantially disappeared depending on a food material or cooking details. Thus, the odor hardly wafts. Accordingly, the power consumption can be further reduced.

[0126]

[Fourth Embodiment]

In a fourth embodiment, the opening and closing of a door 14 are fully automatically performed, and the operation of a fan 20 is controlled corresponding to the open/closed state of the door 14.

[0127]

<Exhaust apparatus for cooking appliance>

Fig. 14 is a front view of an exhaust apparatus for cooking appliance of the fourth embodiment. Fig. 15 is a sectional view of the exhaust apparatus for cooking appliance of the fourth embodiment.

[0128]

An exhaust apparatus for cooking appliance 104 of the fourth embodiment includes an open/close power unit 70 for opening and closing the door. Further, the exhaust apparatus for cooking appliance 104 includes an open button 17a and a close button 17b for issuing instructions to open and close the door. The other configuration is similar to that of the third embodiment. However, in the fourth embodiment, the lock unit 55 is not required. Further, an installation example for indoor circulation or outdoor exhaust is also similar to that of the first embodiment. Thus, description thereof will be omitted. Further, a cooking method is also similar to that of the first embodiment. Thus, description thereof will be omitted.

[0129]

The open/close sensor 51 and the full-open sensor 52 may or may not be provided. In the case where the open/close sensor 51 and the full-open sensor 52 are provided, the open/closed state and the full-open state of the door 14 are detected on the basis of signals from the open/close sensor 51 and the full-open sensor 52. In the case where the open/close sensor 51 and the full-open sensor 52 are not provided, when a load applied to the open/close power unit 70 (specifically, an opening/closing motor) becomes high, the opening/closing motor automatically comes to a stop. In the drawings, the configuration without the open/close sensor 51 and the full-open sensor 52 is illustrated.

[0130]

The open/close power unit 70 is illustrated as a rack and pinion. A rack gear 72, a pinion gear 73, which is engaged with the rack gear 72, and an opening/closing

motor 74 are disposed on each side inside the door 14. The opening/closing motor 74 is driven by control from a control unit 50, and the door 14 is thereby opened or closed. The open/close power unit 70 is not limited
5 thereto, and may employ various modes, such as a chain winding mode, a ball screw mode, and the like.

[0131]

Further, an indicator lamp 18, which indicates the operating state of the fan 20, is provided. The
10 indicator lamp 18 indicates that the fan is operating when the indicator lamp 18 is on and indicates that the fan is at a stop when the indicator lamp 18 is off.

[0132]

<Control Example>

15 (Sixth Control Example)

In a control example (referred to as a sixth control example) of the fourth embodiment, the door 14 is opened in accordance with an opening instruction from the open button 17a and closed in accordance with a
20 closing instruction from the close button 17b. During this, the operation of the fan is controlled.

[0133]

Fig. 16 is a block diagram for describing a control system in the sixth control example.

25 [0134]

In the sixth control example, a DC motor is used as a motor 21 of the fan 20. Control of the DC motor is performed by the control unit 50 corresponding to the open/closed state of the door 14. The control unit 50
30 includes a converter 701, which supplies DC voltage to the DC motor, and a control computer 702, which controls output voltage of the converter 701 together with the

opening and closing of the door 14.

[0135]

The converter 701 converts AC from an AC power supply to DC. The converter 701 changes output voltage
5 (DC) in a stepless manner or in stages in accordance with a command from the control computer 702. The rotation speed of the DC motor changes according to the DC voltage supplied thereto.

[0136]

10 The control computer 702 is, for example, a small computer which is a computer for controlling an apparatus and called a microcomputer or the like. The control computer 702 includes a CPU 711, a ROM 712 in which a program to be executed by the CPU 711 is stored,
15 and a RAM 713 to be a work area of the CPU 711. The control computer 702 is provided with a nonvolatile memory 714 (e.g., an EPROM, a flash memory, or the like) in which a program, a parameter (e.g., a reference value, a predetermined time, or the like), and the like are
20 stored, and the configuration of the control computer 702 is equivalent to the configuration of a general-purpose computer.

[0137]

The open button 17a, the close button 17b, and an
25 open/close power unit 70 are connected to the control computer 702. The control computer 702 opens or closes the door 14 and controls the rotation speed of the motor 21 in accordance with an instruction from the open button 17a or the close button 17b. Further, an
30 indicator lamp 18 is connected to the control computer 702. The indicator lamp 18 is turned on at the instant when the control computer 702 brings the fan 20 into

operation. The indicator lamp 18 may be connected to a wire of the motor 21 and may be turned on when current flows to the motor 21.

[0138]

5 Fig. 17 is a flowchart illustrating a control procedure in the sixth control example.

[0139]

10 The CPU 711 controls the operation of the fan 20 together with the opening and closing operations of the door 14 by executing a program which is created in accordance with the procedure.

[0140]

15 Before describing the control procedure, the air volume will be described. In the sixth control example, the first air volume < the second air volume < the third air volume is satisfied. The ratio between the first to third air volumes is set in such a manner that, when the third air volume is defined as 100%, the first air volume is 10 to 30%, and the second air volume is 30 to 20 60%. The air volume when the door 14 is fully open is set to the second air volume so that the air velocity in the open part becomes 0.2 m/s or higher.

[0141]

 The control procedure will be described.

25 [0142]

 The CPU 711 waits for an input of the open button 17a until the open button 17a is pressed with the door 14 closed (S11).

[0143]

30 When the open button 17a is pressed to perform an input (S11: YES), the CPU 711 commands the converter 701 to output a voltage for the third air volume (S12). When

the door 14 is in a closed state, the motor 21 is at a stop (or may be operated with the first air volume). The motor 21 of the fan 20 is started by the voltage from the converter 701, and the fan 20 is operated with the
5 third air volume. Simultaneously, in S12, the indicator lamp 18 is turned on (in the case of the first air volume with the door closed, the on state is continued).

[0144]

Then, the CPU 711 starts to count time (S13)
10 together with issuing the command to the converter 701. The CPU 711 determines whether a predetermined time has elapsed (S14). The predetermined time is approximately a time within which the fan 20 is started, and the odor inside the cooking chamber 12 can be exhausted. The
15 predetermined time is preferably approximately a time within which air corresponding to a capacity inside the cooking chamber 12 can be exhausted.

[0145]

Then, when the predetermined time has elapsed (S14:
20 YES), the CPU 711 commands the converter 701 to output a voltage for the second air volume (S15). The motor 21 of the fan 20 is decelerated by the voltage from the converter 701, and the fan 20 is operated with the second air volume.

25 [0146]

Then, the CPU 711 commands the open/close power unit 70 to open the door 14 (S16). The opening/closing motor 74 rotates in the direction for opening the door 14 in accordance with the command. When the door 14
30 becomes fully open, the opening/closing motor 74 automatically comes to a stop.

[0147]

Then, the CPU 711 waits for an input of the close button 17b (S17). When the close button 17b is pressed to perform an input (S17: YES) with the door 14 open, the CPU 711 commands the open/close power unit 70 to
5 close the door 14 (S18). The opening/closing motor 74 rotates in the direction for closing the door 14 in accordance with the command. When the door 14 becomes fully closed, the opening/closing motor 74 automatically comes to a stop.

10 [0148]

Then, the CPU 711 commands the converter 701 to stop the voltage output (or output a voltage for the first air volume) (S19). The motor 21 of the fan 20 comes to a stop by the stop of the voltage output from
15 the converter 701, and the fan 20 comes to a stop (or is decelerated and operated with the first air volume) accordingly. Then, the process returns to S11.

[0149]

In this manner, according to the sixth control
20 example, in order to open the door 14, the open button 17a is pressed, and air inside the cooking chamber 12 is thereby exhausted. Then, when the predetermined time has elapsed, the door 14 is automatically opened. Thus, at the point in time when the door 14 is opened, most of
25 the odor inside the cooking chamber 12 has been exhausted. Thus, no odor leaks out. On the other hand, when the close button is pressed, the door 14 is automatically closed, and the fan 20 comes to a stop (or is operated with the first air volume). Thus, when the
30 door 14 is in a closed state, the fan 20 does not consume power.

[0150]

Also in the sixth control example, the air volume after the input of the open button 17a may be the second air volume. Further, control using an AC motor may be performed.

5 [0151]

Further, in the sixth control example, the control computer 702 controls the DC motor. Thus, for example, the rotation speed of the DC motor may be changed in a stepless manner according the open amount of the door 14
10 (the rotation amount of the open/close power unit 70 or the opening/closing motor 74). Accordingly, regardless of the opening degree of the door 14, the air velocity in the open part can be maintained substantially constant.

15 [0152]

The fourth embodiment is provided with the open/close power unit 70, which opens and closes the door 14. Thus, in the fourth embodiment, in the case where the door 14 is open when the fire alarm 41 issues
20 an alarm, the control unit 50 commands the open/close power unit 70 to close the door 14 in response to the alarm. Accordingly, when fire breaks out, it is possible to reduce fire and smoke leaking through the open part of the door.

25 [0153]

[Fifth Embodiment]

In a fifth embodiment, the opening and closing of a door 14 are fully automatically performed, and the operation of a fan 20 is controlled corresponding to the
30 open/closed state of the door 14 and the state inside a cooking chamber 12 detected by a state sensor 61.

[0154] <Exhaust apparatus for cooking appliance>

The configuration of an exhaust apparatus for cooking appliance of the fifth embodiment is similar to that of the fourth embodiment except that the state sensor 61 similar to the state sensor 61 of the third embodiment is provided (refer to Fig. 12, however, the lock unit is not provided). The state sensor 61 has a configuration similar to the configuration of the state sensor 61 of the third embodiment. Further, the other configuration, an installation example, and a cooking method are similar to those of the first embodiment. Thus, description thereof will be omitted.

[0155]

<Control Example>

(Seventh Control Example)

In a control example (referred to as a seventh control example) of the fifth embodiment, the door 14 is opened in accordance with an opening instruction from the open button 17a and closed in accordance with a closing instruction from the close button 17b. During this, the operation of the fan is controlled.

[0156]

Fig. 18 is a block diagram for describing a control system in the seventh control example. The control system of the fifth embodiment differs from the control system of the fourth embodiment in that an input from the state sensor 61 is received. The other configuration is the same as that of the fourth embodiment. Thus, description thereof will be omitted.

[0157]

Fig. 19 is a flowchart illustrating a control procedure. The CPU 711 controls the operation of the fan together with the opening and closing operations of

the door 14 by executing a program which is created on the basis of the procedure.

[0158]

5 The air volume is the same as that in the sixth control example. Further, a part of the control procedure is also the same as that in the sixth control example. Thus, identical step numbers (S numbers) denotes identical steps, and description will be simplified or omitted.

10 [0159]

The control procedure will be described.

[0160]

15 When an input of the open button is received (S11: YES), the CPU 711 commands the converter 701 to output a voltage for the third air volume (S12).

[0161]

Then, the CPU 711 compares a detected value from the state sensor 61 with a reference value (S24). The reference value is stored in the nonvolatile memory 714.

20 [0162]

The reference value used in the present embodiment may be a single reference value which is previously determined like the reference value in the third embodiment, but may be a value corresponding to an environmental change. For example, a value of the state sensor 61 before starting cooking is stored as the reference value, and a value of the state sensor 61 is compared with the stored reference value (the value before starting cooking) after cooking in S24. For example, temperature, pressure, and the like vary according to the whether of the day. Thus, it is possible to precisely determine the state inside the

25
30

cooking chamber 12 according to the variation.

[0163]

Then, when the detected value becomes equal to or less than the reference value (S24: YES), the CPU 711
5 commands the converter 701 to output a voltage for the second air volume (S15).

[0164]

Then, the CPU 711 commands the open/close power unit 70 to open the door 14 (S16), and waits for an
10 input of the close button 17b (S17).

[0165]

Then, an input from the close button 17b is received (S17: YES), the CPU 711 commands the open/close power unit 70 to close the door 14 (S18), and commands
15 the converter 701 to stop the voltage output (or output a voltage for the first air volume) (S19). Then, the process returns to S11.

[0166]

In this manner, according to the seventh control
20 example, in order to open the door 14, the open button 17a is pressed, and air inside the cooking chamber 12 is thereby exhausted. Then, when the state sensor 61 determines that the odor inside the cooking chamber 12 has disappeared, the door 14 is opened. Thus, no odor
25 leaks out. On the other hand, when the close button is pressed, the door 14 is automatically closed, and the fan 20 comes to a stop. Thus, when the door 14 is in a closed state, the fan 20 does not consume power.

[0167]

30 Also in the seventh control example, for example, the rotation speed of the DC motor may be changed in a stepless manner according the open amount of the door 14.

Accordingly, regardless of the opening degree of the door 14, the air velocity in the open part can be maintained substantially constant. Further, control using an AC motor may be performed.

5 [0168]

[Sixth Embodiment]

A sixth embodiment is a mode in which a shutter 25 is disposed on the upstream side of a fan 20 in an air blowing direction.

10 [0169]

<Exhaust apparatus for cooking appliance>

Fig. 20 is a sectional view of an exhaust apparatus for cooking appliance of the sixth embodiment.

[0170]

15 In an exhaust apparatus for cooking appliance 106 of the sixth embodiment, an intake side shutter 80, which is opened and closed, is disposed in a part of an intake port (an open part of a grease filter) on the upstream side (that is, the intake side) of the fan 20 in the air blowing direction. The intake side shutter 80 closes the exhaust side inside the cooking chamber 12.

[0171]

The other configuration may be any of the configurations of the first to fifth embodiments. Further, control of the fan 20 along with the opening and closing of the door 14 is also any of the control examples described in the first to fifth embodiments. Thus, description of the apparatus configuration other than the intake shutter, the installation example, and the control will be omitted.

30

[0172]

The intake side shutter 80 is an electric shutter,

and opened and closed in conjunction with the operation of the fan 20. The opening and closing of the intake side shutter may be controlled by the control unit 50 or may be performed in such a manner that a wire is
5 connected from a wire which supplies power to the fan 20 to a driving source (not illustrated) of the intake side shutter 80, and the intake side shutter 80 is opened when electricity flows through the wire which supplies power to the fan 20 and closed when electricity through
10 the wire which supplies power to the fan 20 is stopped.
[0173]

Further, the intake side shutter 80 operates in conjunction with the fire alarm 41, and is closed when the fire alarm 41 issues an alarm. In the case where the
15 intake side shutter 80 is open when the fire alarm 41 issues an alarm, the control unit 50 issues a command to close the intake side shutter 80 in response to the fire alarm. Accordingly, when fire breaks out, it is possible to prevent or reduce leakage of fire and smoke through
20 the exhaust duct. In this case, in preparation for cut-off of power in the entire apparatus caused by fire, a backup battery or the like is preferably provided so that at least a closing operation can be performed.
[0174]

25 Since the exhaust apparatus for cooking appliance 106 of the sixth embodiment is provided with the intake side shutter 80, it is possible to prevent oily smoke or the like from entering the inside of the fan housing when the fan 20 is at a stop. Thus, it is possible to
30 reduce adhesion and accumulation of dirt of the fan 20 which may cause an odor.
[0175]

[Seventh Embodiment]

A seventh embodiment is a mode in which an inner panel which includes an opening communicating with an intake port of a fan 20 is disposed inside a cooking chamber 12.

[0176]

<Exhaust apparatus for cooking appliance>

Fig. 21 is a sectional view of an exhaust apparatus for cooking appliance of the seventh embodiment.

[0177]

In an exhaust apparatus for cooking appliance 107 of the seventh embodiment, an inner panel 90, which includes an opening communicating with the intake port (the part to which a grease filter 30 is attached) of the fan 20, is disposed inside the cooking chamber 12. The other configuration may be any of the configurations of the first to sixth embodiments. Further, control of the fan 20 along with the opening and closing of the door 14 is also any of the control examples described in the first to fifth embodiments. Thus, description of the apparatus configuration other than the inner panel 90, the installation example, and the control will be omitted.

[0178]

The inner panel 90 covers the ceiling part and the lower part of a housing 35 of the fan 20 inside the cooking chamber 12. In particular, the inner panel 90 preferably covers a part having a corner which is a joint part of the ceiling or the lower part of the housing 35 with the side panel 13b or the back panel 13c. The inner panel 90 has a gentle curved shape having no corner.

[0179]

The inner panel 90 prevents or reduces adhesion of oily smoke or the like generated inside the cooking chamber 12 to the ceiling part and the lower part of the housing 35 due to a direct rising air current. Since the inner panel 90 has a gentle curved shape, the inner panel 90 can be easily cleaned. The adhesion of dirt inside the cooking chamber 12 may cause an odor. Thus, when the cleaning can be easily performed, it is possible to remove a cause of an odor and more reliably prevent the odor from wafting.

[0180]

Further, in order to prevent dirt inside the cooking chamber 12, oil repellent coating is preferably applied to the inner panel 90 and inner walls of the cooking chamber 12 such as the side panel 13b and the back panel 13c. The adhesion of oil dirt is reduced by applying the oil repellent coating to the inner walls of the cooking chamber 12. Also in the other embodiments which are not provided with the inner panel 90, oil repellent coating is preferably applied to the inner walls of the cooking chamber 12 such as the side panel 13b, the back panel 13c, and the ceiling board 13d on the side facing the cooking chamber 12.

[0181]

[Eighth Embodiment]

A seventh embodiment is a mode in which an inner panel 90, which includes an opening communicating with an intake port of a fan 20, is disposed inside a cooking chamber 12.

[0182]

<Exhaust apparatus for cooking appliance>

Fig. 22 is a sectional view of an exhaust apparatus for cooking appliance of the eighth embodiment.

[0183]

In an exhaust apparatus for cooking appliance 108 of the eighth embodiment, an oil remover 801 is disposed inside the cooking chamber 12. The other configuration may be any of the configurations of the first to seventh embodiments. Further, control of the fan 20 along with the opening and closing of the door 14 is also any of the control examples described in the first to fifth embodiments. Thus, description of the apparatus configuration other than the oil remover 801, the installation example, and the control will be omitted.

[0184]

The oil remover 801 is disposed under the ceiling board 13d inside the cooking chamber 12. An oil removing duct 802, which communicates with the downstream side of the fan 20, and a vent 803, which switches an air blowing path, are disposed in a part above the ceiling.

[0185]

A discoid filter which rotates and includes an air vent and a motor which drives the discoid filter (both not illustrated) are housed inside the oil remover 801, and the lower part of the oil remover 801 is open so as to allow air to pass therethrough. In the oil remover 801, when air containing an oil content passes through the rotating disc, oil adheres to the disc. The adhered oil collides with the inner wall of the oil remover 801 by a centrifugal force, and accumulated in an oil reservoir (not illustrated) which is disposed along the inner wall. The oil reservoir is freely detachable, and the accumulated oil is discarded by detaching the oil

reservoir.

[0186]

The oil removing duct 802 is a path which guides air exhausted by the fan 20 to the oil remover 801. The vent 803 is an exhaust path switcher, and guides air exhausted by the fan 20 toward the exhaust port 23 (toward the side to which the exhaust duct 501 is connected) when the door 14 is open and toward the oil remover 801 when the door 14 is closed. The vent 803 may be operated with the opening and closing of the door 14 in the control example described in each of the embodiments.

[0187]

As a control example in the eighth embodiment, the fan 20 is preferably operated even when the door 14 is in a closed state. Accordingly, it is possible to remove an oil content which may become a cause of an odor from air inside the cooking chamber 12.

[0188]

In the case where the oil remover 801 is provided, without using air exhausted by the fan 20, a dedicated fan may be attached to the oil remover 801, and air inside the cooking chamber 12 may be continuously circulated inside the cooking chamber 12 through the oil remover 801. In this case, a dedicated duct may be provided, or the oil remover 801 with the dedicated fan may be disposed inside the cooking chamber 12 without providing the oil removing duct 802.

[0189]

[Cooking Method]

Next, a cooking method using the exhaust apparatus for cooking appliance according to each of the

embodiments described above will be described.

[0190]

First, a user opens the door 14 (presses the open button in some embodiments). Accordingly, the fan 20 is operated as described in each of the embodiments. After opening the door 14, a food material is set on the cooking appliance 200 inside the cooking chamber 12. Then, setting of a cooking time and an operation or the like for starting cooking are also performed on the cooking appliance 200.

[0191]

Then, the user closes the door 14 (presses the close button in some embodiments). Accordingly, the fan 20 comes to a stop, or is operated with the first air volume as described in each of the embodiments.

[0192]

In the cooking appliance 200, when the set cooking time has elapsed, sounding of a chime, a buzzer, or the like which notifies a finish of cooking or display by a lamp or a display device is performed.

[0193]

The user who has recognized the sounding or the display opens the door 14. Accordingly, the fan 20 is operated as described in each of the embodiments. After opening the door 14, the user takes out the cooked food material, and, for example, sets the next food material as needed.

[0194]

According to such a cooking method, the fan 20 is operated as described in each of the control examples in response to the opening and closing of the door 14. Thus, it is possible to prevent or reduce wafting of an odor

from the cooking chamber 12 during or after cooking into the room.

[0195]

(Coordination Mode with Cooking Appliance)

5 As another cooking method, the fan 20 may be controlled in coordination with the cooking appliance 200.

[0196]

10 As described in the above cooking method, the cooking time is set on the cooking appliance 200 in cooking. For example, a frying time is set on an automatic fryer. The coordination may be performed using the cooking time. Specifically, the cooking appliance 200 and the control unit 50 communicate with each other.

15 Accordingly, even when the door 14 is in a closed state at the point in time when the cooking time has elapsed, the fan 20 is started to start exhausting air when the fan 20 is at a stop. The communication between the cooking appliance 200 and the control unit 50 may be a

20 simple switch which starts the fan 20. Further, when the fan 20 is controlled by the control computer 702, a count end signal is transmitted from the cooking appliance 200 to the computer 702, and the fan 20 is started from the control computer 702.

25 [0197]

 Further, in another control example in coordination with the cooking appliance 200, the control unit 50 may receive the cooking time set on the cooking appliance 200, the control unit 50 may count time, and the fan 20

30 may be started to start exhausting air when the fan 20 is at a stop even when the door 14 is in a closed state at the point in time when the set time has elapsed.

Further, in this case, the fan 20 may be started before the finish time set on the cooking appliance 200.

[0198]

5 In this manner, the fan 20 starts to exhaust air at the instant when cooking finishes by starting the fan 20 in coordination with the cooking appliance 200. Thus, even when the door 14 is opened immediately after cooking finishes, air inside the cooking chamber 12 can be exhausted to some extent in a period between the
10 finish of cooking and the opening of the door 14. Thus, odor leakage can be further reduced. Further, when the fan 20 is started before the cooking finish time, air inside the cooking chamber 12 has been able to be exhausted at the point in time when cooking finishes.
15 Thus, the odor inside the cooking chamber 12 has disappeared at the point in time when cooking finishes. Thus, no odor inside the cooking chamber 12 leaks out when the door 14 is opened.

[0199]

20 Although the embodiments to which the present invention is applied have been described above, the present invention is not limited to the above embodiments.

[0200]

25 For example, the exhaust apparatus for cooking appliance may be provided with a temporary stop unit which temporarily stops the door 14 before the door 14 becomes fully open when the door 14 is opened. In a control example in this case, the temporary stop by the
30 temporary stop unit may be cancelled after an elapse of a predetermined temporary stop time with the door 14 temporarily stopped. Accordingly, it is possible to

easily take air into the cooking chamber 12 by slightly opening the door 14. In this case, the temporary stop may be cancelled not after a certain time, but when the state sensor 61 determines that the odor has disappeared
5 (or has been reduced). The opening degree of the door 14 at the temporary stop is preferably 1 to 50% when the opening degree in a full-open state is defined as 100%. When the opening degree at the temporary stop is less than 1%, the amount of air to be drawn in is too small.
10 Thus, a load is not reduced. On the other hand, an opening degree more than 50% is meaningless because there is not much difference between the opening degree more than 50% and the full-open state.

[0201]

15 Further, the door 14 is not limited to the shape of a single plate, and may be, for example, the shape of a plurality of plates, a winding shutter, or the like. Further, the door 14 may have various shapes and modes. For example, the door 14 may slide not up and down, but
20 horizontally. Further, the door 14 may not be a single door, but double doors.

[0202]

Further, the exhaust apparatus for cooking appliance according to the present invention is
25 installed inside an indoor room in many cases. However, also when the exhaust apparatus for cooking appliance is installed in the open (e.g., an exhibition hall in the open), or the like, the exhaust apparatus for cooking appliance can prevent the odor from wafting around and
30 can be used as an energy-saving exhaust apparatus for cooking appliance.

[0203]

In addition, the control examples described in the respective embodiments may be performed not individually, but in combination with each other, or another control may be performed.

5 [0204]

Further, the present invention can be implemented as various modes based on technical ideas described in the claims, and these various modes are also included in the range of the present invention.

10 [0205]

This application is based on Japanese Patent Application No. 2017-216630 filed on November 9, 2017, the entire disclosure of which is incorporated herein by reference in its entirety.

15

Reference Signs List

[0206]

- 11 base
- 12 cooking chamber
- 20 13a front panel
- 13b side panel
- 13c back panel
- 13d ceiling board
- 14 door
- 25 15 handle
- 16 gasket
- 17, 17a open button
- 17b close button
- 18, 18a, 18b, 18c, 19a, 19b indicator lamp
- 30 20 fan
- 21 motor
- 22 sirocco fan

	23	exhaust port	
	25	shutter	
	30	grease filter	
	31	air filter	
5	32	deodorization filter	
	33	smoke removal filter	
	34	oil adsorption filter	
	35	housing	
	41	fire alarm	
10	42	fire extinguisher	
	50	control unit	
	51	open/close sensor	
	52	full-open sensor	
	55	lock unit	
15	57	timer	
	58	electromagnetic solenoid	
	61	state sensor	
	62	control IC	
	70	open/close power unit	
20	72	rack gear	
	73	pinion gear	
	74	opening/closing motor	
	80	intake side shutter	
	90	inner panel	
25	101, 102, 103, 104, 106, 107, 108	exhaust apparatus for cooking appliance	
	200	cooking appliance	
	501, 503	exhaust duct	
	701	converter	
30	702	control computer	
	711	CPU	
	712	ROM	

713 RAM
714 nonvolatile memory
801 oil remover
801 oil removing duct
5 802 vent

CLAIMS

1. An exhaust apparatus for a cooking appliance comprising:
- a cooking chamber which houses a cooking appliance
 - 5 inside;
 - a door installed in or on the cooking chamber;
 - a fan connected to an exhaust duct for exhausting air inside the cooking chamber to inside or outside of a room in which the cooking chamber is placed; and
 - 10 a control unit that changes an operation of the fan corresponding to an open/closed state of the door, wherein
 - the control unit
 - controls the fan so that the fan is kept stopped or
 - 15 operated with a first air volume when the door is in a closed state,
 - controls the fan so that the fan is operated with a third air volume larger than the first air volume between when the door starts to open and when the door
 - 20 becomes fully open, and
 - controls the fan so that the fan is operated with a second air volume larger than the first air volume and smaller than the third air volume after the door becomes fully open.
- 25
2. An exhaust apparatus for a cooking appliance comprising:
- a cooking chamber which houses a cooking appliance
 - inside;
 - 30 a door installed in or on the cooking chamber;
 - a fan connected to an exhaust duct for exhausting

air inside the cooking chamber to inside or outside of a room in which the cooking chamber is placed;

a control unit that changes an operation of the fan corresponding to an open/closed state of the door;

5 an open button that issues an instruction to open the door; and

a lock unit that locks and unlocks the door with the door closed, wherein

the control unit unlocks the lock unit after
10 operating the fan for a certain time when the control unit receives the instruction to open the door from the open button.

3. An exhaust apparatus for a cooking appliance
15 comprising:

a cooking chamber which houses a cooking appliance inside;

a door installed in or on the cooking chamber;

a fan connected to an exhaust duct for exhausting
20 air inside the cooking chamber to inside or outside of a room in which the cooking chamber is placed; and

a control unit that changes an operation of the fan corresponding to an open/closed state of the door;

an open button that issues an instruction to open
25 the door; and

an open/close power unit that opens and closes the door, wherein

the control unit controls the open/close power unit so that the open/close power unit opens the door
30 after operating the fan for a certain time when the control unit receives the instruction to open the

door from the open button.

4. An exhaust apparatus for a cooking appliance comprising:

- 5 a cooking chamber which houses a cooking appliance inside;
- a door installed in or on the cooking chamber;
- a fan connected to an exhaust duct for exhausting air inside the cooking chamber to inside or outside of a
- 10 room in which the cooking chamber is placed;
- a control unit that changes an operation of the fan corresponding to an open/closed state of the door,
- an open button that issues an instruction to open the door;
- 15 a lock unit that locks and unlocks the door with the door closed; and
- a cooking chamber internal state detection sensor that detects a state inside the cooking chamber, wherein the control unit unlocks the door by the lock unit
- 20 when a detected value of at least any of an odor, a temperature, an oil content in air, smoke, and a pressure inside the cooking chamber, detected by the cooking chamber internal state detection sensor, becomes equal to or less than a predetermined reference value.

25

5. An exhaust apparatus for a cooking appliance comprising:

- a cooking chamber which houses a cooking appliance inside;
- 30 a door installed in or on the cooking chamber;
- a fan connected to an exhaust duct for exhausting

air inside the cooking chamber to inside or outside of a room in which the cooking chamber is placed;

a control unit that changes an operation of the fan corresponding to an open/closed state of the door,

5 an open button that issues an instruction to open the door;

an open/close power unit that opens and closes the door; and

a cooking chamber internal state detection sensor
10 that detects a state inside the cooking chamber, wherein
the control unit controls the open/close power unit so that the open/close power unit opens the door when a detected value of at least any of an odor, a temperature, an oil content in air, smoke, and a
15 pressure inside the cooking chamber, detected by the cooking chamber internal state detection sensor, becomes equal to or less than a predetermined reference value.

6. An exhaust apparatus for a cooking appliance
20 comprising:

a cooking chamber which houses a cooking appliance inside;

a door installed in or on the cooking chamber;

a fan connected to an exhaust duct for exhausting
25 air inside the cooking chamber to inside or outside of a room in which the cooking chamber is placed;

a control unit that changes an operation of the fan corresponding to an open/closed state of the door; and

a temporary stop unit that temporarily stops the
30 door between a start of opening of the door and a full-open state of the door, wherein

the control unit cancels a temporary stop by the temporary stop unit after an elapse of a predetermined temporary stop time after the temporary stop unit stops the door.

5

7. An exhaust apparatus for a cooking appliance comprising:

a cooking chamber which houses a cooking appliance inside;

10 a door installed in or on the cooking chamber;

a fan connected to an exhaust duct for exhausting air inside the cooking chamber to inside or outside of a room in which the cooking chamber is placed;

15 a control unit that changes an operation of the fan corresponding to an open/closed state of the door; and

a temporary stop unit that temporarily stops the door between a start of opening of the door and a full-open state of the door; and

20 a cooking chamber internal state detection sensor that detects a state inside the cooking chamber, wherein

the control unit cancels a temporary stop by the temporary stop unit when a detected value of at least any of an odor, a temperature, an oil content in air, smoke, and a pressure inside the cooking chamber,

25 detected by the cooking chamber internal state detection sensor, becomes equal to or less than a predetermined reference value.

30 8. An exhaust apparatus for a cooking appliance comprising:

a cooking chamber which houses a cooking appliance

inside;

a door installed in or on the cooking chamber;

a fan connected to an exhaust duct for exhausting
air inside the cooking chamber to inside or outside of a
room in which the cooking chamber is placed; and

a control unit that changes an operation of the fan
corresponding to an open/closed state of the door,
wherein

the cooking appliance housed in the cooking chamber
is capable of communicating with the control unit, and

the control unit brings the fan into operation when
the fan is at a stop in response to a signal from the
cooking appliance, the signal indicating a finish of
cooking.

15

9. An exhaust apparatus for a cooking appliance
comprising:

a cooking chamber which houses a cooking appliance
inside;

20 a door installed in or on the cooking chamber;

a fan connected to an exhaust duct for exhausting
air inside the cooking chamber to inside or outside of a
room in which the cooking chamber is placed; and

a control unit that changes an operation of the fan
corresponding to an open/closed state of the door,
wherein

the cooking appliance housed in the cooking chamber
is capable of communicating with the control unit, and

the control unit brings the fan into operation when
the fan is at a stop in response to a signal from the
cooking appliance, the signal indicating that a

30

predetermined time has elapsed from a start of cooking.

10. An exhaust apparatus for a cooking appliance comprising:

- 5 a cooking chamber which houses a cooking appliance inside;
- a door installed in or on the cooking chamber;
- a fan connected to an exhaust duct for exhausting air inside the cooking chamber to inside or outside of a
- 10 room in which the cooking chamber is placed; and
- a control unit that changes an operation of the fan corresponding to an open/closed state of the door, wherein the control unit brings the fan into operation when the fan is at a stop after an elapse of a
- 15 predetermined time from a start of cooking.

11. An exhaust apparatus for a cooking appliance comprising:

- 20 a cooking chamber which houses a cooking appliance inside;
- a door installed in or on the cooking chamber;
- a fan connected to an exhaust duct for exhausting air inside the cooking chamber to inside or outside of a room in which the cooking chamber is placed;
- 25 a control unit that changes an operation of the fan corresponding to an open/closed state of the door;
- an oil remover that removes oil content from air inside the cooking chamber; and
- an exhaust path switcher that guides air exhausted
- 30 by the fan toward the exhaust duct when the door is open and toward the oil remover when the door is closed.

12. The exhaust apparatus for the cooking appliance according to any one of claims 2 to 11, wherein the control unit

5 controls the fan so that the fan is kept stopped or operated with a first air volume when the door is in a closed state, and

controls the fan so that the fan is operated with a second air volume larger than the first air volume after
10 the door starts to open.

13. The exhaust apparatus for the cooking appliance according to any one of claims 2 to 11, wherein the control unit

15 controls the fan so that the fan is kept stopped or operated with a first air volume when the door is in a closed state,

controls the fan so that the fan is operated with any one of the first air volume, a second air volume
20 larger than the first air volume, and a third air volume larger than the second air volume between when the door starts to open and when the door becomes fully open, and

controls the fan so that the fan is operated with the second air volume after the door becomes fully open.
25

14. The exhaust apparatus for the cooking appliance according to any one of claims 2 to 11, wherein the control unit

controls the fan so that the fan is kept stopped or
30 operated with a first air volume when the door is in a closed state,

controls the fan so that an air volume of the fan increases as an opening degree of the door increases between when the door starts to open and when the door becomes fully open, and

5 controls the fan so that the fan is operated with a second air volume larger than the first air volume after the door becomes fully open.

15. The exhaust apparatus for the cooking appliance
10 according to claim 12, comprising an open/close sensor that detects the open/closed state of the door, wherein

the control unit defines a point in time when signals from the open/close sensor changes from a signal
15 indicating the closed state of the door to a signal indicating the open state of the door as a start of opening of the door.

16. The exhaust apparatus for the cooking appliance
20 according to claim 1 or 13, comprising:

an open/close sensor that detects the open/closed state of the door; and

a full-open sensor that detects a full-open state of the door, wherein

25 the control unit defines a point in time when signals from the open/close sensor changes from a signal indicating the closed state of the door to a signal indicating the open state of the door as a start of opening of the door, and receives a signal indicating
30 that the door is fully open from the full-open sensor to control the fan.

17. The exhaust apparatus for the cooking appliance according to claim 14, comprising:

an open/close sensor and a full-open sensor that
5 detects the open/closed state of the door and a full-open state of the door; and

an opening degree sensor that detects the opening degree of the door, wherein

the control unit defines a point in time when
10 signals from the open/close sensor changes from a signal indicating the closed state of the door to a signal indicating the open state of the door as a start of opening of the door, receives a signal indicating the opening degree of the door from the opening degree
15 sensor, and receives a signal indicating that the door is fully open from the full-open sensor to control the fan.

18. The exhaust apparatus for the cooking appliance
20 according to any one of claims 1 to 17, comprising a deodorization filter that deodorizes air, the deodorization filter being installed in or on an upstream side or a downstream side of the fan.

25 19. The exhaust apparatus for the cooking appliance according to any one of claims 1 to 18, wherein the control unit controls the fan so that a velocity of air flowing into the cooking chamber becomes equal to or higher than 0.2 m/s when the door is in a full-open
30 state.

20. The exhaust apparatus for the cooking appliance according to any one of claims 1 to 19, comprising a shutter that closes an exhaust side inside the cooking chamber when the fan is at a stop.

5

21. The exhaust apparatus for the cooking appliance according to any one of claims 1 to 20, comprising a fire alarm that monitors the inside of the cooking chamber and issues an alarm when fire breaks out.

10

22. The exhaust apparatus for the cooking appliance according to claim 3 or 5, comprising a fire alarm that monitors the inside of the cooking chamber and issues an alarm when fire breaks out, wherein

15 the control unit closes the door in a case where the door is open when the fire alarm issues the alarm.

23. The exhaust apparatus for the cooking appliance according to any one of claims 1 to 19, comprising:

20 a fire alarm that monitors the inside of the cooking chamber and issues an alarm when fire breaks out; and

 a shutter that closes an exhaust side inside the cooking chamber, wherein

25 the control unit closes the shutter when the fire alarm issues the alarm.

24. The exhaust apparatus for the cooking appliance according to any one of claims 21 to 23, comprising a
30 fire extinguisher that sprays a fire extinguishing agent at least toward the inside of the cooking chamber when

the fire alarm issues the alarm.

25. The exhaust apparatus for the cooking appliance according to any one of claims 1 to 24, wherein the
5 cooking appliance is a fryer.

26. The exhaust apparatus for the cooking appliance according to any one of claims 1 to 25, wherein an oil repellent coating is applied to an inner wall of the
10 cooking chamber.

27. The exhaust apparatus for the cooking appliance according to any one of claims 1 to 26, comprising an inner panel including an opening communicating with an
15 intake port of the fan, the inner panel being installed inside the cooking chamber.

28. The exhaust apparatus for the cooking appliance according to any one of claims 1 to 10, 12 to 27 further
20 comprising an oil remover that removes oil content from air inside the cooking chamber.

29. A cooking method using the exhaust apparatus for the cooking appliance according to any one of claims 1
25 to 28, the method comprising the steps of:

- opening the door and setting a food material in or on the cooking appliance inside the cooking chamber;
- closing the door; and
- opening the door after finishing cooking.