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

(11) **EP 2 040 003 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
25.03.2009 Bulletin 2009/13

(21) Application number: **07767577.5**

(22) Date of filing: **26.06.2007**

(51) Int Cl.:
F24C 1/00 *(2006.01)*

(86) International application number:
PCT/JP2007/062771

(87) International publication number:
WO 2008/007538 (17.01.2008 Gazette 2008/03)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

(30) Priority: **10.07.2006 JP 2006189217**
10.07.2006 JP 2006189218

(71) Applicant: **Panasonic Corporation**
Kadoma-shi
Osaka 571-8501 (JP)

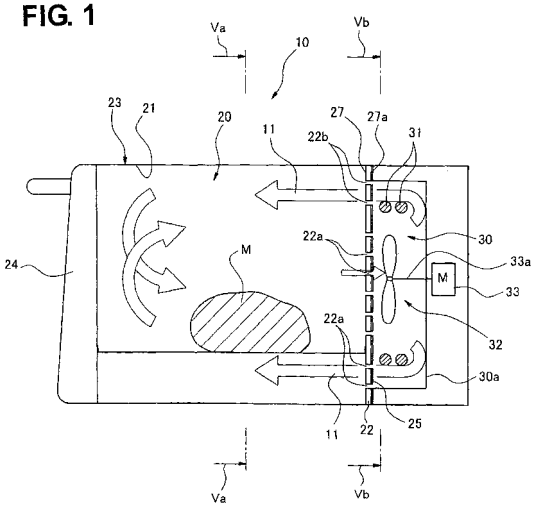
(72) Inventors:
- **YAMASAKI, Takahiko c/o Panasonic Corporation IPROC**
  Osaka 540-6207 (JP)
- **INADA, Ikuhiro c/o Panasonic Corporation IPROC**
  Osaka 540-6207 (JP)
- **MORI, Yasuhisa c/o Panasonic Corporation IPROC**
  Osaka 540-6207 (JP)
- **KAWAI, Hiroshi c/o Panasonic Corporation IPROC**
  Osaka 540-6207 (JP)

(74) Representative: **Grünecker, Kinkeldey,**
Stockmair & Schwanhäusser
Anwaltssozietät
Leopoldstrasse 4
80802 München (DE)

(54) HEATING COOKING APPARATUS

(57) There is provided a heating cooking apparatus which can reduce heating and cooking time by reducing the time for raising the temperature of a heating chamber to a desired temperature. In a heat source chamber 30, since the distance between a heat source 31 formed in the spiral shape in order to heat air and a circulating fan 32 is as close as less than 10mm, ventilation efficiency improves. Further, a coating film 25 is formed on a side surface on the heat source chamber 30 side of a partition plate 22 which forms a boundary between the heat source chamber 30 and a heating chamber 20. Hereby, the heat supplied from the electric heater 31 is stored in the coating film 25, and next the heat is radiated from the coating film 25, with the result that the coating film 25 heats the air in the heat source chamber 30 as a second heat source. Therefore, when the hot air of which the temperature has been raised by the heat source 31 in the heat source chamber 30 is sent into the heating chamber 20 by the circulating fan 32 to perform heat-cooking, the time for raising the temperature of the air in the heat source chamber 30 to a predetermined temperature can be reduced, and power saving can be realized.

FIG. 1



EP 2 040 003 A1

Description

Technical Field

[0001] The present invention relates to a heating cooking apparatus which heats and cooks a subject to be heated which is placed in a heating chamber by means of hot air supplied from a heat source.

Background Art

[0002] As an example of general heating cooking apparatus, a heating cooking apparatus as shown in Fig. 11 has been known (refer to, for example, Patent Document 1).
As shown in Fig. 11, in a heating cooking apparatus 100 disclosed in the Patent Document 1, a heating chamber 102 is located inside an apparatus body 101, and a door 104 is disposed openably and closably at an opening 103 for putting food into or taking food out of the heating chamber 102. At the back of a heating chamber rear wall 105, a hot air chamber 110 is provided, and an electric heater 106 and a hot air circulating fan 107 rotationally driven by a motor 108 are provided in the hot air chamber 110. Generally, an upper surface and right and left side surfaces of the heating chamber 102, and a heating chamber side surface of the heating chamber rear wall 105 are subjected to coating, while a hot air chamber 110 side surface of the heating chamber rear wall 105 is not subjected to coating.
Accordingly, the electric heater 106 heats air in the hot air chamber 110, the heated hot air is sent into the heating chamber 102 from an air port provided in the heating chamber rear wall 105, and the food placed on a placing base 109 is heated and cooked.

Patent Document 1: Japanese Patent No. 3259473 (Fig. 1)

Disclosure of Invention

Problems to be Solved by the Invention

[0003] Since the heating cooking apparatus raises the temperature in the heating chamber from the same state as the chamber temperature to a predetermined cooking temperature thereby to heat and cook the food, reduction of rise time is required in order to reduce the heating and cooking time. Further, also from a viewpoint of energy saving, the reduction of heating and cooking time is desired.
[0004] The present invention, which has been made in order to solve the existing problem, has an object to provide a heating cooking apparatus which can reduce heating and cooking time by reducing the time for which temperature in a heating chamber is raised to a desired temperature.

Means For Solving the Problems

[0005] A heating cooking apparatus according to the present invention includes a heating chamber which accommodates a subject to be heated therein; and a heat source chamber which is adjacent to the heating chamber through a partition plate located at a back portion of the heating chamber, and accommodates therein a heat source and a circulating fan which circulates heat supplied from the heat source. Herein, the heat source is formed in the shape of a plurality of spirals, the circulating fan is arranged in the inside of the circumference of the heat source, and the spaced dimension between the heat source and the circulating fan is less than 10mm.
[0006] According to this component, since the distance between the heat source formed in the spiral shape in order to heat the air in the heat source chamber and the circulating fan is as close as less than 10mm, a heat exchange efficiency improves. Therefore, when the hot air of which the temperature has been raised by the heat source in the heat source chamber is sent into the heating chamber by the circulating fan to perform heat-cooking, the time for raising the temperature of the air in the heat source chamber to a predetermined temperature can be reduced, and the power saving can be realized.
[0007] Further, the heating cooking apparatus according to the present invention includes the heating chamber which accommodates the subject to be heated therein; and the heat source chamber which is adjacent to the heating chamber through the partition plate located at the back portion of the heating chamber, and accommodates therein the heat source and the circulating fan which circulates heat supplied from the heat source. Herein, the heat source is formed in the shape of the plurality of the spirals, the circulating fan is arranged in the inside of the circumference of the heat source, the heat source and the circulating fan are arranged close to each other, and a plane shape along a rotation axis of the circulating fan expands toward an outer periphery of the circulating fan.
[0008] According to this component, since the shape of the circulating fan for sending the air in the heat source chamber heated by the heat source into the heating chamber expands toward the outer periphery, the area of the circulating fan increases, so that the heat from the heat source is easily stored in the circulating fan. Accordingly, the heat from the heat source is stored in the circulating fan, and next the heat is radiated by the ventilation operation of the circulating fan, with the result that the circulating fan heats the air in the heat source chamber as a second heat source. Therefore, when the hot air of which the temperature has been raised by the heat source in the heat source chamber is sent into the heating chamber by the circulating fan to perform heat-cooking, the time for raising the temperature of air in the heat source chamber can be reduced. Further, since the time necessary to raise the temperature is reduced, power saving can be realized.

[0009] Further, in the heating cooking apparatus according to the present invention, an end in a rising direction of a vane portion of the circulating fan does not protrude from an end portion in a spiral axial direction of the heat source.

[0010] According to this component, since the vane portion of the circulating fan rotates within an inner range of the spiral heat source, the heat exchange efficiency improves. Therefore, when the hot air of which the temperature has been raised by the heat source in the heat source chamber is sent into the heating chamber by the circulating fan to perform heat-cooking, the time for raising the temperature of the air in the heating chamber to the predetermined temperature can be reduced, and the power saving can be realized.

[0011] Further, the heating cooking apparatus according to the present invention includes the heat source chamber which accommodates the circulating fan therein, wherein a plane area of the heat source chamber along a depth direction of the heating chamber is substantially the same as a plane area of the heating chamber along the depth direction of the heating chamber.

[0012] According to this component, since the sectional area of the heat source chamber is substantially the same as the sectional area of the heating chamber, the air can be sent from corners of the heating chamber, so that ventilation efficiency improves and the air can be evenly sent all over the heating chamber. Therefore, when the hot air of which the temperature has been raised by the heat source in the heat source chamber is sent into the heating chamber by the circulating fan to perform heat-cooking, uniformity of heat distribution in the heating chamber can be realized, the time for raising the temperature of the air in the heat source chamber to the predetermined temperature can be reduced, and the power saving can be realized.

[0013] Further, the heating cooking apparatus according to the present invention includes the heat source chamber which accommodates the circulating fan therein, wherein the heat source is formed in a spiral shape, the circulating fan is arranged inside the circumference of the heat source, and a fixing member for fixing the heat source onto a depth surface of the heat source chamber has a wall portion which contacts a side surface of the heat source chamber.

[0014] According to this component, since the fixing member for fixing the heat source formed in a spiral shape onto the heat source chamber has the wall portion which contacts the side surface of the heat source chamber, this wall portion regulates the air circulating direction, so that the hot air can be efficiently supplied into the heating chamber. Therefore, when the hot air of which the temperature has been raised by the heat source in the heat source chamber is sent into the heating chamber by the circulating fan to perform heat-cooking, the time for raising the temperature of the air in the heating chamber to the predetermined temperature can be reduced, and power saving can be realized.

[0015] Further, a heating cooking apparatus according to the present invention includes a heating chamber which is formed by a cylindrical portion and a partition plate, and accommodates a subject to be heated therein; and a heat source chamber which is adjacent to the heating chamber through the partition plate, and accommodates therein a heat source and a circulating fan for circulating heat supplied from the heat source. Herein, a side surface on the heat source chamber side of the partition plate is provided with heat storage component.

[0016] According to this component, since the side surface on the heat source chamber side of the partition plate which forms a boundary between the heat source chamber and the heating chamber is provided with heat storage component, the heat supplied from the heat source is stored in the heat storage component, and next the heat is radiated from the side surface on the heat source chamber side of the partition plate, with the result that the side surface on the heat source chamber side of the partition plate heats the air in the heat source chamber as a second heat source. Therefore, when the hot air of which the temperature has been raised by the heat source in the heat source chamber is sent into the heating chamber by the circulating fan to perform heat-cooking, the time for raising the temperature of the air in the heat source chamber can be reduced. Further, since the time necessary for raising the temperature is reduced, power saving can be realized.

[0017] Further, in the heating cooking apparatus according to the present invention, a coating film is formed on the side surface on the heat source chamber side, whereby the heat storage component is provided on the side surface on the heat source chamber side.

[0018] According to this component, since the coating film is formed on the side surface on the heat source chamber side of the partition plate which forms the boundary between the heat source chamber and the heating chamber, the heat from the heat source is stored in the coating film, and next the heat is radiated from the coating film, with the result that the coating film heats the air in the heat source chamber as a second heat source. Therefore, when the hot air of which the temperature has been raised by the heat source in the heat source chamber is sent into the heating chamber by the circulating fan to perform heat-cooking, the time for raising the temperature of the air in the heat source chamber can be reduced. Further, since the time necessary for raising the temperature is reduced, power saving can be also realized.

[0019] Further, in the heating cooking apparatus according to the present invention, the partition plate is formed of material different from material of right and left wall surfaces of the heating chamber, whereby the heat storage component is provided on the side surface of the heat source chamber side.

[0020] According to this component, since the material which is different from the material of the right and left sides of the cylindrical portion forming the heating cham-

ber and high in endothermic efficiency, heat storage efficiency, and radiation efficiency is used for the partition plate, the heat from the heat source is stored in the partition plate, and next the heat is radiated from the partition plate, with the result that the partition plate heats the air in the heat source chamber as a second heat source. Therefore, when the hot air of which the temperature has been raised by the heat source in the heat source chamber is sent into the heating chamber by the circulating fan to perform heat-cooking, the time for raising the temperature of the air in the heat source chamber can be reduced. Further, since the time necessary for raising the temperature is reduced, power saving can be also realized.

[0021] Further, in the heating cooking apparatus according to the present invention, a rough surface formed on a side surface on the heat source chamber side, whereby the heat storage component is provided on the side surface of the heat source chamber side.

[0022] By this component, since the rough surface is formed on the side surface on the heat source chamber side of the partition plate thereby to increase the surface area of the partition plate, endothermic efficiency, heat storage efficiency, and radiation efficiency of the partition plate can be heightened. Accordingly, the heat from the heat source is stored in the partition plate, and next the heat is radiated from the partition plate, with the result that the partition plate heats the air in the heat source chamber as a second heat source. Therefore, when the hot air of which the temperature has been raised by the heat source in the heat source chamber is sent into the heating chamber by the circulating fan to perform heat-cooking, the time for raising the temperature of the air in the heat source chamber can be reduced. Further, since the time necessary for raising the temperature is reduced, power saving can be realized.

Advantages of the Invention

[0023] According to the present invention, since the distance between the heat source formed in the spiral shape in order to heat the air in the heat source chamber and the circulating fan is made close, the heat exchange efficiency can be improved. Therefore, it is possible to provide a heating cooking apparatus which has advantages that: when the hot air of which the temperature has been raised by the heat source in the heat source chamber is sent into the heating chamber by the circulating fan to perform heat-cooking, the time for raising the temperature of the air in the heat source chamber to a predetermined temperature can be reduced, and the power saving can be realized.

[0024] Further, since the present invention has the component the side surface on the heat source chamber side of the partition plate which forms the boundary between the heat source chamber and the heating chamber is provided with heat storage component, the heat supplied from the heat source is stored in the heat storage component, and next the heat is radiated from the heat storage component, with the result that the heat storage component heats the air in the heat source chamber as the second heat source.

Therefore, it is possible to provide a heating cooking apparatus which has advantages that: the time for raising the temperature of the air in the heat source chamber can be reduced; and the power saving can be realized by reducing the time for raising the temperature.

Brief Description of Drawings

[0025]

Fig. 1 is a diagram showing an internal component of a heating cooking apparatus according to a first embodiment of the present invention.

Fig. 2 is a front view of a circulating fan and an electric heater.

Fig. 3 is a perspective view showing an end shape of a vane portion of the circulating fan.

Fig. 4 is a sectional view showing a positional relation between the circulating fan and the electric heater.

Fig. 5A is a sectional view in a Va-Va position in Fig. 1, and Fig. 5B is a sectional view in a Vb-Vb position in Fig. 1.

Fig. 6A is a front view showing a state where the electric heater is fixed in a heat source chamber, and Fig. 6B is a perspective view of a fixing member.

Fig. 7A is a table showing data of a general fan and a fan having the shape according to the present invention, and Fig. 7B is a graph for comparing the amount of air flow between the fans in Fig. 7A.

Fig. 8 is a diagram showing an internal component of a heating cooking apparatus according to a second embodiment of the present invention.

Fig. 9 is a diagram showing an internal component of a heating cooking apparatus according to a third embodiment of the present invention.

Fig. 10 is a diagram showing an internal component of a heating cooking apparatus according to a fourth embodiment of the present invention.

Fig. 11 is a sectional view of a general heating cooking apparatus.

Description of Reference Numerals

[0026]

10	Heating cooking apparatus
20	Heating chamber
21	Cylindrical portion
22	Partition plate
25	Coating film (Heat storage component)
30	Heat source chamber
30a	Depth surface
31	Electric heater (heat source)
32	Circulating fan

32a Vane portion
34 Fixing member
M Meat (subject to be heated)

Best Mode for Carrying Out the Invention

(First embodiment)

[0027] A Heating cooking apparatus according to embodiments of the present invention will be described below with reference to drawings.
Fig. 1 is a diagram showing an internal component of a heating cooking apparatus according to a first embodiment of the present invention, Fig. 2 is a front view of a circulating fan and an electric heater, Fig. 3 is a perspective view showing an end shape of a vane portion of the circulating fan, Fig. 4 is a sectional view showing a positional relation between the circulating fan and the electric heater, Fig. 5A is a sectional view in a Va-Va position in Fig. 1, Fig. 5B is a sectional view in a Vb-Vb position in Fig. 1, Fig. 6A is a front view of a heat source chamber 30, showing a state where the electric heater is fixed in the heat source chamber, Fig. 6B is a perspective view of a fixing member, Fig. 7A is a table showing data of a general fan and a fan having the shape in the present invention, and Fig. 7B is a graph for comparing the flowing amount between the fans in Fig. 7A.

[0028] As shown in Fig. 1, a heating cooking apparatus 10 according to the first embodiment of the present invention is formed by a cylindrical portion 21 and a partition plate 22. The heating cooking apparatus 10 includes a heating chamber 20 which can accommodate a subject to be heated, for example, meat M therein; and a heat source chamber 30 which is adjacent to the heating chamber 20 through the partition plate 22, and accommodates therein an electric heater 31 that is a heat source, and a circulating fan 32 rotationally driven by a motor 33 in order to circulate hot air 11 heated by this electric heater 31.

[0029] The heating chamber 20 includes a front-opened cubic box-shaped body case 23 which is formed by the cylindrical portion 21 having a rectangular section and the partition plate 22 that is a heating chamber rear wall, and a door 24 which is openably and closably provided for a take-out port, which is a front surface of the body case 23, of the subject to be heated. An inner surface (upper surface and right and left side surfaces) of the cylindrical portion 21 in the heating chamber 20 and a side surface of the heating chamber 20 of the partition plate 22 are subjected to heat-resisting coating. The door 24 is coupled, for example, at its lower end by hinges to a lower edge of the body case 23, thereby to be openable and closable in the up-down direction.
In this heating cooking apparatus 10, the heating chamber 20 and the heat source chamber 30 are separately provided, and they are connected through the partition plate 22. Alternatively, the partition plate 22 may be attached near the rear end portion of the body case 23 to provide the heating chamber 20 and the heat source chamber 30.

[0030] In the center portion of the partition plate 22, an intake ventilation hole 22a for sucking air from the heating chamber 20 side to the heat source chamber 30 side is provided; and at the surrounding portion of the partition plate 22, an air flow ventilation hole 22b for sending air from the heat source 30 side to the heating chamber 20 side is provided. Each of the ventilation holes 22a and 22b can be formed as many punch holes. Accordingly, by the circulating fan 32, the air in the heating chamber 20 is sucked from the intake ventilation hole 22a to the heat source chamber 30, and the air in the heat source 30 heated by the electric heater 31 is sent from the air flow ventilation hole 22b to the heating chamber 20.

[0031] Further, on a surface on the heat source chamber 30 side of the partition plate 22, a coating film 25 having thickness of 20 to 30 μm is formed of material which is good in endothermic efficiency, heat storage efficiency, and radiation efficiency, for example, ceramic-based coating material. This coating film 25 constitutes heat storage component. Hereby, the heat supplied from the electric heater 31 is stored in the coating film 25 of the partition plate 22 once, and next the heat is radiated from the coating film 25, with the result that the coating film 25 heats the air in the heat source chamber 30 as a second heat source. Therefore, when the temperature of the air in the heat source chamber 30 is raised by the electric heater 31, the temperature rise time can be reduced, and power saving can be also realized because the time necessary to raise the temperature is reduced.

[0032] As shown in Fig. 2, the circulating fan 32 is provided with plural sheets (for example, 8 sheets) of vane portions 32a extending from a center portion radially, and the center of the circulating fan 32 is fixed to a rotation shaft 33a of the motor 33. The vane portion 32a of the circulating fan 32 is, as shown in Fig. 3, formed by a bottom surface 32b parallel to a rotary plane, and a slant surface 32c which slants with respect to the rotary plane. Accordingly, as shown by an arrow in Fig. 1, when the circulating fan 32 is rotated by the motor 33, the air is moved backward (to the right in Fig. 1) by the slant surface 32c, the air in the heating chamber 20 is sucked into the heat source chamber 30 from the intake ventilation hole 22a in the partition plate 22, and the hot air is sent along the inner wall of the heat source chamber 30 from the air flow ventilation hole 22b into the heating chamber 20.

[0033] As shown in Fig. 2, the electric heater 31 is formed in a spiral shape outside the circulating fan 32, and has the construction that a spaced dimension d between the electric heater 31 and the circulating fan 32 is $d < 10$ mm. Namely, since the distance d between the electric heater 31 which is formed, for example, in the spiral shape in order to heat the air in the heat source chamber 30 and an outermost circumference of the circulating fan 32 is small, heat-exchanging efficiency of sending the hot air heated by the electric heater 31 to

the heating chamber 20 can be improved, so that the time for which the temperature in the heating chamber 20 is heated to the desired temperature can be reduced. Further, with this reduction, power saving can be realized.

[0034] As shown in Figs. 2 and 3, the plane shape on the rotary plane of the circulating fan 32 expands toward the outer periphery. Namely, in Fig. 3, a relation between a width B1 of the end portion and a width B2 of a midway portion is B1 > B2. Since the shape of the circulating fan 32 is thus expanding toward the outer periphery, the area of the vane portion 32a can be made large. Since the heat is easy to be stored in this portion having the large area, the heat from the electric heater 31 is stored in the circulating fan 32. When the heat is radiated from the circulating fan 32, it heats the air in the heat source chamber 30 as a second heat source. Therefore, the time for which the temperature of the air in the heat source chamber 30 is raised can be reduced. Further, since the time necessary to raise the temperature is reduced, the power saving can be realized.

[0035] Further, as shown in Fig. 4, the circulating fan 32 is so constructed that an end 32d in a rising direction of the vane portion 32a does not protrude from an end portion 31 a in a spiral axial direction (in the up-direction in Fig. 4) of the electric heater 31. Namely, in the circulating fan 32, the end 32d of the slant surface 32c of the vane portion 32a rising in the spiral axial direction is included within the thickness of the electric heater 31. Accordingly, the circulating fan 32 sends efficiently air to a high-temperature portion around the electric heater 31 thereby not to perform useless ventilation which does not contribute to the heat exchange, and can send efficiently the air heated by the electric heater 31 into the heating chamber 20. Therefore, the time for which the temperature in the heating chamber 20 is heated to the desired temperature can be reduced, and the power saving can be realized.

[0036] Further, a plane area A2 of the heat source chamber 30 along a depth direction of the heating chamber 20 shown in Fig. 5B is approximately the same as a plane area A1 of the heating chamber 20 along the depth direction shown in Fig. 5A (for example, A2 = about 0.8 $\times$ A1). Namely, since the sectional area A2 of the heat source chamber 30 is approximately the same as the sectional area A1 of the heating chamber 20, the air heated in the heat source chamber 30 can be smoothly sent through the surrounding portion of the heat source chamber 30 to the corners of the heating chamber 20, so that ventilation efficiency improves and the air can be sent all over the heating chamber 20. Therefore, the time for which the temperature in the heating chamber 20 is heated to the desired temperature can be reduced, heat distribution in the heating chamber can be made uniform, and the power saving can be realized.

[0037] Further, as shown in Fig. 6A, the electric heater 31 is fixed onto a depth surface 30a of the heat source chamber 30 through a fixing member 34. Further, as shown in Fig. 6B, the fixing member 34 is formed by, for example, an insulator, has a base portion 34a for attachment onto the depth surface 30a, and is fixed onto the depth surface 30a by a screw or the like. For the base portion 34a, a plane-shaped wall portion 34b rising erectly is provided, and one end surface 34d of this wall portion 34b comes into contact with the side surfaces of the heat source chamber 30 (a ceiling surface and a bottom surface in Fig. 6A). Further, for the other end portion of the wall portion 34b, a grip portion 34c for gripping the electric heater 31 formed in a spiral shape at a predetermined interval is provided. Accordingly, since the wall portion 34b regulates the direction of air circulation produced by the circulating fan 32, the hot air can be efficiently supplied into the heating chamber. Therefore, when the hot air of which the temperature has been raised by the electric heater 31 in the heat source chamber 30 is sent into the heating chamber 20 by the circulating fan 32 to perform heat-cooking, the time for raising the temperature of the air in the heating chamber 20 to the predetermined temperature can be reduced, and the power saving can be realized.

[0038] Figs. 7A and 7B show comparison in the amount of air flow Q between the general circulating fan and the circulating fan 32 according to the present invention. Using the general fan and the fan in the present invention which have dimensions shown in Fig. 7A, while varying static pressure, the comparison in the amount of air flow Q was made. In result of the test, as shown in Fig. 7B, in case that the circulating fan 32 in the present invention is used, compared with the case where the general circulating fan is used, assuming that the static pressure Hs can be made approximately zero due to air communication between the heating chamber inside and the heat source chamber inside, it is founded that the amount of air flow has increased by 40%.

As described above, in the heating cooking apparatus 10 according to the first embodiment of the present invention, the circulating fan 32 and the electric heater 31 are located close to each other so that the spaced dimension d between the circulating fan 32 and the electric heater 31 formed in a spiral shape outside the circulating fan 32 becomes 1mm < d < 10mm. Therefore, it is possible to improve the ventilation efficiency of sending the hot air heated by the electric heater 31 into the heating chamber 20, and it is possible to reduce the time for which the temperature in the heating chamber 20 is heated to the desired temperature. Further, with this reduction, the power saving can be realized.

[0039] Further, the coating film 25 is formed on the surface on the heat source chamber 30 side of the partition plate 22 which forms the boundary between the heat source chamber 30 and the heating chamber 20. Therefore, the heat supplied from the electric heater 31 is stored in the coating film 25, and next the heat is radiated from the coating film 25, whereby the coating film 25 heats the air in the heat source chamber 30 as the second heat source. Therefore, when the hot air of which

the temperature has been raised by the electric heater 31 in the heat source chamber 30 is sent into the heating chamber 20 by the circulating fan 32 to perform heat-cooking, the time for raising the temperature of the air in the heat source chamber 30 can be reduced. Further, since the time necessary to raise the temperature is reduced, the power saving can be realized.

(Second embodiment)

[0040] Next, a heating cooking apparatus according to a second embodiment of the present invention will be described.

As shown in Fig. 8, this heating cooking apparatus 10B is formed by a cylindrical portion 21 and a partition plate 26. The heating cooking apparatus 10B includes a heating chamber 20 which can accommodate a subject to be heated, for example, meat M therein; and a heat source chamber 30 which is adjacent to the heating chamber 20 through the partition plate 26, and accommodates therein an electric heater 31 that is a heat source, and a circulating fan 32 which circulates heat supplied from this electric heater 31. The partition plate 26 is formed of material different from material of the cylindrical portion 31.

The portions common to those in the heating cooking apparatus 10 according to the aforesaid first embodiment are denoted by the same numerals, and the overlapping description is omitted.

[0041] In the partition plate 26, similarly to the partition plate 22 in the aforesaid first embodiment, an intake ventilation hole 22a and an air flow ventilation hole 22b are provided. As material forming the partition plate 26, which is different from the material forming the cylindrical portion 31, material which is good in endothermic efficiency, heat storage efficiency, and radiation efficiency can be used, for example, aluminum plating material, a steel plate having ceramic-based coating iron or manganese with thickness of about 25 μm, or material having coating in which industrial diamonds are included in order to increase thermal conductivity.

[0042] As described above, in the heating cooking apparatus 10B according to the second embodiment of the present invention, the operational advantage in the aforesaid first embodiment is obtained. Further, since the partition plate 26 which forms a boundary between the heat source chamber 30 and the heating chamber 20 is formed of the material which is different from the material of the cylindrical portion 21 and high in endothermic efficiency, heat storage efficiency, and radiation efficiency, the heat from the electric heater 31 is stored in the partition plate 26, and next the heat is radiated from the partition plate 26, with the result that the partition plate 26 heats the air in the heat source chamber 30 as a second heat source. Therefore, when the hot air of which the temperature has been raised by the electric heater 31 in the heat source chamber 30 is sent into the heating chamber 20 by the circulating fan 32 to perform heat-cooking, the time for which the temperature of the air in the heat source chamber 30 is raised can be reduced. Further, since the time necessary to raise the temperature is reduced, power saving can be realized.

(Third embodiment)

[0043] Next, a heating cooking apparatus according to a third embodiment of the present invention will be described.

As shown in Fig. 9, this heating cooking apparatus 10C is formed by a cylindrical portion 21 and a partition plate 27. The heating cooking apparatus 10C includes a heating chamber 20 which can accommodate a subject to be heated, for example, meat M therein; and a heat source chamber 30 which is adjacent to the heating chamber 20 through the partition plate 27, and accommodates therein an electric heater 31 that is a heat source, and a circulating fan 32 which circulates heat supplied from this electric heater 31. On a side surface on the heat source chamber 30 side of the partition plate 27, rough surface 27a is formed. The portions common to those in the heating cooking apparatus 10 according to the aforesaid first embodiment are denoted by the same numerals, and the overlapping description is omitted.

[0044] In the partition plate 27, similarly to the partition plate 22 in the aforesaid first embodiment, an intake ventilation hole 22a and an air flow ventilation hole 22b are provided. The rough surface 27a formed on the side surface on the heat source chamber 30 side of the partition plate 27 can be provided by, for example, the sandblast processing.

[0045] As described above, in the heating cooking apparatus 10C according to the third embodiment of the present invention, the operational advantage in the aforesaid first embodiment is obtained. Further, since the rough surface 27a are provided on the side surface on the heat source chamber 30 side of the partition plate 27 which forms a boundary between the heat source chamber 30 and the heating chamber 20 thereby to increase the surface area of the partition plate 27, endothermic efficiency, heat storage efficiency, and radiation efficiency of the partition plate 27 can be heightened. Accordingly, the heat from the electric heater 31 is stored in the partition plate 27, and next the heat is radiated from the partition plate 27, with the result that the partition plate 27 heats the air in the heat source chamber 30 as a second heat source. Therefore, when hot air heated by the electric heater 31 in the heat source chamber 30 is sent into the heating chamber 20 by the circulating fan 32 to perform heat-cooking, the time for which the temperature of the air in the heat source chamber 30 is raised can be reduced. Further, since the time necessary to raise the temperature is reduced, power saving can be also realized.

(Fourth embodiment)

[0046] Next, a heating cooking apparatus according to

a fourth embodiment of the present invention will be described.

As shown in Fig. 10, this heating cooking apparatus 10D is formed by a cylindrical portion 21 and a partition plate 28. The heating cooking apparatus 10D includes a heating chamber 20 which can accommodate a subject to be heated, for example, meat M therein; and a heat source chamber 30 which is adjacent to the heating chamber 20 through the partition plate 28 and accommodates therein an electric heater 31 that is a heat source, and a circulating fan 32 which circulates heat supplied from this electric heater 31. On a side surface on the heat source chamber 30 side of the partition plate 28, a metal layer 28a is formed. The portions common to those in the heating cooking apparatus 10 according to the aforesaid first embodiment are denoted by the same numerals, and the overlapping description is omitted.

[0047] In the partition plate 28, similarly to the partition plate 22 in the aforesaid first embodiment, an intake ventilation hole 22a and an air flow ventilation hole 22b are provided. Further, the metal layer 28a can be provided by superimposing and joining another metal plate onto the partition plate 28 by, for example, riveting. Further, both ventilation holes 22a and 22b are provided also for the metal layer 28a in the same positions and in the same shape as the partition plate 28.

[0048] As described above, in the heating cooking apparatus 10D according to the fourth embodiment of the present invention, the operational advantage in the aforesaid first embodiment is obtained. Further, since the metal layer 28a is provided on the side surface on the heat source chamber 30 side of the partition plate 28 which forms a boundary between the heat source chamber 30 and the heating chamber 20, endothermic efficiency, heat storage efficiency, and radiation efficiency of the partition plate 28 can be heightened.

Accordingly, the heat supplied from the electric heater 31 which is the heat source is stored in the partition plate 28 and the metal layer 28a, and next the heat is radiated from the partition plate 28 and the metal layer 28a, with the result that the partition plate 28 and the metal layer 28a heat the air in the heat source chamber 30 as second heat sources. Therefore, when hot air heated by the electric heater 31 in the heat source chamber 30 is sent into the heating chamber 20 by the circulating fan 32 to perform heat-cooking, the time for which the temperature of the air in the heat source chamber 30 is raised can be reduced. Further, since the time necessary to raise the temperature is reduced, power saving can be also realized.

[0049] The heating cooking apparatus according to the present invention is not limited to the aforesaid embodiments, but modification and improvement can be appropriately made.

[0050] This application is based on Japanese Patent Applications (No. 2006-189217 and No. 2006-189218) filed on July 10, 2006, the contents of which are herein incorporated by reference.

Industrial Applicability

[0051] As described above, in the heating cooking apparatus according to the present invention, since the distance between the heat source formed in the spiral shape in order to heat the air in the heat source chamber and the circulating fan is made close, the ventilation efficiency can be improved. Therefore, the heating cooking apparatus has advantages that: when the hot air of which the temperature has been raised by the heat source in the heat source chamber is sent into the heating chamber by the circulating fan to perform heat-cooking, the time for raising the temperature of the air in the heat source chamber to a predetermined temperature can be reduced, and the power saving can be realized. Accordingly, the heating cooking apparatus is useful as a heating cooking apparatus which heats and cooks the subject to be heated that is accommodated into the heating chamber by means of the hot air supplied from the heat source.

[0052] Further, in the heating cooking apparatus according to the present invention, since the side surface on the heat source chamber side of the partition plate which forms the boundary between the heat source chamber and the heating chamber is made high in endothermic efficiency, heat storage efficiency, and radiation efficiency, the heat from the heat source is stored in the partition plate and the like, and next the heat is radiated from the partition plate and the like, with the result that the partition plate and the like heat the air in the heat source chamber as the second heat source. Therefore, the present invention has an advantage that it is possible to provide a heating cooking apparatus which has advantages that the time for raising the temperature of the air in the heat source chamber can be reduced, and that the power saving can be realized by reduction of the temperature rise time. Accordingly, the heating cooking apparatus is useful as a heating cooking apparatus which heats and cooks the subject to be heated that is accommodated into the heating chamber by means of the hot air supplied from the heat source.

Claims

1. A heating cooking apparatus, comprising:

a heating chamber which accommodates a subject to be heated therein; and
a heat source chamber which is adjacent to the heating chamber through a partition plate located at a back portion of the heating chamber, and accommodates therein a heat source and a circulating fan which circulates heat supplied from the heat source,

wherein the heat source is formed in a shape of a plurality of spirals;
wherein the circulating fan is arranged inside a cir-

cumference of the heat source; and
wherein the spaced dimension between the heat source and the circulating fan is less than 10 mm.

2. The heating cooking apparatus according to Claim 1, including the heating chamber which accommodates the subject to be heated therein; and the heat source chamber which is adjacent to the heating chamber through the partition plate located at the back portion of the heating chamber, and accommodates therein the heat source and the circulating fan which circulates heat supplied from the heat source,
wherein the heat source is formed in the shape of the plurality of the spirals; the circulating fan is arranged in the inside of the circumference of the heat source,
wherein the heat source and the circulating fan are arranged close to each other; and
wherein a plane shape along a rotation axis of the circulating fan expands toward an outer periphery of the circulating fan.

3. The heating cooking apparatus according to Claim 2, wherein an end in a rising direction of a vane portion of the circulating fan does not protrude from an end portion in a spiral axial direction of the heat source.

4. The heating cooking apparatus according to Claim 1 or 2, including the heat source chamber which accommodates the circulating fan therein,
wherein a plane area of the heat source chamber along a depth direction of the heating chamber is substantially the same as a plane area of the heating chamber along the depth direction of the heating chamber.

5. The heating cooking apparatus according to Claim 1 or 2, including the heat source chamber which accommodates the circulating fan therein,
wherein the heat source is formed in a spiral shape;
wherein the circulating fan is arranged inside the circumference of the heat source; and
wherein a fixing member for fixing the heat source onto a depth surface of the heat source chamber has a wall portion which contacts a side surface of the heat source chamber.

6. A heating cooking apparatus, comprising:

a heating chamber which is formed by a cylindrical portion and a partition plate, and accommodates a subject to be heated therein; and
a heat source chamber which is adjacent to the heating chamber through the partition plate, and accommodates therein a heat source and a circulating fan for circulating heat supplied from the heat source,
wherein a side surface on the heat source chamber side of the partition plate is provided with heat storage component.

7. The heating cooking apparatus according to Claim 6, wherein a coating film is formed on the side surface on the heat source chamber side, whereby the heat storage component is provided on the side surface on the heat source chamber side.

8. The heating cooking apparatus according to Claim 6, wherein the partition plate is formed of material different from material of right and left wall surfaces of the heating chamber, whereby the heat storage component is provided on the side surface of the heat source chamber side.

9. The heating cooking apparatus according to Claim 6, wherein a rough surface is formed on the side surface on the heat source chamber side, whereby the heat storage component is provided on the side surface of the heat source chamber side.

FIG. 1

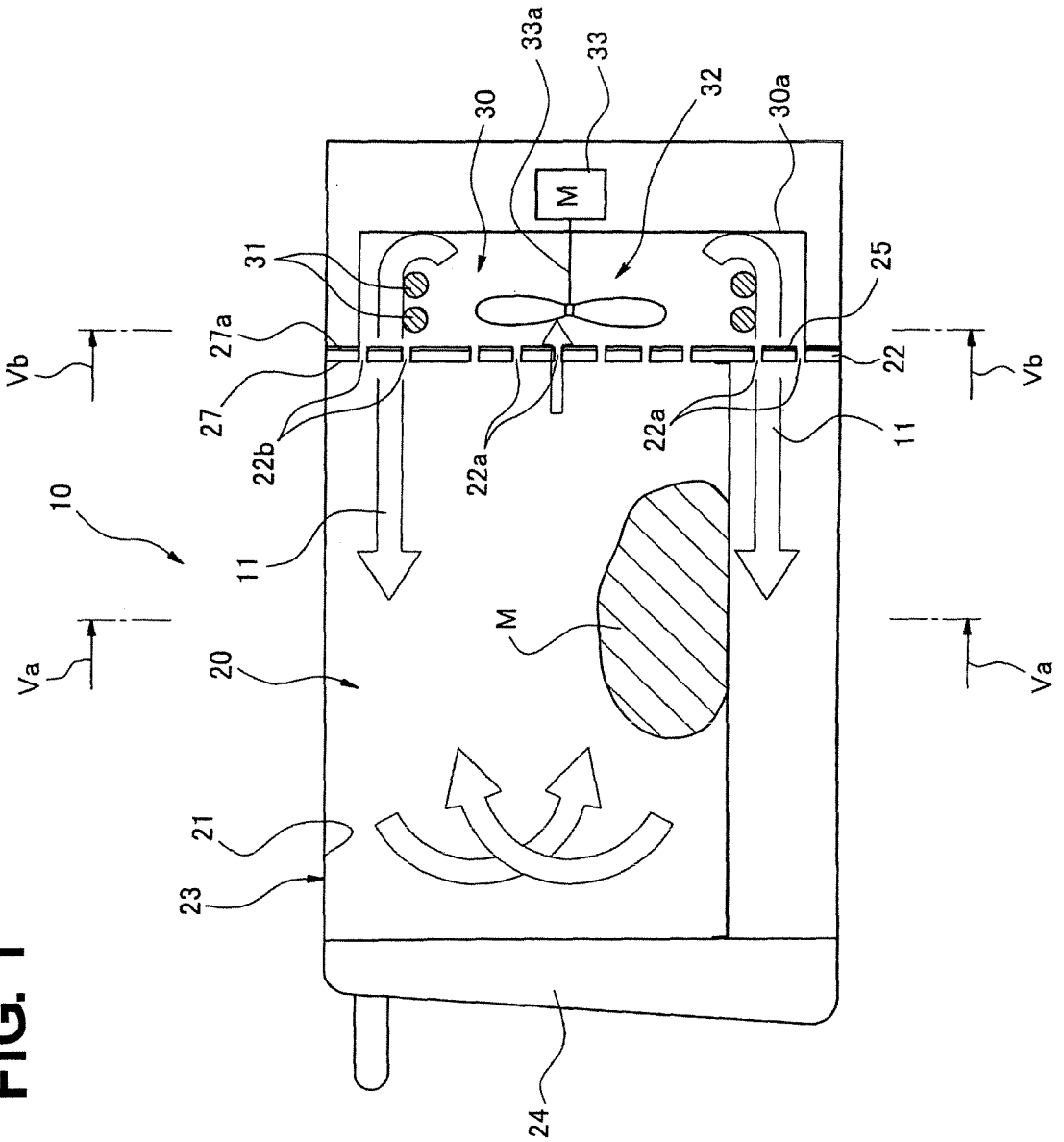

33a
33
30
32
30a
M
31
25
27a
22
Vb
Vb
27
22b
22a
22a
11
10
11
M
Va
Va
20
21
23
24

FIG. 2

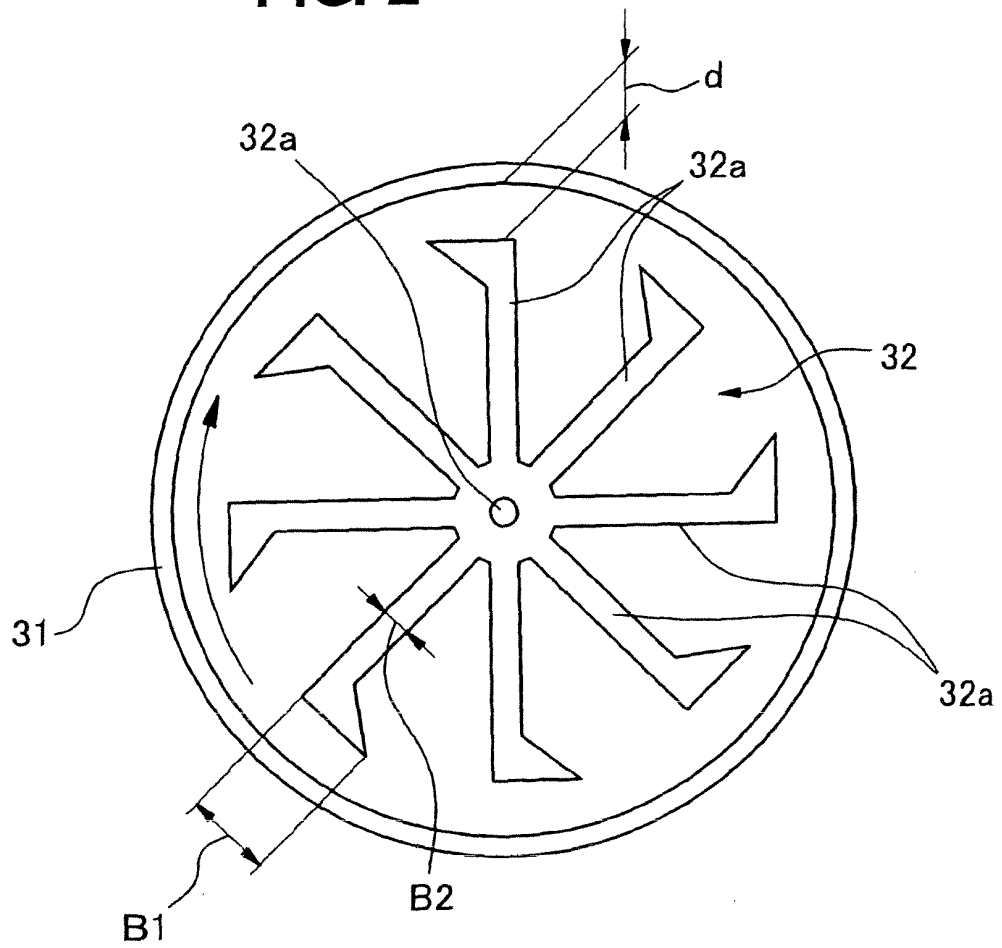


FIG. 3

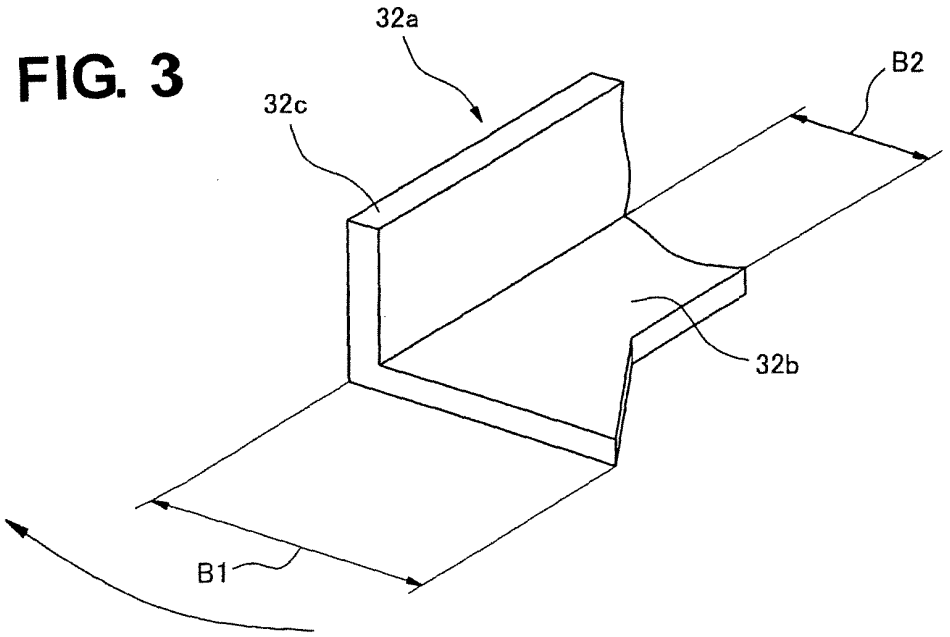


FIG. 4

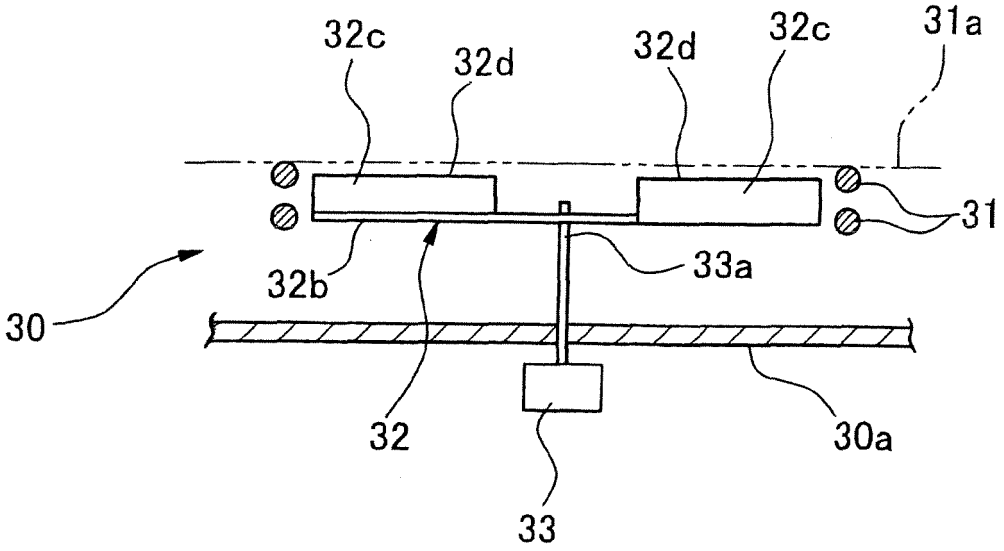


FIG. 5A

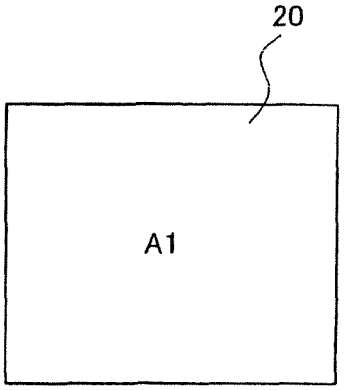


FIG. 5B

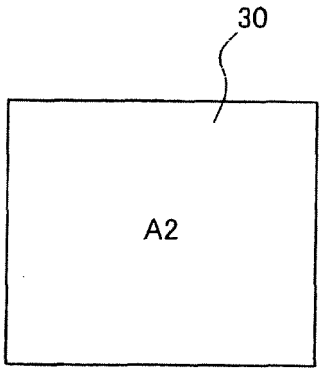


FIG. 6A

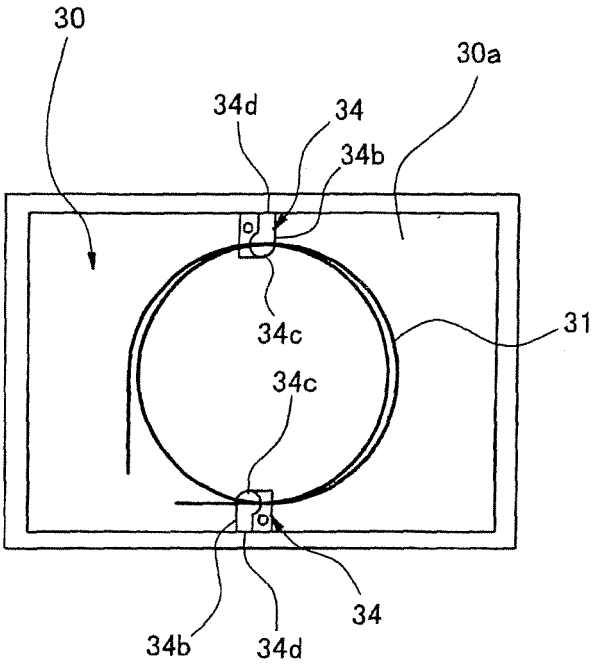


FIG. 6B

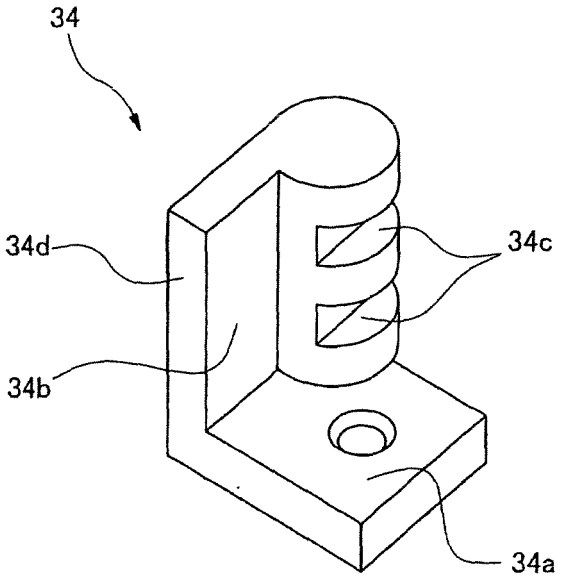


FIG. 7A

	SHAPE OF FAN (cm)		AIR FLOW VOL.	RELATIVE VALUE
	DIAMETER	RADIUS	cm^3	GENERAL-100
GENERAL EXAMPLE	11.5	1.0	104	100
THIS INVENTION	14.0	1.8	231	222

FIG. 7B

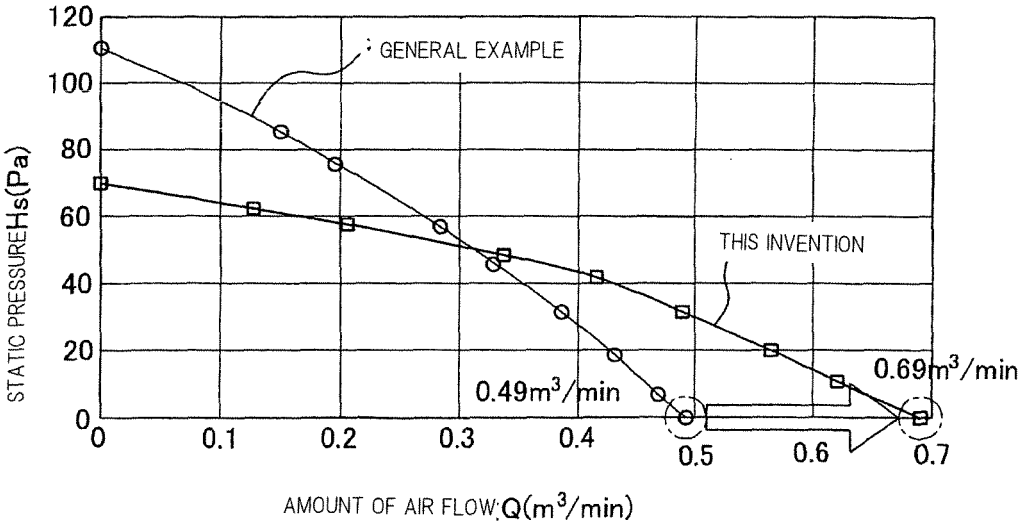


FIG. 8

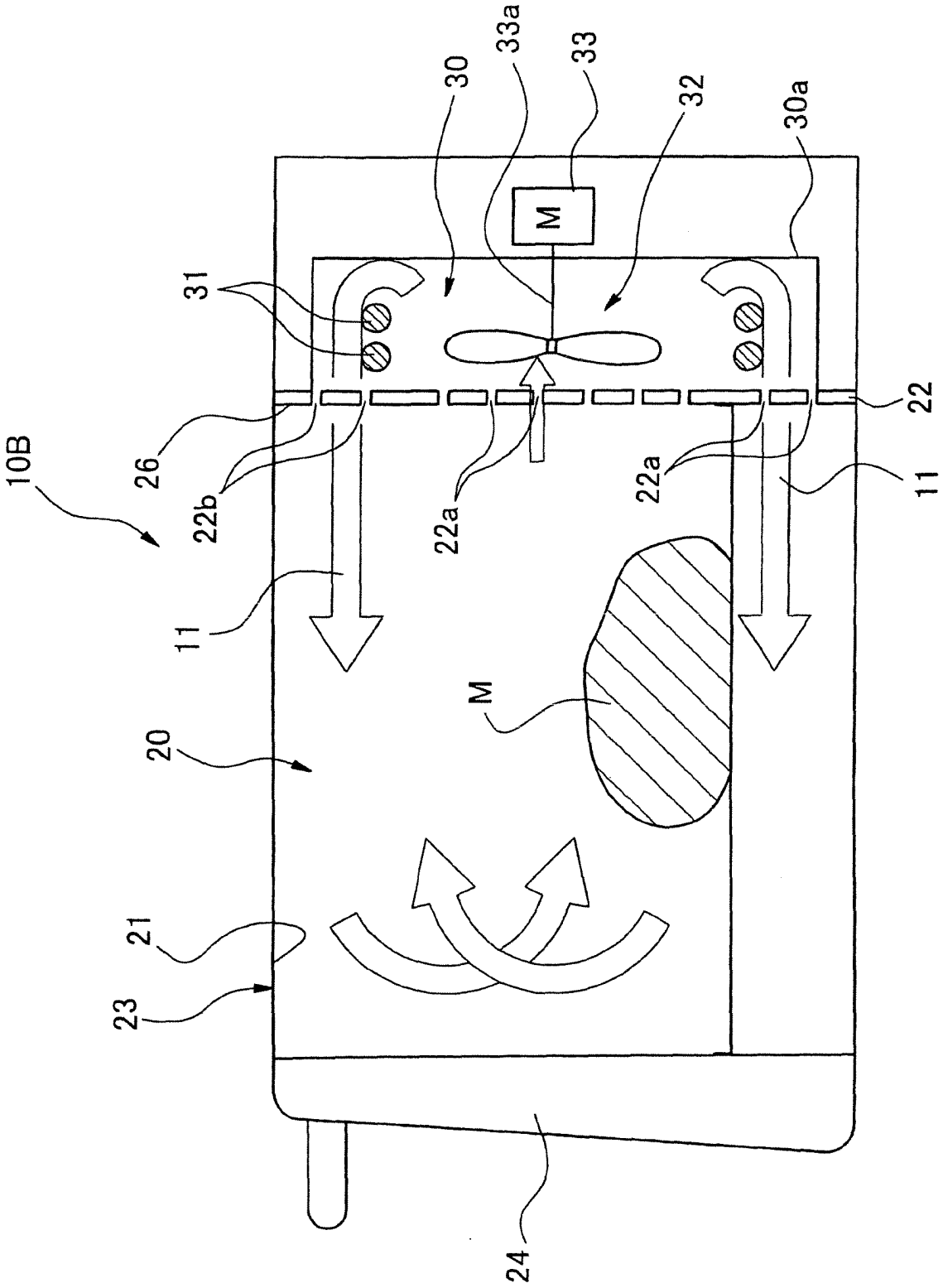


FIG. 9

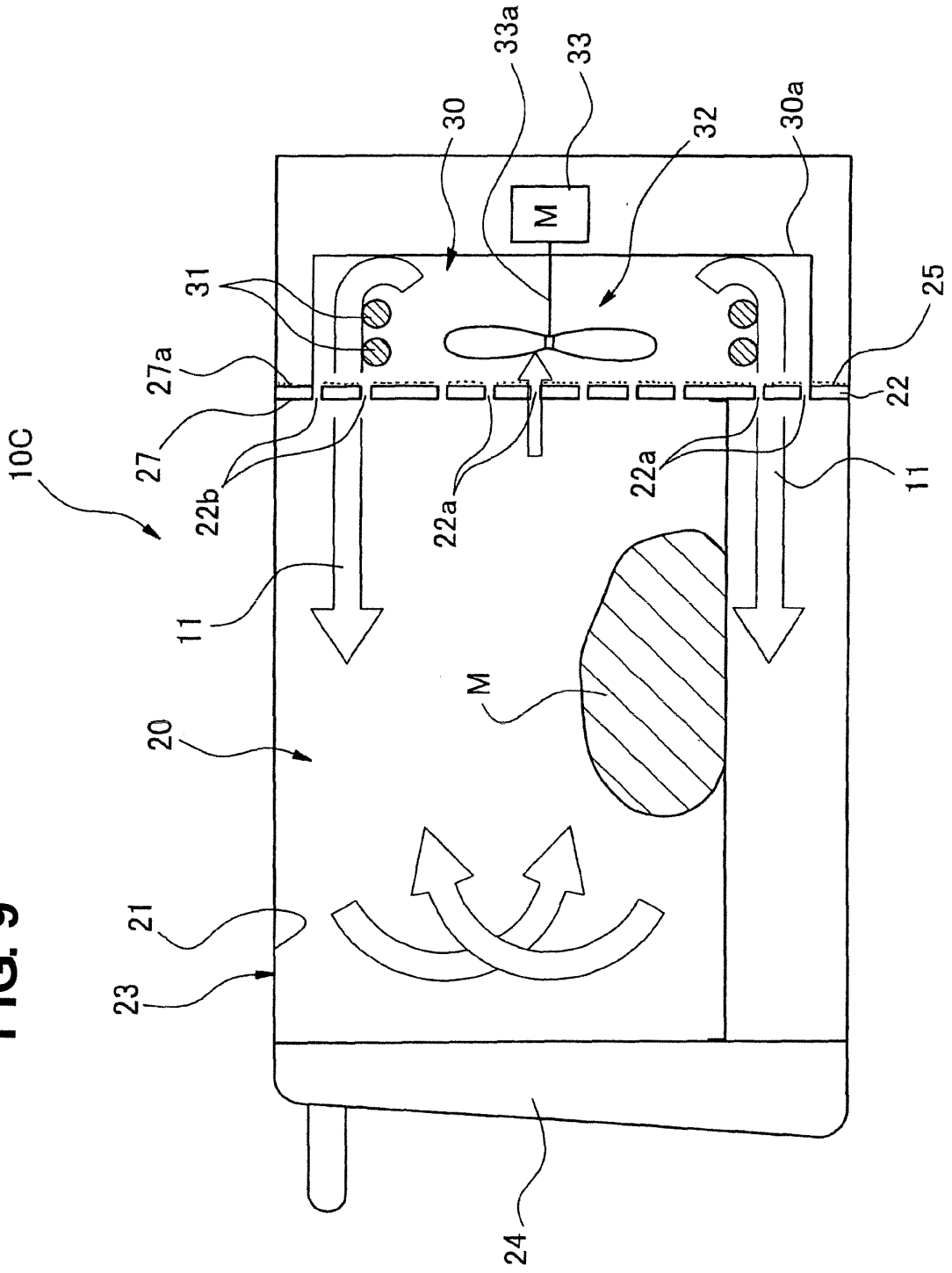


FIG. 10

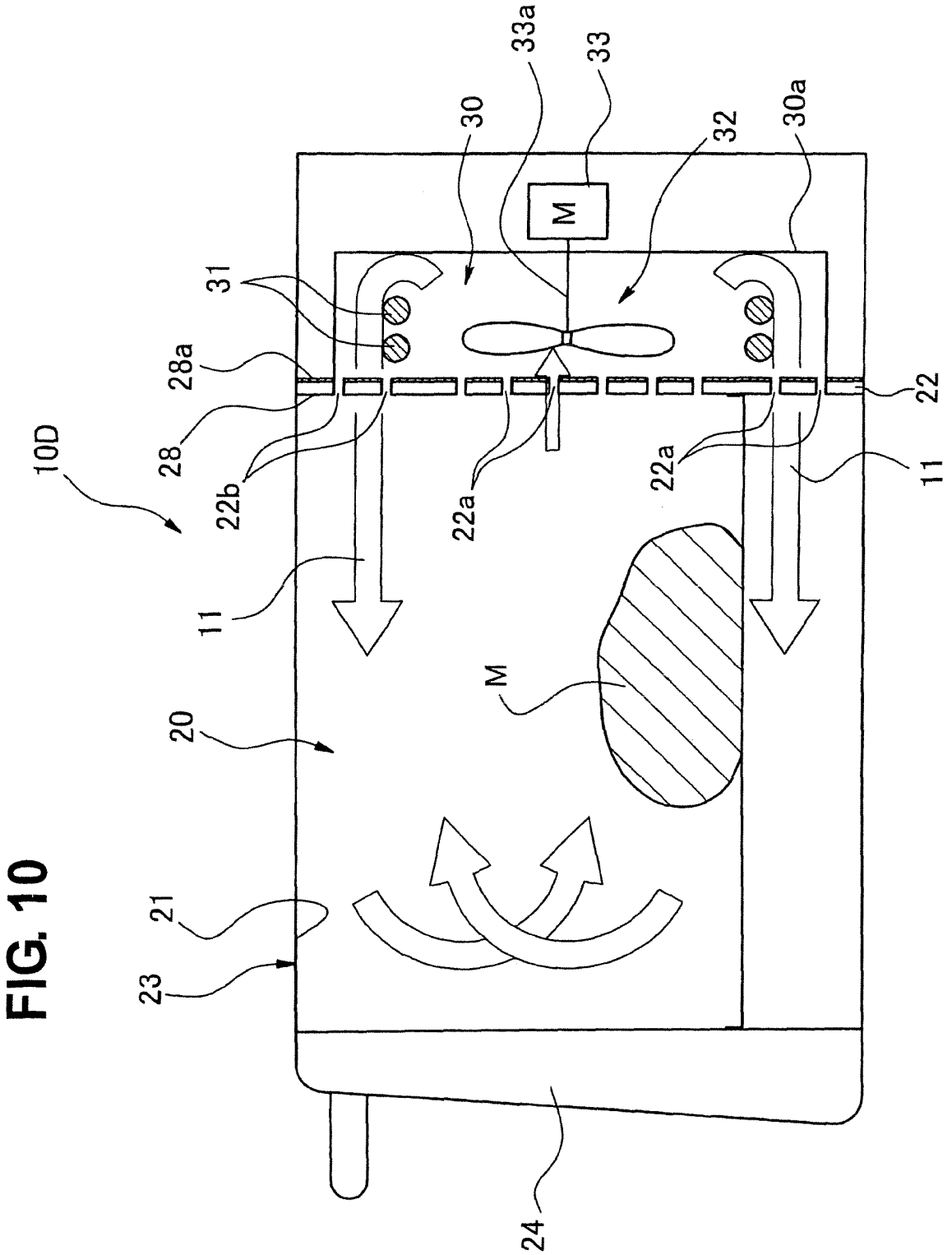
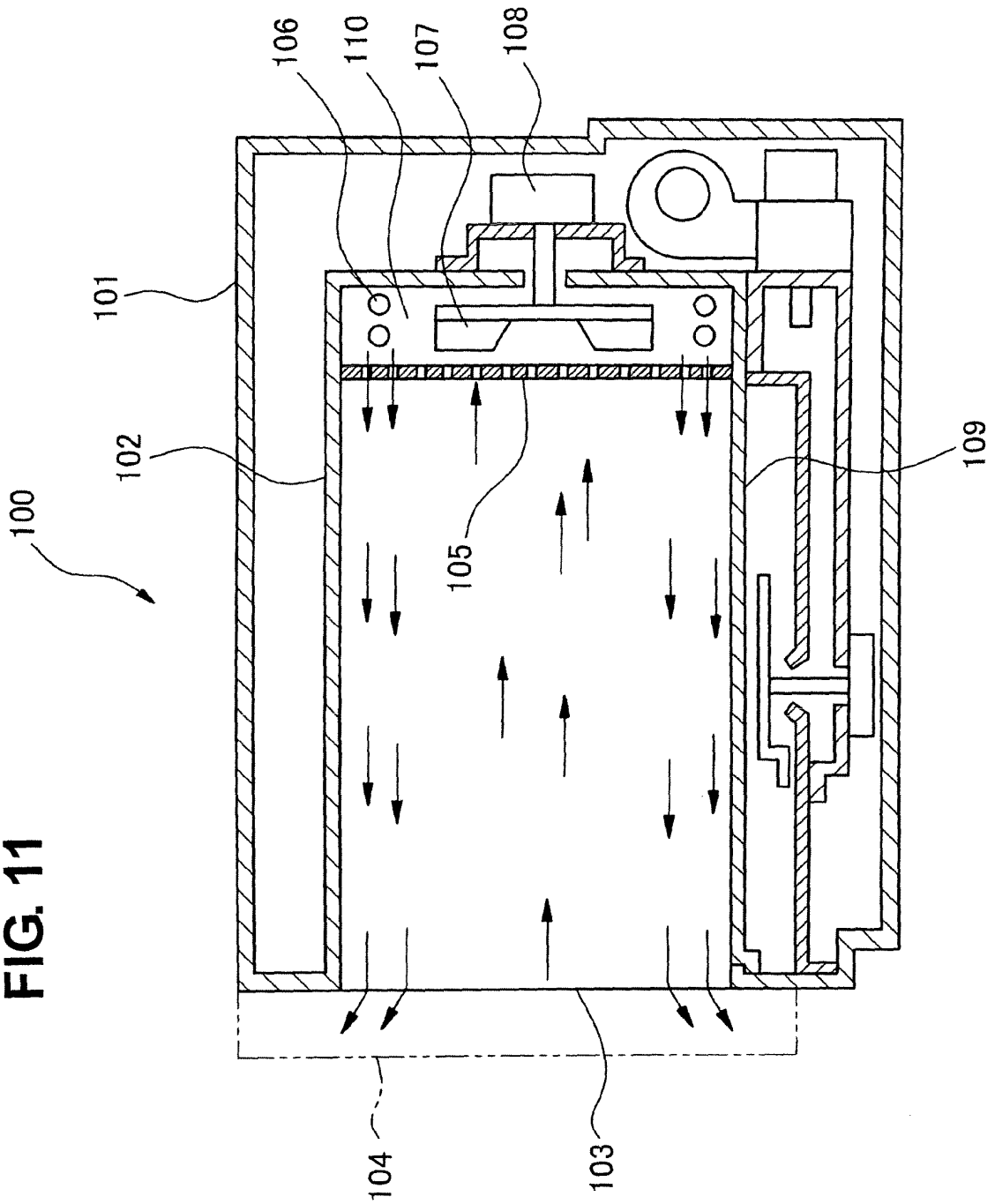


FIG. 11



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/062771

A. CLASSIFICATION OF SUBJECT MATTER
F24C1/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F24C1/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2007
Kokai Jitsuyo Shinan Koho 1971-2007 Toroku Jitsuyo Shinan Koho 1994-2007

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2001-182940 A (Osaka Gas Co., Ltd.), 06 July, 2001 (06.07.01), Par. Nos. [0018] to [0024]; Figs. 1, 2 (Family: none)	1,4 2,3,5
Y	JP 59-18321 A (Matsushita Electric Industrial Co., Ltd.), 30 January, 1984 (30.01.84), Claims; Fig. 6 (Family: none)	2,3

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 September, 2007 (10.09.07)	18 September, 2007 (18.09.07)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/062771

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 69946/1980(Laid-open No. 170899/1981) (Matsushita Electric Industrial Co., Ltd.), 17 December, 1981 (17.12.81), Figs. 1, 2 (Family: none)	3
Y	JP 55-60132 A (Matsushita Electric Industrial Co., Ltd.), 07 May, 1980 (07.05.80), Page 2, upper right column, lines 2 to 9; Figs. 2 to 4 (Family: none)	5

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/062771

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
The result of search reveals that a common matter to the inventions in claims 1-5/6-9 is not novel since it is disclosed in document JP 3259473 B2 (Matsushita Electric Industrial Co., Ltd.), 14 Dec., 2001 (14.12.01), paragraph [0006], Figs. 1-2.
Since the common matter makes no contribution over the prior art, it is not a special technical feature in the meaning of the second sentence of PCT rule 13.2.
Therefore, there is no common matter to all the inventions in claims 1-5/6-9.
Since there is no other common matter considered to be the special technical
(continued to extra sheet)

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-5

Remark on Protest

the

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, payment of a protest fee..

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/062771

Continuation of Box No.III of continuation of first sheet(2)

feature in the meaning of the second sentence of PCT rule 13.2, any technical relation in the meaning of PCT rule 13 cannot be found among these different inventions.

Form PCT/ISA/210 (extra sheet) (April 2005)

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- JP 3259473 B **[0002]**
- JP 2006189217 A **[0050]**
- JP 2006189218 A **[0050]**