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

(11) EP 1 640 667 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
29.03.2006 Bulletin 2006/13

(21) Application number: **04746073.8**

(22) Date of filing: **11.06.2004**

(51) Int Cl.:
F24C 7/02 *(1968.09)* ***F24C 15/00*** *(1968.09)*
F24C 15/08 *(1968.09)* ***F24C 15/34*** *(1968.09)*

(86) International application number:
PCT/JP2004/008560

(87) International publication number:
WO 2004/111541 (23.12.2004 Gazette 2004/52)

(84) Designated Contracting States:
DE FR GB

(30) Priority: **13.06.2003 JP 2003169382**
13.06.2003 JP 2003169452

(71) Applicant: **MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.**
Kadoma-shi, Osaka 571-8501 (JP)

(72) Inventors:
- **ORITA, Masatomo**
  Nara 630-8442 (JP)
- **TSUJIMOTO, Toshiyuki**
  Nara 637-0004 (JP)
- **ABE, Yukio**
  Nara 636-0012 (JP)

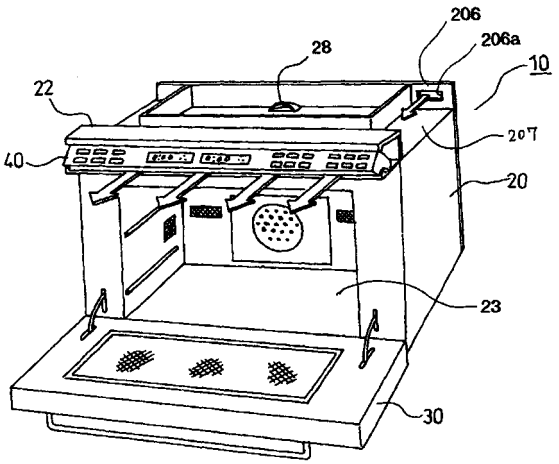
(74) Representative: **Grünecker, Kinkeldey,**
Stockmair & Schwanhäusser
Anwaltssozietät
Maximilianstrasse 58
80538 München (DE)

(54) ELECTRONIC OVEN

(57) A problem to be solved by the present invention is to provide a built-in type microwave oven that has good operability and is not bulky, and that is enabled to prevent liquid crystal display of a control portion is not fogged.

A built-in type microwave oven is configured to have a high frequency generating portion adapted to supply high frequency waves into a heating chamber, a control portion including a control board adapted to control the oven, and an air blowing portion adapted to blow a cooling air into the control portion, and also configured to heat-treat an object, which is to be heated, by supplying high frequency waves to the heating chamber. In this microwave oven, the control portion is constituted by a kangaroo pocket control portion extending in a length direction. The kangaroo pocket control portion is mounted in an upper front portion of the microwave oven. Air supplied from the air blowing portion is led from the back of the kangaroo pocket control portion into the kangaroo pocket control portion. Air having cooled the control board is exhausted from a rotating space of the kangaroo pocket control portion.

FIG. 1



EP 1 640 667 A1

Description

Technical Field

[0001] The present invention relates to a built-in type microwave oven for use with another heating cooker, such as an induction heating cooker or a gas oven. More particularly, the present invention relates to a built-in type microwave oven using a kangaroo pocket control portion.

Background Art

[0002] Hitherto, a built-in type microwave oven for use with another heating cooker, such as an induction heating cooker or a gas oven, has been known.

[0003] Also, there has been known a built-in type microwave oven, which uses a kangaroo pocket type control portion, for use with another heating cooker, such as an induction heating cooker or a gas oven (see, for example, Patent Document 1).

(Patent Document 1) JP-B-8-30579.

[0004] FIG. 16 is a perspective view of an example of a built-in type conventional apparatus.

[0005] In this figure, reference numeral 60 designates the built-in type conventional apparatus, reference numeral 61 denotes an electromagnetic cooker, reference numeral 62 designates a microwave oven, and reference numeral 63 denotes a support. The electromagnetic cooker 61 consists of a heating coil portion 6 1 a and a grill portion 61b.

[0006] The microwave oven 62 has an exhaust slot 62a, an opening/closing door 62b, and a control portion 62c.

[0007] The microwave oven 62 is provided just under the electromagnetic cooker 61. Thus, air having cooled the microwave oven cannot be exhausted upwardly and directly from the ceiling of the microwave oven, though such air can be exhausted from the ceiling of a stand-alone microwave oven. Further, because other built-in kitchen appliances are provided on both side surfaces of the microwave oven 62, such air cannot be exhausted from a side thereof. A wall surface is provided in the vicinity of the back thereof, so that when hot air is exhausted thereto, the hot air is close. This adversely affects cooling effect. Therefore, such air cannot be backwardly exhausted. Consequently, such air having cooled the microwave oven is upwardly exhausted after passed through the casing of the electromagnetic cooker. Alternatively, such air is exhausted from the front exhaust slot 62a, as shown in this figure.

[0008] The control portion (a control panel) 62c is provided on a lateral side portion of the door. This aims at preventing hot water vapor, which is exhausted from the heating chamber when the opening/closing door 62b of the microwave oven is opened, from impinging upon a liquid crystal display part of the control portion so that the liquid crystal display part is fogged with the vapor, or from entering the control portion thereby to cause a malfunction of an electronic component.

[0009] The height of the support 63 is determined at a value based on the arrangement relation between this support and each of other built-in kitchen alliances. Therefore, it is impossible to decrease only the height of the support 63. Thus, the height of the heating chamber of the microwave oven is set to be lower than the top thereof by a thickness of the exhaust slot 62a. The width of the heating chamber is narrowed by that of the controller 62c. As described above, all the internal upward, downward, leftward and rightward dimensions of the built-in type conventional apparatus are reduced.

[0010] Further, because the controller 62c is provided beside the door of the microwave oven, a user squats down when operating the controller 62c. Thus, the controller 62c is difficult to operate (the operability of the controller 62c is poor).

[0011] FIG. 17 is a perspective view of an example of the built-in type conventional apparatus described in the Patent Document 1. In this figure, reference numeral 80 designates the built-in type conventional apparatus, reference numeral 81 denotes a gas cooker, reference numeral 82 designates a microwave oven, and reference numeral 83 denotes a support. The electromagnetic cooker 81 consists of a gas oven 81a and a grill portion 81b.

[0012] The microwave oven 82 has an exhaust slot 82a, an opening/closing door 82b, and a kangaroo pocket type control portion (a control panel) 82c. The microwave oven 82 is provided just under the electromagnetic cooker 81. Thus, air having cooled the microwave oven cannot be exhausted upwardly and directly from the ceiling of the microwave oven, though such air can be exhausted from the ceiling of a stand-alone microwave oven. Further, because other built-in kitchen appliances are provided on both side surfaces of the microwave oven 82, such air cannot be exhausted from a side thereof. A wall surface is provided in the vicinity of the back thereof, so that when hot air is exhausted thereto, the hot air is close. This adversely affects cooling effect. Therefore, such air cannot be backwardly exhausted. Consequently, such air having cooled the microwave oven is upwardly exhausted after passed through the casing of the electromagnetic cooker. Alternatively, such air is exhausted from the front exhaust slot 82a, as shown in this figure.

[0013] The kangaroo pocket control portion is such that a display portion and an operation portion are mounted on a surface of a polyhedron and are not mounted on other surfaces thereof, that the polyhedron is accommodated in a cover rotatably around an axis, that the surfaces, on which no components are mounted, are exposed from the cover when unused, and that when used, the display portion and the operation portion are controlled by rotating the polyhedron to thereby expose the surface, on which the display portion and the operation portion are mounted. Thus, the operability is enhanced. Also, a malfunction can be prevented from occurring due to improper contact.

[0014] This kangaroo pocket control portion 82c is provided beside the door in the conventional apparatus. This aims at preventing hot water vapor, which is exhausted from the heating chamber when the opening/closing door 62b of the microwave door is opened in a case where the kangaroo pocket control portion 82c is provided above the door, from impinging upon a liquid crystal display part of the kangaroo pocket control portion 82c so that the liquid crystal display part is fogged with the vapor, or from entering the kangaroo pocket control portion thereby to cause a malfunction of an electronic component.

[0015] Further, in the case of a microwave oven of the type that are built into a built-in kitchen, the height of the support 83 is determined at a value based on the arrangement relation between this support and each of other built-in kitchen alliances. Therefore, it is impossible to decrease only the height of the support 83. Thus, the height of the heating chamber of the microwave oven is set to be lower than the top thereof by a thickness of the exhaust slot 82a. The width of the heating chamber is narrowed by that of the controller 82c. As described above, all the internal upward, downward, leftward and rightward dimensions of the built-in type conventional apparatus are reduced.

[0016] Further, because the controller 82c is provided beside the door, a user squats down when operating the controller 82c. Thus, the controller 82c is difficult to operate (the operability of the controller 82c is poor).

[0017] Meanwhile, a built-in microwave oven provided with a control portion at an upper part thereof has been known (see, for instance, Patent Document 2).

(Patent Document 2) JP-T-2003-517564.

[0018] FIG. 18 is a perspective view of a primary part of a built-in type microwave oven described in the Patent Document 2. In this figure, reference numeral 70 designates the built-in type microwave oven described in the Patent Document 2, reference numeral 71 denotes a front surface of the microwave oven, reference numeral 72 designates a control panel, reference numeral 73 denotes a suction grille, and reference numeral 74 designates an exhaust grille. This microwave oven 70 is configured so that the control panel 72 is provided above the front surface 71, that the suction grille 73 and the exhaust grille 74 are provided immediately under the control panel 72, and that cooling air goes into the oven and goes out of the oven from the front surface 71. Further, an upper heater and a lower heater are provided in the oven. An upper inside passage, through which air flow generated by an upper heater cooling fan passes, is formed in a part in which this upper heater is provided. Also, a cooling passage, through which air flow generated by a lower heater cooling fan passes, is formed in a part in which a lower heater is provided. A part of air sucked from the suction grille 73 is supplied directly to the front of the exhaust grille 74 and joins with air whose temperature is raised to a high temperature by being passed through the heater. Thereafter, the air is exhausted from the exhaust grille.

[0019] Consequently, the temperature of the air exhausted from the exhaust grille 74 can be lowered. Also, because the control panel 72 is provided at an upper part of the oven, the operability thereof is improved.

[0020] However, because the exhaust grille 74 is provided at a lower part of the oven, dust having been on a floor is blown up. Thus, this microwave oven has a sanitary problem. Further, because the suction grille 73 and the exhaust grille 74 occupy the top part and the bottom part of the front surface of the oven, the height of the oven itself is large. Because this microwave oven is of the built-in type, it is impossible to enlarge only the microwave oven. Therefore, there is no other choice but to decrease the size of the microwave oven, so that the internal capacity of the heating chamber is small.

[0021] The invention is accomplished to solve such problems. An object of the invention is to provide a built-in microwave oven employing a configuration obtained by contriving an exhaust grille to prevent the height thereof from becoming large, thereby enabling that there is no necessity for increasing the size of the microwave oven, that the built-in microwave oven is hygienic, that a controller is easy to use, and that even when water vapor is exhausted when a door of the microwave oven is opened, a display part of the controller is not fogged with the water vapor.

Disclosure of Invention

[0022] To achieve the foregoing object, there is provided a built-in type microwave oven according to the invention described in claim 1, which is configured to have a heating chamber adapted to accommodate an object to be heated, a high frequency generating portion adapted to supply high frequency waves into the heating chamber, a control portion including a control board adapted to control the microwave oven, and an air blowing portion adapted to blow a cooling air into the control portion, and also configured to heat-treat the object by supplying high frequency waves to the heating chamber. This built-in type microwave oven features that the control portion is constituted by a kangaroo pocket control portion extending in a length direction, that the kangaroo pocket control portion is mounted in an upper front portion of the microwave oven, that air supplied from the air blowing portion is led from a back of the kangaroo pocket control portion into the kangaroo pocket control portion, and that air having cooled the control board is exhausted from a rotating gap of the kangaroo pocket control portion.

[0023] With this configuration, the kangaroo pocket control portion is mounted in the upper front portion of the microwave oven. Thus, it is unnecessary for a user to squat down each time he operates operating buttons. Consequently, the operability is improved. Further, originally, a space is provided in a lower part of the kangaroo pocket control portion to allow the control portion to ro-

tate. Air is exhausted from this space. Thus, there is no need for providing a separate exhaust opening. Further, the microwave oven is prevented from being bulky. Also, an air curtain is formed. This prevents the liquid crystal display of the kangaroo pocket control portion from being fogged. Further, the blowout of he cooling air is performed at the upper front portion of the microwave oven. Therefore, dust is not blown up, so that the kitchen is kept clean.

[0024] A built-in type microwave oven according to the invention described in claim 2 features that the air blowing portion is provided at a rear side of the microwave oven according to the invention described in claim 1.

[0025] With this configuration, the intake opening and the exhaust opening are provided in the rear surface and the front surface of the microwave oven separately from each other. Warm air outputted from the exhaust opening is not sucked. The efficiency in cooling is enhanced.

[0026] A built-in type microwave oven according to the invention described in claim 3 features that air supplied from the air blowing portion is led to a ceiling space of the heating chamber, and that the air is led therefrom to the back of the kangaroo pocket control portion, in the built-in type microwave oven according to the invention described in claim 2.

[0027] With this configuration, the ceiling of the microwave oven is cooled.

[0028] A built-in type microwave oven according to the invention described in claim 4 features that the microwave oven further comprises a guide member provided at a rear side of a back plate of the microwave oven and adapted to lead air, which is supplied from the air blowing portion, to a corner portion of the ceiling space, a first partition plate provided at a side of the ceiling space and erected in parallel to a side surface of the microwave oven to be spaced therefrom by a predetermined interval, and a second partition plate configured to be in contact with the first partition plate, and erected to be spaced from the kangaroo pocket control portion by a predetermined interval, in addition to the constituents of the built-in type microwave oven according to the invention described in claim 3.

[0029] With this configuration, the sucked cool air is prevented from being mixed with hot air having cooled the outer periphery of the heating chamber. Also, the hot air is prevented from reaching the control board. Thus, the control board is cooled by the sucked cool air.

[0030] A built-in type microwave oven according to the invention described in claim 5 is configured to have a heating chamber adapted to accommodate an object to be heated, a high frequency generating portion adapted to supply high frequency waves into the heating chamber, a control portion including a control board adapted to control the microwave oven, and an air blowing portion adapted to blow a cooling air into the control portion, and also is configured to heat-treat the object by supplying high frequency waves to the heating chamber. This built-in type microwave oven features that a cutout or an elongated hole extending in a length direction of the control portion is formed in a bottom part of the control portion, that the control portion is mounted in an upper front portion of the microwave oven to thereby form a cooling air blowout space, which is constituted by the cutout or the elongated hole, between the control portion and a front surface of the microwave oven, that air supplied from the air blowing portion is led from a back of the control portion into the control portion, and that the air having cooled the control board is exhausted from the cooling air blowout space.

[0031] With this configuration, the control portion is mounted in the upper front portion of the microwave oven. Thus, it is unnecessary for a user to squat down each time he operates operating buttons. Consequently, the operability is improved. Further, air is exhausted from a cooling air blowout space, which is constituted by a cutout or an elongated hole, between the control portion and the front surface of the microwave oven. Thus, there is no need for providing a separate exhaust opening. Further, the microwave oven is prevented from being bulky. Also, an air curtain is formed. This prevents the liquid crystal display of the kangaroo pocket control portion from being fogged. Further, the blowout of he cooling air is performed at the upper front portion of the microwave oven. Therefore, dust is not blown up, so that the kitchen is kept clean.

[0032] A built-in type microwave oven according to the invention described in claim 6 features that the air blowing portion is provided at a rear side of the microwave oven according to the invention described in claim 5.

[0033] With this configuration, the intake opening and the exhaust opening are provided in the rear surface and the front surface of the microwave oven separately from each other. Warm air outputted from the exhaust opening is not sucked. The efficiency in cooling is enhanced.

[0034] A built-in type microwave oven according to the invention described in claim 7 features that air supplied from the air blowing portion is led to a ceiling space of the heating chamber, and that the air is led therefrom to the back of the control portion, in the built-in type microwave oven according to the invention described in claim 6.

[0035] With this configuration, the ceiling of the microwave oven is cooled.

[0036] A built-in type microwave oven according to the invention described in claim 8 features that the microwave oven further comprises a guide member provided at a rear side of an inner wall of the heating chamber and adapted to lead air, which is supplied from the air blowing portion, to a corner portion of the ceiling space, a first partition plate provided at a side of the ceiling space and erected in parallel to a side surface of the microwave oven to be spaced therefrom by a predetermined interval, and a second partition plate configured to be in contact with the first partition plate, and erected to be spaced from the control portion by a predetermined interval, in addition to the constituents of the built-in type microwave oven according to the invention described in claim 7.

[0037] With this configuration, the sucked cool air is prevented from being mixed with hot air having cooled the outer periphery of the heating chamber. Also, the hot air is prevented from reaching the control board. Thus, the control board is cooled by the sucked cool air.

[0038] A microwave oven according to the invention described in claim 9 is configured to have a heating chamber adapted to accommodate an object to be heated, a high frequency generating portion adapted to supply high frequency waves into the heating chamber, a control portion including a control board adapted to control the microwave oven, and an air blowing portion adapted to blow a cooling air into the control portion, and also is configured to heat-treat the object by supplying high frequency waves to the heating chamber. This microwave oven features that a cutout or an elongated hole extending in a length direction of the control portion is formed in a bottom part of the control portion, that the control portion is mounted in an upper front portion of the microwave oven to thereby form a cooling air blowout space, which is constituted by the cutout or the elongated hole, between the control portion and a front surface of the microwave oven, that air supplied from the air blowing portion is led from a back of the control portion into the control portion, and that the air having cooled the control board is exhausted from the cooling air blowout space.

[0039] With this configuration, an air curtain is formed between the control portion and the heating chamber. Thus, even when the door is opened, and when hot water vapor spills out of the heating chamber, the air curtain due to the air flow exhausted from the cutout or the elongated hole prevents water vapor from approaching the control portion, and from hitting against and fogging the liquid crystal display portion. Also, water vapor is prevented from entering the control portion and from causing malfunction of an electronic component.

Brief Description of Drawings

[0040]

FIG. 1 is a perspective view of a microwave oven (a first embodiment) having a kangaroo pocket control portion according to the invention.

FIG. 2 is a perspective view of the kangaroo pocket control portion, taken from behind.

FIG. 3 is a partially cutaway perspective view of the casing shown in FIG. 2.

FIG. 4 is a side cross-sectional view of the kangaroo pocket control portion; (a) of FIG. 4 illustrates a state in which the kangaroo pocket control portion is not used; (b) of FIG. 4 illustrates a state in which the kangaroo pocket control portion is being rotated; and (c) of FIG. 4 illustrates a state in which the kangaroo pocket control portion is used.

FIG. 5 is a front view of the kangaroo pocket control portion 401; (a) of FIG. 5 illustrates a state in which the kangaroo pocket control portion is used; and (b) of FIG. 5 illustrates a state in which the kangaroo pocket control portion is not used.

FIG. 6 is a perspective view that illustrates the microwave oven in which the kangaroo pocket control portion shown in FIG. 1 is mounted, and that is taken from behind.

FIG. 7 is a perspective view that illustrates the microwave oven shown in FIG. 6 and that is taken from front.

FIG. 8 is a perspective view of a microwave oven (a second embodiment) according to the invention.

FIG. 9 is a perspective view of the control portion, taken from behind.

FIG. 10 is a perspective view that illustrates the microwave oven in which the control portion shown in FIG. 8 is mounted, and that is taken from behind.

FIG. 11 is a perspective view that illustrates the microwave oven shown in FIG. 10 in a state in which the control portion is removed therefrom, and that is taken from front.

FIG. 12 is an upward view of the control portion mounted in the microwave oven casing.

FIG. 13 is a perspective view of a control portion of a first modification, taken from behind.

FIG. 14 is an upward view of the control portion that is mounted in the microwave oven casing and that is shown in FIG. 13.

FIG. 15 is a perspective view of a control portion of a second modification, taken from behind.

FIG. 16 is a perspective view of an example of a built-in type conventional apparatus.

FIG. 17 is a perspective view of a first built-in type conventional apparatus described in the Patent Document 1.

FIG. 18 is a perspective view of a primary part of a built-in type microwave oven described in the Patent Document 2.

[0041] Incidentally, in the drawings, reference numeral 10 designates a microwave oven according to the invention, reference numeral 20 denotes a microwave oven casing, reference numeral 201 designates an intake fan, reference numeral 202 denotes an intake fan cover, reference numeral designates a guide plate, reference numerals 204 and 205 denote partition plates, reference numeral 206 designates a back plate, reference character 206a denotes a back plate opening, a reference numeral 207 designates an air passage, reference numeral 209 denotes a ceiling discharge space, reference numeral 92 designates a control portion accommodating chamber, reference character 92a denotes a control portion receiving projection, reference numeral 221 designates a control portion accommodating chamber top surface, reference numeral 222 denotes a control portion accommodating chamber inner surface, reference character 222a designates a control portion accommodating inner surface opening, reference numeral 223 denotes a control portion accommodating chamber bottom surface, ref-

erence character 223 a designates a pin insertion hole, reference numeral 23 denotes a heating chamber, reference numeral 28 designates a cooling system discharge opening, reference numeral 30 denotes an opening/closing door, reference characters 40, 40', and 40" designate control portions, reference character 40a denotes a control portion bottom cutout, reference character 40b designates a control portion bottom elongated-hole (one slit), reference character 40c denotes a control portion bottom elongated-hole (divided holes), reference numeral 41 designates a bottom plate, reference numeral 401 denotes a kangaroo pocket control portion, reference numeral 42 designates a display/operation face, reference numeral 421 denotes a liquid crystal display portion, reference numeral 422 designates an operating switch, reference numeral 43 denotes a side plate, reference character 43 a designates a pin insertion hole, reference numeral 44 denotes a nonuse-time exposed-surface (a no-component-mounting surface), reference numeral 46 designates an exhaust face, reference character 46a denotes an exhaust face opening, reference numeral 48 designates an intake face opening, and reference numeral 49 denotes a control board.

Best Mode for Carrying Out the Invention

[0042] Hereinafter, preferred embodiments of a microwave oven according to the invention are described in detail by referring to the accompanying drawings.

(First Embodiment)

[0043] FIG. 1 is a perspective view of a microwave oven having a kangaroo pocket control portion according to the invention.

[0044] In this figure, reference numeral 10 designates a microwave oven according to the invention, reference numeral 20 denotes a microwave oven casing, reference numeral 23 designates a heating chamber, reference numeral 28 denotes a cooling system discharge opening, reference numeral 30 designates an opening/closing door, reference numeral 401 denotes a kangaroo pocket control portion, reference numeral 206 designates a back plate, reference character 206a denotes a back plate opening, and reference numeral 207 designates an air passage.

[0045] The microwave oven 10 is a heating cooker adapted to perform dielectric-heating on an object, which is to be heated, by supplying high frequency waves (microwaves) to the heating chamber 23 in which the object is accommodated. Although not shown, the microwave oven 10 includes a magnetron serving as a high frequency generating portion adapted to generate high frequency waves, a circulation fan adapted to stir and circulate air in the heating chamber 23, a convection heater serving as an intra-chamber air heating heater adapted to heat air in the heating chamber 23, and a temperature sensor adapted to detect a temperature in the heating chamber 23, as primary constituents.

[0046] The heating chamber is formed in a front-opened box-shaped microwave oven case 20. An opening/closing door 30, which has a translucent window and is used to open and close a heating-object output opening, is installed in the front surface of the body case 20. The opening/closing door 30 is adapted so that the bottom end thereof is hinge-connected to the bottom edge of the microwave oven case 20, and that the top end thereof moves back and forth by employing the bottom end thereof as the center of rotation, thereby enabling the door 30 to open and close.

[0047] A predetermined adiabatic space is ensured between the heating chamber 23 and the microwave oven case 20. The outer periphery of the heating chamber is cooled by air supplied from another cooling fan (not shown). The air is discharged from the discharge opening 28. Thereafter, the air further rises and is upwardly exhausted through the case of the microwave oven. Adiabatic materials are charged into this space where necessary.

[0048] Although the microwave oven case 20 put into a bare state is drawn in this figure for ready understanding, the entirety of this microwave oven case 20 is actually covered from above with a face panel (not shown) having a U-shape in plan view.

[0049] FIGS. 2 to 5 show a kangaroo pocket control portion according to the invention.

[0050] FIG. 2 is a perspective view of the kangaroo pocket control portion, which is taken from behind. FIG. 3 is a partially cutaway perspective view, which is taken from behind, illustrating the casing shown in FIG. 2. FIG. 4 is a side cross-sectional view of the kangaroo pocket control portion. Further, (a) of FIG. 4 illustrates a state in which the kangaroo pocket control portion is not used, (b) of FIG. 4 illustrates a state in which the kangaroo pocket control portion is being rotated, and (c) of FIG. 4 illustrates a state in which the kangaroo pocket control portion is used. FIG. 5 is a front view of the kangaroo pocket control portion 401. Further, (a) of FIG. 5 illustrates a state in which the kangaroo pocket control portion is used, and (b) of FIG. 5 illustrates a state in which the kangaroo pocket control portion is not used. In FIG. 2, reference numeral 401 designates the kangaroo pocket control portion. This kangaroo pocket control portion 401 may be constructed by using a casing, such as a hollow triangular prism casing, a hollow quadratic prism casing, or a pentagonal prism casing. In this case, it is assumed that the casing is a quadratic prism casing having surfaces 42, 44, 48, and 48, that the surface 42 is a display/operation surface, that the surface 44 is an unused-time exposure surface (a no-component mounting surface), that the surface 46 is an exhaust surface, and that the surface 48 is an intake surface. According to the invention, the exhaust surface 46 is provided with many openings 46a, from which a cooling air is exhausted, in a length direction, while the intake surface 48 is provided with many openings 48a, from which a cooling air is sucked,

in a length direction. Both ends (the left end portion and the right end portion, as viewed in this figure) of the quadratic prism are blocked by a side plate 43. A pin insertion hole 43a is opened in the center of rotation thereof. A pin P is inserted into this pin insertion hole 43a and pin insertion holes 223a formed in both end portions of a control portion accommodating chamber 92 (FIG. 7) fixed to the microwave oven body 20. Thus, the control portion is enabled to rotate therearound.

[0051] Various operating switches 422 (FIG. 5), such as a start switch adapted to designate the start of heating, a changeover switch adapted to switch among a high-frequency heating method and other heating methods, an automatic cooking switch adapted to start to execute a preliminarily prepared program, and so forth are mounted on the display/operation surface 42 of the kangaroo pocket type control portion 401, in addition to a liquid crystal display portion 421 (FIG. 5) adapted to indicate control data, a heating temperature, a heating elapsed time, and the like.

[0052] A control board adapted to control the liquid crystal display portion 421 and the operating switch 422 is mounted in the case. FIG. 3 shows this control board 49.

[0053] The control board 49 is a printed circuit board on which an electric component adapted to control the microwave oven and indicate data, a CPU, and so on are mounted. Many exothermic components are mounted on this printed circuit board. Therefore, this control board 49 needs cooling.

[0054] In FIG. 4, the control portion accommodating chamber 92 is a cross-sectionally U-shaped casing having a top surface 221, an inner surface 222, and a bottom surface 223. An opened surface of this casing is directed to a user. The inner surface 222 is fixed to the microwave oven casing side. Many openings 222a are provided in the inner surface 222 in a length direction thereof (FIG. 6). Further, a control portion receiving projection 92a is provided in the control portion accommodating chamber 92.

[0055] To turn the kangaroo pocket control portion 401 so as to change the state thereof from an unused state to a used state, it is advisable that, for example, a small knob is provided on an operation portion of the kangaroo pocket control portion 401, that the knob is pulled to thereby turn the control portion around the pin P and put the operation portion into a pop-out state, and that the knob is returned to an initial position to thereby bring the control portion into an accommodated state. Alternatively, it is advisable that a pop-out operation pushbutton and an accommodating operation pushbutton are provided on the microwave oven case 20, and that the state of the control portion is changed to the pop-out state by depressing the former button, while the state thereof is returned to the initial state.

[0056] In an unused condition illustrated in FIG. 4(a), the control portion is stable in a state in which the intake surface 48 leans on the control portion receiving projection 92a. In this condition, the nonuse-time exposed-surface 44 of the kangaroo pocket control portion 401 is flush with the front surface of the control portion accommodating chamber 92. Therefore, the display/operation surface 42 hides in the control portion accommodating chamber 92. Consequently, the control switch or the like does not operate due to improper contact (see also FIG. 5(b)). Meanwhile, sometimes, the cooling fan is kept rotated for a predetermined time even after finishing of using the microwave oven. In this case, cooling air enters the chamber from the inner surface opening 222a. Then, the cooling air advances in a direction of an arrow through the intake surface opening 48a and cools the control board 49. Subsequently, the cooling air flows out through a gap A between the kangaroo pocket control portion 401 and the bottom surface 223 of the control portion accommodating chamber 92. Thus, the control board 49 can be kept cooled.

[0057] FIG. 4(b) shows the middle of rotation of the kangaroo pocket control portion 401 around the pin insertion hole 43a in the control portion accommodating chamber 92. In this condition, the nonuse-time exposed-surface 44 starts hiding. Simultaneously, the display/operation surface 42 starts being exposed. Alternatively, vice versa.

[0058] Similarly, in this case, the cooling air can flow out through the gap between the kangaroo pocket control portion 401 and the bottom surface 223 of the control portion accommodating chamber 92 in the direction of an arrow. Thus, the control board 49 is kept cooled, even after finishing of using the microwave oven.

[0059] In an unused condition illustrated in FIG. 4(a), the control portion is stable in a state in which the end of the intake surface 43 leans on an end hook portion 22 1 a of the top surface 221 of the control portion accommodating chamber 92. In this condition, the display/operation surface 42 of the kangaroo pocket control portion 401 is in a supine state (about 45 degrees in this figure). Thus, this control portion is easy to operate, as compared with the vertical extending control portion (FIG. 16).

[0060] During the microwave oven is used, the cooling fan is kept rotated. The cooling air enters the chamber from the inner surface opening 222a. Then, the cooling air advances in a direction of an arrow through the intake surface opening 48a and cools the control board 49. Subsequently, the cooling air flows out through the gap A between the kangaroo pocket control portion 401 and the bottom surface 223 of the control portion accommodating chamber 92. Therefore, the control board 49 can be kept cooled. Thus, the air cooled by being passed through the gap A between the kangaroo pocket control portion 401 and the control portion accommodating chamber 92 is exhausted. Consequently, an air curtain is generated between the kangaroo pocket control portion 401 and the opening/closing door 30 of the microwave oven 20. Accordingly, even when the opening/closing door 30 of the microwave oven 20 is opened during used, and when hot water vapor spills out of the heating

chamber 23 and rises, the water vapor is prevented by the air curtain from approaching the kangaroo pocket control portion 401. The water vapor is prevented from hitting against the liquid crystal display portion. The liquid crystal display portion is prevented from being fogged with the water vapor. Also, the water vapor is prevented from entering the kangaroo pocket control portion 401 and from causing malfunction of an electronic component.

[0061] In a used condition illustrated in FIG. 5(a), the display/operation surface 42 of the kangaroo pocket control portion 401 is in a supine state (about 45 degrees in this figure). Thus, this liquid crystal display portion 421 is easy to watch. Also, the operating switch 422 is easy to operate. Further, the cooling air flows out through the gap between the kangaroo pocket control portion 401 and the bottom surface of the control portion accommodating chamber 92, so that an air curtain is generated.

[0062] In an unused condition illustrated in FIG. 5(b), the display/operation surface 42 hides. Instead, the no-component-mounting surface 44, on which no component is mounted, is exposed. Therefore, the control switch does not operate due to improper contact. Further, as long as the cooling fan rotates, the cooling air flows out through the gap between the kangaroo pocket control portion 401 and the bottom surface of the control portion accommodating chamber 92 to thereby form an air curtain. FIG. 6 is a perspective view that illustrates the microwave oven in which the kangaroo pocket control portion shown in FIG. 1 is mounted, and that is taken from behind. In FIG. 6, reference numeral 10 designates a microwave oven that roughly comprises a microwave oven case 20 and an opening/closing door 30. Under the back plate 206 thereof, the microwave oven case 20 includes an intake fan 201 adapted to take in air into the microwave oven case 20, a cover 202 adapted to cover the intake fan 201, and a guide plate 203 adapted to feed air, which is contained in the cover 202, to an upper part of the case 20. The cover 202 is downwardly opened. When the intake fan 201 rotates, cool air is sucked from the opening and enters the cover 202. The cool air flows in the guide plate 203 and is fed to the upper part of the case 20. An opening 206a (FIG. 1) is provided in a part of the back plate 206 of the case 20, with which part the guide plate 203 is brought into contact. The air having reached the upper part flows through the opening 206a into the ceiling space of the case 20.

[0063] In the ceiling space, a partition plate 204 (FIG. 6) is provided in parallel to a side surface of the case 20 to be spaced therefrom by a predetermined interval. Also, a partition plate 205 is provided in contact with the partition plate 204 and in parallel to the kangaroo pocket control portion 401 to be spaced therefrom by a predetermined interval.

[0064] These partition plates 204 and 205 prevent the air, which has flowed into the ceiling space, from being mixed with hot air discharged from a cooling system discharge opening 28 (FIG. 1) to a ceiling discharge space 209 after cooling an outer periphery of the heating chamber that is another cooling system. Therefore, the air having cooled, which is discharged from the space in a lower part of the kangaroo pocket control portion 401, is prevented from being hot (equal to or higher than 90 degrees). Consequently, there is entirely no fear that a user gets scalded. Incidentally, the hot air discharged from the cooling system discharge opening 28 (FIG. 1) to the ceiling discharge space 209 after cooling the outer periphery of the heating chamber, which is another cooling system, is further upwardly led or rises and flows through the back of the case of the electromagnetic cooker and is upwardly exhausted from a rear corner portion. Air flows through an air passage 207 formed between a side wall of the case 20 and the partition plate and advances to the front of the case 20. Then, the air flows through an air passage formed between the control portion accommodating chamber 92 and the partition plate 205 and then passes through the opening 222a provided in the control portion accommodating chamber 92. Thus, the air enters the rear side of the kangaroo pocket control portion 401. Thereafter, the air flows through the path, which has been described with reference to FIG. 4, and is then discharged outside from the space for the kangaroo pocket control portion 401. When the air is discharged, an air curtain effect acts, so that water vapor or the like is prevented from entering the kangaroo pocket control portion 401. FIG. 7 is a perspective view that illustrates the microwave oven shown in FIG. 6 and that is taken from front. FIG. 7 shows the microwave oven in a state in which the kangaroo pocket control portion 401 is removed. As described with reference to FIG. 6, cool air supplied from the lower part of the back surface of the microwave oven case enters the ceiling space of the case 20 through the opening 206a provided in the upper corner portion of the back plate 206. Then, the cool air flows through the passage 207 and enters the kangaroo pocket control portion 401 from the opening 222a of the control portion accommodating chamber 92. As is understood from FIG. 7, the cool air is discharged outside through the path, which has been described by referring to FIG. 4.

[0065] As described above, the control board 49 is incorporated in the case for the kangaroo pocket control portion 401. Because many exothermic electric and electronic components are mounted on this control board 49, this control board 49 needs cooling. Thus, as described with reference to FIG. 6, cool air is sucked from the back of the microwave oven case 20 (FIG. 1) and is led to the air passage 207 from the opening 206a provided in the back plate 206. Then, the cool air passes through the opening 48a (FIG. 2) of the intake surface 48 of the kangaroo pocket control portion 401 and then cools the control board 49 (FIG. 3). Thereafter, the air passes through the opening 46a of the exhaust surface 46 and is exhausted out of the case for the kangaroo pocket control portion 401. Then, the air flows through the gap A between the kangaroo control portion 401 and the control portion accommodating chamber 92 and is discharged

to the front surface of the microwave oven case 20.

[0066] Therefore, when the opening/closing door is opened, hot water vapor spills out of the heating chamber 23. The air curtain due to the air flow exhausted through the gap A between the kangaroo pocket control portion 401 and the control portion accommodating chamber 92 prevents water vapor from approaching the kangaroo pocket control portion 401, and from hitting against and fogging the liquid crystal display portion. Also, water vapor is prevented from entering the kangaroo pocket control portion 401 and from causing malfunction of an electronic component.

[0067] Further, because the operation portion is placed at the upper part of the oven, a user can operate the operation portion without squatting. Additionally, the kangaroo pocket control portion is employed. Thus, the control panel is not vertical and is inclined at a predetermined angle. Although similarly placed at the upper part, the operability of the operation portion of the embodiment is extremely enhanced, as compared with the operation portion shown in FIG. 18.

[0068] Originally, the kangaroo pocket control portion is not suitable for being placed at an upper part of the heating chamber. This is because the kangaroo pocket control portion requires a space enabling this control portion to rotate. In a development experiment phase, the need for this space is an obstacle. Water vapor enters the kangaroo pocket control portion from this space and adversely affects the control portion, for instance, fogs the liquid crystal display and heats and moistens the electric component.

[0069] Thus, the present applicant made experiments by providing a cushion in the space so as to prevent water vapor from entering the control portion. This configuration additionally needs the cushion and man-hours required to mount the cushion. Consequently, the number of mounting-man-hours increases. This results in increase in the cost of the oven. Also, the aging of the cushion causes water vapor to enter the control portion. More importantly, the operability (the smoothness of rotation) of the kangaroo pocket control portion is deteriorated. However, the present applicant found that the drawbacks could completely be solved by positively utilizing the space as a blowout opening for the air curtain. Such positive utilization of the space as the blowout opening for the air curtain eliminates the necessity for the cushion. Thus, the cost is reduced. Due to the air curtain effect, water vapor is prevented from entering the control portion. Consequently, the operability is improved. This space is a substitute for the original exhaust slot (designated by reference numeral 74 in FIG. 18). Thus, this exhaust slot is unnecessary, so that the space for this exhaust slot can be saved.

[0070] Thus, according to the microwave oven 10 according to the invention, the kangaroo pocket control portion 401 is mounted in the upper front portion of the oven. Therefore, it is unnecessary for a user to squat down each time he operates operating buttons. Consequently, the operability of the control portion is improved. Also, air is exhausted from the space for rotating the kangaroo pocket control portion. Thus, there is no need for providing an additional exhaust opening. Consequently, a large internal space of the heating chamber can be ensured. Also, the air is exhausted at the upper front portion of the oven. Therefore, the dust is not blown up, so that the kitchen is kept clean.

(Second Embodiment)

[0071] FIG. 8 is a perspective view of a microwave oven according to the invention.

[0072] In this figure, reference numeral 10 designates a microwave oven according to the invention, reference numeral 20 denotes a microwave oven casing, reference numeral 23 designates a heating chamber, reference numeral 28 denotes a cooling system discharge opening, reference numeral 30 designates an opening/closing door, reference numeral 40 denotes a control portion, reference numeral 206 designates a back plate, reference character 206a denotes a back plate opening, and reference numeral 207 designates an air passage.

[0073] The microwave oven 10 is a heating cooker adapted to perform dielectric-heating on an object, which is to be heated, by supplying high frequency waves (microwaves) to the heating chamber 23 in which the object is accommodated. Although not shown, the microwave oven 10 includes a magnetron serving as a high frequency generating portion adapted to generate high frequency waves, a circulation fan adapted to stir and circulate air in the heating chamber 23, a convection heater serving as an intra-chamber air heating heater adapted to heat air in the heating chamber 23, and a temperature sensor adapted to detect a temperature in the heating chamber 23, as primary constituents.

[0074] The heating chamber is formed in a front-opened box-shaped microwave oven case 20. An opening/closing door 30, which has a translucent window and is used to open and close a heating-object output opening, is installed in the front surface of the body case 20. The opening/closing door 30 is adapted so that the bottom end thereof is hinge-connected to the bottom edge of the microwave oven case 20, and that the top end thereof moves back and forth by employing the bottom end thereof as the center of rotation, thereby enabling the door 30 to open and close.

[0075] A predetermined adiabatic space is ensured between the heating chamber 23 and the microwave oven case 20. The outer periphery of the heating chamber is cooled by air supplied from another cooling fan (not shown). The air is discharged from the discharge opening 28. Thereafter, the air further rises and is upwardly exhausted through the case of the microwave oven. Adiabatic materials are charged into this space where necessary.

[0076] Although the microwave oven case 20 put into a bare state is drawn in this figure for ready understand-

ing, the entirety of this microwave oven case 20 is actually covered from above with a face panel (not shown) having a U-shape in plan view.

[0077] Various kinds of operating switches, such as a start switch adapted to designate the start of heating, a changeover switch adapted to switch among a high-frequency heating method and other heating methods, an automatic cooking switch adapted to start to execute a preliminarily prepared program, and so forth are mounted on the control portion 40.

[0078] A case for the control portion 40 is cross-sectionally U-shaped. A U-shaped open side thereof is attached to a microwave oven case side.

[0079] FIG. 9 is a perspective view of the control portion 40, taken from behind. In this figure, reference numeral 40 designates a control portion according to the invention, reference numeral 49 denotes a control board, reference character 40a designates a cutout provided in an edge of the bottom portion 41 of the control portion 40 to extend in a length direction. The control board 49 is a printed circuit board on which electric components and a CPU adapted to control the microwave oven and to display data are mounted.

[0080] Thus, the control board 49 is incorporated in the case for the control portion 40. Many exothermic electric and electronic components are mounted on this control board 49. Therefore, this control board 49 needs cooling. Thus, as will be described later, cool air is sucked from the back of the microwave oven case 20 and is led to the air passage 207 from the opening 206a provided in the back plate 206. Further, the air is led therefrom to the back of the control portion 40. After the control board of the control portion 40 is cooled, the air having cooled the board is exhausted from a cutout 40a (FIG. 9) provided in the bottom of the control portion 40.

[0081] Thus, in the microwave oven 10 according to the invention, the control portion 40 is mounted in the upper front portion thereof. Thus, it is unnecessary for a user to squat down each time he operates operating buttons. Consequently, the operability of the control portion is improved. Also, air is exhausted from a cooling air blowout space constituted by a cutout between the control portion 40 and the front surface of the microwave oven case 20. Thus, there is no need for providing an additional exhaust opening. Consequently, a large internal space of the heating chamber can be ensured. Also, the air is exhausted at the upper front portion of the oven. Therefore, the dust is not blown up, so that the kitchen is kept clean.

[0082] FIG. 10 is a perspective view that illustrates the microwave oven in which the control portion shown in FIG. 8 is mounted, and that is taken from behind. In FIG. 10, reference numeral 10 designates a microwave oven that roughly comprises a microwave oven case 20 and an opening/closing door 30. Under the back plate 206 thereof, the microwave oven case 20 includes an intake fan 201 adapted to take in air into the microwave oven case 20, a cover 202 adapted to cover the intake fan 201, and a guide plate 203 adapted to feed air, which is contained in the cover 202, to an upper part of the case 20. The cover 202 is downwardly opened. When the intake fan 201 rotates, cool air is sucked from the opening and enters the cover 202. The cool air flows in the guide plate 203 and is fed to the upper part of the case 20. An opening 206a (FIG. 8) is provided in a part of the back plate 206 of the case 20, with which part the guide plate 203 is brought into contact. The air having reached the upper part flows through the opening 206a into the ceiling space of the case 20. In the ceiling space, a partition plate 204 (FIG. 10) is provided in parallel to a side surface of the case 20 to be spaced therefrom by a predetermined interval. Also, a partition plate 205 is provided in contact with the partition plate 204 and in parallel to the control portion 40 to be spaced therefrom by a predetermined interval. Air flows through an air passage 207 formed between a side wall of the case 20 and the partition plate and advances to the front of the case 20. Then, the air flows through an air passage formed between the front plate 22 and the partition plate 205 and then passes through the opening 22a provided in the front plate 22. Thus, the air enters the rear side of the control portion 40.

[0083] These partition plates 204 and 205 prevent the air, which has flowed into the ceiling space, from being mixed with hot air discharged from a cooling system discharge opening 28 (FIG. 8) to a ceiling discharge space 209 after cooling an outer periphery of the heating chamber that is another cooling system. Therefore, the air having cooled, which is discharged from the cutout of the control portion 40, is prevented from being hot (equal to or higher than 90 degrees). Consequently, there is entirely no fear that a user gets scalded. Incidentally, the hot air discharged from the cooling system discharge opening 28 (FIG. 8) to the ceiling discharge space 209 after cooling the outer periphery of the heating chamber, which is another cooling system, is further upwardly led or rises and flows through the back of the case of the electromagnetic cooker and is upwardly exhausted from a rear corner portion.

[0084] FIG. 11 is a perspective view that illustrates the microwave oven shown in FIG. 10 in a state in which the control portion 40 is removed therefrom, and that is taken from front. Air having entered the ceiling space of the case 20 from the opening 206a provided at the upper corner portion of the back plate 206 flows through the passage 207 and enters the control portion 40 from the opening 22a of the front plate 22.

[0085] The air having entered the control portion 40 cools the control board 49 (FIG. 9) on which many exothermic components are mounted. Thereafter, the air is exhausted from the cutout 49a (FIG. 9) provided in the bottom of the control portion 40.

[0086] FIG. 12 is an upward view of the control portion mounted in the microwave oven casing.

[0087] As is understood from this figure, the gap between the control portion 40 and the microwave oven case 20 is formed by the cutout 40a of the control portion

40. Thus, the air having cooled the control board 49 (FIG. 9) is exhausted from this cutout 40a to the front of the case 20.

[0088] Therefore, when the opening/closing door is opened, hot water vapor spills out of the heating chamber 23. The air curtain due to the air flow exhausted from the cutout 40a prevents water vapor from approaching the control portion 40, and from hitting against and fogging the liquid crystal display portion. Also, water vapor is prevented from entering the control portion 40 and from causing malfunction of an electronic component.

[0089] As described above, the cutout 40a is provided in the bottom portion 41 of the control portion 40 according to the invention. The invention is not limited to this embodiment. Needless to say, in a case where elongated holes as shown in FIGS. 13 and 15 are provided therein, similar advantages can be obtained.

[0090] FIG. 13 is a perspective view of a control portion of a first modification, taken from behind.

[0091] In this figure, reference character 40' designates a control portion according to the first modification, reference numeral 49 denotes a control board, and reference character 40b designates one elongated hole (slit) provided along the edge of the bottom portion 41 of the control portion 40b'. The area of the elongated slit 40b is set to be equal to the area of the cutout 40a shown in FIG. 9.

[0092] Consequently, as is seen from FIG. 14 that is an upward view of the controller 40', air having cooled the control board in the control portion 40' is exhausted outside the microwave oven from the elongated hole 40b of the bottom portion 41 of the control portion 40', so that an air curtain is formed. Therefore, even when the opening/closing door is opened, and when hot water vapor spills out of the heating chamber 23, an air curtain due to the air flow exhausted from the cutout 40b prevents water vapor from approaching the control portion 40' and from hitting against and fogging the liquid crystal display portion.

[0093] Also, FIG. 15 is a perspective view of a control portion of a second modification, taken from behind.

[0094] In this figure, reference character 40" designates a control portion according to the second modification, reference numeral 49 denotes a control board, and reference character 40c designates a plurality of elongated holes provided along the edge of the bottom portion 41 of the control portion 40. The total area of the elongated holes 40c is set to be equal to the area of the cutout 40a shown in FIG. 9. In this case, it is advisable to set the length of a component, which needs especially strong cooling, for example, an elongated hole provided in the bottom portion of the liquid crystal display to be longer than those of other components. Consequently, the strength of the case for the control portion can be increased, as compared with the case of employing the one elongated hole as shown in FIG. 13.

[0095] The advantages of the divided elongated holes are similar to those of the elongated hole shown in FIG. 13. Air having cooled the control board in the control portion 40 is exhausted outside the microwave oven from each of the elongated holes 40c of the bottom portion 41 of the control portion 40", so that an air curtain due to the air flow is formed. Therefore, even when the opening/closing door is opened, and when hot water vapor spills out of the heating chamber 23, an air curtain due to the air flow exhausted from the cutout 40c prevents water vapor from approaching the control portion 40" and from hitting against and fogging the liquid crystal display portion.

[0096] Although the invention has been described in the foregoing description in a case where the invention is applied to the built-in type microwave oven, the air curtain due to the air flow exhausted from the cutout of the control portion according to the invention does not have the advantages only in the case where the invention is applied to the built-in type microwave oven. Needless to say, similar advantages can be obtained in a case where the invention is applied to a control portion of an independent single microwave oven.

[0097] Therefore, even in the single microwave oven adapted to heat-treat an object, which is to be heated, by supplying high frequency waves to a heating chamber, a cutout or an elongated hole, which extends in a length direction of a control portion, is preliminarily formed in the bottom portion of the control portion. Further, the control portion is mounted in the upper front portion of the microwave oven. Thus, a space adapted to blow out a cooling air, which is constituted by the cutout or the elongated hole, can be formed between the control portion and the microwave oven. Consequently, in a case where air supplied from the air blowing portion is led from the back of the control portion into the control portion, and where the air having cooled the control board is exhausted from the cooling air blowout space, an air curtain is formed between the control portion and the heating chamber. Thus, even when the opening/closing door is opened, and when hot water vapor spills out of the heating chamber 23, the air curtain due to the air flow exhausted from the cutout or the elongated hole prevents water vapor from approaching the control portion, and from hitting against and fogging the liquid crystal display portion. Also, water vapor is prevented from entering the control portion and from causing malfunction of an electronic component.

[0098] Although the invention has particularly been described with reference to the specific embodiment, it is apparent to those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the invention.

[0099] The present application is based on Japanese Patent Application Nos. 2003-169452 and 2003-169383 filed June 13, 2003, which are hereby incorporated by reference herein.

Industrial Applicability

[0100] As described above, a built-in type microwave oven according to the invention described in claim 1, is configured to have a heating chamber adapted to accommodate an object to be heated, a high frequency generating portion adapted to supply high frequency waves into the heating chamber, a control portion including a control board adapted to control the microwave oven, and an air blowing portion adapted to blow a cooling air into the control portion, and also configured to heat-treat the object by supplying high frequency waves to the heating chamber. This built-in type microwave oven features that the control portion is constituted by a kangaroo pocket control portion extending in a length direction, that the kangaroo pocket control portion is mounted in an upper front portion of the microwave oven, that air supplied from the air blowing portion is led from a back of the kangaroo pocket control portion into the kangaroo pocket control portion, and that air having cooled the control board is exhausted from a rotating space of the kangaroo pocket control portion. Thus, it is unnecessary for a user to squat down each time he operates operating buttons. Consequently, the operability is improved. Further, air is exhausted from the rotating space of the kangaroo pocket control portion. Thus, there is no need for providing a separate exhaust opening. Further, the microwave oven is prevented from being bulky. Also, an air curtain is formed. This prevents the liquid crystal display of the kangaroo pocket control portion from being fogged.

[0101] A built-in type microwave oven according to the invention described in claim 2 features that the air blowing portion is provided at a rear side of the microwave oven. Thus, the intake opening and the exhaust opening are provided in the rear surface and the front surface of the microwave oven separately from each other. Consequently, warm air outputted from the exhaust opening is not sucked. The efficiency in cooling is enhanced.

[0102] A built-in type microwave oven according to the invention described in claim 3 features that air supplied from the air blowing portion is led to a ceiling space of the heating chamber, and that the air is led therefrom to the back of the kangaroo pocket control portion. Thus, the ceiling of the microwave oven is cooled.

[0103] A built-in type microwave oven according to the invention described in claim 4 features that the microwave oven further comprises a guide member provided at a rear side of a back plate of the microwave oven and adapted to lead air, which is supplied from the air blowing portion, to a corner portion of the ceiling space, a first partition plate provided at a side of the ceiling space and erected in parallel to a side surface of the microwave oven to be spaced therefrom by a predetermined interval, and a second partition plate configured to be in contact with the first partition plate, and erected to be spaced from the kangaroo pocket control portion by a predetermined interval.

[0104] With this configuration, the sucked cool air is prevented from being mixed with hot air having cooled the outer periphery of the heating chamber. Also, the hot air is prevented from reaching the control board. Thus, the control board is cooled by the sucked cool air.

[0105] A built-in type microwave oven according to the invention described in claim 5 features that a cutout or an elongated hole extending in a length direction of the control portion is formed in a bottom part of the control portion, that the control portion is mounted in an upper front portion of the microwave oven to thereby form a cooling air blowout space, which is constituted by the cutout or the elongated hole, between the control portion and a front surface of the microwave oven. Thus, the control portion is mounted in the upper front portion of the microwave oven. Thus, it is unnecessary for a user to squat down each time he operates operating buttons. Consequently, the operability is improved. Further, air is exhausted from a cooling air blowout space, which is constituted by a cutout or an elongated hole, between the control portion and the front surface of the microwave oven. Thus, there is no need for providing a separate exhaust opening. Further, the microwave oven is prevented from being bulky. Also, an air curtain is formed. This prevents the liquid crystal display of the kangaroo pocket control portion from being fogged.

[0106] A built-in type microwave oven according to the invention described in claim 6 features that the air blowing portion is provided at a rear side of the microwave oven. Thus, the intake opening and the exhaust opening are provided in the rear surface and the front surface of the microwave oven separately from each other. Consequently, warm air outputted from the exhaust opening is not sucked. The efficiency in cooling is enhanced.

[0107] A built-in type microwave oven according to the invention described in claim 7 features that air supplied from the air blowing portion is led to a ceiling space of the heating chamber, and that the air is led therefrom to the back of the control portion. Thus, the ceiling of the microwave oven is cooled.

[0108] A built-in type microwave oven according to the invention described in claim 8 features that the microwave oven further comprises a guide member provided at a rear side of an inner wall of the heating chamber and adapted to lead air, which is supplied from the air blowing portion, to a corner portion of the ceiling space, a first partition plate provided at a side of the ceiling space and erected in parallel to a side surface of the microwave oven to be spaced therefrom by a predetermined interval, and a second partition plate configured to be in contact with the first partition plate, and erected to be spaced from the kangaroo pocket control portion by a predetermined interval. Thus, the sucked cool air is prevented from being mixed with hot air having cooled the outer periphery of the heating chamber. Also, the hot air is prevented from reaching the control board. Thus, the control board is cooled by the sucked cool air.

[0109] According to the invention described in claim 9, even in a single microwave oven, an air curtain is formed

between the control portion and the heating chamber. Thus, even when the door is opened, and when hot water vapor spills out of the heating chamber, the air curtain due to the air flow exhausted from the cutout or the elongated hole prevents water vapor from approaching the control portion, and from hitting against and fogging the liquid crystal display portion. Also, water vapor is prevented from entering the control portion and from causing malfunction of an electronic component.

Claims

1. A built-in type microwave oven comprising:

a heating chamber adapted to accommodate an object to be heated by supplying high frequency waves to said heating chamber;
a high frequency generating portion adapted to supply high frequency waves into said heating chamber;
a control portion including a control board adapted to control said microwave oven; and
an air blowing portion adapted to blow a cooling air into said control portion,
wherein said control portion is constituted by a kangaroo pocket control portion extending in a length direction;
said kangaroo pocket control portion is mounted in an upper front portion of said microwave oven;
air supplied from said air blowing portion is led from a back of said kangaroo pocket control portion into said kangaroo pocket control portion; and
air having cooled said control board is exhausted from a rotating space of said kangaroo pocket control portion.

2. The microwave oven according to claim 1, wherein said air blowing portion is provided at a rear side of said microwave oven.

3. The microwave oven according to claim 2, wherein air supplied from said air blowing portion is led to a ceiling space of said heating chamber; and
the air is led therefrom to the back of said kangaroo pocket control portion.

4. The microwave oven according to claim 3, further comprising:

a guide member provided at a rear side of a back plate of said microwave oven and adapted to lead air, which is supplied from said air blowing portion, to a corner portion of said ceiling space;
a first partition plate provided at a side of said ceiling space and erected in parallel to a side surface of said microwave oven to be spaced therefrom by a predetermined interval; and
a second partition plate configured to be in contact with said first partition plate, and erected to be spaced from said kangaroo pocket control portion by a predetermined interval.

5. A built-in type microwave oven comprising:

a heating chamber adapted to accommodate an object to be heated by supplying high frequency waves to said heating chamber;
a high frequency generating portion adapted to supply high frequency waves into said heating chamber;
a control portion including a control board adapted to control said microwave oven; and
an air blowing portion adapted to blow a cooling air into said control portion,
wherein a cutout or an elongated hole extending in a length direction of said control portion is formed in a bottom part of said control portion;
said control portion is mounted in an upper front portion of said microwave oven to thereby form a cooling air blowout space, which is constituted by said cutout or said elongated hole, between said control portion and a front surface of said microwave oven;
air supplied from said air blowing portion is led from a back of said control portion into said control portion; and
the air having cooled said control board is exhausted from said cooling air blowout space.

6. The microwave oven according to claim 5, wherein said air blowing portion is provided at a rear side of said microwave oven.

7. The microwave oven according to claim 6, wherein air supplied from said air blowing portion is led to a ceiling space of said heating chamber; and
the air is led therefrom to the back of said kangaroo pocket control portion.

8. The microwave oven according to claim 7, further comprising:

a guide member provided at a rear side of an inner wall of said heating chamber and adapted to lead air, which is supplied from said air blowing portion, to a corner portion of said ceiling space;
a first partition plate provided at a side of said ceiling space and erected in parallel to a side surface of said microwave oven to be spaced therefrom by a predetermined interval; and
a second partition plate configured to be in contact with said first partition plate, and erected to be spaced from said kangaroo pocket control

portion by a predetermined interval.

9. A microwave oven comprising:

a heating chamber adapted to accommodate an object to be heated by supplying high frequency waves to said heating chamber;
a high frequency generating portion adapted to supply high frequency waves into said heating chamber;
a control portion including a control board adapted to control said microwave oven; and
an air blowing portion adapted to blow a cooling air into said control portion,
wherein a cutout or an elongated hole extending in a length direction of said control portion is formed in a bottom part of said control portion;
said control portion is mounted in an upper front portion of said microwave oven to thereby form a cooling air blowout space, which is constituted by said cutout or said elongated hole, between said control portion and a front surface of said microwave oven;
air supplied from said air blowing portion is led from a back of said control portion into said control portion; and
the air having cooled said control board is exhausted from said cooling air blowout space.

FIG. 1

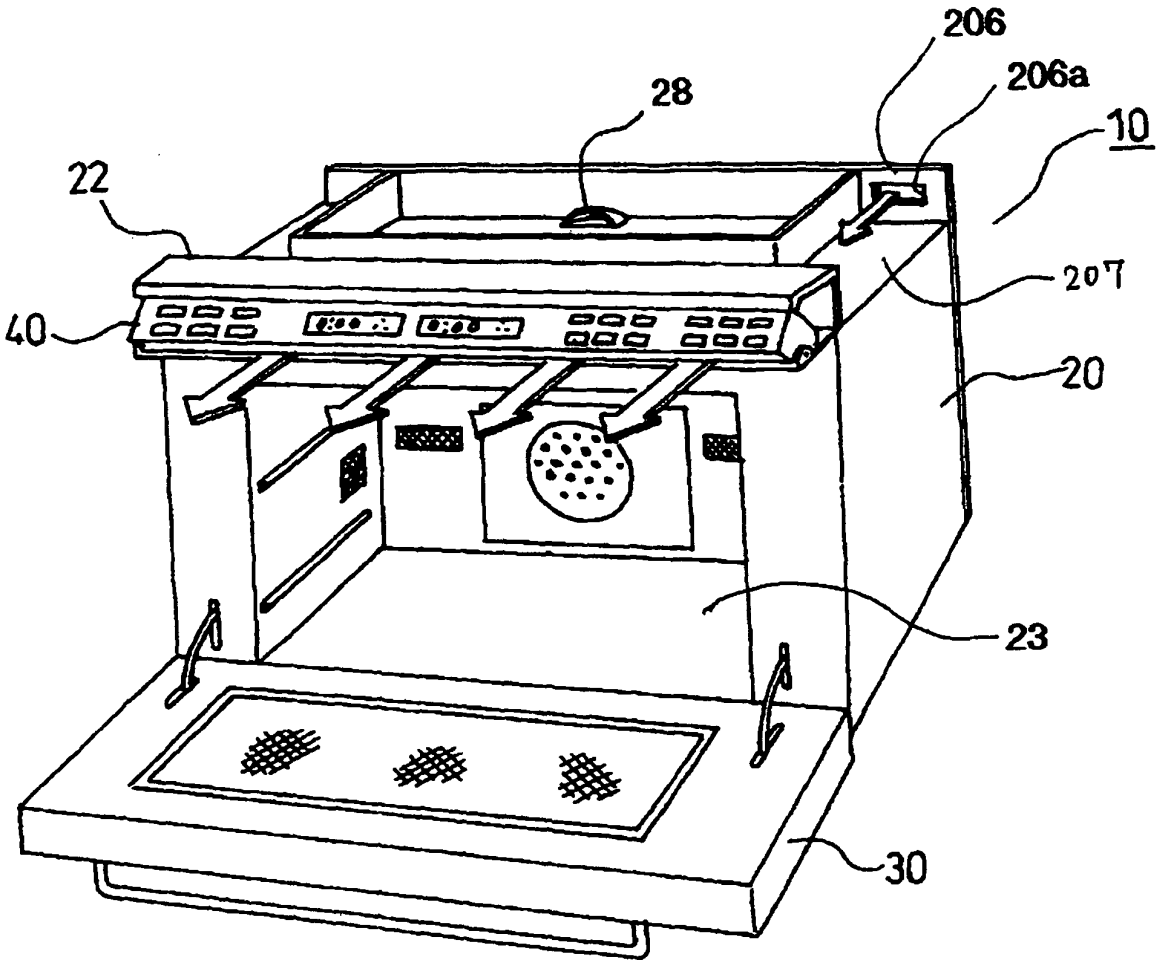


FIG. 2

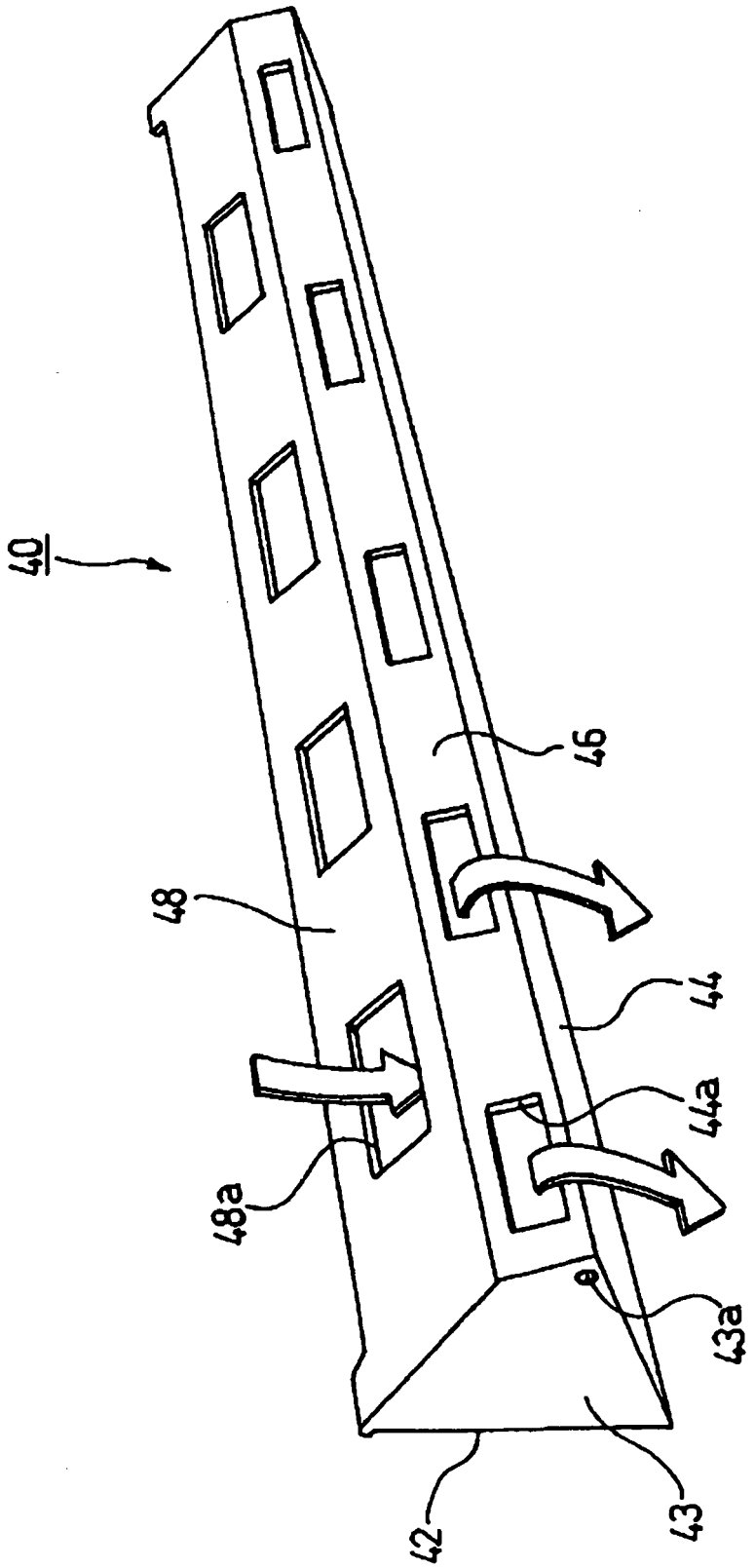


FIG. 3

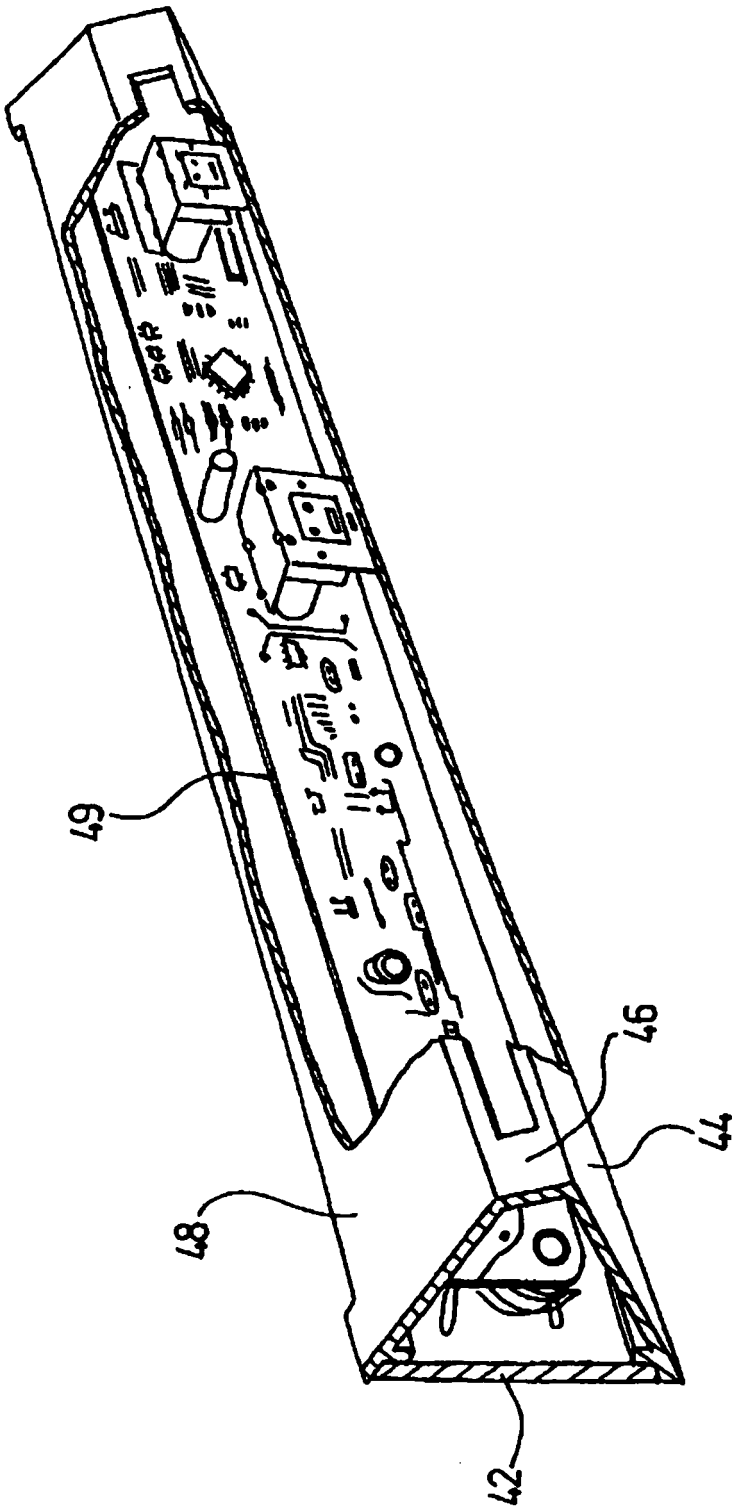


FIG. 4 (a)

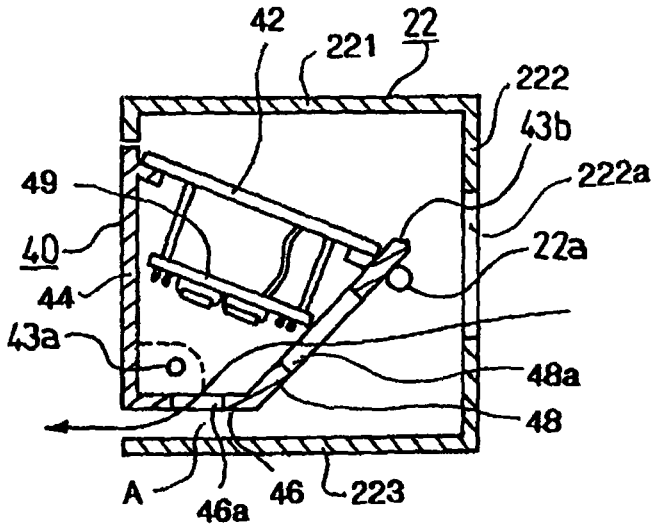


FIG. 4 (b)

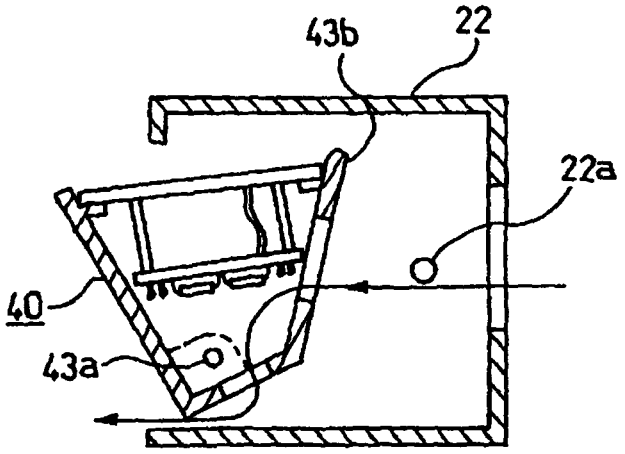
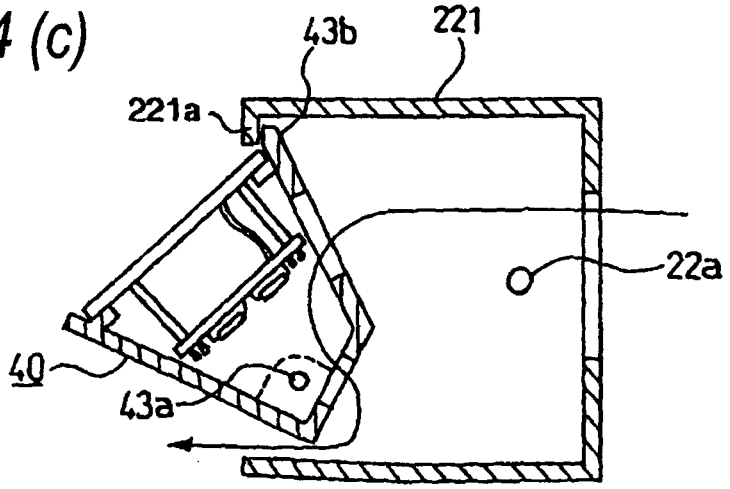


FIG. 4 (c)



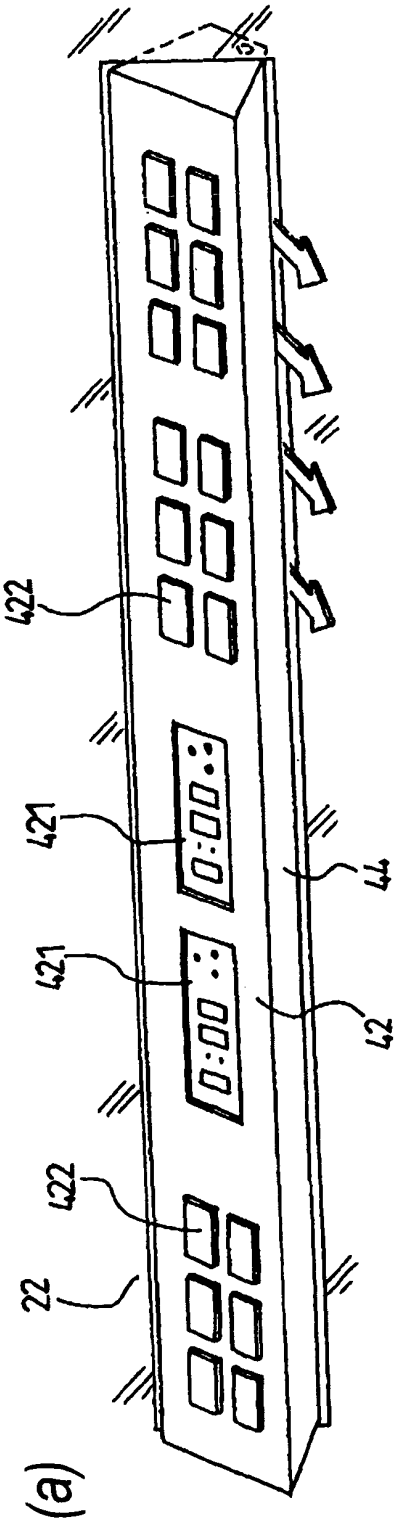


FIG. 5 (a)

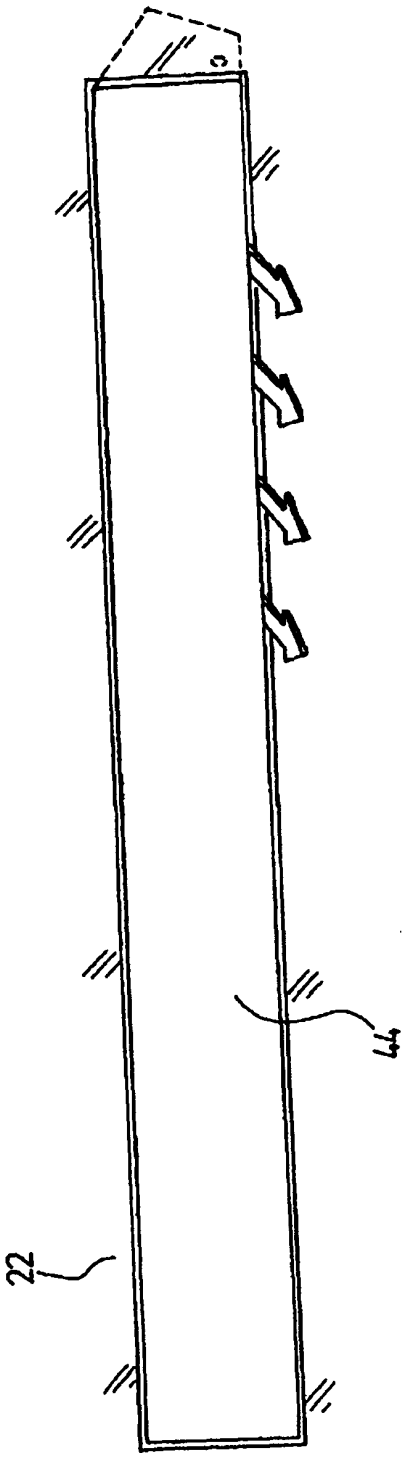


FIG. 5 (b)

FIG. 6

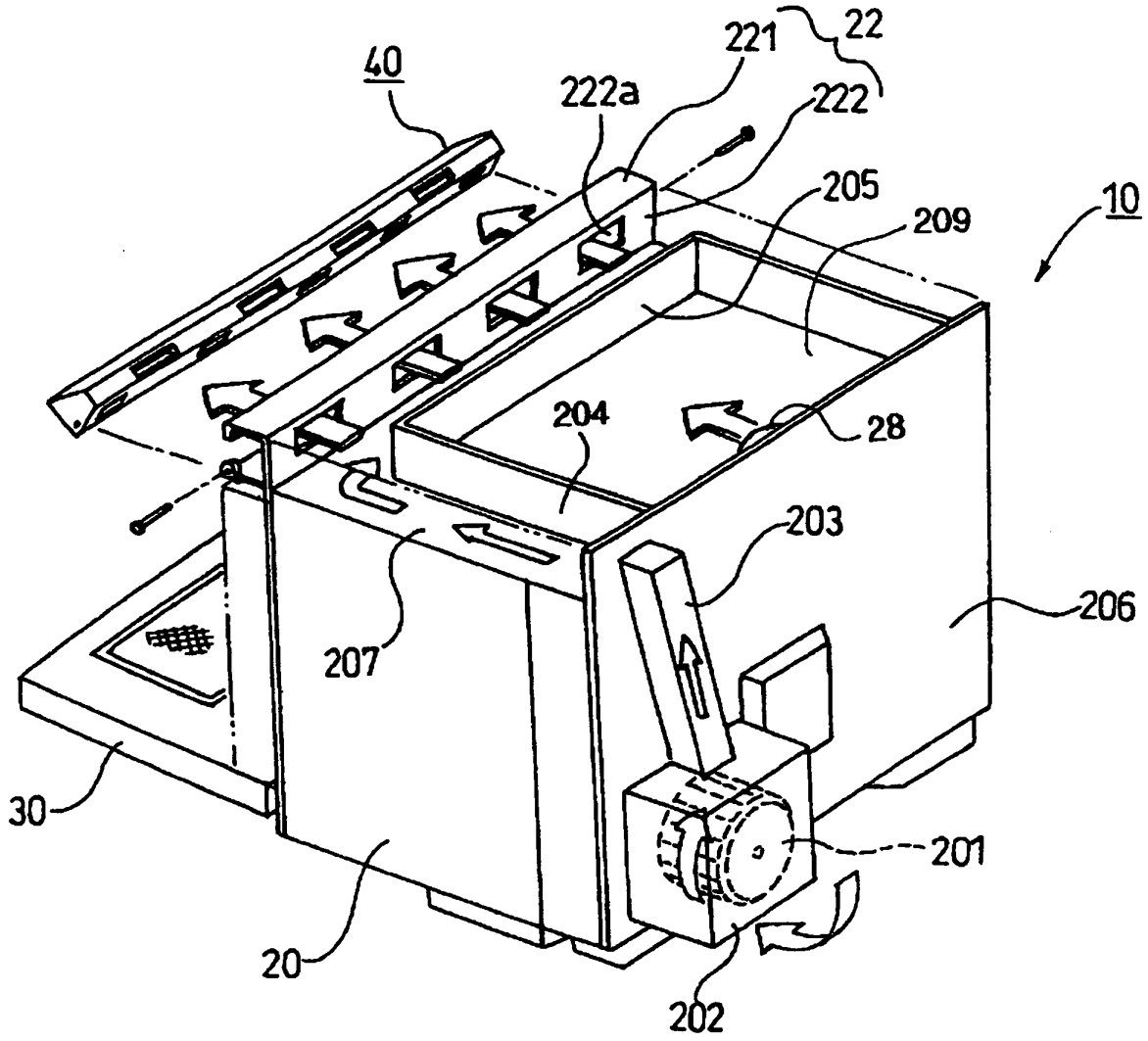


FIG. 7

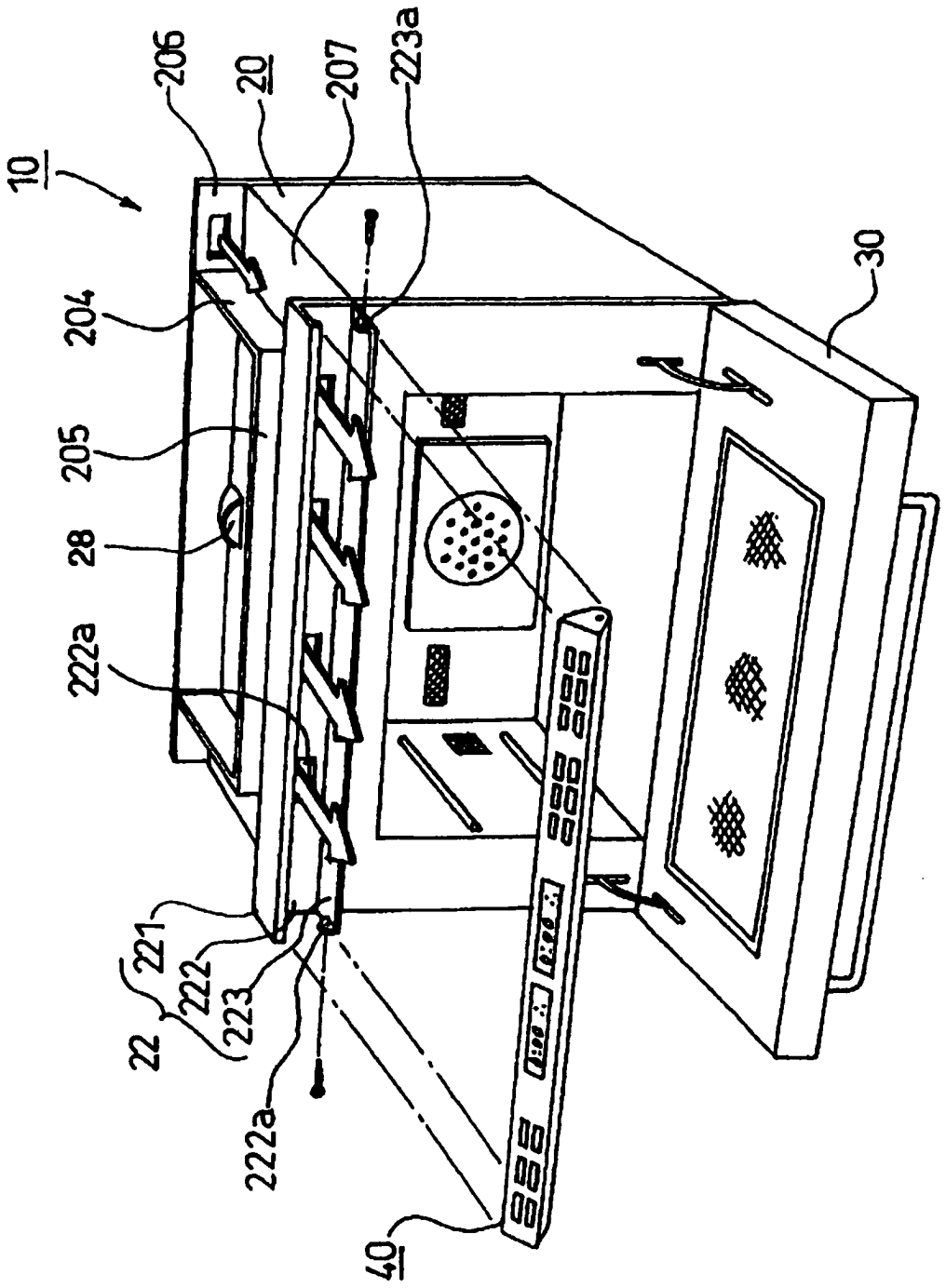


FIG. 8

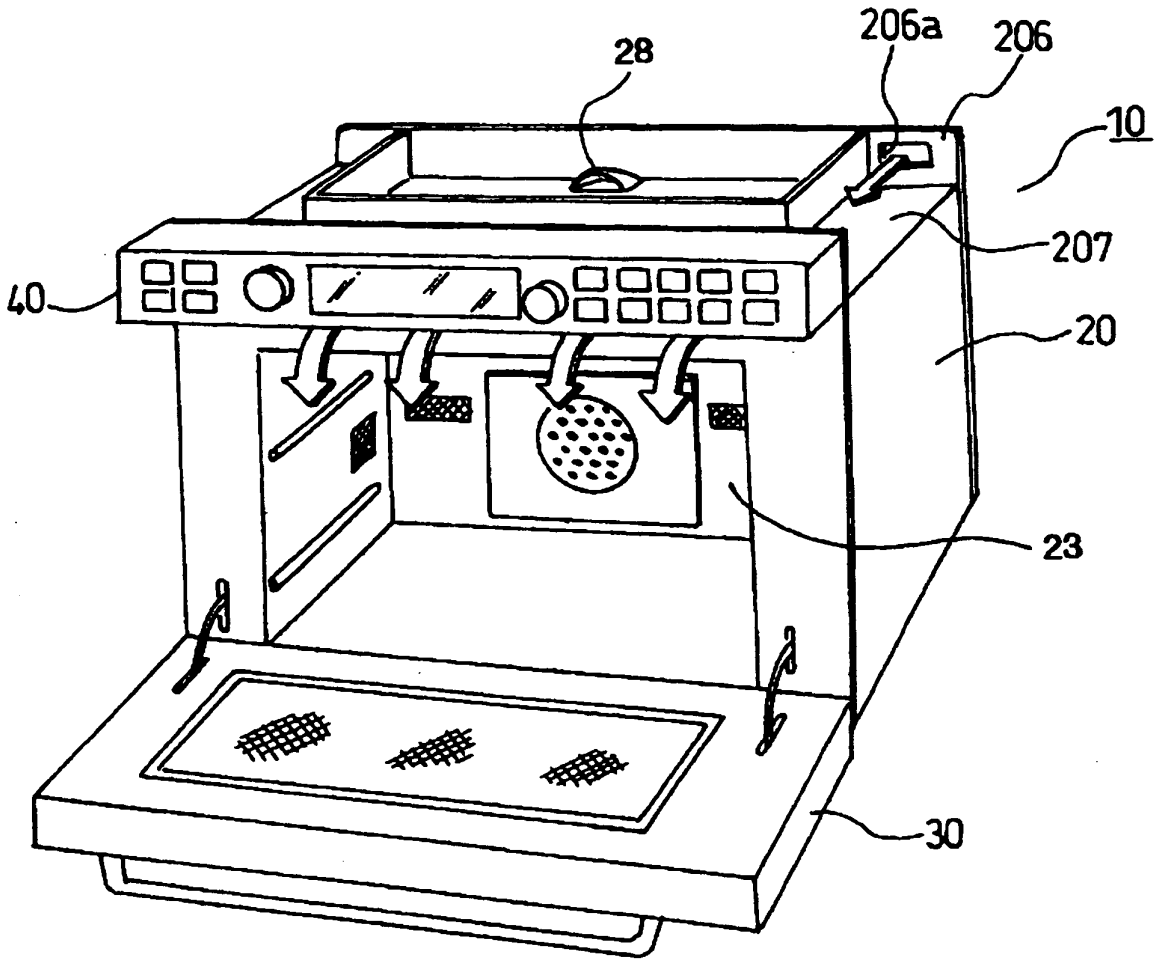


FIG. 9

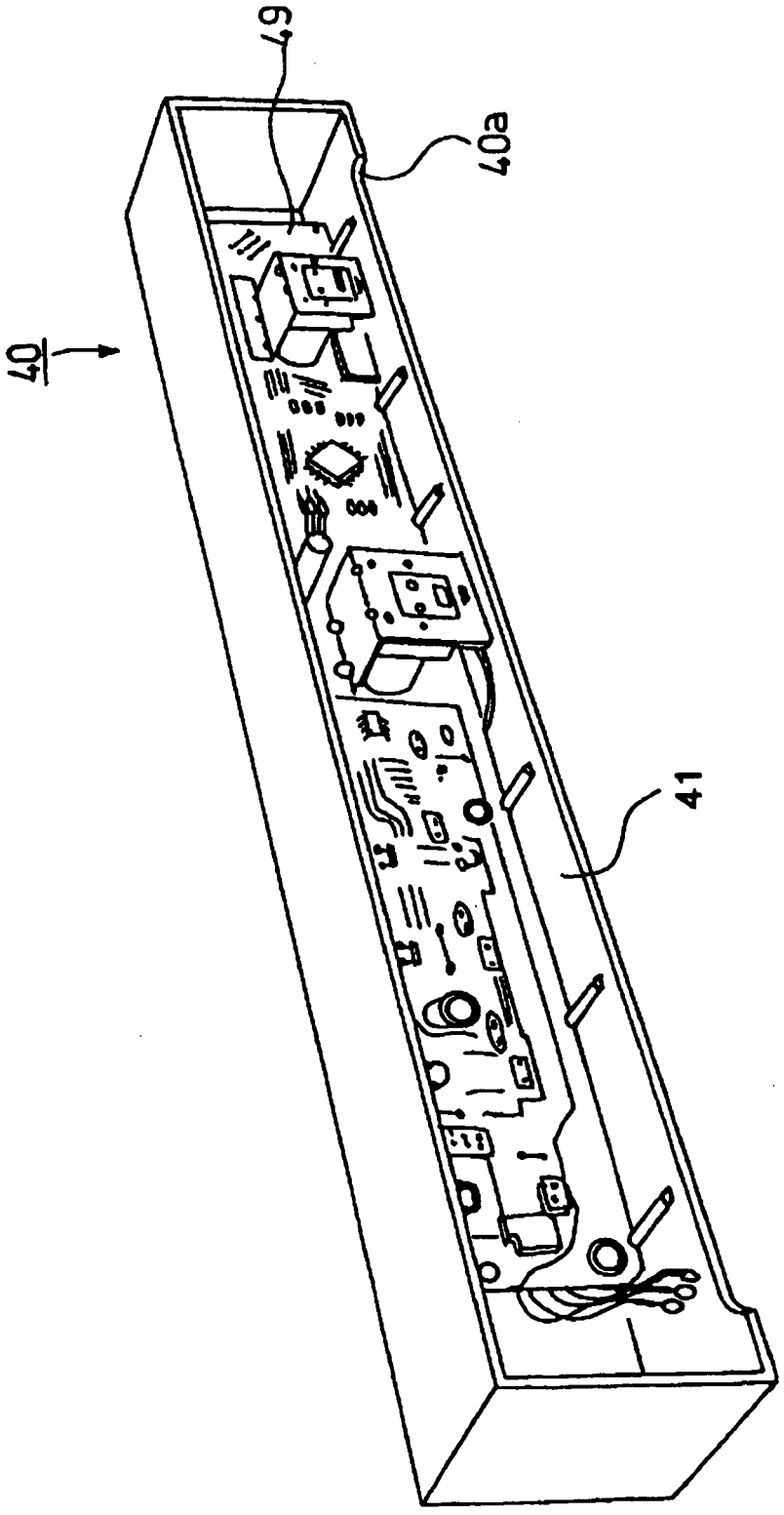


FIG. 10

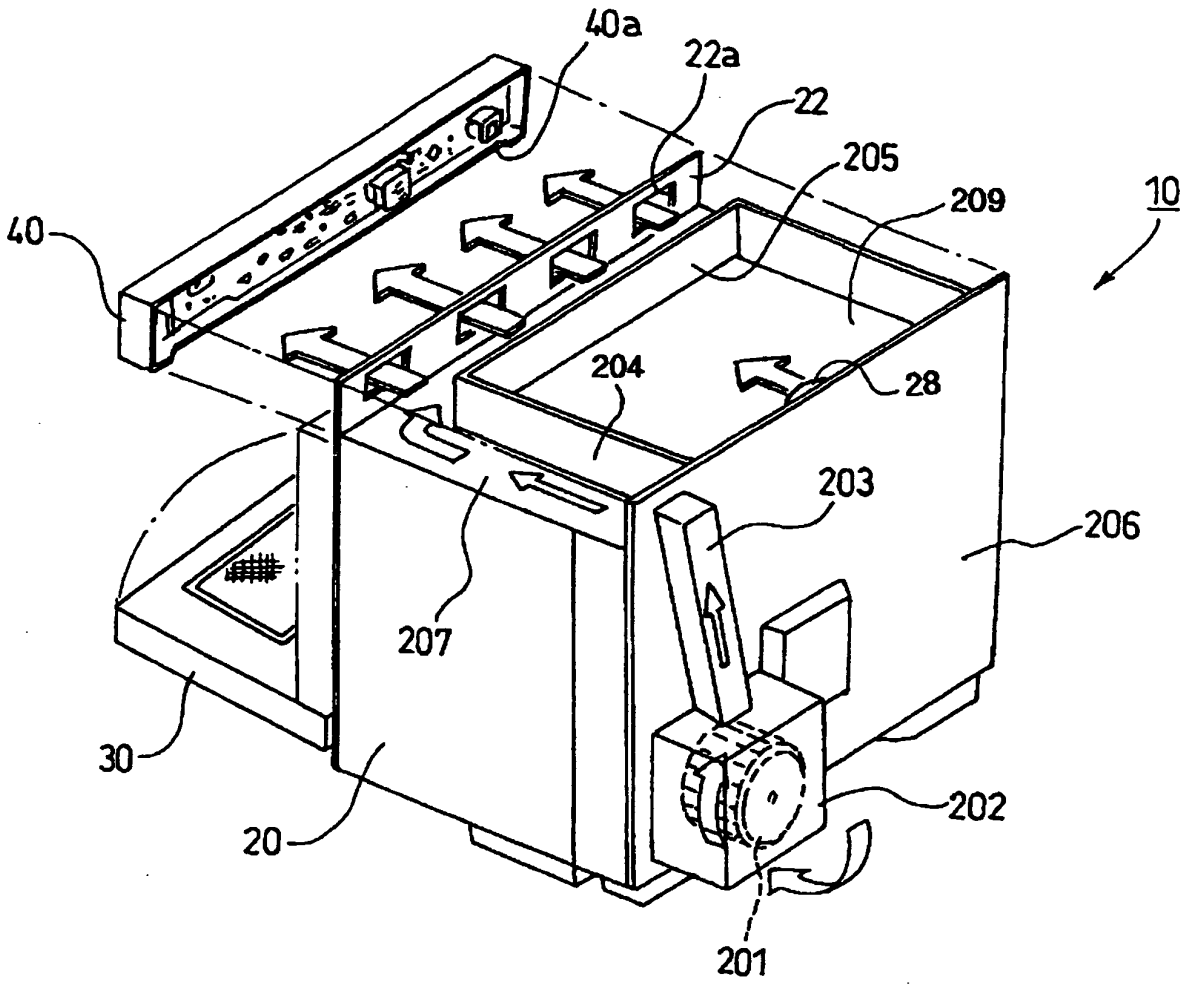


FIG. 11

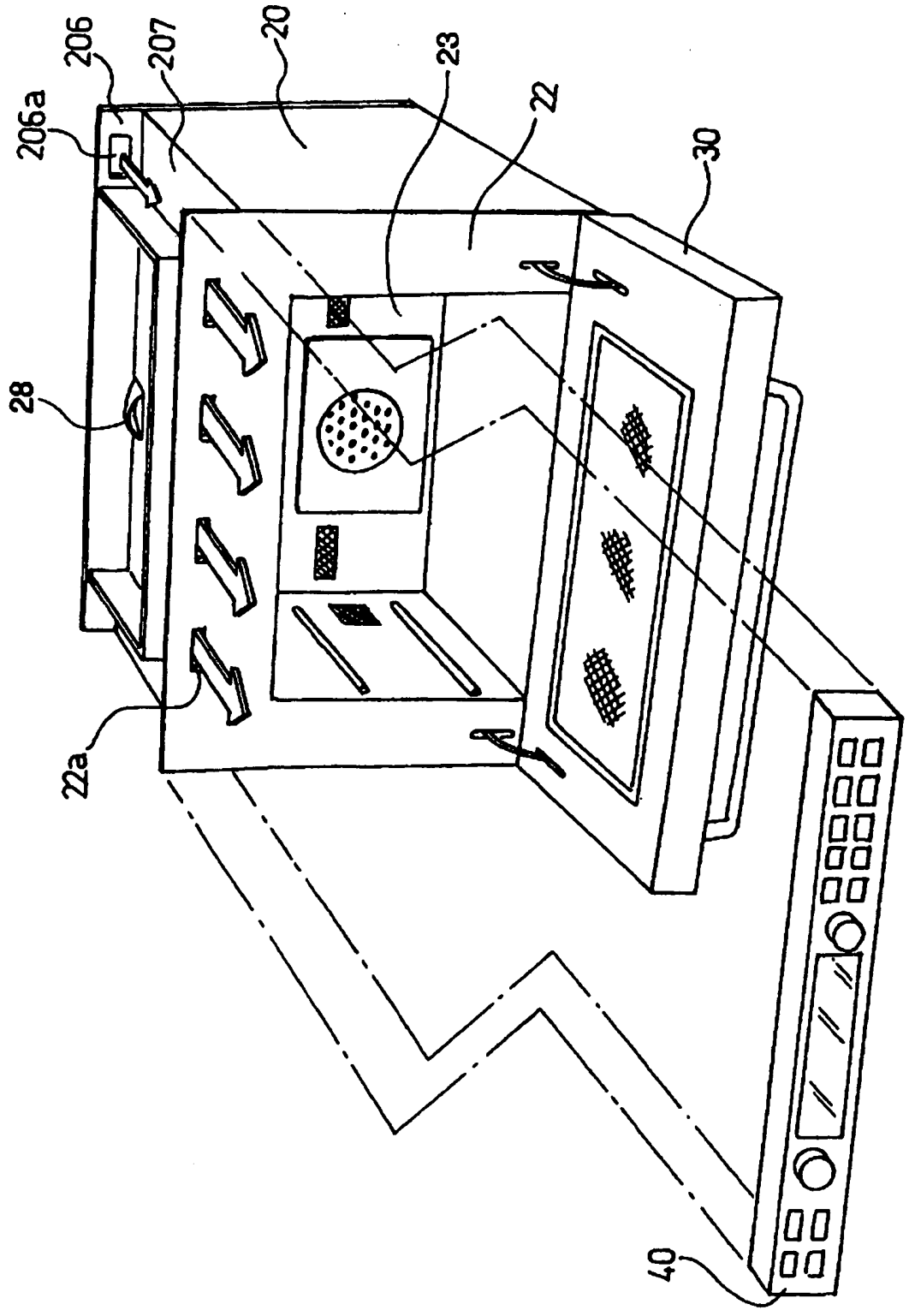


FIG. 12

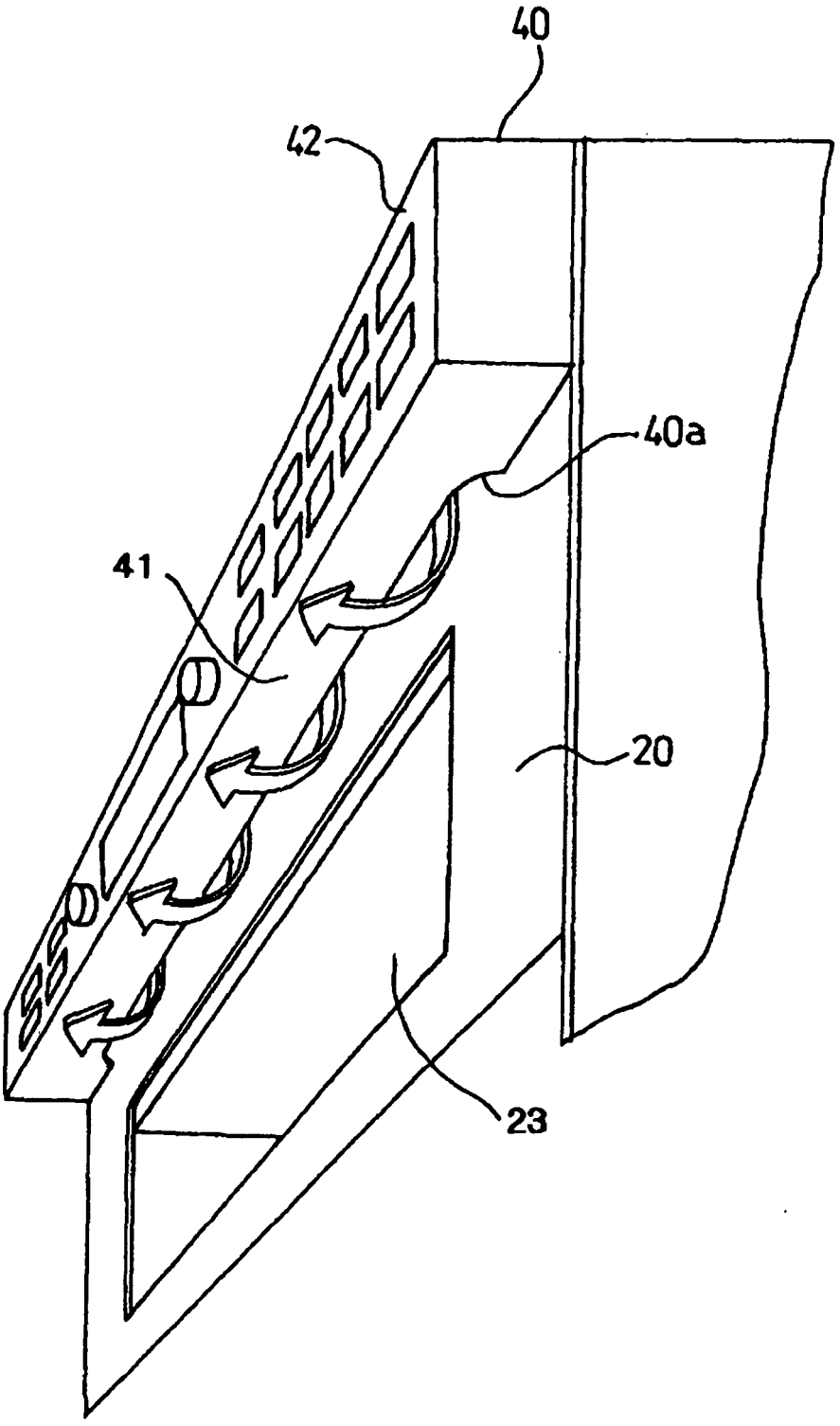


FIG. 13

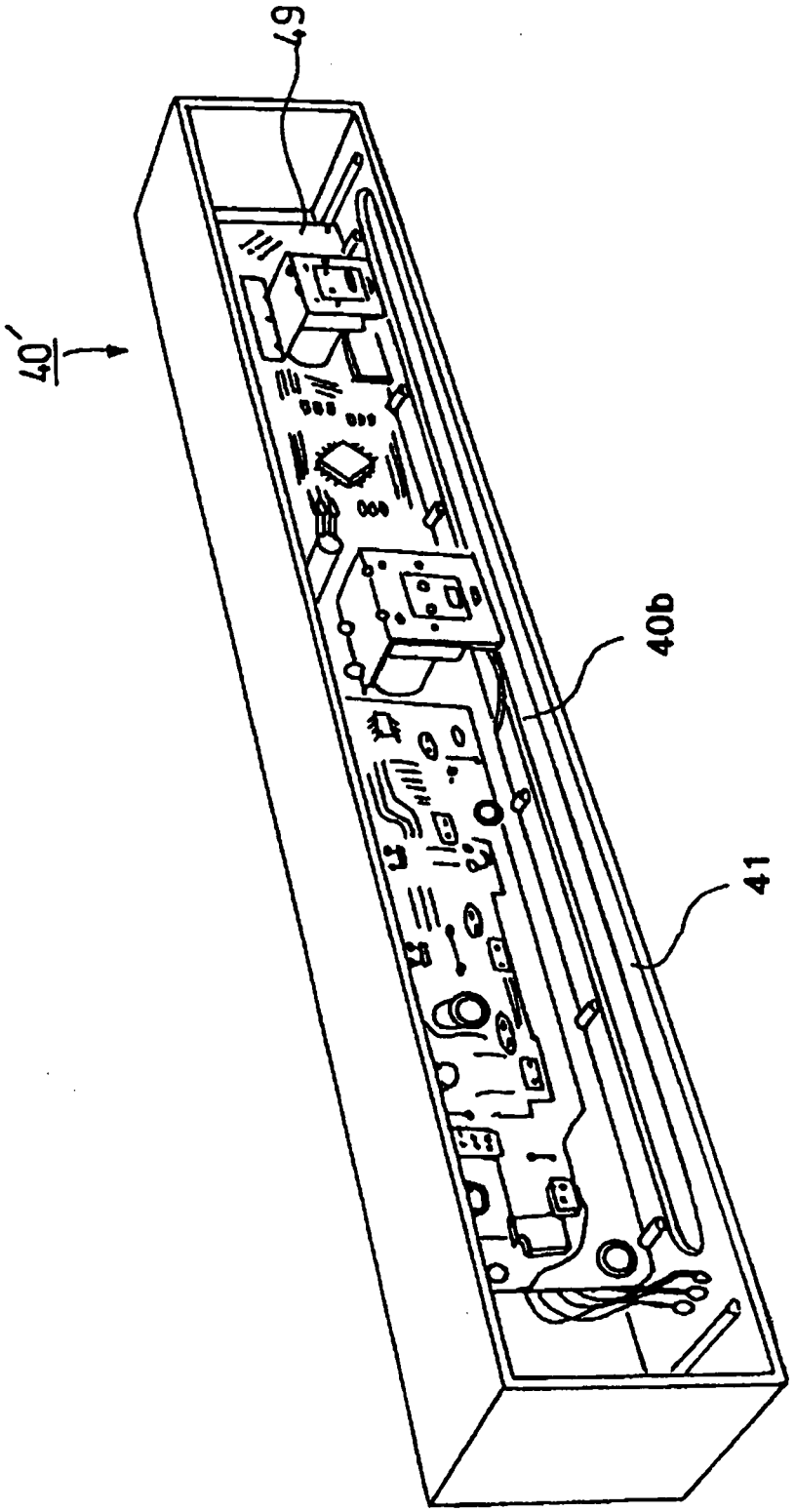


FIG. 14

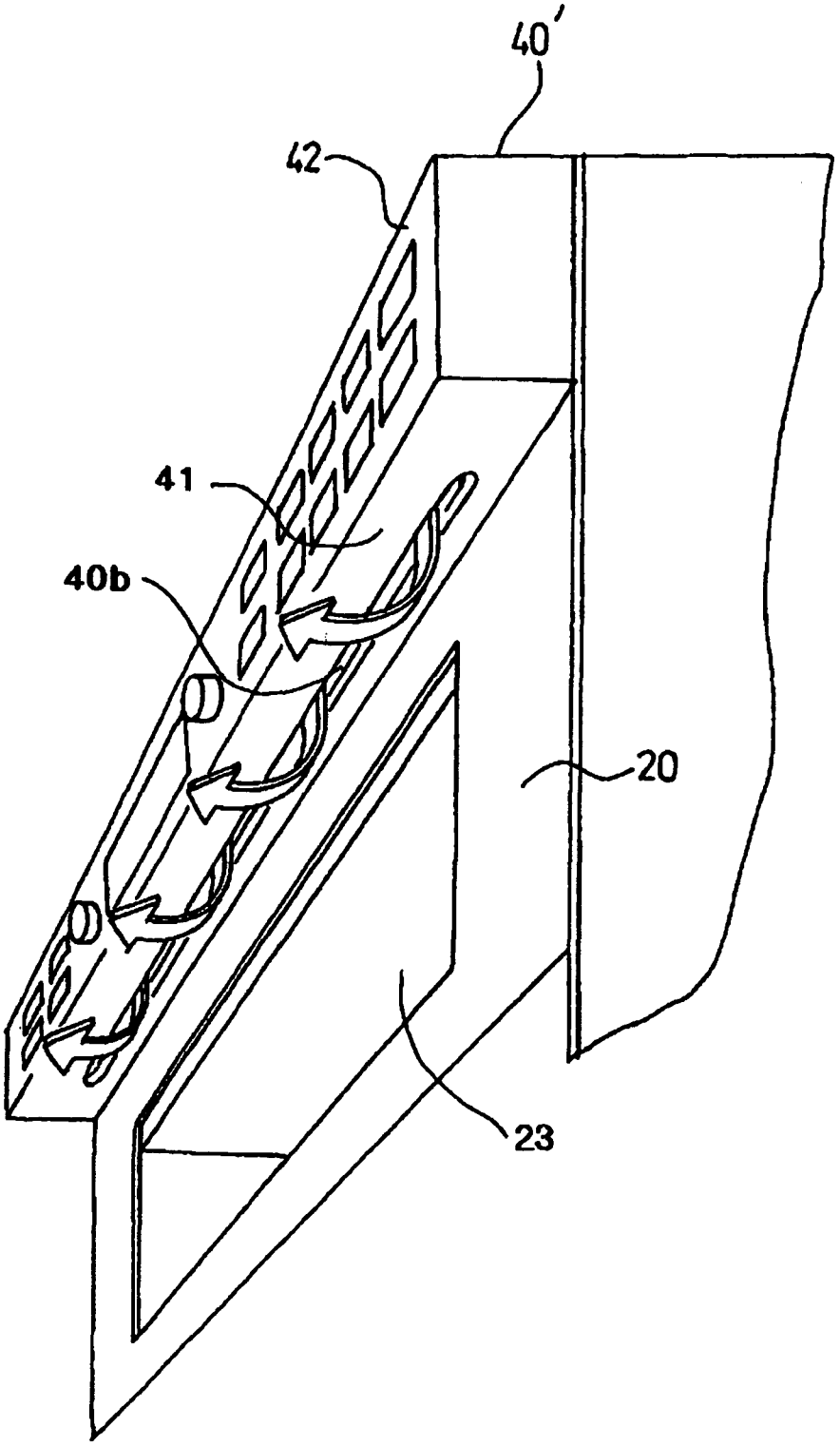


FIG. 15

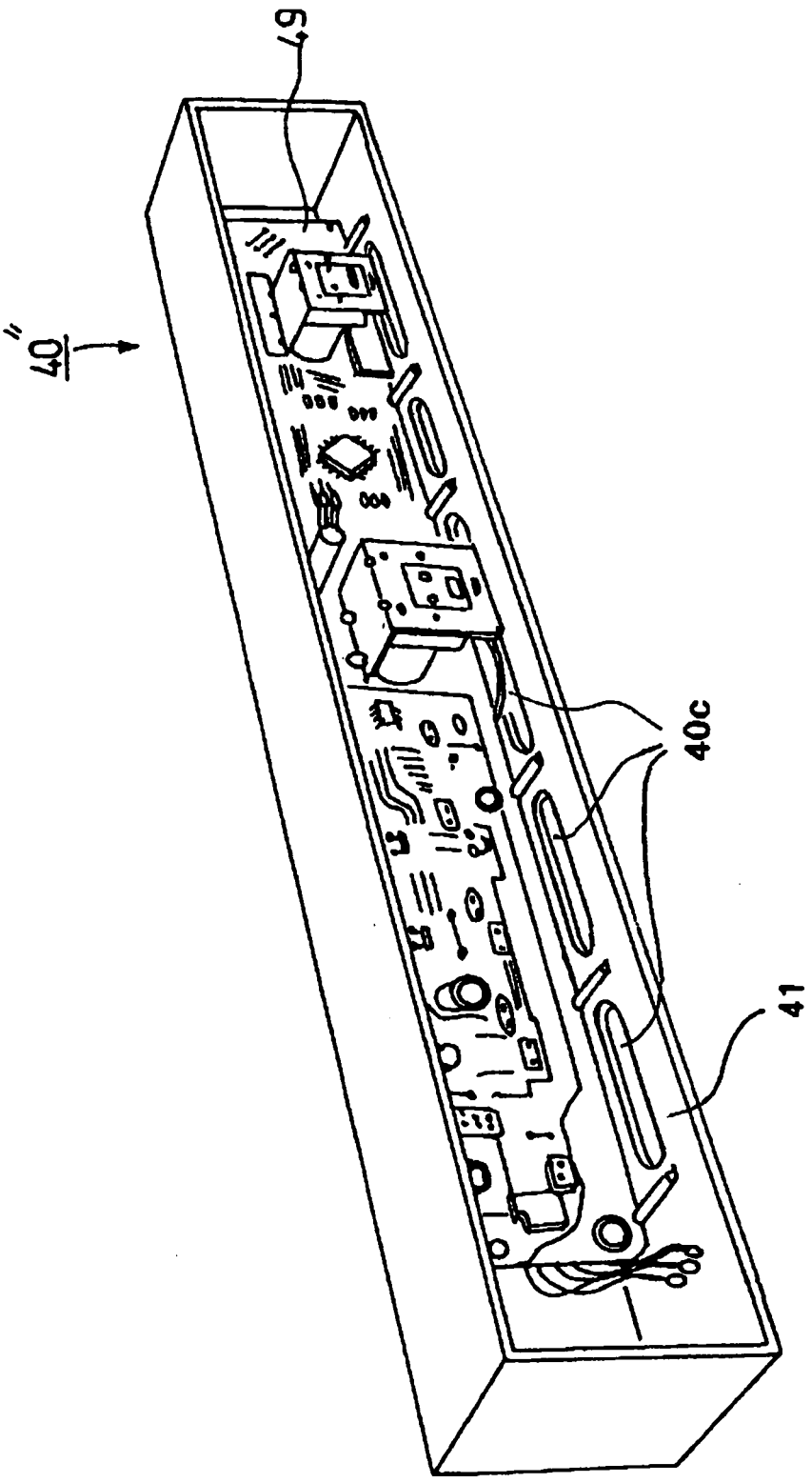


FIG. 16

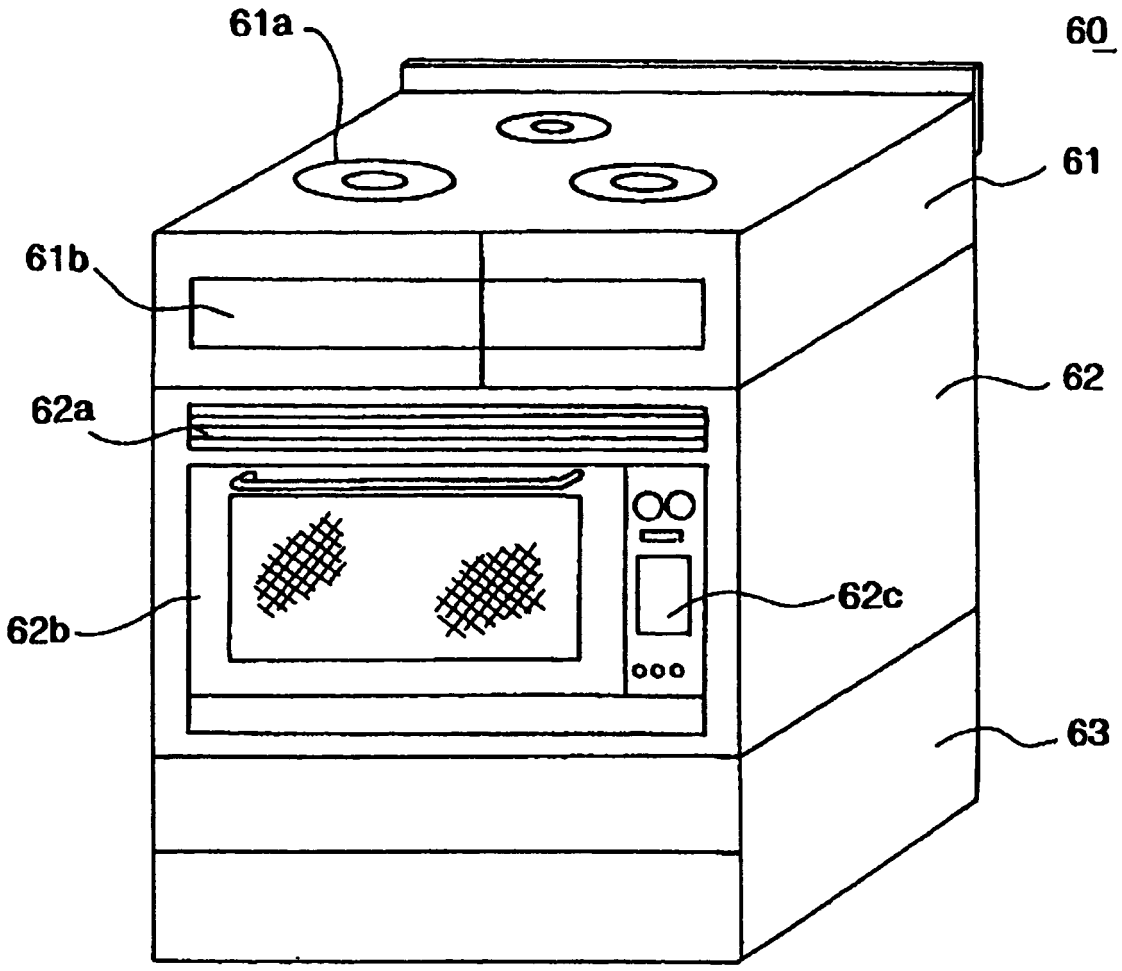


FIG. 17

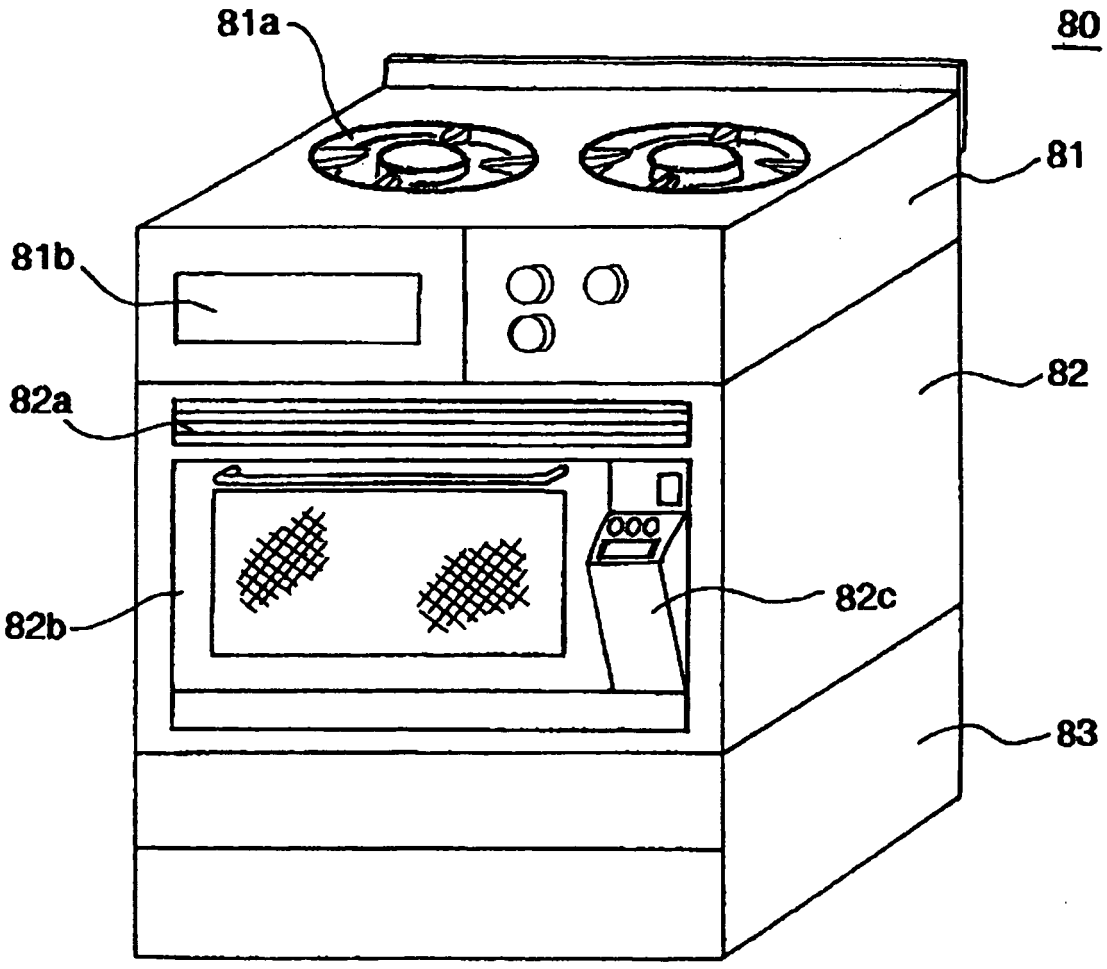
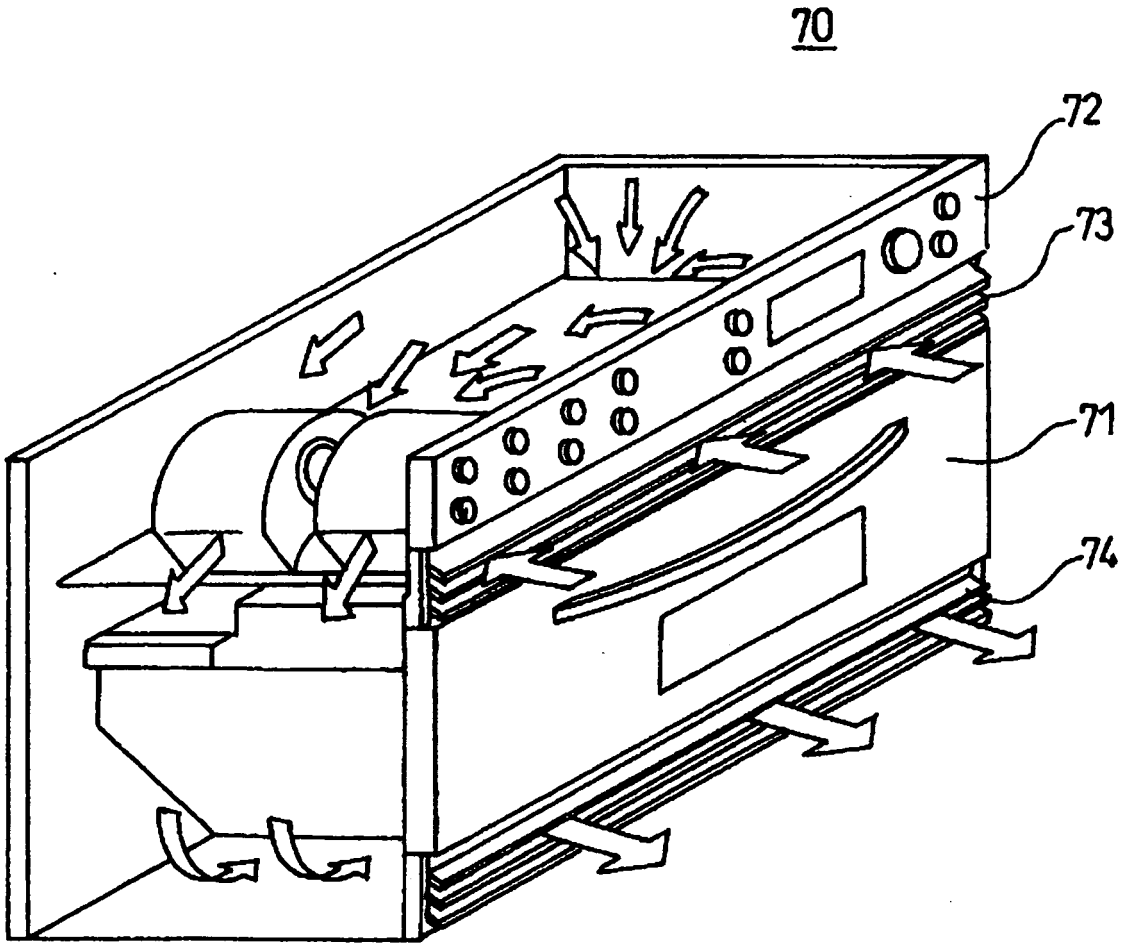


FIG. 18



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/008560

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] F24C7/02, F24C15/00, F24C15/08, F24C15/34

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)
Int.Cl[7] F24C7/02, F24C15/00, F24C15/08, F24C15/34

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Toroku Jitsuyo Shinan Koho	1994-2004
Kokai Jitsuyo Shinan Koho	1971-2004	Jitsuyo Shinan Toroku Koho	1996-2004

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 60-243430 A (Matsushita Electric Industrial Co., Ltd.), 03 December, 1985 (03.12.85), Full text (Family: none)	5-7,9 1-4,8
X Y	JP 54-156779 A (Matsushita Electric Industrial Co., Ltd.), 11 December, 1979 (11.12.79), Full text (Family: none)	5,9 1-4,6-8
X Y	JP 3-267630 A (Matsushita Electric Industrial Co., Ltd.), 28 November, 1991 (28.11.91), Full text (Family: none)	5,9 1-4,6-8

☒ 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 09 September, 2004 (09.09.04)	Date of mailing of the international search report 28 September, 2004 (28.09.04)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/008560

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 10-302949 A (Matsushita Electric Industrial Co., Ltd.), 13 November, 1998 (13.11.98), Full text (Family: none)	1-4
Y	JP 2002-267185 A (Toshiba Corp.), 18 September, 2002 (18.09.02), Full text (Family: none)	1-4
Y	JP 2003-139332 A (Matsushita Electric Industrial Co., Ltd.), 14 May, 2003 (14.05.03), Full text (Family: none)	1-4
Y	CD-ROM of the specification and drawings annexed to the request of Japanese Utility Model Application No. 30058/1992(Laid-open No. 90205/1993) (Toshiba Corp.), 10 December, 1993 (10.12.93), Full text (Family: none)	4,8
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 106745/1977(Laid-open No. 32845/1979) (Matsushita Electric Industrial Co., Ltd.), 03 March, 1979 (03.03.79), Full text (Family: none)	4,8
A	WO 01/49078 A1 (LG ELECTRONICS INC.), 05 July, 2001 (05.07.01), Full text & AU 2030701 A & EP 1243164 A & US 2002-190063 A1 & JP 2003-523494 A	1-9
A	EP 318310 A1 (VALOR ELECTRICAL LTD.), 31 May, 1989 (31.05.89), Full text & GB 2212902 A	1-9

Form PCT/ISA/210 (continuation of second sheet) (January 2004)