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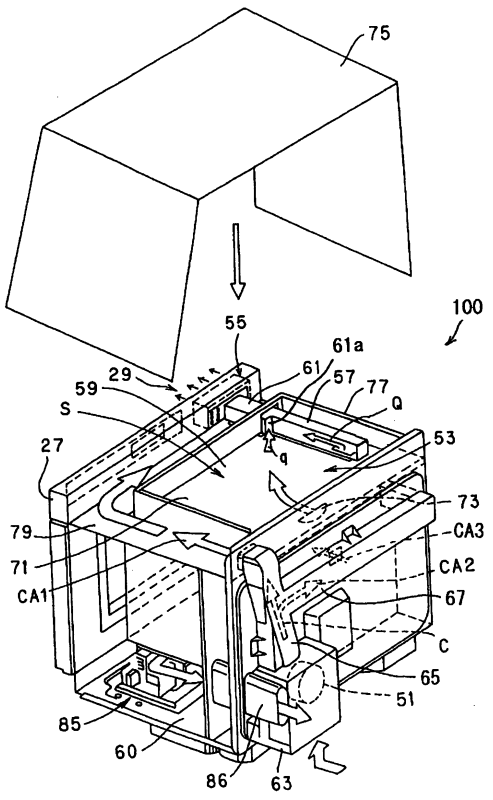
(54) HEATING COOKER CAPABLE OF BEING USED FOR BUIT-IN APPLICATION

(57) A problem to be solved by the invention is to provide a built-in adaptation type heating cooker enabled to highly efficiently mix high-temperature air and cooling air with a small number of air-blowing means and to reduce the capacity of a mixing portion, so that a heating chamber and a heating operation portion can be disposed at upper positions, and is also to enhance workability and operability thereof.

A built-in adaptation type heating cooker is accommodated in a predetermined storage space so that only a front side thereof is exposed to the outside. In the built-in adaptation type heating cooker, a main heat flow, which is supplied from a heating chamber heated by a heat source, and a heating chamber surrounding heat flow, which is generated around the heat chamber by the heat source, are mixed with a cooling air (CA1). Thereafter, a mixture air is exhausted outside of the storage space from an exhaust slot (29). The built-in adaptation type heating cooker includes an air blowing means (51) adapted to suck air and to generate a cooling air, an upper heat collecting chamber (53) provided above the heating chamber and adapted to join heat flows, and a mixing means (55) disposed upstream of the exhaust slot (29) and adapted to mix a heat flow collected in the upper heat collecting chamber (53) with a cooling air.

FIG. 2



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Description

Technical Field

[0001] The present invention relates to a heating cooker configured to be enabled to be built into a prescribed accommodating space.

Background Art

[0002] In recent years, what is called a built-in kitchen is frequently employed as, for example, a household kitchen to enhance workability thereof and efficiency in building various kinds of cooking apparatuses thereinto and in disposing the cooking apparatuses therein. In addition to a cabinet, a sink, a combination faucet, a housing, and the like, what are called built-in adaptation apparatuses, such as a gas cooking stove, a heating cooker, a dishwasher/dishdrier, and the like are built into the built-in kitchen. Incidentally, hitherto, cooking utilizing only high-frequency heating has been the mainstream of cooking to be performed in microwave ovens serving as heating cookers. However, in recent years, cooking utilizing electrothermal heating has been enabled in microwave ovens. Various kinds of cooking have been enabled therein. This holds good for built-in adaptation type heating cookers that are not exceptions.

[0003] This kind of a built-in adaptation type heating cooker is often built into a lower storage space of a cabinet 5 in an upper part of which a built-in type of a gas cooking stove 3 is provided, as shown in FIG. 12. Because the storage space of the cabinet 5 is a closed space, hot air generated by cooking should be exhausted from an exhaust slot 7 provided in a front side of the heating cooker 1. When hot air is directly transmitted to a user, high-temperature exhaust air causes the user to feel discomfort. Thus, contrivances, such as lowering of exhaust air temperature, are made in this kind of a built-in adaptation type heating cooker.

[0004] (Patent Document 1) JP-T-2003-517564.

[0005] An intake slot and an exhaust slot are provided in the front side of the heating cooker disclosed in, for example, the Patent Document 1, so that cooling air and exhaust air go in and out of the front side thereof. Also, an upper heater and a lower heater are provided in the heating cooker. 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 intake slot is supplied directly to the front of the exhaust slot 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 slot. Therefore, the temperature of the air exhausted from the exhaust slot can be set at a low temperature.

[0006] Meanwhile, there is a demand that a heating chamber is disposed as high as possible in the built-in adaptation type heating cooker in view of workability of setting food in and taking cooked food out of the heating chamber. Also, there is a demand that a heating operation portion adapted to set heating conditions and the like is disposed as high as possible in the built-in adaptation type heating cooker in view of operability thereof.

[0007] However, the conventional built-in adaptation type heating cooker is low in efficiency in mixing high temperature air with cooling air. Thus, high temperature air with cooling air should be agitated by ensuring large capacity of a mixing portion. Therefore, it is necessary to ensure the provision of the exhaust slot over the entire width of the cooker. Consequently, the occupied area of the exhaust slot increases. This makes it difficult to place both the heating chamber and the heating operation portion at upper positions (that is, the heating operation portion is longitudinally disposed on a side of the heating chamber). Also, in a case where the exhaust slot extends over the entire width of the cooker, a hot-air warning region is broad. This is a hindrance to enhancement of the added value of articles. Further, the heating cooker disclosed in the Patent Document 1 requires air-blowing means, such as an upper heater cooling fan and a lower heater cooling fan, in addition to an exhaust motor, and is disadvantageous in component cost, electric power consumption, and operation noises.

[0008] The invention is accomplished in view of the aforementioned circumstances. An object of the invention is to provide a built-in adaptation type heating cooker enabled to highly efficiently mix high-temperature air and cooling air with a small number of air-blowing means and to reduce the capacity of a mixing portion, so that a heating chamber and a heating operation portion can be disposed at upper positions, and is also to enhance workability and operability thereof.

Disclosure of Invention

[0009] To achieve the foregoing object, there is provided a built-in adaptation type heating cooker according to the invention described in claim 1, which is accommodated in a predetermined storage space so that only a front side thereof is exposed to an outside, and which is adapted so that a main heat flow, which is supplied from a heating chamber heated by a heat source, and a heating chamber surrounding heat flow, which is generated around the heat chamber by the heat source, are mixed with a cooling air, that a mixture air is subsequently exhausted outside of the storage space from an exhaust slot. The built-in adaptation type heating cooker comprises an air blowing means adapted to suck air and to generate a cooling air, an upper heat collecting chamber provided above the heating chamber and adapted to join heat flows, and a mixing means disposed upstream of the exhaust slot and adapted to mix a heat flow collected in the upper heat collecting chamber with a cooling air.

[0010] According to this built-in adaptation type heat-

ing cooker, an outside air is sucked by the air blowing means to thereby generate a cooling air. First, the heat flows are collected in the upper heat collecting chamber provided above the heating chamber. Thereafter, the cooling air is mixed with the mixed heat flows preliminarily collected in the upper heat collecting chamber, by the mixing means disposed upstream of the exhaust slot. Thus, a high-temperature air and a cooling air can highly efficiently be mixed by a small number of the air blowing means. The capacity of the mixing portion can be reduced. Thus, there is no need for ensuring the exhaust slot over the entire width of the heating cooker. The heating operation portion is disposed in a newly assured upper space. Consequently, both the heating chamber and the heating operation portion can be disposed at upper positions. Further, because the exhaust slot does not extend over the entire width of the heating cooker, the hot-air warning region is narrowed. Thus, the added value of articles is enhanced. Furthermore, because the number of the air blowing means is 1, the cost of components of heating cooker, the power consumption thereof, and the operation noises thereof can be reduced, as compared with the conventional built-in adaptation type heating cooker that requires a plurality of air blowing means.

[0011] A built-in adaptation type heating cooker according to the invention described in claim 2 features that the upper heat collecting chamber has a first heat flow passage configured to lead a main heat flow supplied from the heating chamber to the mixing means, a second heat flow passage configured to lead the heating chamber surrounding heat flow to the mixing means, and a third heat flow passage configured to join and lead the first heat flow passage and the second heat flow passage to the mixing means.

[0012] In this built-in adaptation type heating cooker, a main heat flow and a heating chamber surrounding heat flow join in the third heat flow passage, so that the main heat flow is lowered in temperature before flowing into the mixing means.

[0013] A built-in adaptation type heating cooker according to the invention described in claim 3 features that the heat source has an upper heating heater adapted to heat at a top surface side of the heating chamber, and that the second heat flow passage is formed to include a space provided above a placement plane region of the upper heating heater.

[0014] In this built-in adaptation type heating cooker, the upper heating heater generates heat, so that an object to be heated, which is placed in the heating chamber, can be heat-treated with radiation heat. At that time, heat transmitted from the placement plane region of the upper heating heater is fed to the third heat flow passage by the heating chamber surrounding heat flow that moves in the second heat flow passage. Thus, the temperature of the placement plane region can be suppressed from rising.

[0015] A built-in adaptation type heating cooker according to the invention described in claim 4 features that the heat source has an inner part heating heater adapted to heat at an inner surface side of the heating chamber, that the inner part heating heater is surrounded by a heating chamber inner surface and a back plate, that a partition plate is disposed to be aligned with said heating chamber inner surface across said back plate, and an opening hole adapted to lead a heat flow, which is generated between the back plate and the partition plate, to the upper heat collecting chamber is formed in a part of the second heat flow passage.

[0016] According to this built-in adaptation type heating cooker, the inner part heating heater generates heat, so that an object to be heated, which is placed in the heating chamber, can uniformly be heated at a high temperature. At that time, heat transmitted from the back plate is upwardly fed by a rising heat flow between the back plate and the partition plate. The heat flow is exhausted to the second heat flow passage through the opening hole. Thus, the temperature of the back plate can be suppressed from rising.

[0017] A built-in adaptation type heating cooker according to the invention described in claim 5 features that this built-in adaptation type heating cooker further comprises a first cooling air passage adapted to blow a cooling air, which is supplied from the air blowing means, in a direction perpendicular to a direction of a heat flow in the third heat flow passage.

[0018] In this built-in adaptation type heating cooker, the main heat flow joins with the heat chamber surrounding heat flow in the third heat flow passage. Then, the joined flows are cooled by the cooling air from the outside the third heat flow passage, and are lowered in temperature.

[0019] A built-in adaptation type heating cooker according to the invention described in claim 6 features that the mixing means has a baffle plate adapted to stagnate a heat flow supplied from the upper heat collecting chamber.

[0020] In this built-in adaptation type heating cooker, a heat flow having flowed into the mixing means from the upper heat collecting chamber hits against the baffle and temporarily stagnates. During that, the main heat current supplied from the first heat current passage is lowered in temperature by the thermal conduction between the mixing means and the heat flow and by the heat transfer between the heat flow and a mixture with cool air.

[0021] A built-in adaptation type heating cooker according to the invention described in claim 7 features that the mixing means has an upstream diffusion plate and a downstream diffusion plate, which are disposed substantially in parallel to each other to be spaced from each other by a predetermined distance and are configured so that airholes are formed in each of the diffusion plates, that a vent adapted to lead a heat flow, which is supplied from the upper heat collecting chamber, to a space provided between the upstream diffusion plate and the downstream diffusion plate is formed in the upstream dif-

fusion plate, and that the downstream diffusion plate is configured so that the baffle plate is formed at a position at which the baffle plate faces the vent, and that the heat flows and a cooling air are mixed in a space between the upstream diffusion plate and the downstream diffusion plate and a mixture flow is exhausted.

[0022] In this built-in adaptation type heating cooker, the main heat flow supplied from the first heat flow passage and the heating chamber surrounding heat flow q supplied from the upper heat collecting chamber pass through the vent and flow into the space between the upstream diffusion plate and the downstream diffusion plate and then hit against the baflle plate, so that the flows become a stirred flow. Also, the cooling air having been supplied from the first cooling air passage and also having passed through the airhole of the upstream diffusion plate flows into this space. The cooling air having flowed thereinto is mixed with the stirred flow to thereby promote heat transfer. Consequently, the main heat flow, the heat chamber surrounding heat flow, and the cooling air sufficiently perform heat exchange thereamong in the limited space, so that the temperature of each of the heat flows is lowered. The mixture flow lowered in temperature passes through the airhole of the downstream diffusion plate is exhausted from the exhaust slot.

[0023] A built-in adaptation type heating cooker according to the invention described in claim 8 features that the mixing means has a louver adapted to limit a direction of an air to a downstream side of the baffle plate.

[0024] In this built-in adaptation type heating cooker, a louver adapted to limit the direction of the air to a downstream direction of the baffle plate is provided in the mixing means. Thus, the louver is provided downstream of the baffle plate, so that a hand or a finger can be prevented from touching the baffle plate whose temperature becomes high. Further, the louver is disposed downstream of the baffle plate by a predetermined distance, so that the exhaust heat flow is lower in temperature. Furthermore, the direction of the air is regulated by the louver, so that a hot-air warning region is narrow.

[0025] A built-in adaptation type heating cooker according to the invention described in claim 9 features that a heating operation portion is disposed along a front surface of the heating cooker at a substantially same height as that of the heat collecting chamber provided above the heating chamber, and that the first cooling air passage is disposed along the heating operation portion.

[0026] In this built-in adaptation type heating cooker, the upper heat collecting chamber and the heating operation portion are disposed on substantially the same plane. Further, the first cooling air passage is disposed therebetween. Therefore, the heating operation portion is always cooled by the cooling air flowing through the first cooling air passage without being affected by heat transmitted from the upper heat collecting chamber. Consequently, the upper heat collecting chamber and the heating operation portion can be placed on substantially the same plane. Thus, in a case where the upper heat collecting chamber and the heating operation portion should vertically be aligned with each other, increase in the vertical height of the cooker can be suppressed.

[0027] A built-in adaptation type heating cooker according to the invention described in claim 10 features that a heating operation portion configured to perform a heating operation and the exhaust slot are collaterally disposed above a front surface side of the heating chamber.

[0028] In this built-in adaptation type heating cooker, the heating operation portion and the exhaust slot are collaterally disposed at the top position. Thus, the operability of the heating operation portion is enhanced.

[0029] A built-in adaptation type heating cooker according to the invention described in claim 11 features that the air blowing means is provided on a back side of the heating cooker and is adapted to suck air at the back surface side of the heating cooker.

[0030] In this built-in adaptation type heating cooker, the air blowing means sucks air at the back surface side of the heating cooker. The heating cooker is built into the storage space provided in the cabinet of the built-in kitchen. Air is sucked from the back surface thereof. Thus, the air flows into the heating cooker through clearance or the like of the cabinet. This eliminates the necessity for providing an intake opening. Consequently, the placement of the heating chamber at an upper part and the suppression of increase in the vertical height of the heating cooker can be achieved.

[0031] A built-in adaptation type heating cooker according to the invention described in claim 12 features that this heating cooker further comprises a second cooling air passage adapted to cause a cooling air, which is supplied from the air blowing means, to blow toward an electronic component mounted in the heating cooker.

[0032] In this built-in adaptation type heating cooker, the cooling air sent form the air blowing means passes through the second cooling air passage and is positively supplied to the electronic component. Thus, the influence of heat supplied from the heating chamber surrounding heat flow on the electronic component can be circumvented.

[0033] A built-in adaptation type heating cooker according to the invention described in claim 13 features that the electronic component includes an infrared sensor.

[0034] In this built-in adaptation type heating cooker, the infrared sensor provided on the heating chamber inner surface so as to measure the temperature of the heating chamber and the temperature of an object to be heated is cooled by the cooling air sent from the second cooling air passage, so that the influence of heat supplied from the heat source (the inner part heating heater) on the infrared sensor is circumvented.

[0035] A built-in adaptation type heating cooker according to the invention described in claim 14 features that the electronic component includes a heat-driving component disposed under the heating chamber.

[0036] In this built-in adaptation type heating cooker, a cooling air is supplied to parts provided under the heating chamber from the second cooling air passage to thereby cool electronic components, such as the heat-driving component (the magnetron) and the control circuit board, disposed under the heating chamber. The influence of heat generated by the heat sources and the magnetron itself on the electronic components can surely be circumvented.

Brief Description of Drawings

[0037]

FIG. 1 is an external appearance perspective view illustrating a state in which an opening/closing door of a built-in adaptation type heating cooker according to the invention is opened.
FIG. 2 is a perspective view of a body case from which a face panel is removed, taken obliquely from behind.
FIG. 3 is a plan view of the top surface of the body case shown in FIG. 2.
FIG. 4 is a perspective view of a second cooling air passage.
FIG. 5 is a perspective view of the body case taken from front.
FIG. 6 is an enlarged perspective view of a part in the vicinity of a mixing means.
FIG. 7 is a cross-sectional view taken on line A-A shown in FIG. 5.
FIG. 8 is an explanatory view illustrating a thermal flow.
FIG. 9 is a perspective view of the mixing means taken obliquely from behind.
FIG. 10 is an exploded perspective view of the mixing means taken obliquely from front.
FIG. 11 is an explanatory view illustrating an operation of the mixing means.
FIG. 12 is an external view of a conventional built-in adaptation type heating cooker stored in a built-in kitchen.

[0038] Incidentally, in the drawings, reference numeral 23 designates a heating chamber, reference numeral 27 denotes a heating operation portion, reference numeral 29 designates an exhaust slot, reference numeral 33 denotes a magnetron (a heat-driving component), reference numeral 35 designates an upper heating heater, reference numeral 37 denotes a heating inner surface, reference numeral 39 designates a back plate, reference numeral 41 denotes a convection heater (an inner part heating heater), reference numeral 49 designates an infrared sensor (an electronic component), reference numeral 51 denotes an air blowing means, reference numeral 53 designates an upper heat collecting chamber, reference numeral 55 denotes a mixing means, reference numeral 57 designates a first heat flow passage, reference numeral 59 denotes a second heat flow passage, reference numeral 61 designates a third heat flow passage, reference numeral 67 denotes a second cooling air passage, reference numeral 69 designates a partition plate, reference numeral 73 denotes an opening hole, reference numeral 79 designates a first cooling air passage, reference numeral 85 denotes a control circuit board (an electronic component), reference numeral 91 designates an airhole, reference numeral 93 denotes an upstream diffusion plate, reference numeral 95 designates a downstream diffusion plate, reference numeral 99 denotes a vent, reference numeral 100 designates a heating cooker (a built-in adaptation type heating cooker), reference numeral 101 denotes a baffle plate, reference numeral 103 designates a louver, reference character CA1 denotes cooling air, reference character S designates a placement plane region, reference character denotes a main heat flow, and reference character q designates a heating chamber surrounding heat flow.

Best Mode for Carrying Out the Invention

[0039] Hereinafter, a preferred embodiment of a built-in adaptation type heating cooker according to the invention is described in detail by referring to the accompanying drawings.

[0040] FIG. 1 is an external appearance perspective view illustrating a state in which an opening/closing door of a built-in adaptation type heating cooker according to the invention is opened. FIG. 2 is a perspective view of a body case from which a face panel is removed, taken obliquely from behind. FIG. 3 is a plan view of the top surface of the body case shown in FIG. 2. FIG. 4 is a perspective view of a second cooling air passage. FIG. 5 is a perspective view of the body case taken from front. FIG. 6 is an enlarged perspective view of a part in the vicinity of a mixing means. FIG. 7 is a cross-sectional view taken on line A-A shown in FIG. 5 . FIG. 8 is an explanatory view illustrating a thermal flow. FIG. 9 is a perspective view of the mixing means taken obliquely from behind. FIG. 10 is an exploded perspective view of the mixing means taken obliquely from front. FIG. 11 is an explanatory view illustrating an operation of the mixing means. Hereinafter, a description is given of this embodiment by properly referring to FIGS. 1 to 11.

[0041] As shown in FIG. 1, a built-in adaptation type heating cooker (hereunder referred to simply as a "heating cooker") 100 according to this embodiment is configured so that a heating chamber 23 is formed in a front-opened box-shaped body case 21, and that an opening/closing door, which has a translucent window 25a and is used to open and close a heating-object output opening, is openably installed in the front surface of the body case 21.

[0042] A heating operation portion 27, which is adapted to perform a heating operation, and an exhaust slot 29 are collaterally disposed. The heating operation portion 27 is provided with a display portion, in addition to a

start switch, a heating mode switch, and an automatic cooking switch. The heating operation portion 27 and the exhaust slot 29 are collaterally placed at the top of the heating cooker 100. This enhances the operability of the heating operation portion 27.

[0043] A high frequency generating portion 31 is disposed in a space under the heating chamber 23. The high frequency generating portion 31 is provided with a magnetron 33 and a stirrer blade 34, which are shown in FIG. 2. The high frequency generating portion 31 is adapted to disperse high frequency waves, which are generated by the magnetron 33, to the entire heating chamber 23 by using the stirrer blade 34 for high-frequency stirring. The high-frequency generating portion 31 and the stirrer blade 34 are placed not only on the bottom portion but on another side of the heating chamber 23.

[0044] The upper heating heater 35 (see FIGS. 1 and 7) serving one of heat sources is provided on the top surface of the heating chamber 23. The upper heating heater 35 is adapted to generate heat to thereby perform a heating operation on the object in the heating chamber 23 using radiation heat.

[0045] An inner part heating heater (a convection heater) 41 serving as a heat source is disposed on the back of the heating chamber inner surface 37 (that is, between the heating chamber inner surface 37 and a back plate 39 shown in FIG. 7). The convection heater 41 is formed like a frame and is disposed in a sealed space between the heating chamber inner surface 37 and the back plate 39. A circulation fan 43 is provided to the center of the convection heater 41. Also, the intake hole 45 and the exhaust hole 47 are dug in the heating chamber inner surface 37. The circulation fan 43 is rotationally driven, so that the following hot air circulation is established. That is, the air contained in the heating chamber 23 is sucked through the intake hole 45. Then, the sucked air is then heated by the convection heater 41. Subsequently, the heated air is returned to the heating chamber 23 again through the exhaust hole 47. Consequently, the inside of the heating chamber 23 can uniformly be heated to a high temperature.

[0046] Operations of the convection heater 41 and the circulation fan 43 are performed according to control commands issued from the control portion provided with a microprocessor (not shown). Further, this control portion is supplied with electric power from a power supply portion connected to a commercial power supply, and is adapted to control the supply of electric power to each of the heat sources.

[0047] An infrared sensor 49 serving as an electronic component is provided on the rear side of the heating chamber inner surface 37, as shown in FIG. 7. The infrared sensor 49 is adapted to detect the temperature of the heating chamber 23 and that of an object to be heated. The value of the temperature detected by the infrared sensor 49 is sent to the control portion. The control portion sets timing, with which the heat sources are controlled, according to this value of the detected temperature or by measuring an elapsed time, such as a heating time, through the use of a timer.

[0048] The heating cooker 100 having the aforementioned configuration is accommodated in a predetermined storage space of a cabinet of a built-in kitchen (not shown) by exposing only the front side thereof to the outside. Thus, a main heat flow supplied from the heating chamber 23 which is heated by the heat sources, such as the high-frequency generating portion 31, the upper heating heater 35, and the convection heater 41, and a heating chamber surrounding flow generated by these heat sources are mixed with a cooling air. Thereafter, the mixture air is exhausted from the exhaust hole 47 to the outside of the storage space.

[0049] The cooker is provided with a blowing means (for example, a sirocco fan) 51 shown in FIG. 2, which is adapted to generate a cooling air C, an upper heat collecting chamber 53 provided above the heating chamber 23 and adapted to join the heat flows, and a mixing means 55 disposed upstream of the exhaust slot 29 and adapted to mix the heat flows, which are collected in the upper heat collecting chamber 53, with a cooling air, as basic constituents therefor.

[0050] As shown in FIGS. 2, 3, and 5, the upper heat collecting chamber 53 includes a first heat flow passage 57 adapted to lead a main heat flow Q, which l introduced thereto from the heating chamber 23 through a ventilation hole 24 and a ventilation passage 26 (see FIG. 5) to the mixing means 55, a second heat flow passage 58 adapted to guide a heating chamber surrounding heat flow q to the mixing means 55, and a third heat flow passage 58 configured to join the first heat flow passage 57 and the second heat flow passage 59 at an inlet 61a and to guide the joined flow to the mixing means 55. Thus, the main heat flow A and the heating chamber surrounding heat flow whose temperature is lower than this main heat flow, are joined in the third heat flow passage 61. The temperature of the main heat flow Q is dropped before this flow flows into the mixing means 55.

[0051] Incidentally, the aforementioned upper heating heater 35 is provided on the top surface side of the heating chamber 23. The second heat flow passage 59 is formed to include an upper space provided above the placement plane region S of this upper heating heater 35. Therefore, heat transmitted from the placement plane region S of the upper heating heater 35 is fed to the third heat flow passage 61 by the heating chamber surrounding heat flow q that moves in the second heat flow passage 59. Thus, the temperature of the placement plane region S can be prevented from excessively rising.

[0052] The aforementioned air blowing means 51 is provided on the back surface of the heating cooker 100. The air blowing means 51 is covered with a chamber 63 having an intake opening in, for example, the back surface or the bottom surface thereof (see FIG. 2). Further, as shown in FIG. 4, a duct 65 is connected to the chamber 63, and branches into two channels, one of which is con-

nected to a first cooling air passage (to be described later), and the other of which is a second cooling air passage 67. The air blowing means 51 is rotationally driven to thereby send air, which is sucked from the intake opening, to the first cooling passage and the second cooling passage 67.

[0053] Incidentally, the air blowing means 51 is adapted to suck the air at the back side of the heating cooker 100. The heating cooker 100 is built into the storage space provided in the cabinet of the built-in kitchen, as described above. Air is sucked from the back surface thereof. Thus, the air flows into the heating cooker through clearance or the like of the cabinet. This eliminates the necessity for providing an intake opening. Consequently, the placement of the heating chamber 23 at an upper part and the suppression of increase in the vertical height of the heating cooker 100 can be achieved.

[0054] The convection heater 41 is surrounded by the heating chamber inner surface 37 and the back plate 39 (see FIG. 7). A partition plate 69 is disposed to face the heating chamber inner surface 37 across the back plate 39. A rear space 40 is provided between the partition plate 69 and each of this back plate 39 and the heating chamber inner surface 37. An opening hole 73 is dug in a top surface 71 constituting the second heat flow passage 59, and is adapted to lead a heat flow generated between the back plate 39 and the partition plate 69 (the rear space 40) to the upper heat collecting chamber 53 (see FIG. 3). Consequently, heat of the convection heater 41, which is transmitted from the back plate 39, is upwardly fed by a rising air in the rear space 40 and is then exhausted to the second heat flow passage 59 through the opening hole 73. Thus, the temperature of the back plate 39 and the like can be prevented from excessively rising.

[0055] The top surface 71 and both side surfaces of the body case 21 are covered with a face panel 75 (see FIG. 2). A partition wall 77 having a U-shape in plan view thereof is provided on the top surface 71. The upper heat collecting chamber 53 is provided inside this partition wall 77. A first cooling air passage 79 covered with the partition wall 77, the heating operation portion 27, and the face panel 75 is provided outside the partition wall 77 (see FIG. 3). At the downstream end of this first cooling air passage 79, a cooling air CA1 sent from the air blowing means 51 is blown against the third heat flow passage 61 in a direction perpendicular to a direction of a heat flow in the third heat flow passage 61, as shown in FIG. 6. The main heat flow Q joins with the heating chamber surrounding heat flow q in the third heat flow passage 61 and is lowered in temperature. The joined heat flows are lowered in temperature by cooling the third heat flow passage 61 from the outside with the cooling air CA1. A part of this cooling air CA1 is blown against the third heat flow passage 61 and flows toward the mixing means 55. The rest of the cooling air CA1 flows along the first cooling passage 79 to an electrical chamber 60 provided under the heating chamber 23 through opening holes 64 and 66 (see FIGS. 3 and 5).

[0056] Further, as described above, the heating operation portion 27 is disposed along the front surface of the heating cooker 100 at substantially the same height as that of the aforementioned heat collecting chamber 53 above the heating chamber 23. Further, a first cooling air passage 79 is formed to extend toward the heating operation portion 27. An end of the first cooling air passage 27, which end reaches the heating operation portion 27, is bent at a right angle and is formed along the back surface extending in a longitudinal direction of the heating operation portion 27. Therefore, the heating operation portion 27 is always cooled by the cooling air flowing through the first cooling air passage 79 and is not affected by heat transmitted from the upper heat collecting chamber 53. Consequently, the upper heat collecting chamber 53 and the heating operation portion 27 can be placed on substantially the same plane. Thus, in a case where the upper heat collecting chamber 53 and the heating operation portion 27 should vertically be aligned with each other, increase in the vertical height of the cooker can be suppressed. Further, to prevent the temperature of the heating chamber from lowering, a part of the first cooling air passage 79, which part extends up to the operating operation portion 27, is disposed outside the side surfaces of the heating chamber. A part of the first cooling air passage 79, which part extends along the operating operation portion 27, is disposed outside the placement plane region S of the upper heating heater 35, which is set on the top surface of the heating chamber.

[0057] Meanwhile, the second cooling air passage 67 branched from the duct 65 serves to blow a cooling air CA2, which is outputted from the air blowing means 51, toward an electronic component mounted in the heating cooker 100. That is, the cooling air CA2 sent form the air blowing means 51 passes through the second cooling air passage 67 and is positively supplied to the electronic component. Thus, the influence of heat supplied from the heating chamber surrounding heat flow q on the electronic component can be circumvented.

[0058] Incidentally, an example of the electronic component to be cooled is the infrared sensor 49. As shown in FIG. 7, the infrared sensor 49 is provided between the heating chamber inner surface 37 and the partition plate 69. An opening 81 is formed as a cooling air passage in the partition plate 69 provided in the rear of the infrared sensor 49. This opening 81 is covered with the second cooling air passage 67 with which the exterior of the partition plate 69 is covered. Further, a divider 83 constituted by a U-bent sheet metal member shown in FIG. 4 is provided in the second cooling air passage 67. The divider 83 is adapted to introduce a cooling air CA3 from this opening 81 and to blow the cooling air CA3 to the infrared sensor 49.

[0059] Consequently, the infrared sensor 49 provided on the heating chamber inner surface 37 is cooled by the cooling air CA 3 sent from the second cooling air passage 67, so that the influence of heat supplied from the con-

vection heater 41 on the infrared sensor 49 is circumvented. Incidentally, after cooling the infrared sensor 49, the cooling air CA3 is exhausted from the upper opening hole 73 to the upper heat collecting chamber 53.

[0060] Further, other examples of the electronic component to be cooled are various kinds of heat-driving components disposed under the heating chamber 23. The heat-driving components include the magnetron 33 of the high frequency generating portion 31 and a control circuit board 85. The downstream end 67a of the second cooling air passage 67 is connected to the gap 50 between a side surface of the heating chamber 23 and the face panel 75 (see FIG. 2). This gap 50 communicates with the rear space 40 and the space 60 provided under the heating chamber 23. Therefore, a cooling air CA4 is supplied to parts provided under the heating chamber 23 from the second cooling air passage 67 to thereby cool electronic components, such as the heat-driving component (the magnetron 33) and the control circuit board 85, disposed under the heating chamber 23. Additionally, although an exclusive cooling fan is attached to the magnetron 33, a more cooling effect can be obtained by using the cooling air CA4. With this configuration, the influence of heat generated by the heat sources and the magnetron itself on the electronic components can surely be circumvented. Further, the cooling air CA4 supplied to the parts provided under the heating chamber 23 are exhausted to the outside from an exhaust slot 86 shown in FIG. 2. Further, a pat of the cooling air CA4 supplied to the gap 50 flows into the rear space 40 and is then exhausted from the opening hole 73 to the upper heat collecting chamber 53.

[0061] Hereinafter, an example of how to use the heating cooker 100 is briefly described.

[0062] In this heating cooker 100, an object to be heated is placed in the heating chamber 23. Then, the opening/closing door 25 is closed. Subsequently, various kinds of switches provided in the heating operation portion 27 are operated to set a desired heating mode. Thereafter, a start switch is depressed. Further, in a case where the object is heated in an automatic cooking mode, a preliminarily stored cooking program is selected by depressing an automatic cooking switch or the like. Then, the start switch is depressed.

[0063] At that time, in a case where the upper heating heater 35 is caused to generate heat, the object placed on a container is heat-treated with radiation heat. Then, the convection heater 41 provided on the back of the heating chamber inner surface 37 is caused to generate heat. Thus, the object is more uniformly heated at a high temperature. Each heating pattern is preliminarily stored as a cooking program, and is optionally selected and executed by operating the automatic cooking switch or the like of the heating operation portion. In this case, the temperature of the object in the heating chamber 23 is detected by the infrared sensor 49. An elapsed time, such as a heating time, is measured according to the temperature of the object or through the use of a timer. Then control timing, with which each component is controlled, is set.

[0064] FIG. 8 shows heat flows flowing during the cooking. That is, a heating chamber surrounding heat flow q supplied from the upper heating heater 35 flows into the upper heat collecting chamber 53 through the top surface 71. A heating chamber surrounding heat flow q supplied from the convection heater 41 flows into the upper heat collecting chamber 53 through the opening hole 73. Further, the cooling air CA3 having been blown by the air blowing means 51 and also having cooled the infrared sensor 49 flows into the upper heat collecting chamber 53 through the opening hole 73. Also, the cooling air CA4 having been blown by the air blowing means 51 through the second cooling air passage 67 flows into the part provided under the heating chamber 23 to thereby cool the high frequency generating portion 31, the magnetron 33, and the control circuit board 85. Then, the cooling air CA4 is exhausted from the exhaust slot 86 to the outside. Additionally, a part of the cooling air CA4 flows into the gap between the partition plate 69 and the back plate 39 and is exhausted from the opening hole 73 to the upper heat collecting chamber 53.

[0065] The main heat flow Q supplied from the heating chamber 23 passes in the upper heat collecting chamber 53 through the first heat flow passage 57 and flows into the mixing means 55. Further, the cooling air CA1 blown by the air blowing means 51 flows into the mixing means 55 after cooling the heating operation portion 27 while passing through the first cooling air passage 79.

[0066] As shown in FIG. 9, the mixing means 55 is fixed to the downstream end of the third heat flow passage 61. As shown in FIG. 10, the mixing means 55 has at least an upstream diffusion plate 93 and a downstream diffusion plate 95, which are disposed substantially in parallel to each other to be spaced from each other by a predetermined distance and are configured so that airholes 91 are formed in each of the diffusion plates. The upstream diffusion plate 93 and the downstream diffusion plate 95 are covered with a cover 96 shown in FIG. 9, so that the gap (space) 97 is formed therebetween. A vent 99 adapted to lead the heat flows (Q + q) supplied from the upper heat collecting chamber 53 into the space 97 is formed in the upstream diffusion plate 93.

[0067] A baffle plate 101 adapted to stagnate the flows (Q + q) supplied from the upper heat collecting chamber 53 is formed in the mixing means 55. This baffle plate 101 is formed at a place so that the vent 99 of the upstream diffusion plate 93 faces the baffle plate 101 of the downstream diffusion plate 65. The heat flow having flowed into the mixing means 55 from the upper heat collecting chamber 53 hits against the baffle plate 101 of the downstream diffusion plate 65 and temporarily stagnates and diffuses. During that, the temperature of the heat flow Q or q is lowered by the thermal conduction between the mixing means 55 and the heat flow Q or q and by the heat transfer between the heat flow and a mixture with cool air.

[0068] That is, as shown in FIG. 11, the main heat flow Q supplied from the first heat flow passage 57 and the heating chamber surrounding heat flow q supplied from the upper heat collecting chamber 53 pass through the vent 99 and flow into the space 97 between the upstream diffusion plate 93 and the downstream diffusion plate 95 and then hit against the baffle plate 101, so that the flows become a stirred flow. Also, the cooling air CA1 having been supplied from the first cooling air passage 79 and also having passed through the airhole 91 of the upstream diffusion plate 93 flows into this space 97. The cooling air CA1 having flowed thereinto is mixed with the stirred flow to thereby promote heat transfer. Consequently, the main heat flow Q, the heat chamber surrounding heat flow q, and the cooling air CA1 sufficiently perform heat exchange thereamong in the limited space 97, so that the temperature of each of the heat flows is lowered. The mixture flow lowered in temperature passes through the airhole 91 of the downstream diffusion plate 95 is exhausted from the exhaust slot 29.

[0069] Incidentally, a louver 103 adapted to limit the direction of the air to a downstream direction of the baffle plate 101 is provided in the mixing means 55. Thus, the louver 103 is provided downstream of the baffle plate 101, so that a hand or a finger can be prevented from touching the baffle plate 101 whose temperature becomes high. Further, the louver 103 is disposed downstream of the baffle plate 101 by a predetermined distance, so that the exhaust heat flow is lower in temperature. Furthermore, the direction of the air is regulated by the louver 103, so that a hot-air warning region is narrow.

[0070] Therefore, according to this heating cooker 100, the outside air is sucked by the air blowing means 51 to thereby generate a cooling air C. First, the heat flows (the main heat flow Q and the heating chamber surrounding heat flow q) are collected in the upper heat collecting chamber 53 above the heating chamber 23. Thereafter, the first heat flow passage 57, in which the main heat flow Q flows, is cooled by the heating chamber surrounding heat flow q, which is lower in temperature than the main heat flow Q. The heat flows are mixed to thereby lower the temperature of the min heat flow Q. Further, the cooling air CA1 is mixed with the mixed heat flows (Q + q), which are supplied from the upper heat collecting chamber 53, by the mixing means 55 disposed upstream of the exhaust slot 29. Thus, a high-temperature air and a cooling air can highly efficiently be mixed by a small number of the air blowing means 51. The capacity of the mixing portion can be reduced. For example, when the heating chamber is heated to 300°C, the temperature of a heat flow flowing through the third heat flow passage 61 exceeds 100°C. However, the temperature of the heat flow is lowered by the cooling air CA1 supplied from the first cooling air passage 79. Thus, the heat flow is changed to a warm air, which has a temperature of about 60°C and is exhausted from the exhaust slot 29.

[0071] Thus, there is no need for ensuring the exhaust slot 29 over the entire width of the heating cooker 100. The heating operation portion 27 is disposed in a newly assured upper space. Consequently, both the heating chamber 23 and the heating operation portion 27 can be disposed at upper positions. Further, because the exhaust slot 29 does not extend over the entire width of the heating cooker 100, the hot-air warning region is narrowed. Thus, the added value of articles is enhanced. Furthermore, because the number of the air blowing means 51 is 1, the cost of components of heating cooker 100, the power consumption thereof, and the operation noises thereof can be reduced, as compared with the conventional built-in adaptation type heating cooker that requires a plurality of air blowing means.

[0072] 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.

[0073] The present application is based on Japanese Patent Application No. 2003-169383 filed June 13, 2003, which is hereby incorporated by reference herein.

Industrial Applicability

[0074] As above described in detail, the built-in adaptation type heating cooker according to the invention includes an air blowing means adapted to suck air and to generate a cooling air, an upper heat collecting chamber provided above the heating chamber and adapted to join heat flows, and a mixing means disposed upstream of the exhaust slot and adapted to mix a heat flow collected in the upper heat collecting chamber with a cooling air. Thus, a high-temperature air and a cooling air can highly efficiently be mixed by a small number of the air blowing means. The capacity of the mixing portion can be reduced. Therefore, there is no need for ensuring the exhaust slot over the entire width of the heating cooker. Both the heating chamber and the heating operation portion can be disposed at upper positions. Consequently, a built-in adaptation type heating cooker, which excels in workability and operability, can be obtained. Furthermore, because the number of the air blowing means is 1, the cost of components of heating cooker, the power consumption thereof, and the operation noises thereof can be reduced, as compared with the built-in adaptation type heating cooker that requires a plurality of air blowing means.

Claims

1. A built-in adaptation type heating cooker which is accommodated in a predetermined storage space so that only a front side thereof is exposed to an outside, and which is adapted so that a main heat flow supplied from a heating chamber heated by a heat source, and a heating chamber surrounding

heat flow generated around said heat chamber by said heat source are mixed with a cooling air, that a mixture air is subsequently exhausted outside of the storage space from an exhaust slot, said heating cooker comprising:

an air blowing means adapted to suck air and to generate a cooling air;
an upper heat collecting chamber provided above said heating chamber and adapted to join the above-mentioned heat flows; and
a mixing means disposed upstream of said exhaust slot and adapted to mix a heat flow collected in said upper heat collecting chamber with a cooling air.

2. The built-in adaptation type heating cooker according to claim 1, wherein said upper heat collecting chamber has a first heat flow passage configured to lead a main heat flow supplied from said heating chamber to said mixing means, a second heat flow passage configured to lead the heating chamber surrounding heat flow to said mixing means, and a third heat flow passage configured to join and lead said first heat flow passage and said second heat flow passage to said mixing means.

3. The built-in adaptation type heating cooker according to claim 2, wherein said heat source has an upper heating heater adapted to heat at a top surface side of said heating chamber; and said second heat flow passage is formed to include a space provided above a placement plane region of said upper heating heater.

4. The built-in adaptation type heating cooker according to claim 2 or 3, wherein said heat source has an inner part heating heater adapted to heat at an inner surface side of said heating chamber; said inner part heating heater is surrounded by a heating chamber inner surface and a back plate; a partition plate is disposed to be aligned with said heating chamber inner surface across said back plate; and an opening hole adapted to lead a heat flow, which is generated between said back plate and said partition plate, to said upper heat collecting chamber is formed in a part of said second heat flow passage.

5. The built-in adaptation type heating cooker according to one of claims 2 to 4, further comprising:

a first cooling air passage adapted to blow a cooling air, which is supplied from said air blowing means, in a direction perpendicular to a direction of a heat flow in said third heat flow passage.

6. The built-in adaptation type heating cooker according to one of claims 1 to 5, wherein said mixing means has a baffle plate adapted to stagnate a heat flow supplied from said upper heat collecting chamber.

7. The built-in adaptation type heating cooker according to claim 6, wherein said mixing means has an upstream diffusion plate and a downstream diffusion plate, which are disposed substantially in parallel to each other to be spaced from each other by a predetermined distance and are configured so that air-holes are formed in each of said diffusion plates;
a vent adapted to lead a heat flow, which is supplied from said upper heat collecting chamber, to a space provided between said upstream diffusion plate and said downstream diffusion plate is formed in said upstream diffusion plate; and
said downstream diffusion plate is configured so that said baffle plate is formed at a position at which said baffle plate faces said vent, and that the heat flows and a cooling air are mixed in a space between said upstream diffusion plate and said downstream diffusion plate and a mixture flow is exhausted.

8. The built-in adaptation type heating cooker according to claim 6 or 7, wherein said mixing means has a louver adapted to limit a direction of an air to a downstream side of said baffle plate.

9. The built-in adaptation type heating cooker according to one of claims 2 to 8, wherein a heating operation portion is disposed along a front surface of said heating cooker at a substantially same height as that of said heat collecting chamber provided above said heating chamber; and said first cooling air passage is disposed along said heating operation portion.

10. The built-in adaptation type heating cooker according to one of claims 1 to 9, wherein a heating operation portion configured to perform a heating operation and said exhaust slot are collaterally disposed above a front surface side of said heating chamber.

11. The built-in adaptation type heating cooker according to one of claims 1 to 10, wherein said air blowing means is provided on a back side of said heating cooker and is adapted to suck air at the back surface side of said heating cooker.

12. The built-in adaptation type heating cooker according to one of claims 1 to 11, further comprising a second cooling air passage adapted to cause a cooling air, which is supplied from said air blowing means, to blow toward an electronic component mounted in said heating cooker.

13. The built-in adaptation type heating cooker according to claim 12, wherein said electronic component includes an infrared sensor.

14. The built-in adaptation type heating cooker according to claim 12 or 13, wherein said electronic component includes a heat-driving component disposed under said heating chamber.

FIG. 1

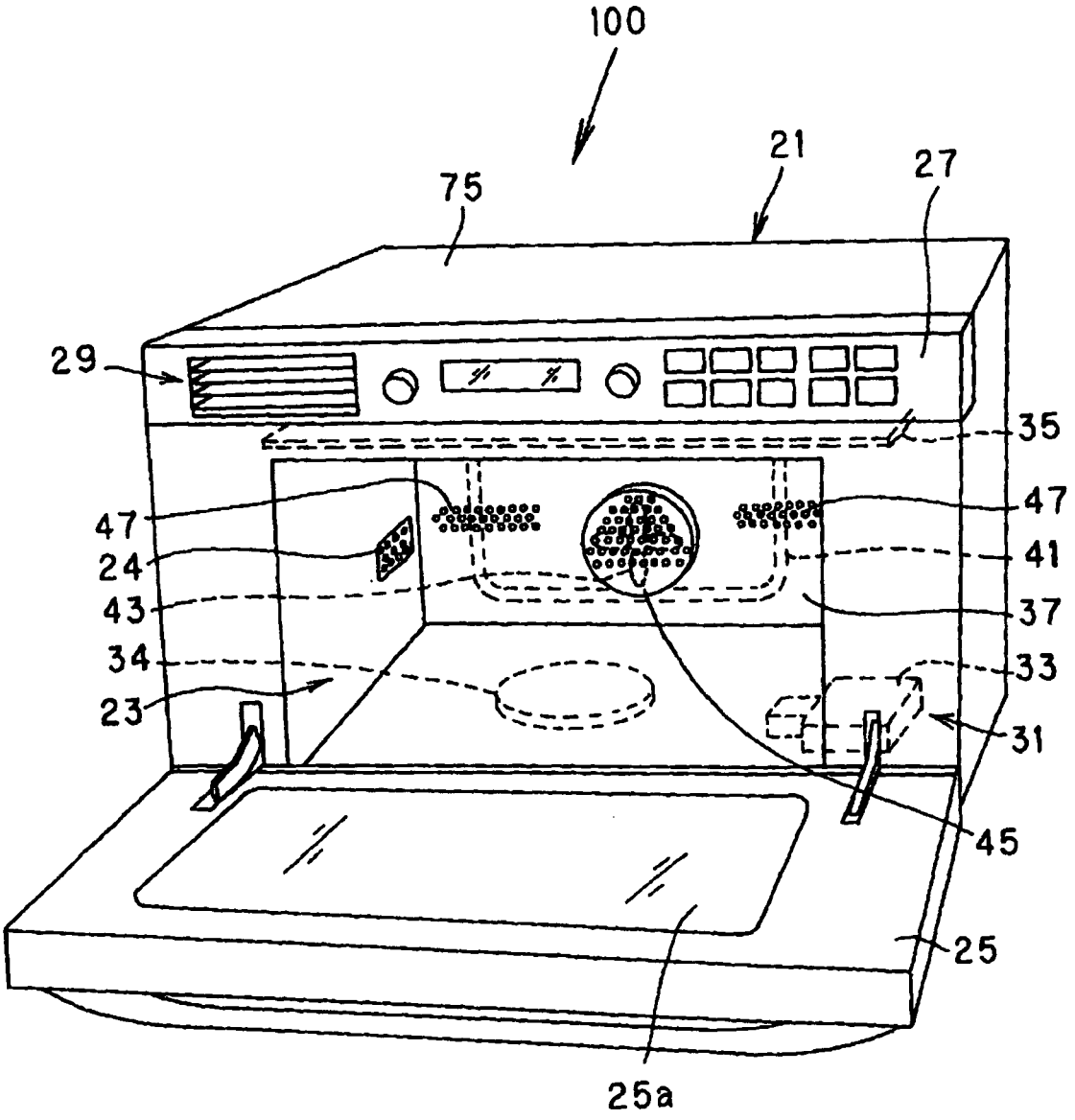


FIG. 2

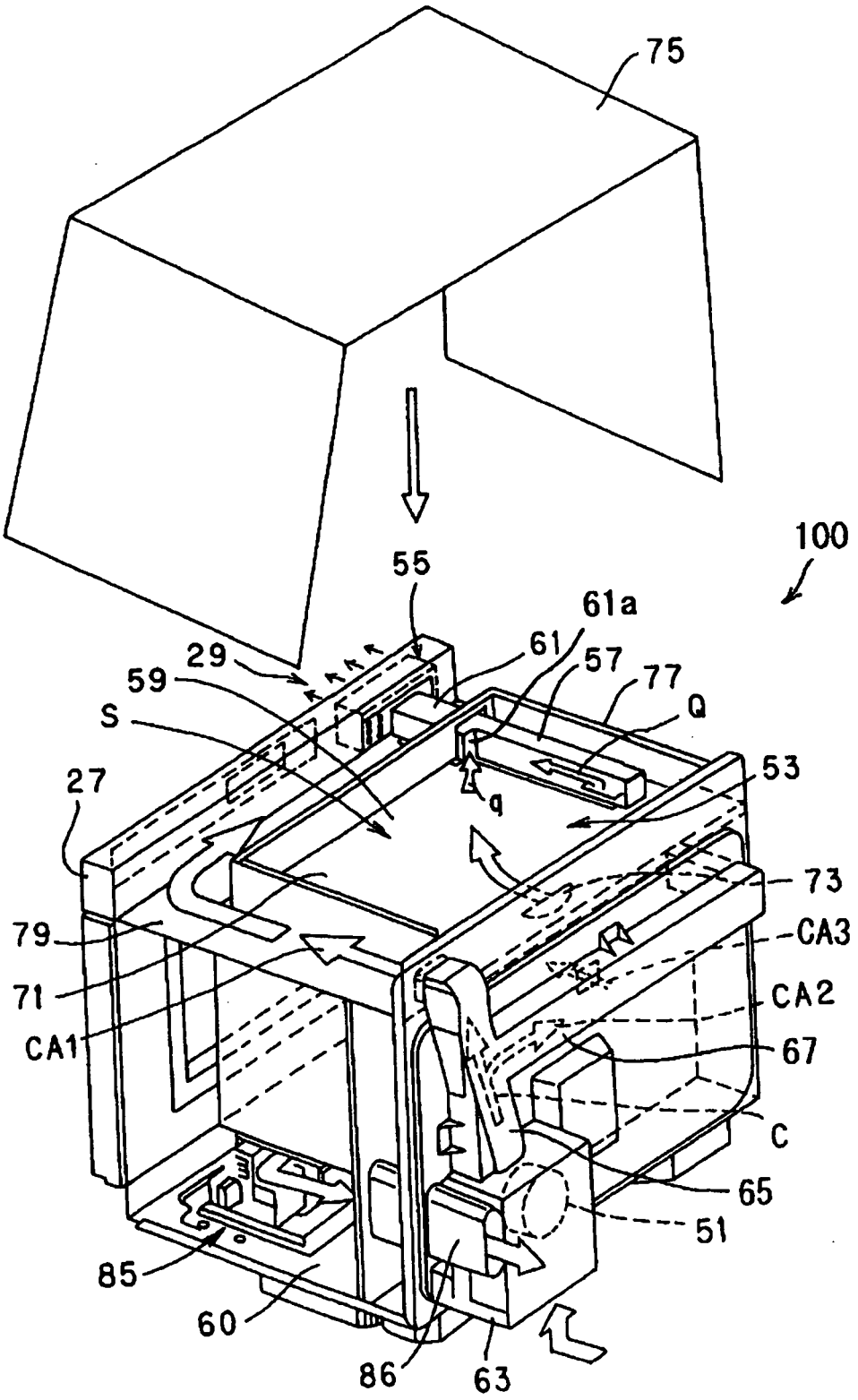

75
100
55
61a
61
57
77
Q
29
59
S
27
q
53
73
79
CA3
71
CA2
CA1
67
C
65
51
85
60
86
63

FIG. 3

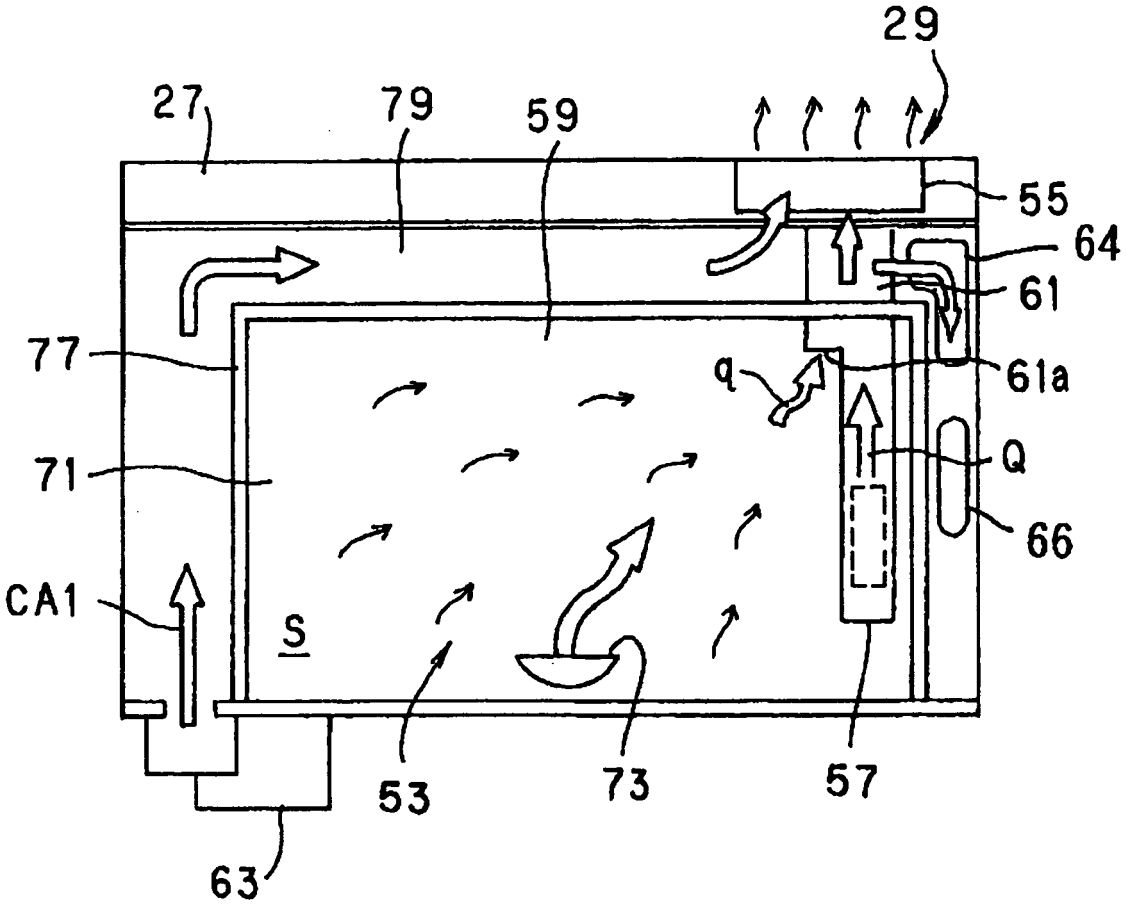


FIG. 4

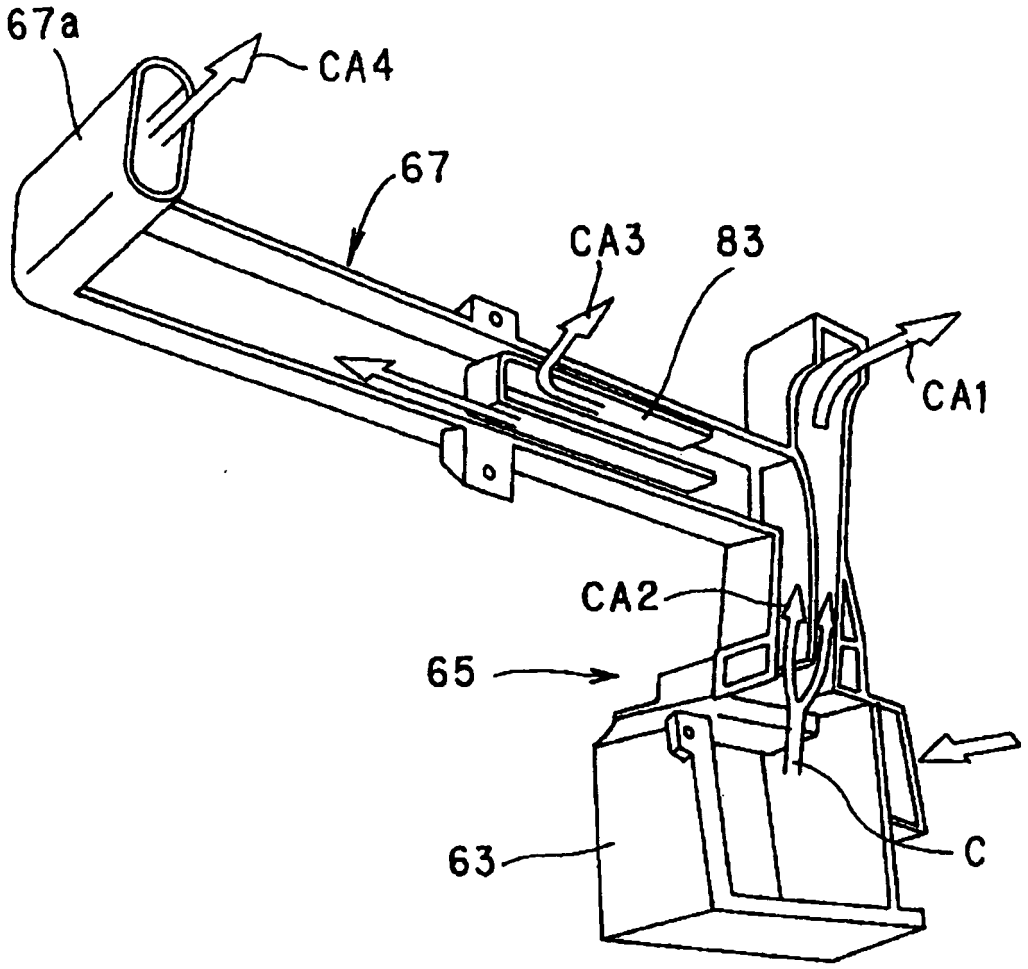


FIG. 5

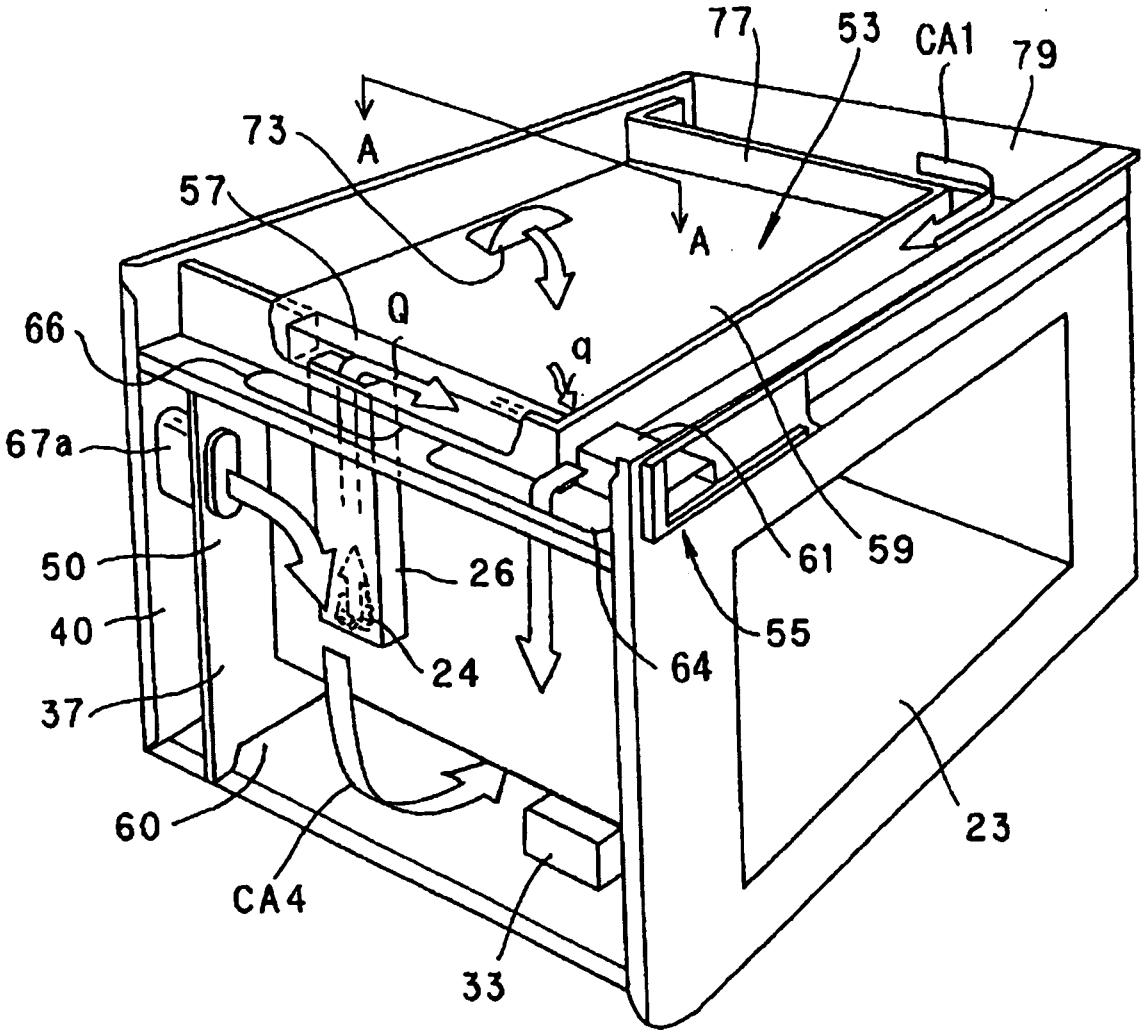


FIG. 6

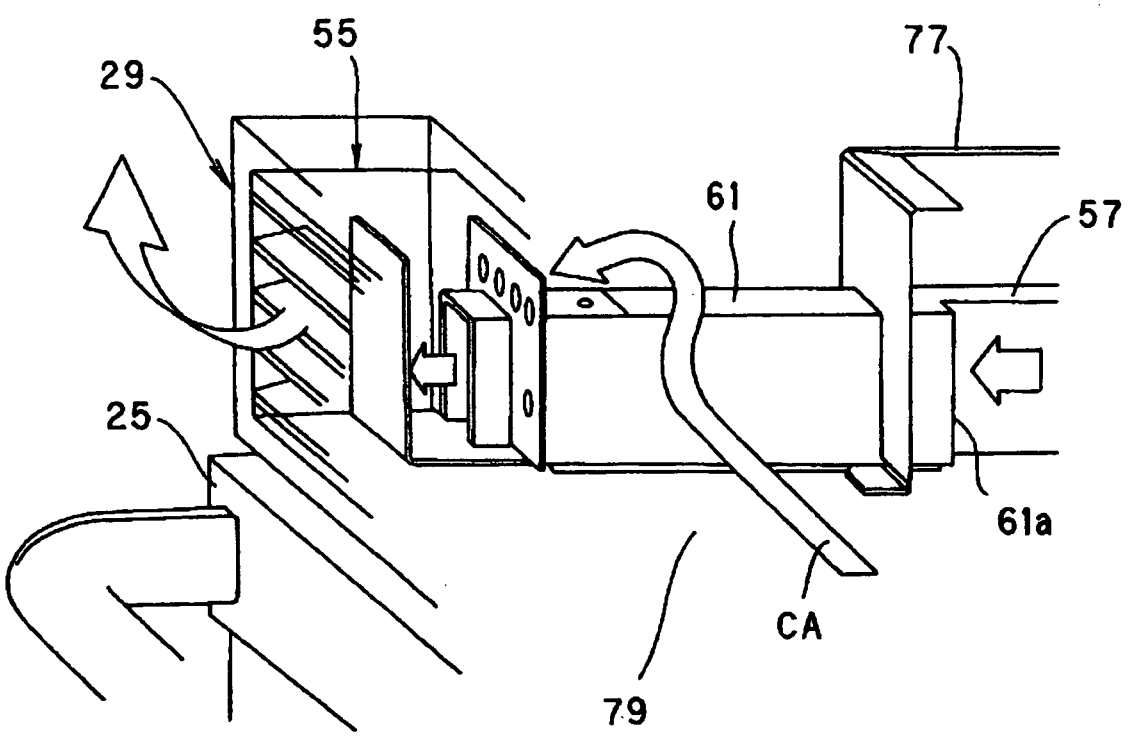


FIG. 7

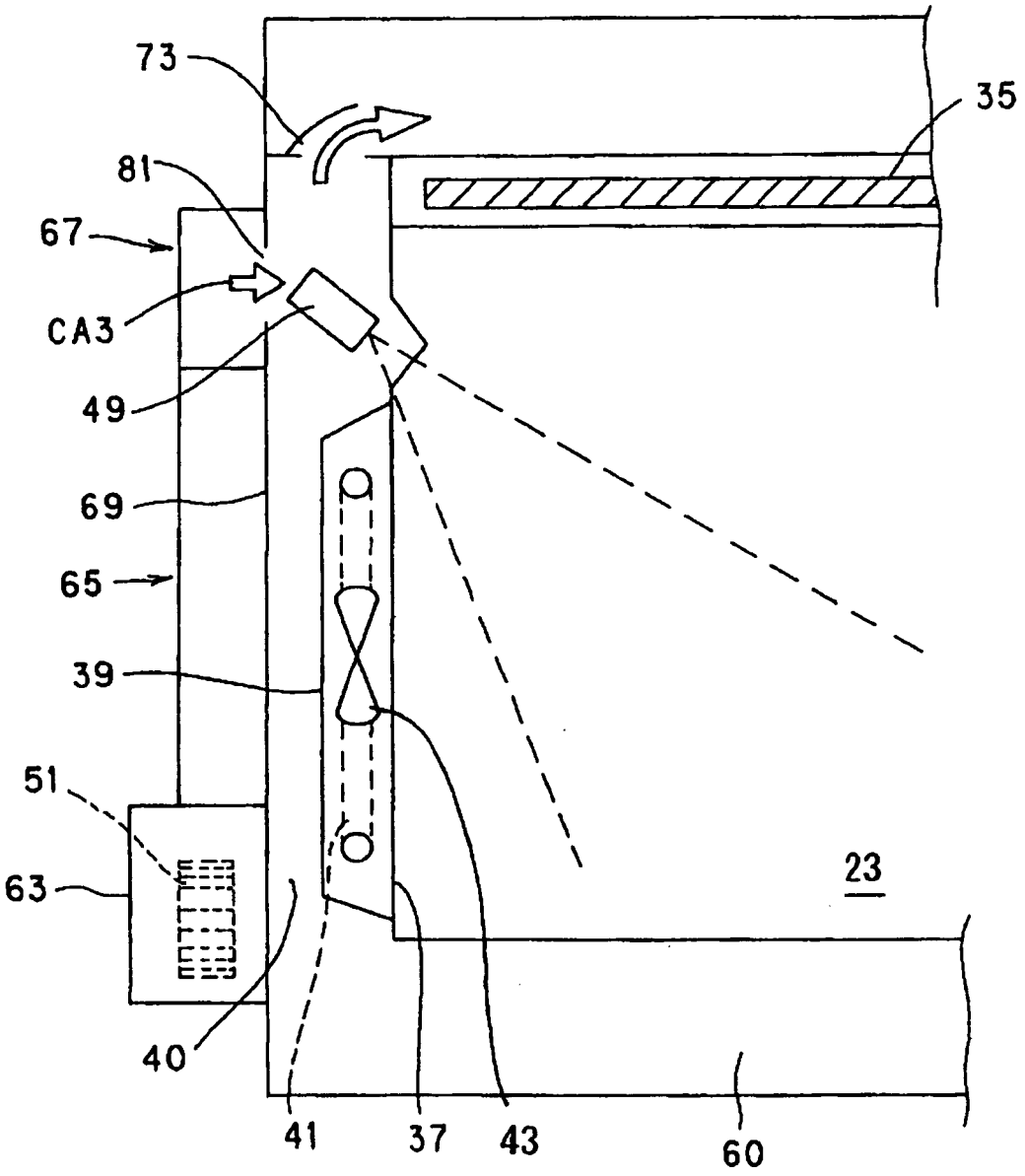


FIG. 8

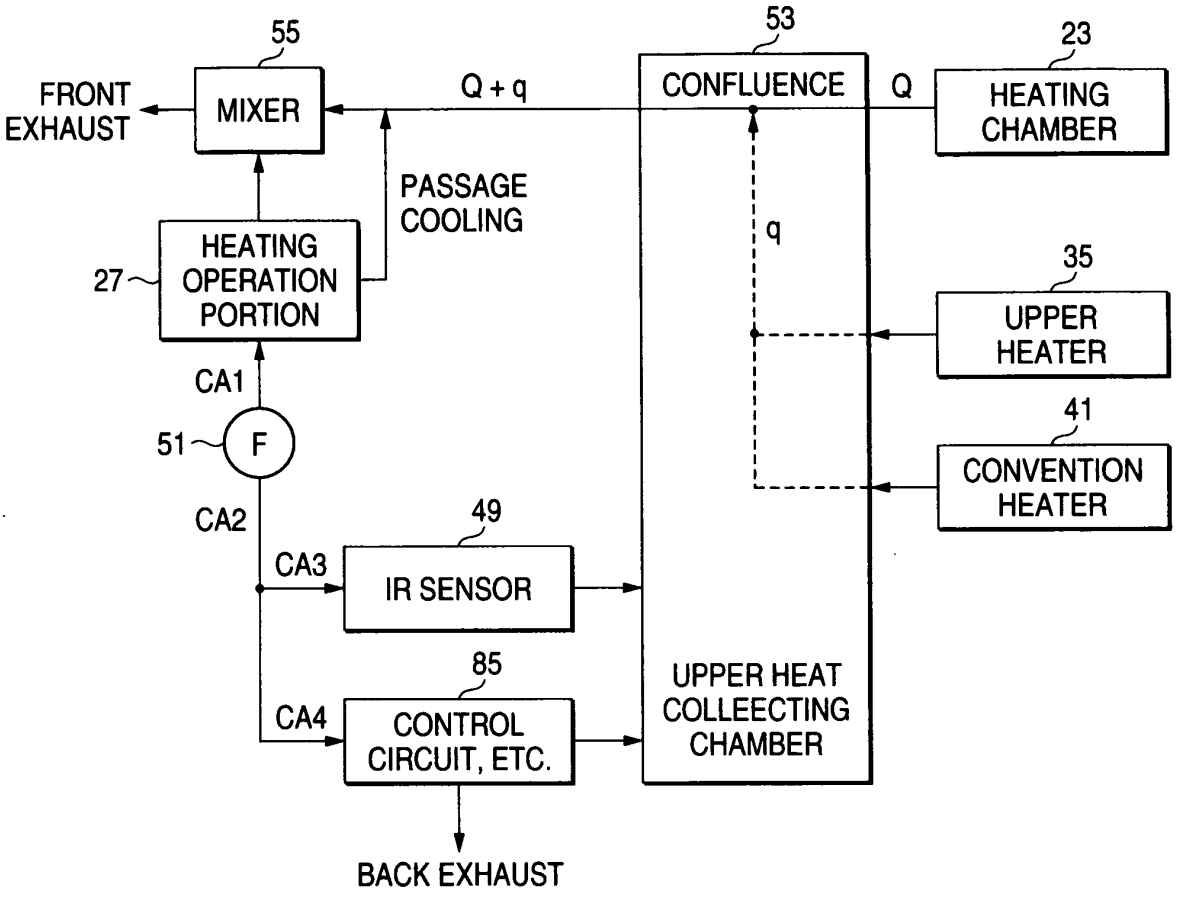

55
53
23
FRONT EXHAUST
MIXER
Q + q
CONFLUENCE
Q
HEATING CHAMBER
PASSAGE COOLING
q
27
HEATING OPERATION PORTION
35
UPPER HEATER
CA1
41
51
F
CONVENTION HEATER
CA2
49
CA3
IR SENSOR
85
UPPER HEAT COLLEECTING CHAMBER
CA4
CONTROL CIRCUIT, ETC.
BACK EXHAUST

FIG. 9

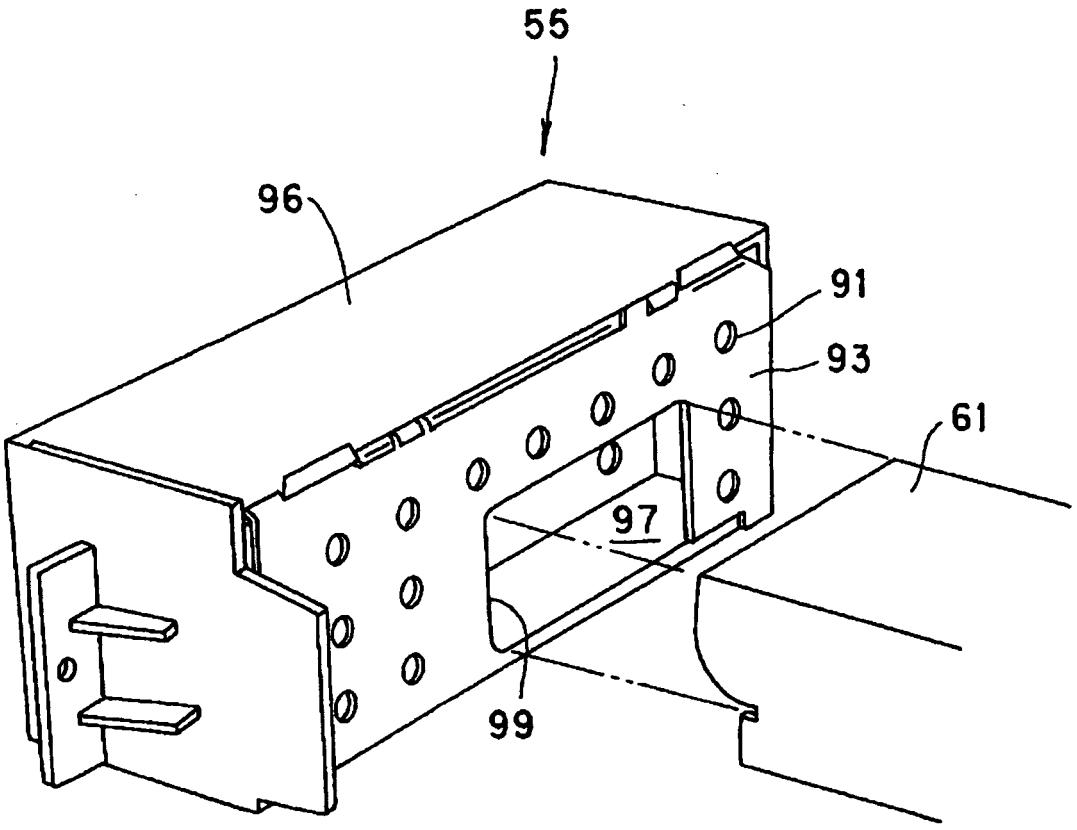


FIG. 10

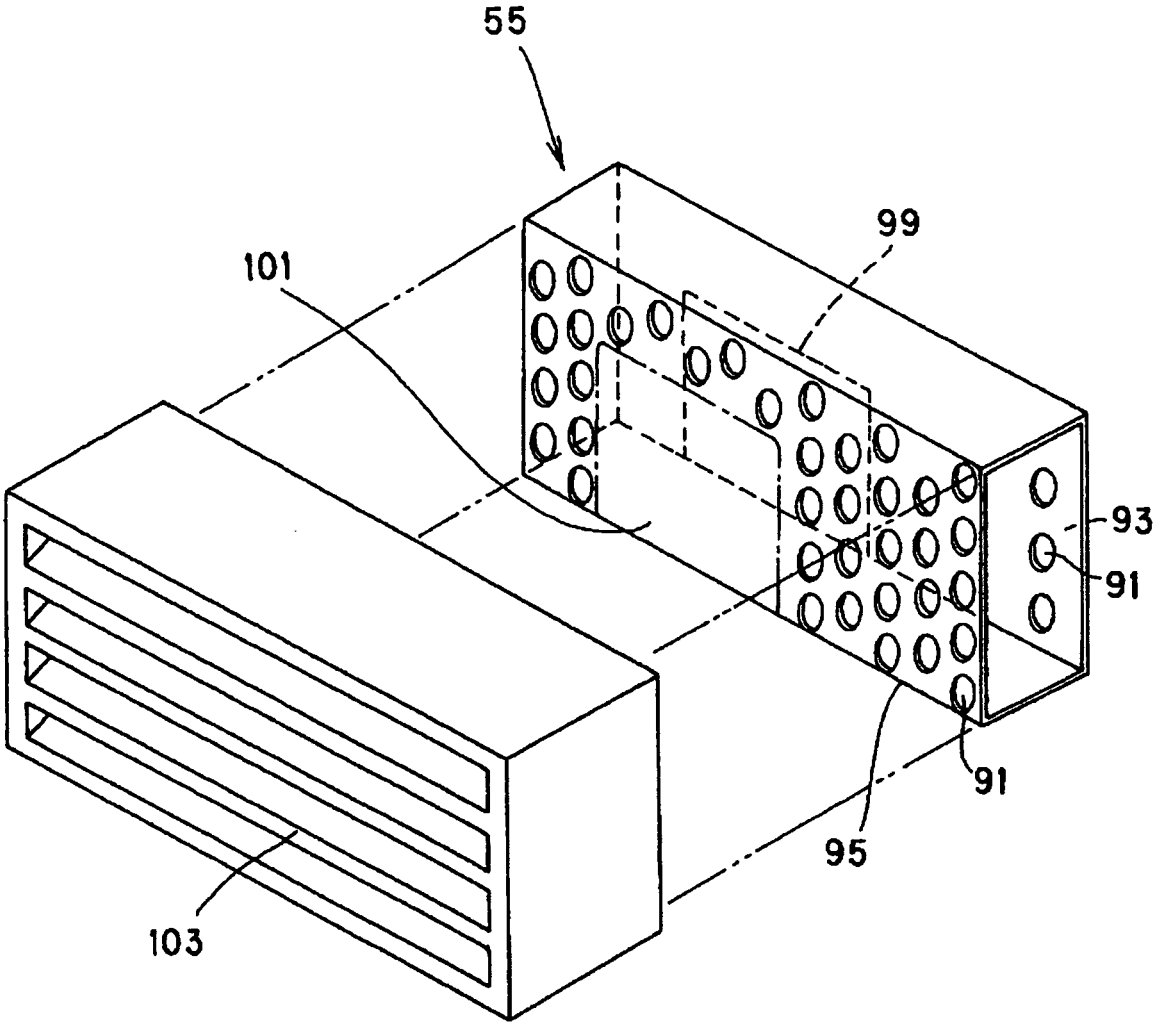


FIG. 11

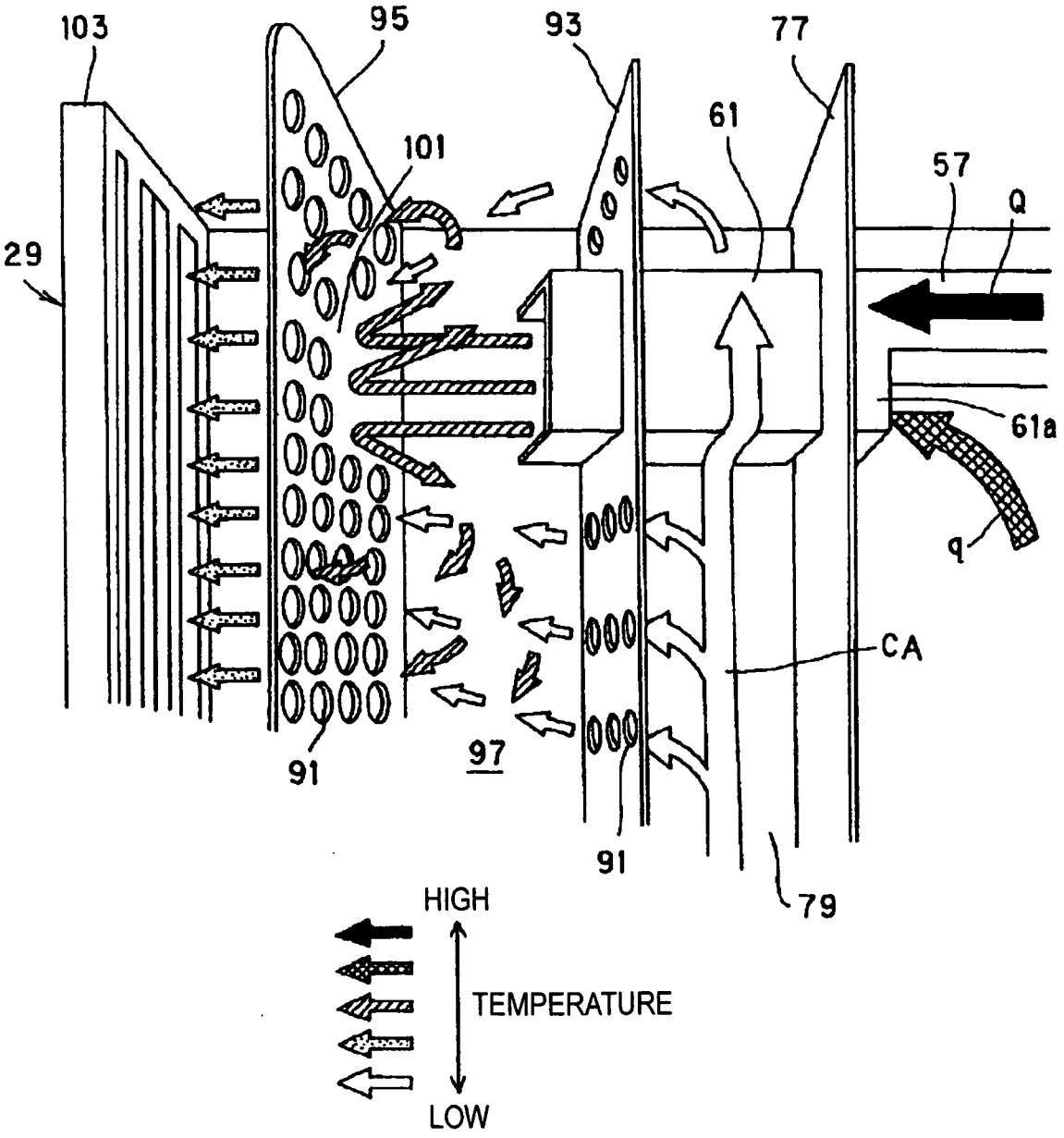
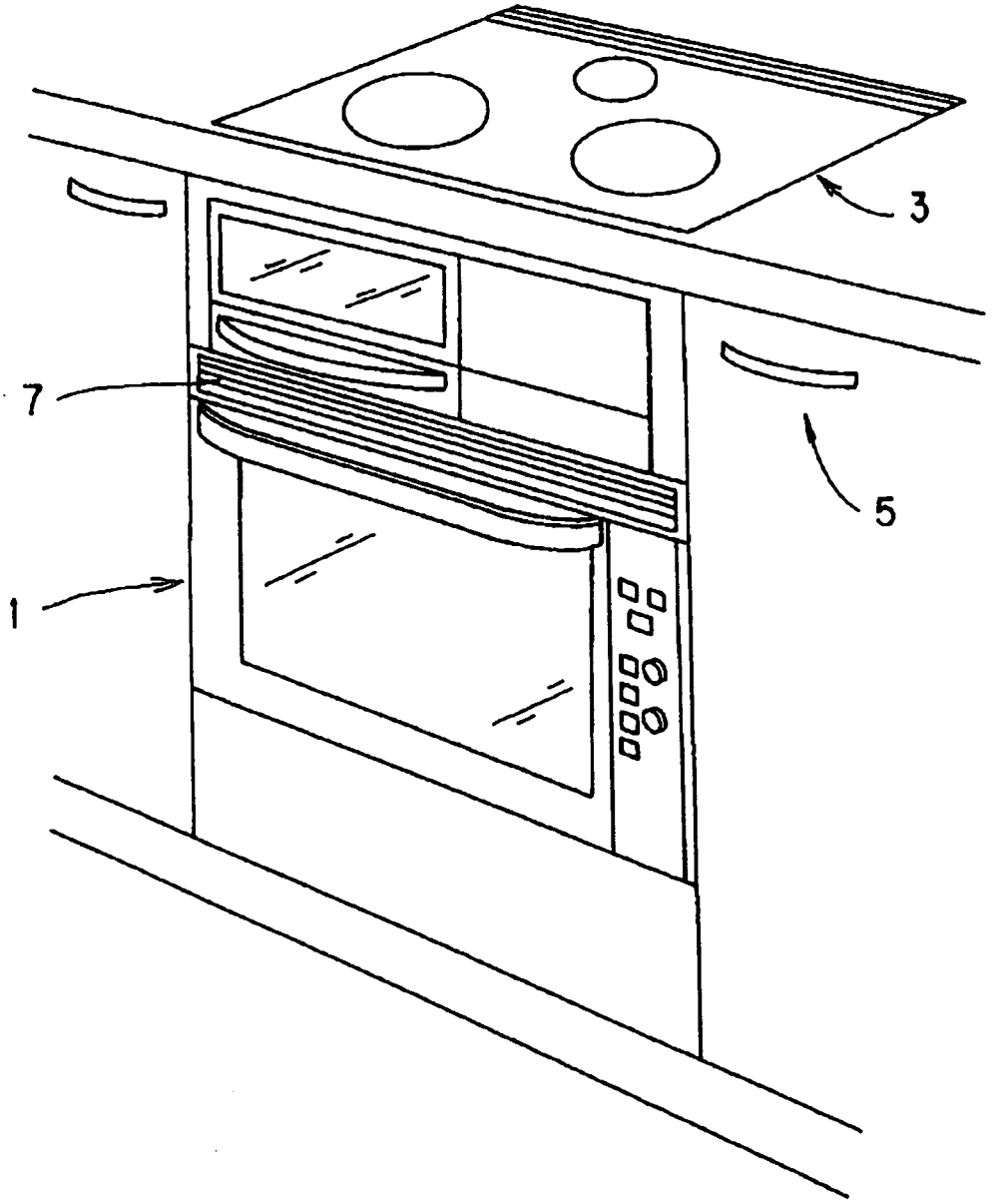

103
95
93
77
61
101
57
Q
29
61a
q
CA
91
97
91
79
HIGH
TEMPERATURE
LOW

FIG. 12



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/008572

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 A	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)	1-3,11-14 5,6,8,10 4,7,9
X Y A	GB 2190486 A (EDWARD ROSE (TELFORD) LTD.), 18 November, 1987 (18.11.87), Full text & GB 8612055 A0	1,10,11 2,3,6,8, 12-14 4,5,7,9

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

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"&" 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.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/008572

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 8-42858 A (Sanyo Electric Co., Ltd.), 16 February, 1996 (16.02.96), Full text (Family: none)	1-3,5,6,8, 10-14 4,7,9
Y	JP 2003-517564 A (LG Electronics Inc.), 27 May 2003 (27.05.03), Full text & WO 01/45466 A	3,8
Y	JP 51-14517 Y2 (Sanyo Electric Co., Ltd.), 17 April, 1976 (17.04.76), Full text (Family: none)	10
A	DE 2256941 A (BURGER EISENWERKE AG.), 22 May, 1974 (22.05.74), Full text & NL 7309171 A & FR 2207259 A & CH 553542 A & AT 571273 A & IT 996613 A	4
A	EP 1239224 A1 (BRANDT INDUSTRIES), 11 September, 2002 (11.09.02), Full text & FR 2821920 A	1-14
A	US 4601279 A (Jacky Guerin), 22 July, 1986 (22.07.86), Full text (Family: none)	1-14

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