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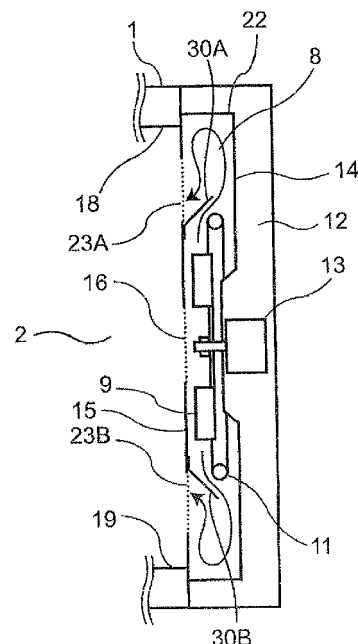
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(54) **HEATING DEVICE**

(57) A heating device according to the present invention is of a convection heating type and includes a heat-source room (8) which communicates with a heating room (2) for housing objects to be heated, through a suction port (16) and a plurality of blow-off ports (23A and 23B) formed in a partition wall (15) formed between it and the heating room (2). In the heat-source room, there are provided an air-blower portion (9) for creating air flows, a heating portion (11) for heating air flows, and flow-path formation portions (30A and 30B) which form flow paths for moving air flows heated by the heating portion (11) toward a surface facing the partition wall (15), then circulating the air flows in at least a partial space within the heat-source room and blowing off air flows toward the center of the heating room (2) through at least a single blow-off port out of the plurality of blow-off ports (23A and 23B).

Fig. 2



Description

Technical Field

[0001] The present invention relates to heating devices which heat objects to be heated within a heating room, using convection heating systems for creating hot air flows with a blower fan and a heater and, further, causing convection of created hot air flows into the heating room.

Background Art

[0002] Conventionally, a heating cooker as a heating device of this type has been generally provided with a hot-air-flow circulation mechanism including a blower fan and a heater, in the rear of a rear wall, which forms a rear surface of a heating room for placing objects to be heated. The hot-air-flow circulation mechanism is structured to suck air within the heating room, with the blower fan, through a suction port provided in the rear wall of the heating room, further to blow them onto the heater and to blow off hot air flows having been heated by the heater into the heating room through blow-off ports provided in the rear wall of the heating room. The heating cooker including the hot-air-flow circulation mechanism is adapted to perform cooking for objects to be heated within the heating room, using a convection heating system utilizing circulations of hot air flows within the heating room.

[0003] Among such conventional heating cookers, there have been heating cookers adapted to supply hot air flows into a heating room through blow-off ports using airflow direction plates provided in a hot-air-flow circulation mechanism, in order to uniformize the temperature distribution within the heating room (refer to Japanese Examined Patent Application Publication No. H7-111256 (Patent Literature 1), for example). Further, there have been heating cookers adapted to collect portions of hot air flows from a blower fan and to cause hot air flows from blow-off ports to spread over a heating room, with airflow-direction changing members provided near the blow-off ports in a hot-air-flow circulation mechanism, in order to enable heating cooking for objects to be heated without inducing heating unevenness (refer to Japanese Unexamined Patent Publication No. 2006-71124 (Patent Literature 2), for example).

[0004] Fig. 19 is a side cross-sectional view illustrating the interior structure of a conventional heating cooker disclosed in Patent Literature 1. In the heating cooker illustrated in Fig. 19, there is provided an inner casing 103 on an outer surface of a rear wall 102 which forms a rear surface of a heating room 101, wherein the rear wall 102 and the inner casing 103 constitute a casing of a hot-air-flow circulation mechanism. Inside the hot-air-flow circulation mechanism, there are provided a blower fan 104 constituted by a centrifugal fan, and a substantially-annular heater 105. The rear wall 102 of the heating room 101 is provided, at the center thereof, with a suction port 106 formed from a plurality of punched holes. In the

rear wall 102, there are formed a plurality of blow-off ports 107 constituted by a plurality of punched holes at upper and lower positions sandwiching the suction port 106 therebetween.

[0005] The blower fan 104 constituted by a centrifugal fan is provided inside the inner casing 103, such that it faces the suction port 106 formed at the center of the rear wall 102 of the heating room 101. The blower fan 104 is driven to be rotated by a motor 108 which is provided outside the inner casing 103. The heater 105 is a substantially-annular sheathed heater which is provided in such a way as to surround the blower fan 104.

[0006] The conventional heating cooker illustrated in Fig. 19 is structured in such a way as to block, by airflow direction plates 109, portions of hot air flows having been blown in the centrifugal direction from the blower fan 104 and heated by the heater 105. The airflow direction plates 109 are provided near the blow-off ports 107 in the rear of the blow-off ports 107, in the direction of flowing of hot air flows blown from the blower fan 104. The airflow direction plates 109 are for the purpose of blocking and collecting portions of hot air flows from the blower fan 104 for increasing the amount of hot air flows supplied to the heating room 101 through the blow-off ports 107. In order to attain this purpose, in the conventional heating cooker illustrated in Fig. 19, the airflow direction plates 109 are placed, such that their plate surfaces, with which hot air flows from the blower fan 104 come into contact, are vertical with respect to the rear wall 102 and, also, are parallel with the upward and downward directions of the blower fan 104 or with the centrifugal direction with respect to the rotational center of the blower fan 104.

[0007] Further, a conventional heating cooker disclosed in Patent Literature 2 is also adapted to block, by airflow direction changing members, portions of hot air flows having been blown in a centrifugal direction from a blower fan and heated by a heater, thereby changing airflow directions of hot air flows supplied to a heating room through blow-off ports, similarly to the heating cooker disclosed in Patent Literature 1. The airflow direction changing members are placed in the rear of the blow-off ports near the blow-off ports, in the direction of flowing of hot air flows from the blower fan. The conventional heating cooker disclosed in Patent Literature 2 is for the purpose of blocking portions of hot air flows from the blower fan and changing the airflow directions thereof by the airflow direction changing members, for reducing unevenness of hot air flows within the heating room.

[0008] In the conventional heating cookers having the aforementioned structures, if an object to be heated is housed within the heating room and, then, heating cooking is started, the blower fan is driven to be rotated by the motor, so that air within the heating room is sucked through the suction port into the hot-air-flow circulation mechanism. Further, due to the rotation of the blower fan, air within the hot-air-flow circulation mechanism is blown in the centrifugal direction. Such air blown in the centrifugal direction from the blower fan is heated by the

heater and, further, is supplied to the heating room through the plurality of blow-off ports (at an upper position, a lower position and side positions in the rear wall, for example). As described above, hot air flows are circulated within the heating room and within the hot-air-flow circulation mechanism, thereby performing convection heating on the object to be heated within the heating room.

[0009] The conventional heating cookers are structured such that, after the start of convection heating, portions of hot air flows come into contact with the airflow direction plates (the airflow direction changing members) within the hot-air-flow circulation mechanism, so that hot air flows are directed in the opposite direction from the direction of the rotation of the blower fan, and hot air flows are supplied to the inside of the heating room through the blow-off ports near the airflow direction plates. Due to the provision of the plurality of airflow direction plates (the airflow direction changing members) within the hot-air-flow circulation device as described above, hot air flows are supplied to the inside of the heating room through the plurality of blow-off ports, thereby suppressing heating unevenness, namely so-called burning unevenness.

[0010] Further, there have been suggested heating cookers adapted to adjust airflow directions of hot air flows circulating within a heating room, according to the sizes and shapes of objects to be heated and the positions at which they are housed within the heating room (refer to Japanese Unexamined Patent Publication No. H6-347041 (Patent Literature 3) and Japanese Unexamined Patent Publication No. 2004-353922 (Patent Literature 4), for example). The conventional heating cookers disclosed in Patent Literatures 3 and 4 are structured to provide means for changing airflow directions within the heating room, thereby forcibly changing the direction of circulations of hot air flows within the heating room.

Citation List

Patent Literatures

[0011] Patent Literature 1: Japanese Examined Patent Application Publication No. H7-111256

[0012] Patent Literature 2: Japanese Unexamined Patent Publication No. 2006-71124

[0013] Patent Literature 3: Japanese Unexamined Patent Publication No. H6-347041

[0014] Patent Literature 4: Japanese Unexamined Patent Publication No. 2004-353922

Non Patent Literature

[0015] NPL1: Patent Company Publication "Variations of Hand Scanner" Editor Tokkyo Ichiro

Summary of Invention

Technical Problem

[0016] The conventional heating cookers disclosed in Patent Literatures 1 and 2 are structured such that air flows from the blower fan constituted by a centrifugal fan are blown in the centrifugal direction of the blower fan and, further, are flowed along the rear wall of the heating room within the hot-air-flow circulation mechanism.

[0017] In addition thereto, the airflow directions of air flows from the blower fan are inclined from the radial direction to the rotational direction of the blower fan along with the rotation of the blower fan, so that they have a so-called outward spiral shape. Further, depending on the relationship between the rotational speed of the blower fan and the amount of air flows blown from the blower fan, air flows may be blown in directions approximate to tangential directions of the rotation of the blower fan. Therefore, a larger part of hot air flows blown off from the hot-air-flow circulation device is blown through the plurality of blow-off ports in the rear wall of the heating room, in an outward spiral shape or onto the side surfaces, the ceiling surface and the bottom surface of the heating room.

[0018] The conventional heating cookers disclosed in Patent Literatures 1 and 2 are structured to increase the amount of hot air flows blown through the blow-off ports, through the airflow direction plates (the airflow direction changing members) provided within the hot-air-flow circulation mechanism. The airflow directions of hot air flows blown off through the blow-off ports are directions approximate to substantially-tangential directions of the rotation of the blower fan. Therefore, hot air flows blown through the blow-off ports formed at a lower position in the rear wall of the heating room are flowed along the bottom surface of the heating room, hot air flows blown through the blow-off ports formed at an upper position in the rear wall of the heating room are flowed along the ceiling surface of the heating room and, further, hot air flows blown through the blow-off ports formed at side positions in the rear wall of the heating room are flowed along the side surfaces. As a result thereof, hot air flows blown off from the hot-air-flow circulation mechanism are caused to mainly heat the wall surfaces of the heating room.

[0019] Accordingly, the conventional heating cookers have had the problem that the wall surfaces of the heating room are raised to higher temperatures than that of objects to be heated within the heating room, which has increased heat dissipation losses, thereby preventing efficient heating of the objects to be heated.

[0020] Further, with the conventional heating cookers, hot air flows blown off into the heating room from the hot-air-flow circulation mechanism are in substantially-tangential directions of the circle of rotations of the blower fan through the blow-off ports and, thus, may be blown off in directions perpendicular to the rotational axis of the

blower fan and may be flowed along the rear wall of the heating room.

[0021] Such hot air flows blown off through the blow-off ports such that they are along the rear wall of the heating room are impinged on the upper, lower, left and right wall surfaces of the heating room, thereby directly heating these wall surfaces. As a result thereof, such conventional heating cookers have had the problem of further degradation of the heating efficiency for objects to be heated.

[0022] The aforementioned conventional heating cookers disclosed in Patent Literatures 3 and 4 have been structured to enable securing a control mechanism at a predetermined position within the heating room, according to the shapes and the sizes of objects to be heated and the positions at which they are housed within the heating room, for adjusting airflow directions of hot air flows within the heating room during heating operations.

[0023] Accordingly, the conventional heating cookers disclosed in Patent Literatures 3 and 4 are not enabled to change airflow directions of hot air flows during heating operations, which has induced the problem as follows. That is, it is impossible to attain both efficient heating of objects to be heated through hot air flows being directly impinged on the objects to be heated and uniform heating of objects to be heated prone to cause burning unevenness therein.

[0024] The present invention was made in order to overcome problems in heating devices as conventional heating cookers as described above and aims at providing a heating device capable of uniformly impinging hot air flows through blow-off ports on objects to be heated within a heating room while inhibiting hot air flows from directly heating the wall surfaces of the heating room for intensively heating the objects to be heated, thereby reducing losses due to heat dissipation through the wall surfaces of the heating room and, thus, efficiently heating the objects to be heated.

Solution to Problem

[0025] In a first aspect of the present invention, there is provided a heating device including: a heating room for housing an object to be heated; and a heat-source room which communicates with the heating room through a suction port and a plurality of blow-off ports which are formed in a partition wall formed between the heat-source room and the heating room; wherein, inside the heat-source room, there are provided an air-blower portion for creating an air flow, a heating portion for heating the air flow, and a flow-path formation portion which forms a flow path for moving the air flow heated by the heating portion toward a surface facing the partition wall, then circulating the air flow in at least a partial space within the heat-source room and, thereafter, blowing off the air flow toward a center of the heating room through at least a single blow-off port out of the plurality of blow-off ports. With the heating device having the aforementioned structure

in the first aspect of the present invention, hot air flows created by the air-blower portion and the heating portion within the heat-source room are flowed through the flow path formed by the flow-path formation portion, so that hot air flows blown off through the blow-off ports into the heating room can be flowed toward the center of the heating room.

[0026] In a second aspect of the present invention, in the heating device in the aforementioned first aspect, the flow-path formation portion is placed within an air flow path from the heating portion to the blow-off ports. With the heating device having the aforementioned structure in the second aspect of the present invention, it is possible to certainly form the air-flow path for causing hot air flows created by the air-blower portion and the heating portion within the heat-source room to be blown off toward the center of the heating room through the blow-off ports.

[0027] In a third aspect of the present invention, in the heating device in the aforementioned first aspect, the flow-path formation portion includes a guide surface for moving an air flow heated by the heating portion toward the surface facing the partition wall and is adapted such that the air flow moved toward the surface facing the partition wall by the guide surface is circulated in at least the partial space within the heat-source room, then is brought into contact with a surface opposite from the guide surface and, then, is blown off through the blow-off ports. With the heating device having the aforementioned structure in the third aspect of the present invention, it is possible to uniformly impinge hot air flows through the blow-off ports on objects to be heated within the heating room and, further, it is possible to inhibit hot air flows from directly heating the wall surfaces of the heating room, thereby enabling operations for intensively heating the objects to be heated.

[0028] In a fourth aspect of the present invention, in the heating device in the aforementioned third aspect, the air-blower portion is constituted by a centrifugal fan which is adapted to suck air within the heating room through the suction port in the partition wall and to eject air in a centrifugal direction, and the heating portion is provided in such a way as to surround an outer periphery of the air-blower portion. With the heating device having the aforementioned structure in the fourth aspect of the present invention, air sucked through the partition wall can be certainly heated by the heating portion provided around the centrifugal fan, and hot air flows can be blown off in a desired direction into the heating room through the hot-air-flow path formed by the flow-path formation portion, within the heat-source room. This can suppress heat dissipation losses, which enables efficiently heating objects to be heated, thereby enabling speed-up for pre-heating of the heating room and for heating cooking.

[0029] In a fifth aspect of the present invention, in the heating device in the aforementioned third aspect, the guide surface at least partially includes an inclined surface which is inclined at a predetermined angle with re-

spect to an axial direction of a rotational shaft of the air-blower portion. With the heating device having the aforementioned structure in the fifth aspect of the present invention, it is possible to suppress pressure losses in the heat-source room.

[0030] In a sixth aspect of the present invention, in the heating device in the aforementioned third aspect, the guide surface is at least partially formed from a curved surface. With the heating device having the aforementioned structure in the sixth aspect of the present invention, it is possible to suppress pressure losses in the heat-source room and, further, it is possible to direct the airflow directions of hot air flows through the blow-off ports more forwardly in the heating room.

[0031] In a seventh aspect of the present invention, in the heating device in the aforementioned third aspect, the guide surface is formed in such a way as to cover at least the blow-off ports in their entirety, with a predetermined interval interposed between the guide surface and the blow-off ports. With the heating device having the aforementioned structure in the seventh aspect of the present invention, it is possible to adjust the flow path for hot air flows within the heat-source room, thereby adjusting the direction of hot air flows blown off into the heating room.

[0032] In an eighth aspect of the present invention, in the heating device in the aforementioned third aspect, the guide surface at least partially includes an inclined surface which is inclined at a predetermined angle with respect to an axial direction of a rotational shaft of the air-blower portion, whereby an air flow blown off through the blow-off ports is changed, in direction, by changing the angle of the inclined surface. With the heating device having the aforementioned structure in the eighth aspect of the present invention, it is possible to adjust the flow path for hot air flows within the heat-source room, thereby adjusting the direction of hot air flows blown off into the heating room.

[0033] In a ninth aspect of the present invention, in the heating device in the aforementioned third aspect, an air flow blown off through the blow-off ports is changed in direction by changing the rotational speed of the air-blower portion. With the heating device having the aforementioned structure in the ninth aspect of the present invention, it is possible to easily change the direction of hot air flows through the blow-off ports, by changing the rotational speed of the air-blower portion.

[0034] In a tenth aspect of the present invention, in the heating device in the aforementioned first aspect, the flow-path formation portion includes a longitudinal flow-path formation portion which includes a guide surface for moving an air flow heated by the heating portion toward the surface facing the partition wall and is adapted such that the air flow moved toward the surface facing the partition wall by the guide surface is circulated in at least the partial space within the heat-source room, then is brought into contact with a surface opposite from the guide surface and, then, is blown off through the blow-off ports,

and a lateral flow-path formation portion which is provided downstream from the blow-off ports in the direction of flowing of an air flow created by the air-blower portion and includes a block surface placed in such a way as to block a portion of the air flow from the air-blower portion to cause it to be blown off through the blow-off ports. With the heating device having the aforementioned structure in the tenth aspect of the present invention, air sucked through the partition wall can be heated and, further, hot air flows can be blown off in a desired direction into the heating room through the flow path formed by the flow-path formation portion, within the heat-source room. This can suppress heat dissipation losses, which enables efficiently heating objects to be heated, thereby enabling speed-up for preheating of the heating room and for heating cooking.

[0035] In an eleventh aspect of the present invention, in the heating device in the aforementioned first aspect, the flow-path formation portion includes a longitudinal flow-path formation portion which includes a guide surface for moving an air flow heated by the heating portion toward the surface facing the partition wall and is adapted such that the air flow moved toward the surface facing the partition wall by the guide surface is circulated in at least the partial space within the heat-source room, then is brought into contact with a surface opposite from the guide surface and, then, is blown off through the blow-off ports, a lateral flow-path formation portion which is provided downstream from the blow-off ports in the direction of flowing of an air flow created by the air-blower portion and includes a block surface placed in such a way as to block a portion of the air flow from the air-blower portion to cause it to be blown off through the blow-off ports, and a ceiling flow-path formation portion which includes a ceiling surface which covers the blow-off ports with a predetermined interval interposed between the ceiling surface and the blow-off ports and, further, makes the longitudinal flow-path formation portion and the lateral flow-path formation portion continuous with each other. With the heating device having the aforementioned structure in the eleventh aspect of the present invention, it is possible to certainly form the flow path for causing hot air flows created by the air-blower portion and the heating portion within the heat-source room to be blown off toward the center of the heating room through the blow-off ports.

[0036] In a twelfth aspect of the present invention, in the heating device in the aforementioned tenth or eleventh aspect, the guide surface in the longitudinal flow-path formation portion and the block surface in the lateral flow-path formation portion are placed around the blow-off ports, such that the guide surface and the block surface are orthogonal to each other. With the heating device having the aforementioned structure in the twelfth aspect of the present invention, hot air flows created by the air-blower portion and the heating portion within the heat-source room can be blown off toward the center of the heating room through the blow-off ports, thereby enabling

uniform heating within the heating room.

[0037] In a thirteenth aspect of the present invention, in the heating device in the aforementioned tenth or eleventh aspect, the air-blower portion is constituted by a centrifugal fan which is adapted to suck air within the heating room through the suction port in the partition wall and to eject air in a centrifugal direction, and the heating portion is provided in such a way as to surround an outer periphery of the air-blower portion. With the heating device having the aforementioned structure in the thirteenth aspect of the present invention, air sucked through the partition wall can be certainly heated by the heating portion provided around the centrifugal fan, and hot air flows can be blown off in a desired direction into the heating room through the hot-air-flow path formed by the flow-path formation portion, within the heat-source room.

[0038] In a fourteenth aspect of the present invention, in the heating device in the aforementioned tenth or eleventh aspect, the guide surface at least partially includes an inclined surface which is inclined at a predetermined angle with respect to an axial direction of a rotational shaft of the air-blower portion. With the heating device having the aforementioned structure in the fourteenth aspect of the present invention, it is possible to suppress pressure losses in the heat-source room.

[0039] In a fifteenth aspect of the present invention, in the heating device in the aforementioned tenth or eleventh aspect, the guide surface is at least partially formed from a curved surface. With the heating device having the aforementioned structure in the fifteenth aspect of the present invention, it is possible to suppress pressure losses in the heat-source room.

Advantageous Effects of Invention

[0040] With the heating device according to the present invention, it is possible to uniformly impinge hot air flows through the blow-off ports on objects to be heated within the heating room while inhibiting hot air flows from directly heating the wall surfaces of the heating room, thereby enabling operations for intensively heating the objects to be heated. This can reduce losses due to heat dissipation through the wall surfaces of the heating room, thereby enabling efficiently heating the objects to be heated.

Brief Description of Drawings

[0041]

Fig. 1 is a side cross-sectional view schematically illustrating the internal structure of a heating cooker according to a first embodiment of the present invention.

Fig. 2 is a plan cross-sectional view of a portion of the heating cooker illustrated in Fig. 1, taken along the line II-II.

Fig. 3 is a perspective view illustrating a partition wall which forms a rear-surface wall of a heating room,

in the heating cooker according to the first embodiment.

Fig. 4 is a plan cross-sectional view illustrating a heat-source room and a driving room in a heating cooker according to a second embodiment of the present invention.

Fig. 5 is a plan cross-sectional view illustrating a heat-source room and a driving room in a heating cooker according to a third embodiment of the present invention.

Fig. 6 is a perspective view illustrating the interior of the heat-source room illustrated in Fig. 5.

Fig. 7A is a plan cross-sectional view illustrating a heat-source room and a driving room in a state at a temperature equal to or lower than a predetermined temperature, in a heating cooker according to a fourth embodiment of the present invention.

Fig. 7B is a plan cross-sectional view illustrating the heat-source room and the driving room in a state at a temperature higher than the predetermined temperature, in the heating cooker according to the fourth embodiment of the present invention.

Fig. 8 is a perspective view of a partition wall and the like in the heating cooker according to the fourth embodiment, when it is viewed at its rear-surface side.

Fig. 9 is a plan cross-sectional view illustrating a heat-source room and a driving room in a heating cooker according to a fifth embodiment of the present invention.

Fig. 10 is a block diagram illustrating the structure of a control portion in the heating cooker according to the fifth embodiment.

Fig. 11 is a pattern diagram illustrating operation processes for heating cooking with the heating cooker according to the fifth embodiment.

Fig. 12 is a pattern diagram illustrating operation processes for heating cooking with a heating cooker according to a sixth embodiment of the present invention.

Fig. 13 is a plan cross-sectional view illustrating a heat-source room and a driving room in a heating cooker according to a seventh embodiment of the present invention.

Fig. 14 is a perspective view of a partition wall which forms a rear-surface wall of a heating room in the heating cooker according to the seventh embodiment, when it is viewed at its rear side.

Fig. 15 is a plan cross-sectional view illustrating a heat-source room and a driving room in a heating cooker according to an eighth embodiment of the present invention.

Fig. 16 is a plan cross-sectional view illustrating a heat-source room and a driving room in a heating cooker according to a ninth embodiment of the present invention.

Fig. 17 is a perspective view of a partition wall which forms a rear-surface wall of a heating room in the

heating cooker according to the ninth embodiment, when it is viewed at its rear side.

Fig. 18 is a plan cross-sectional view illustrating a heat-source room and a driving room in a heating cooker according to a tenth embodiment of the present invention.

Fig. 19 is a side cross-sectional view illustrating the internal structure of a conventional heating cooker.

Description of Embodiments

[0042] Hereinafter, with reference to the accompanying drawings, there will be described heating cookers as embodiments of a heating device according to the present invention. Further, the heating device according to the present invention is not limited to the structures of the heating devices which will be described in the following embodiments and is intended to include heating devices structured based on technical concepts equivalent to the technical concepts which will be described in the following embodiments and based on technical common senses in the present technical field.

(First Embodiment)

[0043] A first embodiment of the present invention will be described, with reference to the accompanying Figs. 1 to 3. Fig. 1 is a side cross-sectional view illustrating the schematic structure of the interior of a heating cooker according to the first embodiment of the present invention. Fig. 2 is a plan cross-sectional view of a portion of the heating cooker illustrated in Fig. 1, taken along the line II-II. Fig. 3 is a perspective view illustrating a rear-surface wall, which forms a rear wall of a heating room, in the heating cooker according to the first embodiment.

[0044] Further, in the description of the heating cooker according to the first embodiment, the description will be given by assuming that its surface provided with a door which enables taking in and out objects to be heated is a front surface of the heating cooker, and the leftward and rightward directions of the heating cooker are the directions which can be viewed when it is viewed at its front surface. In the respective embodiments which will be described later, similarly, the front surface and the leftward and rightward directions will be defined as described above.

[0045] As illustrated in Fig. 1, the heating cooker according to the first embodiment includes the heating room 2 having a substantially rectangular parallelepiped structure which is formed inside a main body 1, in order to enable housing ingredients as objects 10 to be heated. The heating room 2 includes wall plates which are made of metal materials and form a ceiling surface, a bottom surface, a left side surface, a right side surface and a rear surface, the door 3 which is to be opened and closed for taking in and out the objects 10 to be heated, and a plurality of supporting portions 4 for supporting cooking plates 5 for placing the objects 10 to be heated. In the

heating cooker according to the first embodiment, the supporting portions 4 are formed such that the cooking plates 5 can be placed on the supporting portions 4 in three stages.

[0046] Under the heating room 2, a magnetron 6 and an antenna 7 are installed and structured such that electromagnetic waves generated from the magnetron 6 can be radiated within the heating room 2 through the antenna 7. The heating room 2 having the aforementioned structure is structured such that, when the door 3 is closed, the electromagnetic waves supplied to the inside of the heating room 2 can be enclosed within the heating room 2.

[0047] Further, while, in the first embodiment, electromagnetic waves from the magnetron 6 are supplied to the heating room through the antenna, the present invention can be also applied to structures which employ circuit structures employing semiconductor devices for creating electromagnetic waves and supplying the electromagnetic waves to the heating room and, also, can be applied to structures of oven cookers of simple convection-heating types.

[0048] Further, the heating cooker according to the first embodiment is provided with a heat-source room 8, adjacent to the heating room 2, in a rear-surface side in the rear of the heating room 2. Inside the heat-source room 8, there are installed a blower fan 9 constituted by a centrifugal fan, and a heater 11 constituted by a sheathed heater, which is adapted to heat air blown through rotational operations of the blower fan 9. In the heating cooker according to the first embodiment, the heater 11 is placed outside the blade portions of the blower fan 9, further is provided at a position displaced rearwardly from the blade portions and, further, has a substantially-square frame shape.

[0049] Further, while the first embodiment will be described with respect to an example where the heater 11 has a substantially-square frame shape, the present invention is not limited to this structure, and the heater 11 can have other shapes, such as annular frame shapes, for example.

[0050] Within a driving room 12 which forms a space in the rear of the heat-source room 8, there is installed a motor 13 as a driving power source. The shaft of the motor 13 penetrates a heat-source-room rear-surface wall 14 which forms the rear surface of the heat-source room 8, and the blower fan 9 as an air-blowing portion is mounted to the tip end of this shaft. As described above, the heat-source room 8, in which there is installed the heater 11 as a heating portion as a heat source, is separated and thermally insulated from the driving room 12 in which there is installed the motor 13 as the driving power source, by an inner case 22 including the heat-source-room rear-surface wall 14.

[0051] Further, there is provided a partition wall 15 which forms a heating-room rear-surface wall, between the heating room 2 in which the objects 10 to be heated are housed, and the heat-source room 8 in which there

are installed the blower fan 9 and the heater 11. The partition wall 15 spatially separates the heating room 2 and the heat-source room 8 from each other.

[0052] The partition wall 15 which forms the heating-room rear-surface wall is provided with a suction port 16 at a position which faces the vicinity of the center of the blower fan 9 (a center area). Further, the partition wall 15 is provided with a plurality of blow-off ports 17A, 17B, 23A and 23B (see Fig. 3) which are constituted by a plurality of punched holes, in its areas close to the wall surfaces of the heating room 2 and outside the blower fan 9.

[0053] In the heating cooker according to the first embodiment, as illustrated in Fig. 1, the heat-source-room rear-surface wall 14 is formed to have a convex shape protruding toward the heat-source room at its center portion for providing the motor 13 in the driving room 12 in the rear of the heating cooker, rather than being formed to have a flat-plate shape. In other words, the heat-source-room rear-surface wall 14 is formed to have a concave shape protruding toward the driving room at its outer peripheral portion. The heat-source-room rear-surface wall 14 is structured such that the motor 13 is placed in the concave-portion space in the driving-room side which is formed at the center portion of the heat-source-room rear-surface wall 14.

[0054] In the heating cooker according to the first embodiment, as described above, the heating room 2 is constituted by the left side surface 18, the right side surface 19, the bottom surface 20, the ceiling surface 21, and the partition wall 15 which forms the heating-room rear-surface wall as the rear surface, in addition to the door 3 which forms the front surface. The left side surface 18 and the right side surface 19 are provided with the supporting portion 4 protruding inside the heating room 2, in three stages upwardly and downwardly, substantially in parallel with the bottom surface 20. These supporting portions 4 are adapted to hold the cooking plates 5 within the heating room 2.

[0055] As described above, in the rear of the partition wall 15 which forms the rear surface of the heating room 2, there is placed the heat-source room 8 formed by being surrounded by the partition wall 15, and the inner case 22 including the heat-source-room rear-surface wall 14. Namely, the partition wall 15 which forms the rear surface of the heating room 2 has the function of separating the heating room 2 and the heat-source room 8 from each other. Inside the heat-source room 8, there are provided the heater 11, and the blower fan 9 constituted by a centrifugal fan. The blower fan 9 and the heater 11 are adapted to be controlled by a control portion 24 provided inside the main body 1.

[0056] As illustrated in Fig. 2 and Fig. 3, the partition wall 15 which forms the rear surface of the heating room 2 is provided, at its center portion, with the suction port 16 formed from a plurality of punched holes. Further, the partition wall 15 is provided with the plurality of blow-off ports 17A, 17B, 23A and 23B in areas around the suction port 16, such that the suction port 16 is at the center of

them. In an area of the partition wall 15 which is close to the upper end portion, there is formed the upper blow-off port 17A having a band shape which is formed from a plurality of punched holes, such that it is elongated in the horizontal direction, in an area from the vicinity of the end portion proximal to the left side surface 18 of the heating room 2 to a substantially-center portion of the partition wall 15. Similarly, in an area of the partition wall 15 which is close to the lower end portion, there is formed the lower blow-off port 17B having a band shape which is formed from a plurality of punched holes, such that it is elongated in the horizontal direction, in an area from the vicinity of the end portion proximal to the right side surface 19 of the heating room 2 to a substantially-center portion of the partition wall 15. Namely, the two blow-off ports formed in the partition wall 15, which are the upper blow-off port 17A and the lower blow-off port 17B, are formed point-symmetrically with respect to the center of the suction port 16. In Fig. 3, an arrow indicates the direction of the rotation of the blower fan 9.

[0057] Further, in the partition wall 15, there are formed, in the horizontal direction, the blow-off ports 23A and 23B having a band shape with a larger width which are constituted by a plurality of punched holes, in areas which are to the left and right of the suction port 16 (see Fig. 3).

[0058] As described above, the partition wall 15 is provided with the left blow-off port 23A and the right blow-off port 23B which are constituted by a plurality of punched holes, similarly, at left and right positions which sandwich the suction port 16. The upper blow-off port 17A and the lower blow-off port 17B are formed to have a shape having a larger length in the horizontal direction and a smaller width in the vertical direction, than those of the shape of the left blow-off port 23A and the right blow-off port 23B (see Fig. 3). The heating room 2 and the heat-source room 8 communicate with each other, through the respective punched holes in the suction port 16, the upper and lower blow-off ports 17A and 17B, and the left and right blow-off ports 23A and 23B in the partition wall 15.

[0059] The punched holes forming the suction port 16, the upper and lower blow-off ports 17A and 17B and the left and right blow-off ports 23A and 23B are formed to be groups of a plurality of holes having diameters in the range of about 2 to 5 mm, in order to prevent leakages of electromagnetic waves to the outside of the heating room 2 during heating with electromagnetic waves.

[0060] The air-suction portion of the blower fan 9 within the heat-source room 8 is placed such that it faces the suction port 16 in the partition wall 15. Around the outer peripheral portion of the blower fan 9, which forms the air-exhaust portion, there is provided the heater 11 having a substantially-square frame shape and having a substantially-annular shape. The blower fan 9 is rotated and driven by the motor 13 provided outside the heat-source room 8 to generate air flows for blowing air in the centrifugal direction. Air flows generated are heated by the heat-

er 11 at a position around the outer periphery of the blower fan 9 to form hot air flows and, then, are supplied to the inside of the heating room 2 through the upper and lower blow-off ports 17A and 17B and the left and right blow-off ports 23A and 23B in the partition wall 15 to perform convection heating on the objects 10 to be heated.

[0061] The partition wall 15 forming the rear-surface wall of the heating room 2 is provided, on its the rear surface facing the heating-source room 8, with a first flow-path formation portion 30A, between the left blow-off port 23A and the suction port 16 at the center. Further, the partition wall 15 is provided, on its rear surface, with a second flow-path formation portion 30B between the right blow-off port 23B and the suction port 16 at the center. The first flow-path formation portion 30A and the second flow-path formation portion 30B are formed, such that they are secured at their one ends to the rear surface of the partition wall 15 and, further, are protruded, at the other ends, obliquely within the internal space of the heat-source room 8. The respective protruding end portions of the first flow-path formation portion 30A and the second flow-path formation portion 30B are placed, such that there is a predetermined gap between them and the heat-source-room rear-surface wall 14. Further, the first flow-path formation portion 30A and the second flow-path formation portion 30B are provided between the respective blow-off ports 23A and 23B and the heater 11 placed to surround the blower fan 9. As described above, the blower fan 9, the heater 11, the first flow-path formation portion 30A and the second flow-path formation portion 30B are provided inside the heat-source room 8 constituted by the partition wall 15 and the inner case 22 including the heat-source-room rear-surface wall 14, so that they create specific air flows within the heat-source room 8.

[0062] As illustrated in Fig. 2 and Fig. 3, on the rear surface of the partition wall 15, the first flow-path formation portion 30A and the second flow-path formation portion 30B at positions to the left and right of the suction port 16 at the center are formed to have fixed portions 30Ab and 30Bb secured to the partition wall 15, and inclined portions 30Aa and 30Ba having guide surfaces which are inclined to be opened outwardly at an angle of about 45 degrees with respect to the flat surface (the vertical surface) formed by the partition wall 15. The fixed portions 30Ab and 30Bb are placed near the respective center sides of the left and right blow-off ports 23A and 23B on the rear surface, and the inclined portions 30Aa and 30Bb are obliquely extended in such a way as to cover the center sides of the left and right blow-off ports 23A and 23B. The fixed portions 30Ab and 30Bb are mounting portions for securing the first flow-path formation portion 30A and the second flow-path formation portion 30B to the partition wall 15, and these fixed portions 30Ab and 30Bb are secured to the partition wall 15 through staking or welding. In the first embodiment, the first flow-path formation portion 30A and the second flow-path formation portion 30B are formed from respective

metal plates folded along straight lines. Further, the materials of the first flow-path formation portion 30A and the second flow-path formation portion 30B are not limited to metal materials and can be any materials having enough thermal resistance to maintain their shapes.

[0063] While, in the first embodiment, the first flow-path formation portion 30A and the second flow-path formation portion 30B will be described as being structured such that the inclined portions 30Aa and 30Bb are opened outwardly at an angle of about 45 degrees with respect to the flat surface (the vertical surface) of the partition wall 15, this angle is determined by specifications of the heating cooker. According to operation characteristics of the heating cooker, the inclined portions 30Aa and 30Ba are adapted to be opened outwardly at an angle within the range of 30 to 70 degrees with respect to the flat surface (the vertical surface) of the partition wall 15.

[0064] Further, in the first embodiment, the first flow-path formation portion 30A and the second flow-path formation portion 30B are formed from rectangular-shaped plate members which are folded and, further, they are placed such that the folding lines, which are straight lines, are in the vertical direction, as illustrated in Fig. 3. Further, the first flow-path formation portion 30A and the second flow-path formation portion 30B are formed such that they are shorter than the length of the partition wall 15 in the upward and downward directions but longer than the length of the left and right blow-off ports 23A and 23B in the upward and downward directions. Further, the first flow-path formation portion 30A and the second flow-path formation portion 30B are provided along the center sides (the suction-port sides) of the left and right blow-off ports 23A and 23B.

[0065] Further, although there has been described an example where the first flow-path formation portion 30A and the second flow-path formation portion 30B are formed such that they are longer than the length of the left and right blow-off ports 23A and 23B in the upward and downward directions, the present invention is not limited to this structure, and they can be also formed such that they are shorter than the length of the left and right blow-off ports in the upward and downward directions, according to specifications of the heating device and the like.

[0066] In the heating cooker according to the first embodiment, the heat-source room 8 and the driving room 12 are formed such that they have smaller depthwise sizes, in order to cause the main body 1 including the heat-source room 8 including the blower fan 9 and the heater 11 and the driving room 12 including the motor 13 to have a smaller depthwise size, while maintaining the internal capacity of the heating room 2.

[0067] The heating cooker according to the first embodiment employs the blower fan 9 constituted by a centrifugal fan which does not degrade its air-blowing performance even though it has a smaller depthwise size, whereby the blower fan 9 can have a reduced depthwise size at its center portion which forms the air-suction

portion. Therefore, the heat-source-room rear-surface wall 14, through which the shaft of the motor 13 penetrates, has such a shape as to have a concavity toward the heating room (toward the front surface) at its portion proximal to the motor 13, wherein the motor 13 is placed inside this concavity. This results in reduction of the depthwise size of the combination of the heat-source room 8 and the driving room 12.

[0068] As illustrated in Fig. 1, in the heating cooker according to the first embodiment, the heat-source-room rear-surface wall 14 is formed as described above, and the motor 13 is placed inside the concavity in the heat-source-room rear-surface wall 14, so that the heat-source room 8 has a reduced depthwise size, at its portion proximal to the motor 13 (its center portion). At the other portion (the outer peripheral portion) of the heat-source room 8 than its portion proximal to the motor 13, the heat-source room 8 is made to have a larger depthwise size than that of its center portion, thereby securing a space for placing, therein, the heater 11 as a heating portion as a heat source. Further, in the heating cooker according to the first embodiment, there are secured spaces for placing, therein, the first flow-path formation portion 30A and the second flow-path formation portion 30B at predetermined positions outside the heater 11. Particularly, there are secured air-flow paths within the heat-source room 8, which are formed by the first flow-path formation portion 30A and the second flow-path formation portion 30B. Further, inside the heat-source room 8, the heater 11 is placed, such that the position of the center of the thickness (the depthwise length) of the heater 11 is in the rear of the position of the center of the depthwise length of the blades of the blower fan 9.

[0069] Hereinafter, there will be described heating operations in the heating cooker according to the first embodiment of the present invention. In the heating cooker according to the first embodiment, for example, in cases of performing oven cooking, the cooking plates 5 on which objects 10 to be heated such as cookies are placed are engaged with the supporting portions 4 provided in the left and right wall surfaces of the heating room 2 and, further, these cooking plates 5 are inserted into the heating room 2. The cooking plates 5 are pushed until they come into contact with the partition wall 15 which forms the rear-surface wall of the heating room 2 and, then, the door 14 is closed so that the heating room 2 forms a heating space. Manipulations are performed on predetermined buttons in a manipulation portion (not illustrated) provided in the front surface of the main body 1, which starts oven cooking in the heating cooker.

[0070] Through the manipulation portion, cooking conditions such as the heating time and the heating temperature for the objects 10 to be heated are set. Signals indicative of the cooking conditions having been set through the manipulation portion are inputted to the control portion 24 constituted by a microcomputer. The control portion 24 drives and controls the heater 11, the motor 13 and the like, based on the signals indicative of the

cooking conditions.

[0071] The rotation of the motor 13 causes the blower fan 9, which is constituted by a centrifugal fan, to start a rotating operation. Due to the rotating operation of the blower fan 9, outward air flows in a spiral shape are blown from the outer peripheral portion of the blower fan 9. Air flows blown from the blower fan 9 are heated by the heater 11 placed in such a way as to surround the outer peripheral portion of the blower fan 9 to form air flows at a higher temperature (hot air flows). Further, portions of air flows from the blower fan 9 come into contact with the inclined portions 30Aa and 30Ba of the first flow-path formation portion 30A and the second flow-path formation portion 30B, which are provided at positions to the left and right of the blower fan 9, and, thus, these portions of air flows are guided thereby toward the heat-source-room rear-surface wall 14 in the rear side of the heat-source room 8. Out of the air flows having been guided to the rear side of the heat-source room 8, larger amounts of air flows are flowed toward the heater 11 placed slightly in the rear of the blower fan 9 and, thus, are heated thereby to form air flows at a higher temperature (hot air flows).

[0072] Out of the hot air flows having been blown toward the outer-periphery side from the blower fan 9 and heated by the heater 11 as described above, hot air flows blown to above the blower fan 9 are blown into the heating room 2 through the upper blow-off port 17A in the partition wall 15, while hot air flows blown to below the blower fan 9 are blown into the heating room 2 through the lower blow-off port 17B. These hot air flows are flowed in outward directions in a spiral shape along the direction of the rotation of the blower fan 9, so that the hot air flows from the upper blow-off port 17A are flowed in directions to the ceiling surface 21 and the right side surface 19 of the heating room 2, while the hot air flows from the lower blow-off port 17B are flowed in directions to the bottom surface 20 and the left side surface 18 of the heating room 2. Further, as described above, the upper blow-off port 17A and the lower blow-off port 17B, which are constituted by a plurality of punched holes, are formed to have a band shape elongated in the horizontal direction and, further, to be narrower and longer than the shape of the left blow-off port 23A and the right blow-off port 23B, which are formed from a plurality of punched holes (see Fig. 3).

[0073] Further, in the heat-source room 8, out of the hot air flows having been blown toward the outer-periphery side from the blower fan 9 and heated by the heater 11, hot air flows blown in the leftward and rightward directions of the blower fan 9 are brought into contact with the first flow-path formation portion 30A and the second flow-path formation portion 30B and, thus, are guided thereby toward the heat-source-room rear-surface wall 14 which forms the rear surface of the heat-source room 8. The hot air flows guided to the heat-source-room rear-surface wall 14 flow along the heat-source-room rear-surface wall 14 and change their directions at the left and right end portions of the heat-source room 8 and, further,

are directed toward the first flow-path formation portion 30A and the second flow-path formation portion 30B, again. Thus, the hot air flows are guided by the rear surfaces of the first flow-path formation portion 30A and the second flow-path formation portion 30B and, then, are blown into the heating room 2 through the respective blow-off ports 23A and 23B.

[0074] At this time, the hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B are flowed, within the heat-source room 8, in directions from its left and right end portions toward the center, and, therefore, they are blown toward substantially the center of the heating room 2. Namely, the hot air flows blown into the heating room 2 through both the left and right blow-off ports 23A and 23B are directed toward the objects 10 to be heated within the heating room 2 and, thus, are flowed in such a way as to intensively heat the objects 10 to be heated. Accordingly, the hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B are prevented from directly heating the wall surfaces of the heating room 2.

[0075] As described above, with the heating cooker according to the first embodiment, greater parts of hot air flows blown to the inside of the heating room 2 through the left and right blow-off ports 23A and 23B from the heat-source room 8 can be concentrated on the objects 10 to be heated. As a result, with the heating cooker according to the first embodiment, it is possible to largely reduce heating losses due to intensive heating of the wall surfaces of the heating room 2 by hot air flows, which enables efficiently heating the inside of the heating room, thereby enabling efficient heating cooking for the objects to be heated. Accordingly, with the heating cooker according to the first embodiment, it is possible to reduce times for pre-heating the heating room and cooking times, thereby enabling speed-up for cooking.

[0076] Further, with the heating cooker according to the first embodiment, since the heat-source-room rear-surface wall is provided with a concavity, and the motor 13 is placed in the concavity, the driving room 12 and the heat-source room 8 which are placed in the rear of the heating room 2 are enabled to have reduced thicknesses at their portions coupled to each other. With the structure of the heating cooker according to the first embodiment, it is possible to provide a heating cooker with excellent energy-saving performance which is capable of having a reduced depthwise size over the entire device while maintaining the capacity of the heating room.

[0077] Further, while the heating cooker according to the first embodiment has been described with respect to an example where the heater 11 is constituted by a substantially-annular shaped sheathed heater, it is also possible to employ, as a heater, a sheathed heater having a surface provided with a plurality of heat dissipation fins, which enables efficiently heating air from the blower fan 9.

[0078] Further, while the heating cooker according to the first embodiment has been described with respect to

an example where the first flow-path formation portion 30A and the second flow-path formation portion 30B are secured (adhered through staking or welding) to the partition wall 15 which forms the rear-surface wall of the heating room 2, the first flow-path formation portion 30A and the second flow-path formation portion 30B can be also adapted to be secured to other members constituting the heat-source room 8, such that they are placed at pre-determined positions with respect to the left and right blow-off ports 23A and 23B.

(Second Embodiment)

[0079] Hereinafter, there will be described a heating cooker according to a second embodiment of the present invention, with reference to the accompanying Fig. 4. The heating cooker according to the second embodiment of the present invention is different from the heating cooker according to the aforementioned first embodiment, in terms of the structure of flow-path formation portions provided within a heat-source room. Accordingly, the heating cooker according to the second embodiment will be described with respect to the flow-path formation portions, in particular, and elements having the same functions and structures as those of the heating cooker according to the first embodiment will be designated by the same reference characters, and the aforementioned description of the first embodiment will be substituted for the description.

[0080] Fig. 4 is a plan cross-sectional view illustrating the heat-source room and a driving room in the rear of a heating room in the heating cooker according to the second embodiment. As illustrated in Fig. 4, the heating cooker according to the second embodiment is different from the heating cooker according to the first embodiment, in terms of the shapes of a first flow-path formation portion 40A and a second flow-path formation portion 40B which are provided on a partition wall 15 which forms a rear-surface wall of the heating room 2. In the heating cooker according to the second embodiment, the first flow-path formation portion 40A and the second flow-path formation portion 40B are formed to include respective inclined portions 40Aa and 40Ba formed from curved surfaces. The first flow-path formation portion 40A is constituted by the inclined portion 40Aa having a concave surface which faces a left blow-off port 23A, and a fixed portion 40Ab for securing it to the partition wall 15 which forms the rear-surface wall of the heating room 2. Further, the second flow-path formation portion 40B is constituted by the inclined portion 40Ba having a concave surface which faces a right blow-off port 23B, and a fixed portion 40Bb for securing it to the partition wall 15, similarly to the first flow-path formation portion 40A.

[0081] Further, while the heating cooker according to the second embodiment will be described with respect to an example where the first flow-path formation portion 40A and the second flow-path formation portion 40B are secured (adhered through staking or welding) to the par-

tion wall 15, the first flow-path formation portion 40A and the second flow-path formation portion 40B can be also adapted to be secured to other members constituting the heat-source room 8 such that they are placed at predetermined positions with respect to the left and right blow-off ports 23A and 23B.

[0082] Further, in the heating cooker having the aforementioned structure according to the second embodiment, in the heat-source room 8, hot air flows blown in the leftward and rightward directions of the blower fan 9 are brought into contact with the guide surface formed from the smooth curved surface (the convex surface) in the inclined portion 40Aa in the first flow-path formation portion 40A and the guide surface formed from the smooth curved surface (the convex surface) in the inclined portion 40Ba in the second flow-path formation portion 40B and, then, these hot air flows are guided thereby toward the heat-source-room rear-surface wall 14 which forms the rear-surface wall of the heat-source room. The hot air flows guided to the heat-source-room rear-surface wall 14 flow along the heat-source-room rear-surface wall 14, then change their airflow directions at the left and right end portions of the heat-source room 8 and, further, are directed toward the inclined portion 40Aa in the first flow-path formation portion 40A, again. Further, the hot air flows are guided by the smooth curved surface (the concave surface) in the opposite side from the guide surface of the inclined portion 40Aa and the smooth curved surface (the concave surface) in the opposite side of the inclined portion 40Ba and, then, are blown into the heating room 2 through the respective blow-off ports 23A and 23B.

[0083] At this time, the hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B are flowed, within the heat-source room 8, in directions from its left and right end portions toward the center, and, therefore, they are blown toward substantially the center of the heating room 2 from the left and right blow-off ports 23A and 23B. Namely, the hot air flows blown into the heating room 2 through both the left and right blow-off ports 23A and 23B are directed toward objects 10 to be heated within the heating room 2 and, thus, are flowed in such a way as to intensively heat the objects 10 to be heated.

[0084] Further, in the first flow-path formation portion 40A and the second flow-path formation portion 40B, at the fixed-portion sides of the curved surfaces in the respective inclined portions (the guide surfaces), it is possible to adjust the angle between the partition wall 15 and the end portions of these curved surfaces, which can adjust the airflow directions of hot air flows blown off into the heating room 2 through the left and right blow-off ports 23A and 23B.

[0085] With the heating cooker according to the second embodiment, the respective inclined portions 40Aa and 40Ba in the first flow-path formation portion 40A and the second flow-path formation portion 40B are formed to have the smooth curved surfaces (the guide surfaces),

so that hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B can be directed toward the front side of the heating room 2, more smoothly than with the heating cooker according to the aforementioned first embodiment.

[0086] As described above, with the heating cooker according to the second embodiment, hot air flows blown off into the heating room 2 through the left and right blow-off ports 23A and 23B from the heat-source room 8 can be caused to smoothly change their directions and, thus, can be flowed in directions toward the front side and the center. As a result, it is possible to largely reduce heating losses due to intensive heating of the wall surfaces of the heating room 2 by hot air flows, which enables efficiently heating the inside of the heating room 2, thereby enabling efficient heating cooking for the objects 10 to be heated. Accordingly, with the heating cooker according to the second embodiment, it is possible to reduce times for pre-heating the heating room 2 and cooking times, thereby enabling speed-up for cooking.

(Third Embodiment)

[0087] Hereinafter, there will be described a heating cooker according to a third embodiment of the present invention, with reference to the accompanying Figs. 5 and 6. The heating cooker according to the third embodiment of the present invention is different from the heating cooker according to the aforementioned first embodiment, in terms of the structure of flow-path formation portions provided within a heat-source room. Accordingly, the heating cooker according to the third embodiment will be described with respect to the flow-path formation portions, in particular, and elements having the same functions and structures as those of the heating cooker according to the first embodiment will be designated by the same reference characters, and the aforementioned description of the first embodiment will be substituted for the description.

[0088] Fig. 5 is a plan cross-sectional view illustrating the heat-source room and a driving room in the rear of a heating room in the heating cooker according to the third embodiment. Fig. 6 is a perspective view illustrating the interior of the heat-source room illustrated in Fig. 5, wherein a partition wall 15 which forms a rear-surface wall of the heating room is removed.

[0089] As illustrated in Fig. 5 and Fig. 6, in the heating cooker according to the third embodiment, a first flow-path formation portion 50A and a second flow-path formation portion 50B which are provided within the heat-source room 8 include respective inclined portions 50Aa and 50Ba and respective wing portions 50Ac and 50Bc.

[0090] The first flow-path formation portion 50A is formed in such a way as to cover the rear surface of a left blow-off port 23A with a predetermined interval interposed. The first flow-path formation portion 50A is constituted by the inclined portion 50Aa inclined (at about 45 degrees) with respect to the rear surface of the partition

wall 15, and the wing portion 50Ac which is continuous with an extended end portion of the inclined portion 50Aa and has a surface parallel with the rear surface of the partition wall 15. In this case, the surfaces of the inclined portion 50Aa and the wing portion 50Ac which are faced to the heat-source-room rear-surface wall 14 form a guide surface. The guide surface is adapted to guide portions of hot air flows blown in the centrifugal direction from a blower fan 9 toward the heat-source-room rear-surface wall 14.

[0091] Similarly, the second flow-path formation portion 50B is formed in such a way as to cover the rear surface of a right blow-off port 23B with a predetermined interval interposed. The second flow-path formation portion 50B is constituted by the inclined portion 50Ba inclined (at about 45 degrees) with respect to the rear surface of the partition wall 15, and the wing portion 50Bc which is continuous with an extended end portion of the inclined portion 50Ba and has a surface parallel with the rear surface of the partition wall 15. In this case, the surfaces of the inclined portion 50Ba and the wing portion 50Bc which are faced to the heat-source-room rear-surface wall 14 form a guide surface.

[0092] The wing portions 50Ac and 50Bc in the first flow-path formation portion 50A and the second flow-path formation portion 50B are placed such that there is a predetermined interval between them and the heat-source-room rear-surface wall 14, thereby forming air flow paths for passing hot air flows between the wing portions 50Ac and 50Bc and the heat-source-room rear-surface wall 14.

[0093] As illustrated in the perspective view of Fig. 6, the first flow-path formation portion 50A and the second flow-path formation portion 50B are extended to the upper and lower end portions of the heat-source room 8 and, thus, have the same length as the length of the heat-source-room rear-surface wall 14 in the upward and downward directions (the vertical direction). Accordingly, the first flow-path formation portion 50A and the second flow-path formation portion 50B are secured to the upper and lower end portions of an inner case 22 which forms the heat-source room 8 and, thus, are placed at predetermined positions.

[0094] With the heating cooker having the aforementioned structure according to the third embodiment, in the heat-source room 8, hot air flows blown in the leftward and rightward directions of the blower fan 9 are brought into contact with the inclined surface of the inclined portion 50Aa in the first flow-path formation portion 50A and the inclined surface of the inclined portion 50Ba in the second flow-path formation portion 50B and, then, the hot air flows are guided thereby toward the heat-source-room rear-surface wall 14, similarly to in the heating cookers according to the aforementioned first and second embodiments. The hot air flows guided to the heat-source-room rear-surface wall 14 flow along the heat-source-room rear-surface wall 14, then change their directions at the left and right end portions of the heat-source room

8 and, further, are directed toward the first flow-path formation portion 50A and the second flow-path formation portion 50B, again. Then, the hot air flows are guided by the inclined surface (the rear surface) of the inclined portion 50Aa in the first flow-path formation portion 50A and by the inclined surface (the rear surface) of the inclined portion 50Ba in the second flow-path formation portion 50B and, then, the hot air flows are blown off into the heating room 2 through the respective blow-off ports 23A and 23B.

[0095] At this time, the hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B are flowed, within the heat-source room 8, in directions from its left and right end portions toward the center, and, therefore, they are blown toward substantially the center of the heating room 2 from the left and right blow-off ports 23A and 23B. Namely, the hot air flows blown into the heating room 2 through both the left and right blow-off ports 23A and 23B are directed toward objects 10 to be heated within the heating room 2 and, thus, are flowed in such a way as to intensively heat the objects 10 to be heated.

[0096] As described above, with the heating cooker according to the third embodiment, hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B from the heat-source room 8 can be flowed intensively toward the objects 10 to be heated. As a result, it is possible to largely reduce heating losses due to intensive heating of the wall surfaces of the heating room 2 by hot air flows, which enables efficiently heating the inside of the heating room, thereby enabling efficient heating cooking for the objects to be heated. Accordingly, with the heating cooker according to the third embodiment, it is possible to reduce times for pre-heating the heating room and cooking times, thereby enabling speed-up for cooking.

(Fourth Embodiment)

[0097] Hereinafter, there will be described a heating cooker according to a fourth embodiment of the present invention, with reference to the accompanying Figs. 7A, 7B and 8. The heating cooker according to the fourth embodiment of the present invention is different from the heating cooker according to the aforementioned first embodiment, in terms of the structure of flow-path formation portions provided within a heat-source room. Accordingly, the heating cooker according to the fourth embodiment will be described with respect to the flow-path formation portions, in particular, and elements having the same functions and structures as those of the heating cooker according to the first embodiment will be designated by the same reference characters, and the aforementioned description of the first embodiment will be substituted for the description.

[0098] Fig. 7A and Fig. 7B are plan cross-sectional views illustrating the heat-source room and a driving room in the rear of a heating room in the heating cooker

according to the fourth embodiment. Fig. 7A illustrates a state where the flow-path formation portions are at a temperature equal to or lower than a predetermined temperature, and Fig. 7B illustrates a state where the flow-path formation portions are at a temperature higher than the predetermined temperature. Fig. 8 is a perspective view of a partition wall 15 and the like in the heating cooker according to the fourth embodiment, when it is viewed at its rear-surface side.

[0099] In the heating cooker according to the fourth embodiment, in the heat-source room 8 in the rear of the heating room 2, there is formed a first flow-path formation portion 51A between a suction port 16 formed at the center portion of the partition wall 15 and a left blow-off port 23A formed to the left of the suction port 16. Similarly, there is formed a second flow-path formation portion 51B between the suction port 16 and a right blow-off port 23B formed to the right of the suction port 16. The first flow-path formation portion 51A and the second flow-path formation portion 51B are formed, such that they are secured at their one ends to the rear surface of the partition wall 15 and, further, are protruded, at the other ends, obliquely within the internal space of the heat-source room 8. The respective protruding end portions of the first flow-path formation portion 51A and the second flow-path formation portion 51B are placed, such that there is a predetermined interval between them and the heat-source-room rear-surface wall 14. Further, the first flow-path formation portion 51A and the second flow-path formation portion 51B are provided between the respective blow-off ports 23A and 23B and a heater 11 placed to surround a blower fan 9.

[0100] As illustrated in Fig. 7A and Fig. 7B, on the rear surface of the partition wall 15, the first flow-path formation portion 51A and the second flow-path formation portion 51B at positions to the left and right of the suction port 16 are formed to include fixed portions 51Ab and 51Bb secured to the partition wall 15, and inclined portions 51Aa and 51Ba which are inclined outwardly with respect to the flat surface formed by the partition wall 15. The fixed portions 51Ab and 51Bb are placed near the center sides of the left and right blow-off ports 23A and 23B on the rear surface, and the inclined portions 51Aa and 51Ba are obliquely extended in such a way as to cover the rear-surface sides of the left and right blow-off ports 23A and 23B. There is a predetermined interval between the heat-source-room rear-surface wall 14 and the protruding end portions of the inclined portions 51Aa and 51Ba, which secures air-flow paths. The fixed portions 51Ab and 51Bb are mounting portions for securing the first flow-path formation portion 51A and the second flow-path formation portion 51B to the partition wall 15, and these fixed portions 51Ab and 51Bb are secured to the partition wall 15 through staking or welding.

[0101] In the fourth embodiment, the first flow-path formation portion 51A and the second flow-path formation portion 51B are each made of a bimetal formed from two metal plates with different thermal expansion coefficients

which are attached to each other or made of a shape memory alloy. The first flow-path formation portion 51A and the second flow-path formation portion 51B having the aforementioned structure has the function of changing the airflow directions of hot air flows depending on the temperature of the hot air flows.

[0102] As illustrated in Fig. 7A, when the first flow-path formation portion 51A and the second flow-path formation portion 51B are at a temperature equal to or lower than the predetermined temperature, the inclined portions 51Aa and 51Ba in the first flow-path formation portion 51A and the second flow-path formation portion 51B are mounted such that they are outwardly opened at an angle of about 45 degrees with respect to the partition wall 15. Since the first flow-path formation portion 51A and the second flow-path formation portion 51B are made of a bimetal formed from two metal plates with different thermal expansion coefficients which are attached to each other or made of a shape memory alloy, they have the function of changing airflow directions inside the heat-source room 8.

[0103] As illustrated in Fig. 7B, when the first flow-path formation portion 51A and the second flow-path formation portion 51B are at a temperature higher than the predetermined temperature, the inclined portions 51Aa and 51Ba in the first flow-path formation portion 51A and the second flow-path formation portion 51B are positioned in such a way as to be inclined outwardly at an angle of about 60 degrees with respect to the partition wall 15. It is preferable that this inclination angle can be changed within the range of 30 degrees to 70 degrees.

[0104] In the heating cooker according to the fourth embodiment, as illustrated in Fig. 8, the first flow-path formation portion 51A and the second flow-path formation portion 51B, which are provided at positions to the left and the right of the suction port 16, are formed such that they are shorter than the length of the partition wall 15 but longer than the length of the left and right blow-off ports 23A and 23B, in the vertical direction. Further, the first flow-path formation portion 51A and the second flow-path formation portion 51B are provided in such a way as to cover at least center-side areas of the left blow-off port 23A and the right blow-off port 23B.

[0105] Further, although there has been described an example where the first flow-path formation portion 51A and the second flow-path formation portion 51B are formed such that they are longer than the length of the left and right blow-off ports 23A and 23B in the upward and downward directions, the present invention is not limited to this structure, and they can be also formed such that they are shorter than the length of the left and right blow-off ports in the upward and downward directions, according to specifications of the heating device, and the like.

[0106] In the heating cooker according to the fourth embodiment, the heat-source room 23 and the driving room 12 are made to have smaller depthwise sizes at their portions coupled to each other, in order to cause

the main body 1 including the heat-source room 8 including the blower fan 9 and the heater 11 and the driving room 12 including a motor 13 to have a smaller depthwise size, while maintaining the internal capacity of the heating room 2.

[0107] The heating cooker according to the fourth embodiment employs the blower fan 9 constituted by a centrifugal fan which does not degrade its air-blowing performance even though it has a smaller depthwise size, whereby the blower fan 9 can have a reduced depthwise size at its center portion which forms the air-suction portion. Therefore, the heat-source-room rear-surface wall 14, through which the shaft of the motor 13 penetrates, has such a shape as to have a concavity toward the heating room (toward the front surface) at its portion proximal to the motor 13, wherein the motor 13 is placed inside this concavity. This results in reduction of the depthwise size of the combination of the heat-source room 8 and the driving room 12.

[0108] As illustrated in Fig. 7A and 7B, in the heating cooker according to the fourth embodiment, the heat-source-room rear-surface wall 14 is formed as described above, and the motor 13 is placed inside the concavity, so that the heat-source room 8 has a reduced depthwise size, at its portion proximal to the motor 13 (its center portion). At the other portion (the outer peripheral portion) of the heat-source room 8 than its portion proximal to the motor 13, the heat-source room 8 is made to have a larger depth-wise size than that of its center portion, thereby securing a space for placing the heater 11. Further, in the heating cooker according to the fourth embodiment, there are secured spaces for placing the first flow-path formation portion 51A and the second flow-path formation portion 51B at predetermined positions outside the heater 11. Particularly, there are secured air-flow paths within the heat-source room 8 which are formed by the first flow-path formation portion 51A and the second flow-path formation portion 51B. Further, inside the heat-source room 8, the heater 11 is placed slightly in the rear of the position of the center of the depthwise length of the blades of the blower fan 9.

[0109] Hereinafter, there will be described heating operations in the heating cooker according to the fourth embodiment of the present invention. In the heating cooker according to the fourth embodiment, for example, in cases of performing oven cooking, cooking plates 5 on which objects 10 to be heated such as roast chickens are placed are engaged with supporting portions 4 provided in the left and right wall surfaces of the heating room 2 and, further, these cooking plates 5 are inserted into the heating room 2. The cooking plates 5 are pushed until they come into contact with the partition wall 15 and, then, a door 14 is closed so that the heating room 2 forms a heating space. Manipulations are performed on predetermined buttons in a manipulation portion (not illustrated), which is electrically connected to a control portion 24, which starts oven cooking in the heating cooker.

[0110] Through the manipulation portion, cooking con-

ditions such as the heating time and the heating temperature for the objects 10 to be heated are set. Signals indicative of the cooking conditions set through the manipulation portion are inputted to the control portion 24 constituted by a microcomputer. The control portion 24 controls the heater 11, the motor 13 and the like, based on the signals indicative of the cooking conditions.

[0111] Due to the rotation of the motor 13, the blower fan 9 starts a rotating operation. Due to the rotating operation of the blower fan 9, air flows are blown outwardly in a spiral shape from the outer peripheral portion of the blower fan 9, which is constituted by a centrifugal fan. Air flows from the blower fan 9 are heated by the heater 11 placed in such a way as to surround the outer peripheral portion of the blower fan 9 to form air flows at a higher temperature (hot air flows). Further, portions of air flows from the blower fan 9 come into contact with the inclined portions 51Aa and 51Ba of the first flow-path formation portion 51A and the second flow-path formation portion 51B, which are provided at positions to the left and right of the blower fan 9, and, thus, these portions of air flows are guided thereby toward the heat-source-room rear-surface wall 14 in the rear side of the heat-source room 8. Out of the air flows having been guided to the rear side of the heat-source room 8, larger amounts of air flows are flowed toward the heater 11 placed slightly in the rear of the blower fan 9 and are heated thereby to form air flows at a higher temperature (hot air flows).

[0112] Out of hot air flows having been blown toward the outer-periphery side from the blower fan 9 and heated by the heater 11 as described above, hot air flows blown to above the blower fan 9 are blown into the heating room 2 through an upper blow-off port 17A in the partition wall 15, while hot air flows blown to below the blower fan 9 are blown into the heating room 2 through a lower blow-off port 17B (see Fig. 8). These hot air flows are flowed in outward directions in a spiral shape along the direction of the rotation of the blower fan 9, so that the hot air flows from the upper blow-off port 17A are flowed in directions to the ceiling surface 21 and the right side surface 19 of the heating room 2, while the hot air flows from the lower blow-off port 17B are flowed in directions to the bottom surface 20 and the left side surface 18 of the heating room 2.

[0113] Further, in the heat-source room 8, out of hot air flows having been blown toward the outer-periphery side from the blower fan 9 and heated by the heater 11, hot air flows blown in the leftward and rightward directions of the blower fan 9 are brought into contact with the first flow-path formation portion 51A and the second flow-path formation portion 51B, further change their directions within the heat-source room 8 and, then, are blown into the heating room 2 through the respective blow-off ports 23A and 23B.

[0114] Further, in an initial stage of a heating operation which is illustrated in Fig. 7A, for example, when the first flow-path formation portion 51A and the second flow-path formation portion 51B are at a temperature equal to or

lower than the predetermined temperature (for example, when it is equal to or lower than 150 degrees C), hot air flows from the blower fan 9 are brought into contact with the respective inclined portions 51Aa and 51B forming the respective guide surfaces in the first flow-path formation portion 51A and the second flow-path formation portion 51B and, thus, these hot air flows are guided thereby toward the heat-source-room rear-surface wall 14 and, then, are flowed along the heat-source-room rear-surface wall 14. Further, the hot air flows change their directions at the left and right end portions of the heat-source room 8 and, further, are directed toward the first flow-path formation portion 51A and the second flow-path formation portion 51B, again. Thus, the hot air flows are guided by the rear surfaces of the first flow-path formation portion 51A and the second flow-path formation portion 51B and, then, are blown into the heating room 2 through the respective blow-off ports 23A and 23B. Therefore, the hot air flows from the blow-off ports 23A and 23B are blown toward substantially the center of the heating room 2.

[0115] Further, in a heating operation illustrated in Fig. 7B, for example, when the first flow-path formation portion 51A and the second flow-path formation portion 51B are at a temperature higher than the predetermined temperature (for example, when it is higher than 150 degrees C), hot air flows from the blower fan 9 are brought into contact with the respective inclined portions 51Aa and 51B in the first flow-path formation portion 51A and the second flow-path formation portion 51B and, thus, these hot air flows are directed thereby toward the heat-source-room rear-surface wall 14, then change their directions at the heat-source-room rear-surface wall 14, then are guided to the first flow-path formation portion 51A and the second flow-path formation portion 51B again and, then, are blown into the heating room 2 through the respective blow-off ports 23A and 23B. Therefore, the hot air flows from the blow-off ports 23A and 23B are blown into the heating room 2 substantially in parallel with the forward direction.

[0116] As described above, the heating cooker according to the fourth embodiment is adapted such that, in heating operations, in a heating initial stage, hot air flows are blown into the heating room 2 through the left and right blow-off ports 23A and 23B in different directions from those in subsequent heating operation stages. This enables efficiently heating the inside of the heating room during heating operations and, further, enables heating cooking according to conditions of objects to be heated within the heating room. The heating cooker according to the fourth embodiment is adapted such that hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B are directed toward the objects 10 to be heated within the heating room 2 until a predetermined condition is satisfied, which enables intensively heating the objects 10 to be heated.

[0117] As described above, with the heating cooker according to the fourth embodiment, hot air flows blown

into the inside of the heating room 2 through the left and right blow-off ports 23A and 23B from the heat-source room 8 can be concentrated on the objects 10 to be heated. As a result, with the heating cooker according to the fourth embodiment, it is possible to largely reduce heating losses due to intensive heating of the wall surfaces of the heating room 2 by hot air flows, which enables efficient heating cooking for the objects to be heated. Accordingly, with the heating cooker according to the fourth embodiment, it is possible to reduce times for pre-heating the heating room and cooking times, thereby enabling speed-up for cooking.

[0118] With the heating cooker according to the fourth embodiment, since the temperature of the heater 11 is raised to raise the temperature of hot air flows with the elapse of the heating time, the first flow-path formation portion 51A and the second flow-path formation portion 51B, which are made of a bimetal, are deformed due to the difference in thermal expansion coefficient between the metal plates attached to each other. Namely, as illustrated in Fig. 7B, the oblique portions 51Aa and 51Ba (the guide surfaces) of the first flow-path formation portion 51A and the second flow-path formation portion 51B are increased in inclination angle with respect to the partition wall 15 and, thus, these oblique portions 51Aa and 51Ba (the guide surfaces) are erected in the vertical direction with respect to the partition wall 15.

[0119] As described above, in heating operations with the heating cooker according to the fourth embodiment, due to the change of the inclination angle of the first flow-path formation portion 51A and the second flow-path formation portion 51B, the airflow directions of hot air flows blown off into the heating room 2 through the left and right blow-off ports 23A and 23B are changed from directions to the center of the heating room 2 to such directions as to surround the ingredients as the objects 10 to be heated, thereby attaining such an airflow-direction change as to prevent hot air flows from directly impinging on the objects 10 to be heated. Accordingly, in cases where the objects 10 to be heated are ingredients which tend to cause burnt-color unevenness, it is possible to change the airflow directions in such a way as to prevent hot air flows from directly impinging on the ingredients after the hot air flows have been raised to a higher temperature. Therefore, with the heating cooker according to the fourth embodiment, it is possible to prevent burnt-color unevenness in the objects 10 to be heated.

[0120] As described above, with the heating cooker according to the fourth embodiment, due to the provision of the first flow-path formation portion 51A and the second flow-path formation portion 51B, hot air flows created by the blower fan 9 and the heater 11 within the heat-source room 8 are caused to be blown toward the center of the heating room 2 through the left and right blow-off ports 23A and 23B and, therefore, these hot air flows are prevented from directly heating the wall surfaces forming the heating room 2. As a result, the heating cooker according to the fourth embodiment forms an energy-saving

cooking device capable of efficiently heating objects to be heated.

[0121] Further, by changing the angle of the inclined parts of the respective inclined portions 51Aa and 51Ba (the guide surfaces) in the first flow-path formation portion 51A and the second flow-path formation portion 51B, it is possible to change the airflow directions of hot air flows from the left and right blow-off ports 23A and 23B during heating operations. As a result, with the heating cooker according to the fourth embodiment, in cases of objects to be heated which tend to cause burnt-color unevenness, it is possible to heat the objects to be heated in such a way as to cause hot air flows to surround the objects to be heated in airflow directions along the side wall surfaces, without causing hot air flows to directly impinge on the objects to be heated.

[0122] Further, the heating cooker according to the fourth embodiment can be also structured to blow off hot air flows toward the center of the heating room during pre-heating of the heating room 2 and to blow off hot air flows such that they surround objects to be heated during cooking operations with hot air flows having been raised to above a predetermined temperature. With the heating cooker having this structure, it is possible to change the airflow directions of hot air flows blown into the heating room for heating objects to be heated within the heating room, which can improve the cooking performance.

[0123] Further, if hot air flows from the blow-off ports 23A and 23B directly impinge on the objects 10 to be heated within the heating room 2, hot air flows ejected from the blow-off ports 23A and 23B may be immediately flowed to the suction port 16 in a short-circuit manner, depending on conditions such as the temperature and the velocity of the hot air flows, which may prevent hot air flows from sufficiently spreading throughout the inside of the heating room 2. Further, if hot air flows from the blow-off ports 23A and 23B directly impinge on the objects 10 to be heated within the heating room 2, this may prevent the objects to be heated from being efficiently heated, depending on conditions. In such cases, with the heating cooker according to the fourth embodiment, it is possible to change the airflow directions of hot air flows during heating operations, which enables efficiently heating the heating room 2 and, also, enables efficiently cooking the objects 10 to be heated.

(Fifth Embodiment)

[0124] Hereinafter, there will be described a heating cooker according to a fifth embodiment of the present invention, with reference to the accompanying Figs. 9 to 11. The heating cooker according to the fifth embodiment of the present invention is different from the heating cooker according to the aforementioned first embodiment, in terms of the shape of flow-path formation portions provided within a heat-source room, the structure of a control portion and the control method. Accordingly, the heating cooker according to the fifth embodiment will be de-

scribed with respect to the flow-path formation portions and the control portion, in particular, and elements having the same functions and structures as those of the heating cooker according to the first embodiment will be designated by the same reference characters, and the aforementioned description of the first embodiment will be substituted for the description.

[0125] Fig. 9 is a plan cross-sectional view illustrating the heat-source room and a driving room in the rear of a heating room in the heating cooker according to the fifth embodiment. Fig. 10 is a block diagram illustrating the structure of the control portion 24 in the heating cooker according to the fifth embodiment. Fig. 11 is a pattern diagram illustrating operation processes for heating cooking with the heating cooker according to the fifth embodiment.

[0126] In the heating cooker according to the fifth embodiment, as illustrated in Fig. 9, a first flow-path formation portions 52A and a second flow-path formation portion 52B which are provided at left and right positions on a partition wall 15 are formed to cover left and right blow-off ports 23A and 23B, respectively. The first flow-path formation portions 52A and the second flow-path formation portion 52B are structured to include fixed portions 52Ab and 52Bb secured to the partition wall 15, and curved-surface portions 52Aa and 52Ba having concave curved surfaces faced to the respective blow-off ports 23A and 23B. The curved-surface portions 52Aa and 52Ba are formed to cover the rear-surface sides of the left and right blow-off ports 23A and 23B, and there is a predetermined interval between the heat-source-room rear-surface wall 14 and the protruding end portions of the curved-surface portions 52Aa and 52Ba. The fixed portions 52Ab and 52Bb are mounting portions for securing the first flow-path formation portion 52A and the second flow-path formation portion 52B to the partition wall 15, and these fixed portions 52Ab and 52Bb are secured to the partition wall 15 through staking or welding.

[0127] The first flow-path formation portion 52A and the second flow-path formation portion 52B having the aforementioned structure are adapted to send portions of hot air flows having been heated by a heater 11 toward the heat-source-room rear-surface wall 14 for causing them to largely round inside the heat-source room 8. Further, the first flow-path formation portion 52A and the second flow-path formation portion 52B are adapted to guide, again, hot air flows having largely rounded inside the heat-source room 8 for causing them to be forwardly blown off toward the door 3 into the heating room 2 through the left and right blow-off ports 23A and 23B. Accordingly, with the heating cooker according to the fifth embodiment, it is possible to smoothly change the airflow directions of hot air flows blown off into the heating room 2 through the left and right blow-off ports 23A and 23B to directions to the front side and the center of the heating room 2, unlike the structure of the heating cooker according to the aforementioned first embodiment.

[0128] As illustrated in Fig. 10, in the heating cooker

according to the fifth embodiment, the control portion 24 is provided with a timer portion 25, an airflow-direction determination portion 26, an operation-condition storage portion 27, and a rotational-speed control portion 28. The timer portion 25 is for measuring running times for heating cooking and the like. The airflow-direction determination portion 26 is a portion for determining and deciding airflow directions of hot air flows supplied to the inside of the heating room 2.

[0129] The operation-condition storage portion 27 stores predetermined operation conditions of respective driving components which are electrically connected to the control portion 24, such as a motor 13, for heating cooking operations. The rotational-speed control portion 28 is a portion which is capable of changing the rotational speed of the motor 13 for a blower fan 9 for controlling the amount and the velocity of hot air flows created thereby for controlling the airflow directions of air flows within the heating room 2, wherein this portion constitutes an airflow-direction changing means.

[0130] In the heating cooker having the aforementioned structure according to the fifth embodiment, at first, a user selects a mode of pre-heating at a predetermined temperature (for example, 250 degrees C) and starts a pre-heating operation, through button manipulations on the manipulation portion (not illustrated), without introducing the cooking plates 5. After the start of the pre-heating operation, as illustrated in Fig. 11, the timer portion 25 starts measuring the elapsed time in the pre-heating mode. Further, in Fig. 11, the horizontal axis represents the time, wherein it is assumed that the pre-heating mode is started at a time T_s .

[0131] Further, at the same time as the start of the pre-heating operation, the control portion 24 starts energization of the heater 11 and the motor 13. At this time, based on operation conditions of the motor 13 in the pre-heating mode, which are stored in the operation-condition storage portion 27 in the control portion 24, the airflow-direction determination portion 26 performs a determination, and the rotational-speed control portion 28 sets the rotational speed of the motor 13 at "Medium Speed".

[0132] In the pre-heating mode, the motor 13 having been set to "Medium Speed" is driven, which causes the blower fan 9 to rotate, thereby causing hot air flows to be blown in the centrifugal direction by being energized by the blower fan 9. Portions of hot air flows from the blower fan 9 are guided to the first flow-path formation portion 52A and the second flow-path formation portion 52B and, further, are blown in directions to the front side of the heating room 2 through the left and right blow-off ports 23A and 23B. At this time, these hot air flows blown have a not-high velocity and, therefore, are drawn by flows being sucked by the suction port 16 at the center, so that hot air flows blown through the blow-off ports 23A and 23B are directed toward the center of the heating room 2.

[0133] This can prevent hot air flows from the left and right blow-off ports 23A and 23B from being directly blown onto the wall surfaces of the heating room 2, which can

prevent the temperatures of the wall surfaces of the heating room 2 from being raised to above the temperature of air in the heating room 2. Accordingly, with the heating cooker according to the fifth embodiment, it is possible to prevent the temperatures of the wall surfaces of the heating room 2 from being raised to above the temperature of air within the heating room 2, which can reduce the amount of heat dissipation to the outside through the wall surfaces of the heating room 2, thereby increasing the heating efficiency. This enables completing the pre-heating operation with higher efficiency in a relatively-shorter time period.

[0134] The heating cooker according to the fifth embodiment is structured to notify the user of the completion of the pre-heating operation, through an annunciation sound (display light) and the like, when the temperature within the heating room 2 has reached a predetermined temperature (250 degrees C, for example). On recognizing the completion of the pre-heating operation through the annunciation sound and the like, the user introduces, into the heating room 2, the cooking plates 5 on which objects 10 to be heated such as roast chickens are placed and, then, he or she closes the door 3 in the heating room 2. Thereafter, the user manipulates a predetermined button in the manipulation portion (not illustrated) to start a cooking operation through oven cooking (an oven mode) with the heating cooker (the oven mode is started at a time T_1).

[0135] At this time, the timer portion 25 starts measurement of the elapsed time in the oven mode. At the same time, the airflow-direction determination portion 26 determines operation conditions of the motor 13, based on operation conditions of the motor 13 in the oven mode, which are stored in the operation-condition storage portion 27. The rotational-speed control portion 28, to which signals from the airflow-direction determination portion 26 have been inputted, sets the rotational speed of the motor 13 to "Medium Speed", in an initial stage in the oven mode.

[0136] If the airflow-direction determination portion 26 detects the elapse of a predetermined time (for example, 2 minutes) since the start of the oven mode, based on signals inputted from the timer portion 25, the rotational-speed control portion 28 changes and sets the rotational speed of the motor 13 to "High Speed", based on signals from the airflow-direction determination portion 26 (the high-speed operation in the oven mode is started at a time T_2).

[0137] In the oven mode, due to the change in the motor 13 to high-speed rotations, a larger amount of hot air flows are generated from the blower fan 9, further are guided to the first flow-path formation portion 52A and the second flow-path formation portion 52B and, further, are blown in directions to the front side of the heating room 2 through the left and right blow-off ports 23A and 23B. At this time, hot air flows blown through the left and right blow-off ports 23A and 23B have a sufficient velocity and, therefore, are flowed in airflow directions substan-

tially parallel with the left and right side surface walls, without being drawn by flows being sucked by the suction port 16. Namely, hot air flows from the left and right blow-off ports 23A and 23B are caused to heat the objects 10 to be heated in such a way as to surround them, without being directly blown onto the objects 10 to be heated.

[0138] With the heating cooker having the aforementioned structure according to the fifth embodiment, hot air flows created by the blower fan 9 and the heater 11 within the heat-source room 8 are guided to the first flow-path formation portion 52A and the second flow-path formation portion 52B, further largely round in left and right sides within the heat-source room 8 to change their airflow directions and, then, are blown off through the respective blow-off ports 23A and 23B toward the center of the heating room 2 or in directions parallel with the left and side wall surface walls, rather than being directly blown off into the heating room 2 through the two blow-off ports 23A and 23B in the left and right sides. Accordingly, with the structure of the heating cooker according to the fifth embodiment, hot air flows blown through the left and right blow-off ports 23A and 23B are prevented from being directly directed toward the wall surfaces of the heating room 2.

[0139] Accordingly, with the structure of the heating cooker according to the fifth embodiment, it is possible to prevent hot air flows blown through the left and right blow-off ports 23A and 23B from directly heating the wall surfaces of the heating room 2 to raise the wall surfaces of the heating room 2 to higher temperatures than that of the objects 10 to be heated. With the heating cooker according to the fifth embodiment, it is possible to reduce losses due to heat dissipation through the wall surfaces of the heating room, thereby enabling efficiently heating the objects to be heated. As a result, with the heating cooker according to the fifth embodiment, it is possible to enable speed-up for pre-heating of the heating room 2 and for heating cooking.

[0140] With the heating cooker according to the fifth embodiment, it is possible to change the airflow directions of hot air flows blown through the left and right blow-off ports 23A and 23B, through the placement of the flow-path formation portions and adjustments of the rotational speed of the motor 13, which enables heating the objects 10 to be heated in such a way as to cause hot air flows to surround the objects 10 to be heated in airflow directions parallel with the side surface walls of the heating room, without causing hot air flows from directly impinging on the objects 10 to be heated.

[0141] Further, with the heating cooker according to the fifth embodiment, it is possible to change the airflow directions for performing heating, such that hot air flows are blown off toward the center of the heating room 2 during operations for pre-heating the heating room 2, and such that hot air flows surround the objects 10 to be heated during cooking. Accordingly, with the heating cooker according to the fifth embodiment, it is possible to further improve the cooking performance.

[0142] With ordinary heating cookers, if hot air flows are directly impinged on objects to be heated, hot air flows blown off from the blow-off ports may immediately return to the suction port in a short-circuit manner, depending on conditions such as the temperature and the velocity of hot air flows, which may prevent hot air flows from sufficiently spreading through the inside of the heating room. This may induce a phenomenon of significant degradation of the efficiency of heating the objects to be heated within the heating room. The heating cooker according to the fifth embodiment of the invention of the present application is adapted to change the airflow directions for heating, such that hot air flows surround the objects 10 to be heated during cooking and, therefore, has higher efficiency for heating the objects to be heated and higher cooking performance.

[0143] Further, the heating cooker according to the fifth embodiment is capable of easily changing the airflow directions of hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B during heating cooking, since it includes the airflow-direction changing means capable of changing the rotational speed of the blower fan 9 for changing the airflow directions.

[0144] The heating cooker according to the fifth embodiment includes the control portion 24 which drives the airflow-direction changing means for controlling the airflow directions. The control portion 24 includes the timer portion 25 for measuring the elapsed time during heating cooking, the airflow-direction determination portion 26 for determining and deciding the airflow directions of hot air flows based on inputs from the timer portion 25, and the operation-condition storage portion 27 which stores operation conditions of the motor 13 and the like for respective set conditions. The control portion 24 controls the airflow directions of hot air flows blown off into the heating room 2 through the left and right blow-off ports 23A and 23B in the partition wall 15 according to heating processes. As described above, the heating cooker according to the fifth embodiment is capable of controlling the airflow directions of hot air flows blown off through the left and right blow-off ports 23A and 23B and, therefore, is capable of changing the airflow directions of hot air flows supplied to the inside of the heating room 2 to preferable airflow directions, according to heating processes.

[0145] Further, while the heating cooker according to the fifth embodiment has been described as being structured to change the airflow directions with the airflow-direction determination portion 26 based on only inputs from the timer portion 25, the present invention is not limited to this structure and, for example, it is also possible to provide sensors for detecting the temperature and the burnt colors in objects 10 to be heated and to change the airflow directions of hot air flows through the blow-off ports 23A and 23B with the airflow-direction determination portion 26, based on outputs from these sensors.

(Sixth Embodiment)

[0146] Hereinafter, there will be described a heating cooker according to a sixth embodiment of the present invention, with reference to the accompanying Fig. 12. The heating cooker according to the sixth embodiment of the present invention is different from the heating cooker according to the aforementioned fifth embodiment, in terms of control methods with a control portion. Accordingly, the heating cooker according to the sixth embodiment will be described with respect to the control methods with the control portion, in particular. In the description of the sixth embodiment, elements having the same functions and structures as those of the heating cookers according to the first to fifth embodiments will be designated by the same reference characters, and the aforementioned descriptions of the respective embodiments will be substituted for the description.

[0147] Fig. 12 is a pattern diagram illustrating operation processes for heating cooking with the heating cooker according to the sixth embodiment. As illustrated in Fig. 12, at first, a user selects a pre-heating mode and starts a pre-heating operation, through button manipulations on a manipulation portion, without introducing cooking plates 5. After the start of the pre-heating operation, as illustrated in Fig. 12, a timer portion 25 starts measuring the elapsed time in the pre-heating mode. Further, in Fig. 12, the horizontal axis represents the time, wherein it is assumed that the pre-heating mode is started at a time T_s .

[0148] Further, at the same time as the start of the pre-heating operation, the control portion 24 starts energization of a heater 11 and a motor 13. At this time, based on operation conditions of the motor 13 in the pre-heating mode, which are stored in an operation-condition storage portion 27 in the control portion 24, an airflow-direction determination portion 26 performs a determination, and a rotational-speed control portion 28 sets the rotational speed of the motor 13 at "Medium Speed".

[0149] In the pre-heating mode, the motor 13 having been set to "Medium Speed" is driven, which causes a blower fan 9 to rotate, thereby causing air flows to be blown in the centrifugal direction by being energized by the blower fan 9. Portions of hot air flows from the blower fan 9 are guided to a first flow-path formation portion 52A and a second flow-path formation portion 52B and, further, are blown in directions to the front side of the heating room 2 through left and right blow-off ports 23A and 23B. At this time, these hot air flows blown have a not-high velocity and, therefore, are drawn by flows being sucked by a suction port 16 at the center, so that air flows through the blow-off ports 23A and 23B are directed toward the center of the inside of the heating room 2. Since hot air flows through the blow-off ports 23A and 23B are directed toward the center of the inside of the heating room 2 as described above, it is possible to complete the pre-heating operation with higher efficiency in a relatively-shorter time period.

[0150] The heating cooker according to the sixth embodiment is structured to notify the user of the completion of the pre-heating operation, through an annunciation sound (display light) and the like, when the temperature within the heating room 2 has reached a predetermined temperature (180 degrees C, for example). On recognizing the completion of the pre-heating operation through the annunciation sound and the like, the user introduces, into the heating room 2, the cooking plates 5 on which objects 10 to be heated such as cookies are placed and, then, he or she closes the door 3 in the heating room 2. Thereafter, the user manipulates a predetermined button in the manipulation portion (not illustrated) to start a cooking operation through oven cooking (an oven mode) with the heating cooker (the oven mode is started at a time T_1).

[0151] At this time, the timer portion 25 starts measurement of the elapsed time in the oven mode. At the same time, the airflow-direction determination portion 26 determines operation conditions of the motor 13, based on operation conditions of the motor 13 in the oven mode, which are stored in the operation-condition storage portion 27. The rotational-speed control portion 28, to which signals from the airflow-direction determination portion 26 have been inputted, sets the rotational speed of the motor 13 to "High Speed", in an initial stage in the oven mode (the oven mode is started at a time T_1).

[0152] Since the motor 13 is set to high-speed rotations in the oven mode, increased amounts of hot air flows from the blower fan 9 are guided to the first flow-path formation portion 52A and the second flow-path formation portion 52B, so that increased amounts of hot air flows are blown in directions to the front side of the heating room 2 through the left and right blow-off ports 23A and 23B.

[0153] At this time, hot air flows blown off through the left and right blow-off ports 23A and 23B have a sufficient velocity and, therefore, are flowed in airflow directions substantially parallel with the left and right side surface walls, without being drawn by flows being sucked by the suction port 16. Namely, hot air flows from the left and right blow-off ports 23A and 23B are caused to heat the objects 10 to be heated in such a way as to surround them, without being directly blown onto the objects 10 to be heated.

[0154] With the heating cooker having the aforementioned structure according to the sixth embodiment, it is possible to change the airflow directions of hot air flows blown off through the left and right blow-off ports 23A and 23B. Accordingly, in cases of objects 10 to be heated which tend to cause burnt-color unevenness, such as cookies, it is possible to blow off hot air flows in such a way as to flow them in parallel with the side surface walls of the heating room for causing them to surround the objects 10 to be heated for heating them, without causing hot air flows from directly impinging on the objects 10 to be heated.

[0155] Further, the heating cooker according to the sixth embodiment is structured to change the airflow di-

rections for performing heating, such that hot air flows are blown off toward the center of the inside of the heating room 2 during operations for pre-heating the heating room 2, and such that hot air flows are blown off in such a way as to surround objects 10 to be heated during cooking operations. Accordingly, with the heating cooker according to the sixth embodiment, it is possible to enable both speed-up for pre-heating and improvement of the cooking performance.

[0156] As described above, the heating cooker according to the sixth embodiment is structured to change the airflow directions of hot air flows blown off into the heating room 2 through the left and right blow-off ports 23A and 23B in the partition wall 15 according to respective heating processes during heating operations. Therefore, the heating cooker according to the sixth embodiment is capable of supplying hot air flows blown into the heating room, while changing the airflow directions to preferable airflow directions, according to heating processes.

(Seventh Embodiment)

[0157] Hereinafter, there will be described a heating cooker according to a seventh embodiment of the present invention, with reference to the accompanying Figs. 13 and 14. The heating cooker according to the seventh embodiment of the present invention is different from the heating cooker according to the aforementioned first embodiment, in terms of the structure of flow-path formation portions provided within a heat-source room. Accordingly, the heating cooker according to the seventh embodiment will be described with respect to the flow-path formation portions, in particular, and elements having the same functions and structures as those of the heating cooker according to the first embodiment will be designated by the same reference characters, and the aforementioned description of the first embodiment will be substituted for the description.

[0158] Fig. 13 is a plan cross-sectional view illustrating the heat-source room and a driving room in the rear of a heating room in the heating cooker according to the seventh embodiment. As illustrated in Fig. 13, the heating cooker according to the seventh embodiment is different from the heating cooker according to the first embodiment, in terms of the structure of a first flow-path formation portion 61A and a second flow-path formation portion 62 which are provided on a partition wall 15. Fig. 14 is a perspective view of the partition wall 15 which forms a rear-surface wall of the heating room 2 in the heating cooker according to the seventh embodiment, when it is viewed at its rear side.

[0159] The partition wall 15 forming the rear-surface wall of the heating room 2 is provided, on its the rear surface facing the heating-source room 8, with the first flow-path formation portion 61 between a left blow-off port 23A and a suction port 16 at the center. Further, the partition wall 15 is provided, on its rear surface, with the second flow-path formation portion 62 between a right

blow-off port 23B and the suction port 16 at the center. The first flow-path formation portion 61 and the second flow-path formation portion 62 are formed, such that they are secured at their one ends to the rear surface of the partition wall 15 and, further, are protruded, at the other ends, within the internal space of the heat-source room 8. The respective protruding end portions of the first flow-path formation portion 61 and the second flow-path formation portion 62 are placed, such that there is a predetermined gap between them and the heat-source-room rear-surface wall 14. Further, the first flow-path formation portion 61 and the second flow-path formation portion 62 are provided between the respective blow-off ports 23A and 23B and a heater 11 placed to surround a blower fan 9. The blower fan 9, the heater 11, the first flow-path formation portion 61 and the second flow-path formation portion 62 are provided within the internal space of the heat-source room 8 constituted by the partition wall 15 and an inner case 22 including the heat-source-room rear-surface wall 14.

[0160] As illustrated in Fig. 13 and Fig. 14, the first flow-path formation portion 61 is constituted by a longitudinal flow-path formation portion 61A and a lateral flow-path formation portion 61B, and the second flow-path formation portion 62 is constituted by a longitudinal flow-path formation portion 62A and a lateral flow-path formation portion 62B. The respective longitudinal flow-path formation portion 61A and 62A in the first flow-path formation portion 61 and the second flow-path formation portion 62 include fixed portions 61Ab and 62Ab secured to the partition wall 15, and inclined portions 61Aa and 61Ba which are inclined to be opened outwardly at an angle of about 45 degrees with respect to the flat surface formed by the partition wall 15. The fixed portions 61Ab and 62Ab are placed at positions closer to the center than the left and right blow-off ports 23A and 23B, respectively. The inclined portions 61Aa and 62Aa in the respective longitudinal flow-path formation portions 61A and 62A are extended in such a way as to cover the center-sides of the left and right blow-off ports 23A and 23B. The fixed portions 61Ab and 62Ab in the respective longitudinal flow-path formation portions 61A and 62A are mounting portions for securing the respective longitudinal flow-path formation portions 61A and 62A to the partition wall 15, and these fixed portions 61Ab and 62Ab are certainly secured to the partition wall 15 through staking or welding.

[0161] Further, the respective lateral flow-path formation portion 61B and 62B in the first flow-path formation portion 61 and the second flow-path formation portion 62 include fixed portions 61Bb and 62Bb secured to the partition wall 15, and block portions 61Ba and 62Ba which are orthogonal to the flat surface formed by the partition wall 15.

[0162] In the seventh embodiment, the first flow-path formation portion 61 and the second flow-path formation portion 62 are each integrally formed from a folded metal plate. Further, the material of the first flow-path formation

portion 61 and the second flow-path formation portion 62 is not limited to a metal and can be any material having enough thermal resistance to maintain their shapes.

[0163] In the first flow-path formation portion 61, the longitudinal flow-path formation portion 61A and the lateral flow-path formation portion 61B are placed in an L shape and are formed integrally with each other. The first flow-path formation portion 61 formed as described above is placed along a portion of the upper side and the center side (the suction-port side) of the periphery of the left blow-off port 23A. The longitudinal flow-path formation portion 61A includes surfaces parallel with the normal direction (the vertical direction), while the lateral flow-path formation portion 61B includes surfaces parallel with the horizontal direction.

[0164] Further, in the seventh embodiment, the longitudinal flow-path formation portion 61A and the lateral flow-path formation portion 61B are structured to include surfaces which are parallel with the normal direction and the horizontal direction, respectively. However, the present invention is not limited to this structure, and the longitudinal flow-path formation portion and the lateral flow-path formation portion can be placed at positions which form an appropriate angle, according to specifications of this heating device, and the like.

[0165] The longitudinal flow-path formation portion 61A is placed between the blower fan 9 and the left blow-off port 23A and is placed at a position at which hot air flows having been blown in the leftward direction from the blower fan 9 and heated by the heater 11. come into contact. On the other hand, the lateral flow-path formation portion 61B is placed downstream from the longitudinal flow-path formation portion 61A in the direction of the rotation of the blower fan 9 and proximally to the downstream-side of the left blow-off port. The lateral flow-path formation portion 61B is provided in such a way as to block portions of hot air flows from the blower fan 9 and to cause them to be blown off through the left blow-off port 23A.

[0166] The second flow-path formation portion 62 is structured similarly to the first flow-path formation portion 61, wherein the longitudinal flow-path formation portion 62A and the lateral flow-path formation portion 62B are placed in an L shape and are formed integrally with each other. The second flow-path formation portion 62 is placed in an L shape, along a portion of the lower side and the center side of the right blow-off port 23B. The longitudinal flow-path formation portion 62A includes surfaces parallel with the normal direction (the vertical direction), while the lateral flow-path formation portion 62B includes surfaces parallel with the horizontal direction. The longitudinal flow-path formation portion 62A is placed between the blower fan 9 and the right blow-off port 23B and is placed at a position at which hot air flows having been blown in the rightward direction from the blower fan 9 and heated by the heater 11 come into contact. On the other hand, the lateral flow-path formation portion 62B is placed downstream from the longitudinal

flow-path formation portion 62A in the direction of the rotation of the blower fan 9 and, thus, is provided in such a way as to block portions of hot air flows from the blower fan 9 and to cause them to be blown off through the right blow-off port 23B.

[0167] As illustrated in Fig. 14, the respective inclined portions 61Aa and 62Aa (the guide surfaces) in the first flow-path formation portion 61 and the second flow-path formation portion 62 are formed such that they are shorter than the length of the partition wall 15 in the upward and downward directions but longer than the length of the left and right blow-off ports 23A and 23B in the upward and downward directions. Further, the inclined portions 61Aa and 62Aa (the guide surfaces) are provided in such a way as to cover portions of the left and right blow-off ports 23A and 23B, respectively.

[0168] In the heating cooker according to the seventh embodiment, the heat-source room 8 and the driving room 12 are made to have smaller depthwise sizes at their portions coupled to each other, in order to cause the main body 1 including the heat-source room 8 including the blower fan 9 and the heater 11 and the driving room 12 including the motor 13 to have a smaller depthwise size, while maintaining the internal capacity of the heating room 2.

[0169] The heating cooker according to the seventh embodiment employs the blower fan 9 constituted by a centrifugal fan which does not degrade its air-blowing performance even though it has a smaller depthwise size, whereby the blower fan 9 can have a reduced depthwise size at its center portion which forms the suction portion. Therefore, the heat-source-room rear-surface wall 14, through which the shaft of the motor 13 penetrates, has such a shape as to have a concavity toward the heating room (toward the front surface) at its portion proximal to the motor 13, wherein the motor 13 is placed inside this concavity. This results in reduction of the depthwise size of the portions of the heat-source room 8 and the driving room 12 which are coupled to each other.

[0170] As illustrated in Fig. 13, in the heating cooker according to the seventh embodiment, the heat-source-room rear-surface wall 14 is formed as described above, and the motor 13 is placed inside the concavity, so that the heat-source room 8 has a reduced depthwise size, at its portion proximal to the motor 13 (its center portion). At the other portion (the outer peripheral portion) of the heat-source room 8 than its portion proximal to the motor 13, the heat-source room 8 is made to have a larger depthwise size than that of its center portion, thereby securing a space for placing, therein, the heater 11, the first flow-path formation portion 61 and the second flow-path formation portion 62 at predetermined positions and, further, securing air flow paths inside the heat-source room 8. Particularly, there are certainly secured air-flow paths which are formed by the first flow-path formation portion 61 and the second flow-path formation portion 62. Further, inside the heat-source room 8, the heater 11 is placed slightly in the rear of the position of the center of

the depthwise length of the blades of the blower fan 9.

[0171] Hereinafter, there will be described heating operations with the heating cooker according to the seventh embodiment of the present invention. In the heating cooker according to the seventh embodiment, for example, in cases of performing oven cooking, cooking plates 5 on which objects 10 to be heated such as cookies are placed are engaged with supporting portions 4 provided in the left and right wall surfaces of the heating room 2 and, further, these cooking plates 5 are inserted into the heating room 2. The cooking plates 5 are pushed thereinto until they come into contact with the partition wall 15 which forms the rear-surface wall of the heating room 2 and, then, the door 14 is closed so that the heating room 2 forms a heating space. Manipulations are performed on predetermined buttons in a manipulation portion (not illustrated) provided in the front surface of the main body 1, which starts oven cooking with the heating cooker.

[0172] Through the manipulation portion, cooking conditions such as the heating time and the heating temperature for the objects 10 to be heated are set. Signals indicative of the cooking conditions having been set through the manipulation portion are inputted to a control portion 24 constituted by a microcomputer. The control portion 24 drives and controls the heater 11, the motor 13 and the like, based on the signals indicative of the cooking conditions.

[0173] The rotation of the motor 13 causes the blower fan 9 to start a rotating operation. Due to the rotating operation of the blower fan 9, outward air flows in a spiral shape are blown from the outer peripheral portion of the blower fan 9, which is constituted by a centrifugal fan. Air flows blown from the blower fan 9 are heated by the heater 11 placed in such a way as to surround the outer peripheral portion of the blower fan 9 to form air flows at a higher temperature. Further, portions of air flows from the blower fan 9 come into contact with the inclined portions 61Aa and 62Aa of the first flow-path formation portion 61 and the second flow-path formation portion 62, which are provided at positions to the left and right of the blower fan 9, and, thus, these portions of air flows are guided thereby toward the heat-source-room rear-surface wall 14 in the rear side of the heat-source room 8. Out of the air flows having been guided to the rear side of the heat-source room 8, larger amounts of air flows are flowed toward the heater 11 placed slightly in the rear of the blower fan 9 and, thus, are heated thereby to form air flows at a higher temperature (hot air flows).

[0174] Further, in the heating cooker according to the seventh embodiment, the block portions 61Ba and 62Ba in the first flow-path formation portion 61 and the second flow-path formation portion 62 are adapted to block and collect portions of outward air flows in a spiral shape from the outer peripheral portion of the blower fan 9 and to guide these portions of air flows in such a way as to flow them through the left and right blow-off ports 23A and 23B. Therefore, the heating cooker according to the seventh embodiment is adapted such that larger amounts

of air flows are blown off through the left and right blow-off ports 23A and 23B.

[0175] Out of hot air flows having been blown toward the outer-periphery side from the blower fan 9 and heated by the heater 11 as described above, hot air flows blown to above the blower fan 9 are blown into the heating room 2 through an upper blow-off port 17A in the partition wall 15, while hot air flows blown to below the blower fan 9 are blown into the heating room 2 through a lower blow-off port 17B. These hot air flows are flowed in outward airflow directions in a spiral shape along the direction of the rotation of the blower fan 9, so that the hot air flows through the upper blow-off port 17A are flowed in directions to the ceiling surface 21 and the right side surface 19 of the heating room 2, while the hot air flows through the lower blow-off port 17B are flowed in directions to the bottom surface 20 and the left side surface 18 of the heating room 2.

[0176] Further, in the heat-source room 8, out of hot air flows having been blown toward the outer-periphery side from the blower fan 9 and heated by the heater 11, hot air flows blown in the leftward and rightward directions of the blower fan 9 are brought into contact with the inclined portions 61Aa and 62Aa (the guide surfaces) of the first flow-path formation portion 61 and the second flow-path formation portion 62 and, thus, these hot air flows are guided thereby toward the heat-source-room rear-surface wall 14. The hot air flows guided to the heat-source-room rear-surface wall 14 flow along the heat-source-room rear-surface wall 14, further change their airflow directions at the left and right end portions of the heat-source room 8 and, further, are directed toward the first flow-path formation portion 61 and the second flow-path formation portion 62, again. Next, the hot air flows are guided by the rear surfaces (the surfaces opposite from the guide surfaces) of the inclined portions 61Aa and 62Aa of the first flow-path formation portion 61 and the second flow-path formation portion 62 and, then, are blown into the heating room 2 through the respective blow-off ports 23A and 23B.

[0177] At this time, the hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B are flowed, within the heat-source room 8, in directions from its left and right end portions toward the center. Therefore, they are blown toward substantially the center of the heating room 2. Namely, the hot air flows blown into the heating room 2 through both the left and right blow-off ports 23A and 23B are directed toward the objects 10 to be heated within the heating room 2 and, thus, are flowed in such a way as to intensively heat the objects 10 to be heated.

[0178] As described above, with the heating cooker according to the seventh embodiment, hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B from the heat-source room 8 can be flowed in such a way as to intensively heat the objects 10 to be heated. As a result, with the heating cooker according to the seventh embodiment, it is possible to

largely reduce heating losses due to intensive heating of the wall surfaces of the heating room 2 by hot air flows, which enables efficiently heating the heating room 2, thereby enabling efficient heating cooking for the objects 10 to be heated. Accordingly, with the heating cooker according to the seventh embodiment, it is possible to reduce times for pre-heating the heating room and cooking times, thereby enabling speed-up for cooking.

(Eighth Embodiment)

[0179] Hereinafter, there will be described a heating cooker according to an eighth embodiment of the present invention, with reference to the accompanying Fig. 15. The heating cooker according to the eighth embodiment of the present invention is different from the heating cookers according to the aforementioned first and seventh embodiments, in terms of the structure of flow-path formation portions provided within a heat-source room. Accordingly, the heating cooker according to the eighth embodiment will be described with respect to the flow-path formation portions, in particular, and elements having the same functions and structures as those of the heating cookers according to the first and seventh embodiments will be designated by the same reference characters, and the aforementioned descriptions of the first and seventh embodiments will be substituted for the description.

[0180] Fig. 15 is a plan cross-sectional view illustrating the heat-source room and a driving room in the rear of a heating room in the heating cooker according to the eighth embodiment. As illustrated in Fig. 15, the heating cooker according to the eighth embodiment is different from the heating cooker according to the seventh embodiment, in terms of the shape of a first flow-path formation portion 63 and a second flow-path formation portion 64 which are provided on a partition wall 15 which forms a rear-surface wall of the heating room 2. In the heating cooker according to the eighth embodiment, the first flow-path formation portion 63 and the second flow-path formation portion 64 include respective inclined portions (guide surfaces) which are formed from curved surfaces.

[0181] The first flow-path formation portion 63 is integrally structured to include a longitudinal flow-path formation portion 63A and a lateral flow-path formation portion 63B, similarly to the first flow-path formation portion 61 according to the aforementioned seventh embodiment illustrated in Fig. 14. The longitudinal flow-path formation portion 63A includes an inclined portion having a concave surface which faces a left blow-off port 23A, and a fixed portion for securing it to a partition wall 15 which forms a rear-surface wall of the heating room 2. Further, the lateral flow-path formation portion 63B includes a block portion having a horizontal surface, and a fixed portion for securing it to the partition wall 15 which forms the rear-surface wall of the heating room 2.

[0182] Further, the second flow-path formation portion 64 is integrally structured to include a longitudinal flow-

path formation portion 64A and a lateral flow-path formation portion 64B, similarly to the first flow-path formation portion 63. The longitudinal flow-path formation portion 64A includes an inclined portion having a concave surface which faces a right blow-off port 23B, and a fixed portion for securing it to the partition wall 15. Further, the lateral flow-path formation portion 64B includes a block portion having a horizontal surface, and a fixed portion for securing it to the partition wall 15.

[0183] Further, while the heating cooker according to the eighth embodiment will be described with respect to an example where the first flow-path formation portion 63 and the second flow-path formation portion 64 are secured (adhered through staking or welding) to the partition wall 15, the first flow-path formation portion 63 and the second flow-path formation portion 64 can be also secured to other members constituting the heat-source room 8 and can be placed at predetermined positions with respect to the left and right blow-off ports 23A and 23B.

[0184] Further, in the heating cooker having the aforementioned structure according to the eighth embodiment, in the heat-source room 8, hot air flows blown in the leftward and rightward directions of the blower fan 9 are brought into contact with the guide surfaces formed from the smooth curved surface (the convex surface) of the inclined portion in the first flow-path formation portion 63 and the smooth curved surface (the convex surface) of the inclined portion in the second flow-path formation portion 64 and, thus, these hot air flows are guided thereby toward the heat-source-room rear-surface wall 14. The hot air flows guided to the heat-source-room rear-surface wall 14 flow along the heat-source-room rear-surface wall 14, further change their airflow directions at the left and right end portions of the heat-source room 8 to round therein and, further, flow toward the first flow-path formation portion 63 and the second flow-path formation portion 64, again. Thus, the hot air flows are guided by the surfaces opposite from the guide surfaces, which are formed from the smooth curved surface (the concave surface) of the inclined portion of the first flow-path formation portion 63 and the smooth curved surface (the concave surface) of the inclined portion of the second flow-path formation portion 64. Thus, these hot air flows are blown into the heating room 2 through the respective blow-off ports 23A and 23B.

[0185] At this time, the hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B are flowed, within the heat-source room 8, in directions from its left and right end portions toward the center. Therefore, the hot air flows are blown toward substantially the center of the heating room 2 through the left and right blow-off ports 23A and 23B. Namely, hot air flows blown into the heating room 2 through both the left and right blow-off ports 23A and 23B are directed toward the objects 10 to be heated within the heating room 2 and, thus, are flowed in such a way as to intensively heat the objects 10 to be heated.

[0186] Further, in the first flow-path formation portion 63 and the second flow-path formation portion 64, at the fixed-portion sides of the curved surfaces in the respective inclined portions (the guide surfaces), it is possible to adjust the angle between the partition wall 15 and the end portions of these curved surfaces, which can adjust the airflow directions of hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B.

[0187] With the heating cooker according to the eighth embodiment, the respective inclined portions (the guide surfaces) in the first flow-path formation portion 63 and the second flow-path formation portion 64 are formed from the smooth curved surfaces, so that hot air flows brown into the heating room 2 through the left and right blow-off ports 23A and 23B can be directed toward the front side of the heating room 2, more smoothly than with the heating cooker according to the aforementioned seventh embodiment.

[0188] As described above, with the heating cooker according to the eighth embodiment, it is possible to cause hot air flows blown off into the heating room 2 through the left and right blow-off ports 23A and 23B from the heat-source room 8 to smoothly change their directions to directions to the front side and the center, with respect to the objects 10 to be heated. As a result, it is possible to largely reduce heating losses due to intensive heating of the wall surfaces of the heating room 2 by hot air flows, which enables efficiently heating the heating room 2, thereby enabling efficient heating cooking for the objects 10 to be heated. Accordingly, with the heating cooker according to the eighth embodiment, it is possible to reduce times for pre-heating the heating room 2 and cooking times, thereby enabling speed-up for cooking.

(Ninth Embodiment)

[0189] Hereinafter, there will be described a heating cooker according to a ninth embodiment of the present invention, with reference to the accompanying Fig. 16 and Fig. 17. The heating cooker according to the ninth embodiment of the present invention is different from the heating cooker according to the aforementioned first embodiment, in terms of the structure of flow-path formation portions provided within a heat-source room. Accordingly, the heating cooker according to the ninth embodiment will be described with respect to the flow-path formation portions, in particular, and elements having the same functions and structures as those of the heating cooker according to the first embodiment will be designated by the same reference characters, and the aforementioned description of the first embodiment will be substituted for the description.

[0190] Fig. 16 is a plan cross-sectional view illustrating the heat-source room and a driving room in the rear of a heating room in the heating cooker according to the ninth embodiment. As illustrated in Fig. 16, the heating cooker according to the ninth embodiment is different from the

heating cooker according to the first embodiment, in terms of the structure of a first flow-path formation portion 65 and a second flow-path formation portion 66 which are provided on a partition wall 15 which forms a rear-surface wall of the heating room 2. Fig. 17 is a perspective view of the partition wall 15 which forms the rear-surface wall of the heating room 2 in the heating cooker according to the ninth embodiment, when it is viewed at its rear surface.

[0191] On the partition wall 15 which forms the rear-surface wall of the heating room 2, on the rear surface thereof facing the heat-source room 8, there is formed a first flow-path formation portion 65 between a left blow-off port 23A and a suction port 16 at the center. Further, on the rear surface of the partition wall 15, there is formed a second flow-path formation portion 66 between a right blow-off port 23B and the suction port 16 at the center. The first flow-path formation portion 65 and the second flow-path formation portion 66 are formed, such that they are secured at their one ends to the rear surface of the partition wall 15 and, further, are protruded, at the other ends, within the internal space of the heat-source room 8. The respective protruding end portions of the first flow-path formation portion 65 and the second flow-path formation portion 66 are placed, such that there is a predetermined gap between them and the heat-source-room rear-surface wall 14. Further, the first flow-path formation portion 65 and the second flow-path formation portion 66 are provided between the respective blow-off ports 23A and 23B and a heater 11 placed to surround a blower fan 9. The blower fan 9, the heater 11, the first flow-path formation portion 65 and the second flow-path formation portion 66 are provided inside the heat-source room 8 constituted by the partition wall 15, and an inner case 22 including the heat-source-room rear-surface wall 14.

[0192] As illustrated in Fig. 16 and Fig. 17, the first flow-path formation portion 65 is constituted by a longitudinal flow-path formation portion 65A, a lateral flow-path formation portion 65B and a ceiling flow-path formation portion 65C. Further, the second flow-path formation portion 66 is constituted by a longitudinal flow-path formation portion 66A, a lateral flow-path formation portion 66B, and a ceiling flow-path formation portion 66C. The respective longitudinal flow-path formation portions 65A and 66A in the first flow-path formation portion 65 and the second flow-path formation portion 66 include fixed portions 65Ab and 66Ab secured to the partition wall 15, and inclined portions 65Aa and 66Aa which are inclined to be opened outwardly at an angle of about 45 degrees with respect to the flat surface formed by the partition wall 15.

[0193] The inclined portions 65Aa and 66Aa in the respective longitudinal flow-path formation portions 65A and 66A are extended in such a way as to cover portions of the rear-surface sides of the left and right blow-off ports 23A and 23B, and there is a predetermined gap between the heat-source-room rear-surface wall 14 and the protruding end portions of the inclined portions 65Aa and

66Aa. The fixed portions 65Ab and 66Ab in the respective longitudinal flow-path formation portions 65A and 66A are mounting portions for securing the respective longitudinal flow-path formation portions 65A and 66A to the partition wall 15, and these fixed portions 65Ab and 66Ab are certainly secured to the partition wall 15 through staking or welding.

[0194] Further, the respective lateral flow-path formation portions 65B and 66B in the first flow-path formation portion 65 and the second flow-path formation portion 66 include fixed portions 65Bb and 66Bb secured to the partition wall 15, and block portions 65Ba and 66Ba which are orthogonal to the flat surface formed by the partition wall 15.

[0195] In the ninth embodiment, the first flow-path formation portion 65 and the second flow-path formation portion 66 are each integrally formed from a bent metal plate. Further, the material of the first flow-path formation portion 65 and the second flow-path formation portion 66 is not limited to a metal and can be any material having enough thermal resistance to maintain their shapes.

[0196] In the first flow-path formation portion 65, the longitudinal flow-path formation portion 65A and the lateral flow-path formation portion 65B are placed in an L shape and are placed along a portion of the upper side and the center side (the suction-port side) of the periphery of the left blow-off port 23A. Further, the longitudinal flow-path formation portion 65A and the lateral flow-path formation portion 65B are covered, at their end portions protruded toward the heat-source-room rear-surface wall 14, with the ceiling flow-path formation portion 65C forming the ceiling surface, so that they are formed integrally with one another. The first flow-path formation portion 65 having the aforementioned structure is adapted to surround the left blow-off port 23A in an L shape. The longitudinal flow-path formation portion 65A has surfaces parallel with the normal direction (the vertical direction), while the lateral flow-path formation portion 65B has surfaces parallel with the horizontal direction. The ceiling flow-path formation portion 65C is constituted by a surface which is substantially parallel with the partition wall 15.

[0197] Further, in the ninth embodiment, the longitudinal flow-path formation portion 65A and the lateral flow-path formation portion 65B are structured to include surfaces which are parallel with the normal direction and the horizontal direction, respectively. However, the present invention is not limited to this structure, and the longitudinal flow-path formation portion and the lateral flow-path formation portion can be placed at positions which form an appropriate angle, according to specifications of this heating device, and the like.

[0198] The longitudinal flow-path formation portion 65A is placed between the blower fan 9 and the left blow-off port 23A and is placed at a position at which hot air flows having been blown in the leftward direction from the blower fan 9 and heated by the heater 11 come into contact. On the other hand, the lateral flow-path forma-

tion portion 65B is placed downstream from the longitudinal flow-path formation portion 65A, proximally thereto, in the direction of the rotation of the blower fan 9, and, thus, the lateral flow-path formation portion 65B is provided in such a way as to block and collect portions of hot air flows from the blower fan 9 and to cause them to be blown off through the left blow-off port 23A.

[0199] The second flow-path formation portion 66 is formed similarly to the first flow-path formation portion 65, wherein the longitudinal flow-path formation portion 66A and the lateral flow-path formation portion 66B are placed in an L shape. Further, the longitudinal flow-path formation portion 66A and the lateral flow-path formation portion 66B are covered, at their end portions protruded toward the heat-source-room rear-surface wall 14, with the ceiling flow-path formation portion 66C forming the ceiling surface, so that they are formed integrally with one another. The second flow-path formation portion 66 having the aforementioned structure is placed in an L shape along a portion of the lower side and the center side of the outer side of the right blow-off port 23B. The longitudinal flow-path formation portion 66A has surfaces parallel with the normal direction (the vertical direction), while the lateral flow-path formation portion 66B has surfaces parallel with the horizontal direction. The ceiling flow-path formation portion 66C is constituted by a surface which is substantially parallel with the partition wall 15.

[0200] The longitudinal flow-path formation portion 66A is placed between the blower fan 9 and the right blow-off port 23B and is placed at a position at which hot air flows having been blown in the rightward direction from the blower fan 9 and heated by the heater 11 come into contact. On the other hand, the lateral flow-path formation portion 66B is placed downstream from the longitudinal flow-path formation portion 66A, proximally thereto, in the direction of the rotation of the blower fan 9, and, thus, the lateral flow-path formation portion 66B is provided in such a way as to block and collect portions of hot air flows from the blower fan 9 and to cause them to be blown off through the right blow-off port 23B.

[0201] As illustrated in Fig. 17, the respective inclined portions 65Aa and 66Aa (the guide surfaces) in the first flow-path formation portion 65 and the second flow-path formation portion 66 are formed such that they are shorter than the length of the partition wall 15 in the upward and downward directions but longer than the length of the left and right blow-off ports 23A and 23B in the upward and downward directions. Further, the respective inclined portions 65Aa and 66Aa (the guide surfaces) are provided in such a way as to cover portions of the left and right blow-off ports 23A and 23B.

[0202] In the heating cooker according to the ninth embodiment, the heat-source room 8 and the driving room 12 are made to have smaller depthwise sizes at their portions coupled to each other, in order to cause the main body 1 including the heat-source room 8 including the blower fan 9 and the heater 11 and the driving room 12

including the motor 13 to have a smaller depthwise size, while maintaining the internal capacity of the heating room 2.

[0203] The heating cooker according to the ninth embodiment employs the blower fan 9 constituted by a centrifugal fan which does not degrade its air-blowing performance even though it has a smaller depthwise size, whereby the blower fan 9 can have a reduced depthwise size at its center portion which forms the suction portion. Therefore, the heat-source-room rear-surface wall 14, through which the shaft of the motor 13 penetrates, has such a shape as to have a concavity toward the heating room (toward the front surface) at its portion proximal to the motor 13, wherein the motor 13 is placed inside this concavity. This results in reduction of the depthwise size of the combination of the heat-source room 8 and the driving room 12.

[0204] As illustrated in Fig. 16, in the heating cooker according to the ninth embodiment, the heat-source-room rear-surface wall 14 is formed as described above, and the motor 13 is placed inside the concavity, so that the heat-source room 8 has a reduced depth-wise size, at its portion proximal to the motor 13 (at its center portion). At the other portion (the outer peripheral portion) of the heat-source room 8 than its portion proximal to the motor 13, the heat-source room 8 is made to have a larger depthwise size than that of its center portion, thereby securing a space for placing, therein, the heater 11, the first flow-path formation portion 65 and the second flow-path formation portion 66 at predetermined positions and, further, securing air-flow paths within the heat-source room 8. Further, there are certainly secured air-flow paths formed by the first flow-path formation portion 65 and the second flow-paths formation portion 66. Further, inside the heat-source room 8, the heater 11 is placed slightly in the rear of the position of the center of the depthwise length of the blades of the blower fan 9.

[0205] Hereinafter, there will be described heating operations with the heating cooker according to the ninth embodiment of the present invention. In the heating cooker according to the ninth embodiment, for example, in cases of performing oven cooking, cooking plates 5 on which objects 10 to be heated such as cookies are placed are engaged with supporting portions 4 provided in the left and right wall surfaces of the heating room 2 and, further, these cooking plates 5 are inserted into the heating room 2. The cooking plates 5 are pushed thereinto until they come into contact with the partition wall 15 and, then, the door 14 is closed so that the heating room 2 forms a heating space. Manipulations are performed on predetermined buttons in a manipulation portion (not illustrated) provided in the front surface of the main body 1, which starts oven cooking in the heating cooker.

[0206] Through the manipulation portion, cooking conditions such as the heating time and the heating temperature for the objects 10 to be heated are set. Signals indicative of the cooking conditions having been set through the manipulation portion are inputted to a control

portion 24, which is constituted by a microcomputer. The control portion 24 controls the heater 11, the motor 13 and the like, based on the signals indicative of the cooking conditions.

[0207] The rotation of the motor 13 causes the blower fan 9 to start a rotating operation. Due to the rotating operation of the blower fan 9, outward air flows in a spiral shape are blown from the outer peripheral portion of the blower fan 9, which is constituted by a centrifugal fan. Air flows blown from the blower fan 9 are heated by the heater 11 placed in such a way as to surround the outer peripheral portion of the blower fan 9 to form air flows at a higher temperature. Further, portions of air flows from the blower fan 9 come into contact with the inclined portions 65Aa and 66Aa of the first flow-path formation portion 65 and the second flow-path formation portion 66, which are provided at positions to the left and right of the blower fan 9, and, thus, these portions of air flows are guided thereby toward the heat-source-room rear-surface wall 14 in the rear side of the heat-source room 8. Out of the air flows having been guided to the rear side of the heat-source room 8, larger amounts of air flows are flowed toward the heater 11 placed slightly in the rear of the blower fan 9 and, thus, are heated thereby to form air flows at a higher temperature.

[0208] Further, in the heating cooker according to the ninth embodiment, the block portions 65Ba and 66Bb in the first flow-path formation portion 65 and the second flow-path formation portion 66 are adapted to block and collect portions of outward air flows in a spiral shape from the outer peripheral portion of the blower fan 9 and to guide these portions of air flows in such a way as to flow them through the left and right blow-off ports 23A and 23B. Therefore, the heating cooker according to the ninth embodiment is structured such that larger amounts of air flows are blown off through the left and right blow-off ports 23A and 23B. Further, in the heating cooker according to the ninth embodiment, since the ceiling flow-path formation portions 65C and 66C are formed in the first flow-path formation portion 65 and the second flow-path formation portion 66, which can guide portions of outward air flows in a spiral shape from the outer peripheral portion of the blower fan 9 such that they are certainly flowed through the left and right blow-off ports 23A and 23B.

[0209] Out of hot air flows having been blown toward the outer-periphery side from the blower fan 9 and heated by the heater 11 as described above, hot air flows blown to above the blower fan 9 are blown into the heating room 2 through an upper blow-off port 17A in the partition wall 15. Further, hot air flows blown to below the blower fan 9 are blown into the heating room 2 through a lower blow-off port 17B. These hot air flows are flowed in outward airflow directions in a spiral shape along the direction of the rotation of the blower fan 9, so that the hot air flows through the upper blow-off port 17A are flowed in directions to the ceiling surface 21 and the right side surface 19 of the heating room 2, while the hot air flows through the lower blow-off port 17B are flowed in directions to the

bottom surface 20 and the left side surface 18 of the heating room 2.

[0210] Further, in the heat-source room 8, out of hot air flows having been blown toward the outer-periphery side from the blower fan 9 and heated by the heater 11, hot air flows blown in the leftward and rightward directions of the blower fan 9 are brought into contact with the inclined portions 65Aa and 66Aa (the guide surfaces) in the first flow-paths formation portion 65A and the second flow-path formation portion 66 and, thus, these hot air flows are guided thereby toward the heat-source-room rear-surface wall 14. The hot air flows guided to the heat-source-room rear-surface wall 14 flow along the heat-source-room rear-surface wall 14, further change their airflow directions at the left and right end portions of the heat-source room 8 to largely round and, further, flow toward the first flow-path formation portion 65 and the second flow-path formation portion 66, again. Next, the hot air flows are guided by the rear surfaces (the surfaces opposite from the guide surfaces) of the inclined portions 65Aa and 66Aa in the first flow-path formation portion 65 and the second flow-path formation portion 66 and, then, are blown into the heating room 2 through the respective blow-off ports 23A and 23B.

[0211] At this time, the hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B are flowed, within the heat-source room 8, in directions from its left and right end portions toward the center. Therefore, these hot air flows are blown toward substantially the center of the heating room 2. Namely, the hot air flows blown into the heating room 2 through both the left and right blow-off ports 23A and 23B are directed toward the objects 10 to be heated within the heating room 2 and, thus, are flowed in such a way as to intensively heat the objects 10 to be heated.

[0212] As described above, with the heating cooker according to the ninth embodiment, hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B from the heat-source room 8 can be flowed in such a way as to intensively heat the objects 10 to be heated. As a result, with the heating cooker according to the ninth embodiment, it is possible to largely reduce heating losses due to intensive heating of the wall surfaces of the heating room 2 by hot air flows, which enables efficiently heating the heating room 2, thereby enabling efficient heating cooking for the objects 10 to be heated. Accordingly, with the heating cooker according to the ninth embodiment, it is possible to reduce times for pre-heating the heating room and cooking times, thereby enabling speed-up for cooking.

(Tenth Embodiment)

[0213] Hereinafter, there will be described a heating cooker according to a tenth embodiment of the present invention, with reference to the accompanying Fig. 18. The heating cooker according to the tenth embodiment of the present invention is different from the heating cook-

ers according to the aforementioned first and ninth embodiments, in terms of the structure of flow-path formation portions provided within a heat-source room. Accordingly, the heating cooker according to the tenth embodiment will be described with respect to the flow-path formation portions, in particular, and elements having the same functions and structures as those of the heating cookers according to the first and ninth embodiment will be designated by the same reference characters, and the aforementioned descriptions of the first and ninth embodiments will be substituted for the description.

[0214] Fig. 18 is a plan cross-sectional view illustrating the heat-source room and a driving room in the rear of a heating room in the heating cooker according to the tenth embodiment. As illustrated in Fig. 18, the heating cooker according to the tenth embodiment is different from the heating cooker according to the ninth embodiment, in terms of the shape of a first flow-path formation portion 67 and a second flow-path formation portion 68 which are provided on a partition wall 15 which forms a rear-surface wall of the heating room 2. In the heating cooker according to the tenth embodiment, the first flow-path formation portion 67 and the second flow-path formation portion 68 include respective inclined portions (guide surfaces) formed from curved surfaces.

[0215] The first flow-path formation portion 67 is constituted by a longitudinal flow-path formation portion 67A, a lateral flow-path formation portion 67B and a ceiling flow-path formation portion 67C, similarly to the first flow-path formation portion 65 according to the aforementioned ninth embodiment illustrated in Fig. 16. The longitudinal flow-path formation portion 67A includes a fixed portion for securing it to the partition wall 15 which forms the rear-surface wall of the heating room 2, and an inclined portion having a concave surface which faces a left blow-off port 23A. The lateral flow-path formation portion 67B includes a fixed portion for securing it to the partition wall 15, and a block portion having a horizontal surface.

[0216] Further, the second flow-path formation portion 68 is constituted by a longitudinal flow-path formation portion 68A, a lateral flow-path formation portion 68B and a ceiling flow-path formation portion 68C, similarly to the first flow-path formation portion 67. The longitudinal flow-path formation portion 68A includes a fixed portion for securing it to the partition wall 15, and an inclined portion having a concave surface which faces a right blow-off port 23B. Further, the lateral flow-path formation portion 68B includes a fixed portion for securing it to the partition wall 15, and a block portion having a horizontal surface.

[0217] Further, while the heating cooker according to the tenth embodiment will be described with respect to an example where the first flow-path formation portion 67 and the second flow-path formation portion 68 are secured (adhered through staking or welding) to the partition wall 15, the first flow-path formation portion 67 and the second flow-path formation portion 68 can be also secured to other members constituting the heat-source

room 8 and can be provided at predetermined positions with respect to the left and right blow-off ports 23A and 23B.

[0218] In the heating cooker having the aforementioned structure according to the tenth embodiment, in the heat-source room 8, hot air flows blown in the leftward and rightward directions of the blower fan 9 are brought into contact with the smooth curved surface (the convex surface) in the inclined portion of the first flow-path formation portion 67 and the smooth curved surface (the convex surface) in the inclined portion of the second flow-path formation portion 68 and, thus, these hot air flows are guided thereby toward the heat-source-room rear-surface wall 14. The hot air flows guided to the heat-source-room rear-surface wall 14 flow along the heat-source-room rear-surface wall 14, further change their airflow directions at the left and right end portions of the heat-source room 8 to largely round therein and, further, flow toward the first flow-path formation portion 67 and the second flow-path formation portion 68, again. Thus, the hot air flows are guided by the surfaces opposite from the guide surfaces, which are formed from the smooth curved surface (the concave surface) in the inclined portion of the first flow-path formation portion 67 and the smooth curved surface (the concave surface) in the inclined portion of the second flow-path formation portion 68 and, then, these hot air flows are blown into the heating room 2 through the respective blow-off ports 23A and 23B.

[0219] At this time, the hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B are flowed, within the heat-source room 8, in directions from its left and right end portions toward the center. Therefore, the hot air flows are blown toward substantially the center of the heating room 2 through the left and right blow-off ports 23A and 23B. Namely, the hot air flows blown into the heating room 2 through both the left and right blow-off ports 23A and 23B are directed toward the objects 10 to be heated within the heating room 2 and, thus, are flowed in such a way as to intensively heat the objects 10 to be heated.

[0220] Further, in the first flow-path formation portion 67 and the second flow-path formation portion 68, at the fixed-portion sides of the curved surfaces in the respective inclined portions (the guide surfaces), it is possible to adjust the angle between the partition wall 15 and the end portions of these curved surfaces, which can adjust the airflow directions of hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B.

[0221] With the heating cooker according to the tenth embodiment, the respective inclined portions (the guide surfaces) in the first flow-path formation portion 67 and the second flow-path formation portion 68 are formed from the smooth curved surfaces, so that hot air flows brown into the heating room 2 through the left and right blow-off ports 23A and 23B can be directed toward the front side of the heating room 2, more smoothly than with

the heating cooker according to the aforementioned ninth embodiment.

[0222] As described above, with the heating cooker according to the tenth embodiment, it is possible to cause hot air flows blown into the heating room 2 through the left and right blow-off ports 23A and 23B from the heat-source room 8 to smoothly change their directions to flow in directions to the front side and the center. As a result, it is possible to largely reduce heating losses due to intensive heating of the wall surfaces of the heating room 2 by hot air flows, which enables efficiently heating the inside of the heating room 2, thereby enabling efficient heating cooking for the objects 10 to be heated. Accordingly, with the heating cooker according to the tenth embodiment, it is possible to reduce times for pre-heating the heating room 2 and cooking times, thereby enabling speed-up for cooking.

[0223] Further, with the heating cookers according to the aforementioned respective embodiments, since the heat-source-room rear-surface wall is provided with a concavity, and the motor 13 is placed in the concavity, it is possible to reduce the thicknesses of the driving room 12 and the heat-source room 8 which are placed in the rear of the heating room 2. This can provide a heating cooker with excellent energy-saving performance which enables reduction of the depthwise size of the entire device while maintaining the capacity of the heating room.

[0224] Further, while the heating cookers according to the aforementioned respective embodiments have been described with respect to examples where the heater 11 is constituted by an annular-shaped sheathed heater, it is also possible to employ, as a heater, a sheathed heater having a surface provided with a plurality of heat dissipation fins, which enables efficiently heating air from the blower fan 9.

[0225] Further, the heating device according to the present invention, which has been described by exemplifying the heating cookers according to the aforementioned respective embodiments, is structured such that a greater amount of hot air flows is blown off through the blow-off ports toward the center of the heating room, which enables efficiently heating objects to be heated within the heating room, thereby reducing times required for operations for pre-heating the heating room and times required for heating operations.

[0226] With the heating device according to the present invention, it is possible to change the airflow directions of hot air flows through the blow-off ports. Accordingly, in cases of objects to be heated which tend to cause burning unevenness with the heating cooker, it is possible to heat the objects to be heated in such a way as to cause hot air flows to surround the objects to be heated without causing hot air flows from directly impinging on these objects to be heated. Further, it is possible to change the airflow directions of hot air flows during heating operations.

Industrial Applicability

[0227] The present invention is adaptable to various types of heating devices, such as household microwave ovens and electric ovens which have convection-heating oven functions, various types of commercial oven heating devices, industrial heating devices such as drying devices, heating devices and sintering devices for use in ceramics, heating devices for use in biochemical reactions, and the like.

Reference Signs List

[0228]

1	Main body	
2	Heating room	
3	Door	
4	Supporting portion	
5	Cooking plate	
8	Heat-source room	
9	Blower fan	
10	Object to be heated	
11	Heater	
12	Driving room	
13	Motor	
14	Heat-source-room rear-surface wall	
15	Partition wall	
16	Suction port	
17A	Upper blow-off port	
17B	Lower blow-off port	
23A	Left blow-off port	
23B	Right blow-off port	
30A	First flow-path formation portion	
30B	Second flow-path formation portion	

Claims

1. A heating device comprising:

a heating room for housing an object to be heated; and
 a heat-source room which communicates with the heating room through a suction port and a plurality of blow-off ports which are formed in a partition wall formed between the heat-source room and the heating room;
 wherein, inside the heat-source room, there are provided an air-blower portion for creating an air flow, a heating portion for heating the air flow, and a flow-path formation portion which forms a flow path for moving the air flow heated by the heating portion toward a surface facing the partition wall, then circulating the air flow in at least a partial space within the heat-source room and, thereafter, blowing off the air flow toward a center of the heating room through at least a single

blow-off port out of the plurality of blow-off ports.

2. The heating device according to Claim 1, wherein the flow-path formation portion is placed within an air flow path from the heating portion to the blow-off ports.
3. The heating device according to Claim 1, wherein the flow-path formation portion includes a guide surface for moving an air flow heated by the heating portion toward the surface facing the partition wall and is adapted such that the air flow moved toward the surface facing the partition wall by the guide surface is circulated in at least the partial space within the heat-source room, then is brought into contact with a surface opposite from the guide surface and, then, is blown off through the blow-off ports.
4. The heating device according to Claim 3, wherein the air-blower portion comprises a centrifugal fan which is adapted to suck air within the heating room through the suction port in the partition wall and to eject air in a centrifugal direction, and the heating portion is provided in such a way as to surround an outer periphery of the air-blower portion.
5. The heating device according to Claim 3, wherein the guide surface at least partially includes an inclined surface which is inclined at a predetermined angle with respect to an axial direction of a rotational shaft of the air-blower portion.
6. The heating device according to Claim 3, wherein the guide surface is at least partially formed from a curved surface.
7. The heating device according to Claim 3, wherein the guide surface is formed in such a way as to cover at least the blow-off ports in their entirety, with a predetermined interval interposed between the guide surface and the blow-off ports.
8. The heating device according to Claim 3, wherein the guide surface at least partially includes an inclined surface which is inclined at a predetermined angle with respect to an axial direction of a rotational shaft of the air-blower portion, whereby an air flow blown off through the blow-off ports is changed, in direction, by changing the angle of the inclined surface.
9. The heating device according to Claim 3, wherein an air flow blown off through the blow-off ports is changed in direction by changing the rotational speed of the air-blower portion.
10. The heating device according to Claim 1, wherein the flow-path formation portion includes

a longitudinal flow-path formation portion which includes a guide surface for moving an air flow heated by the heating portion toward the surface facing the partition wall and is adapted such that the air flow moved toward the surface facing the partition wall by the guide surface is circulated in at least the partial space within the heat-source room, then is brought into contact with a surface opposite from the guide surface and, then, is blown off through the blow-off ports, and

a lateral flow-path formation portion which is provided downstream from the blow-off ports in the direction of flowing of an air flow created by the air-blower portion and includes a block surface placed in such a way as to block a portion of the air flow from the air-blower portion to cause it to be blown off through the blow-off ports.

11. The heating device according to Claim 1, wherein the flow-path formation portion includes
a longitudinal flow-path formation portion which includes a guide surface for moving an air flow heated by the heating portion toward the surface facing the partition wall and is adapted such that the air flow moved toward the surface facing the partition wall by the guide surface is circulated in at least the partial space within the heat-source room, then is brought into contact with a surface opposite from the guide surface and, then, is blown off through the blow-off ports,
a lateral flow-path formation portion which is provided downstream from the blow-off ports in the direction of flowing of an air flow created by the air-blower portion and includes a block surface placed in such a way as to block a portion of the air flow from the air-blower portion to cause it to be blown off through the blow-off ports, and
a ceiling flow-path formation portion which includes a ceiling surface which covers the blow-off ports with a predetermined interval interposed between the ceiling surface and the blow-off ports and, further, makes the longitudinal flow-path formation portion and the lateral flow-path formation portion continuous with each other.
12. The heating device according to Claim 10 or 11, wherein
the guide surface in the longitudinal flow-path formation portion and the block surface in the lateral flow-path formation portion are placed around the blow-off ports, such that the guide surface and the block surface are orthogonal to each other.
13. The heating device according to Claim 10 or 11, wherein
the air-blower portion comprises a centrifugal fan which is adapted to suck air within the heating room through the suction port in the partition wall and to

eject air in a centrifugal direction, and
the heating portion is provided in such a way as to surround an outer periphery of the air-blower portion.

14. The heating device according to Claim 10 or 11, wherein
the guide surface at least partially includes an inclined surface which is inclined at a predetermined angle with respect to an axial direction of a rotational shaft of the air-blower portion.
15. The heating device according to Claim 10 or 11, wherein
the guide surface is at least partially formed from a curved surface.

Fig. 1

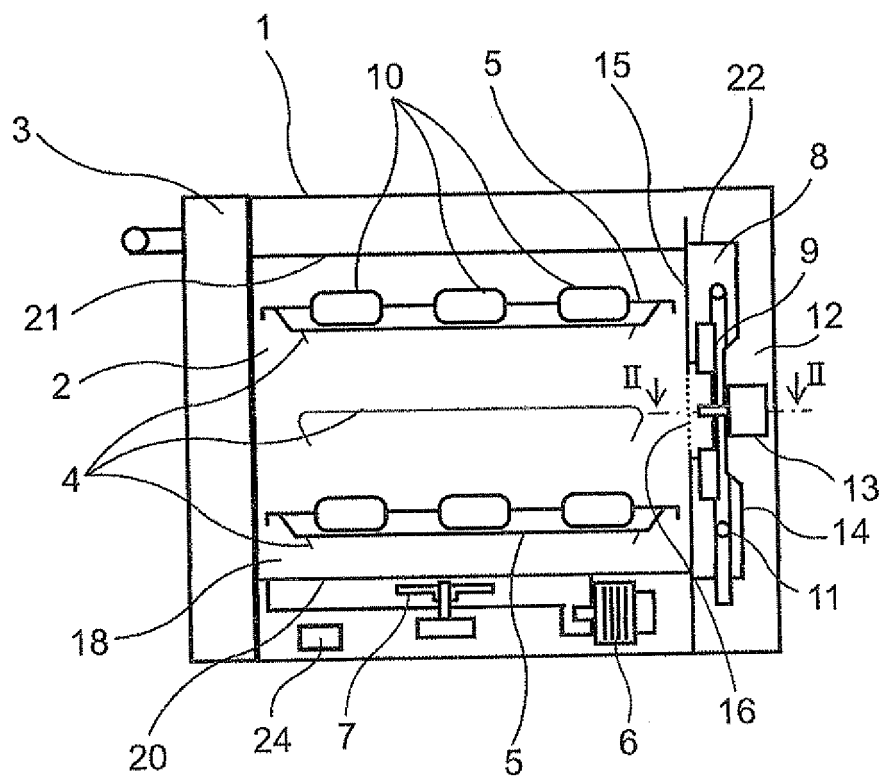


Fig.2

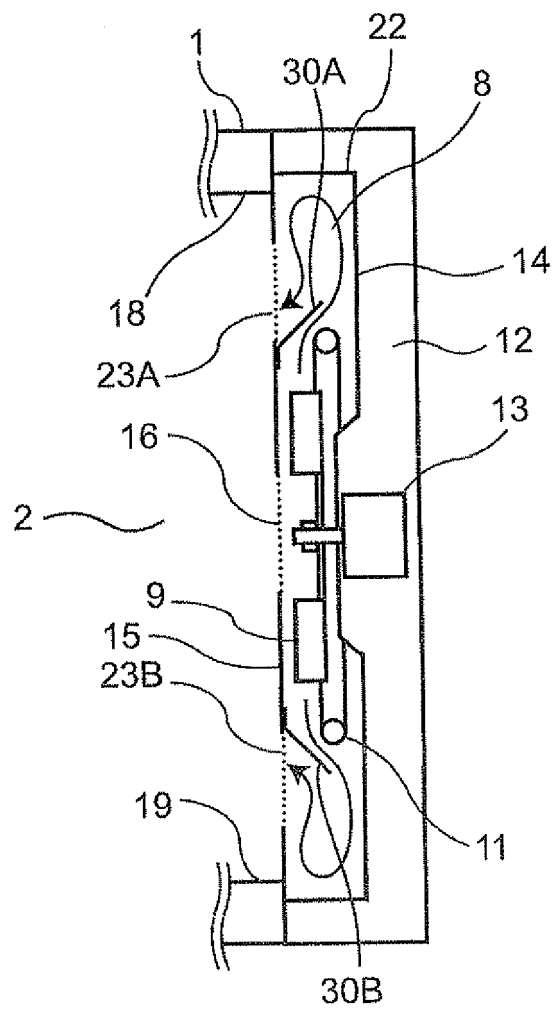


Fig.3

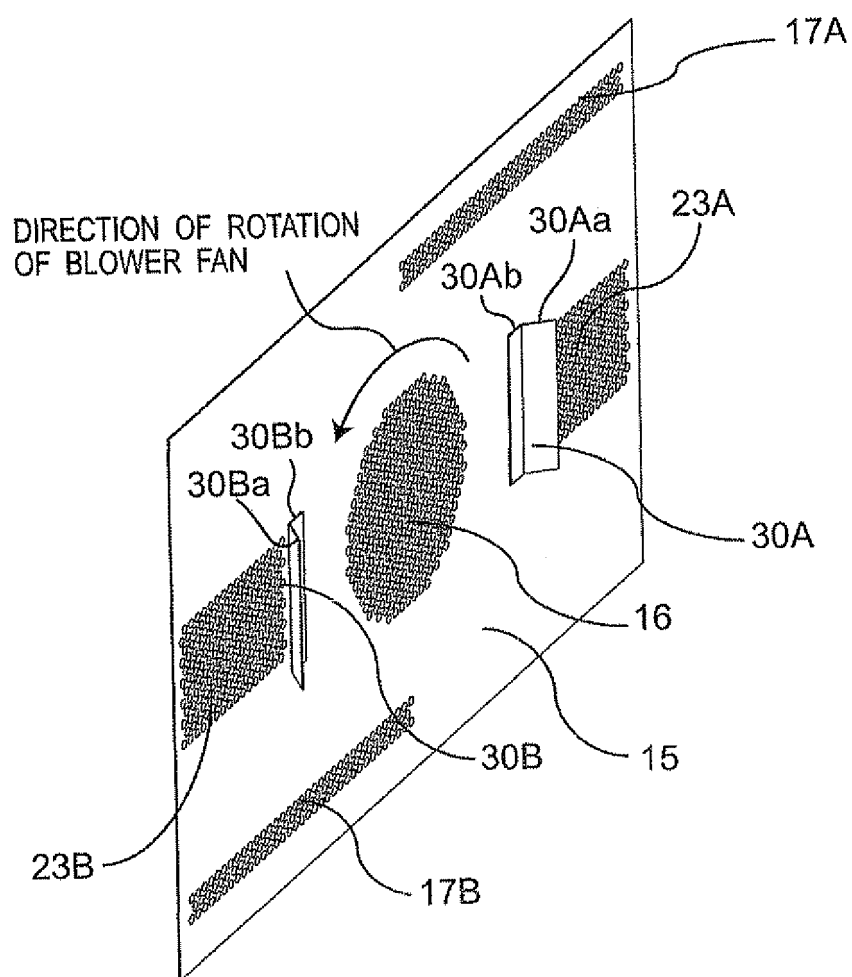


Fig.4

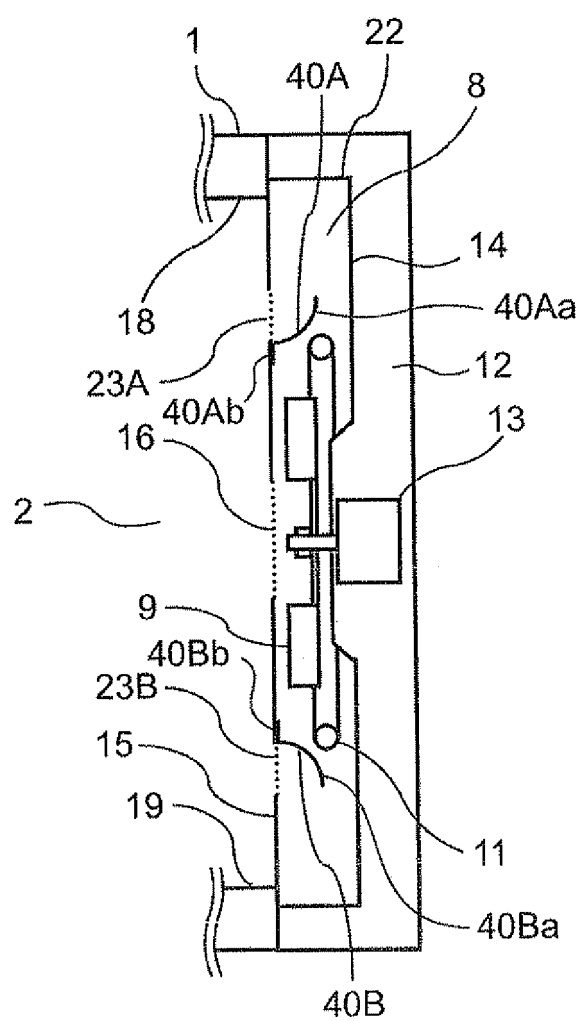


Fig.5

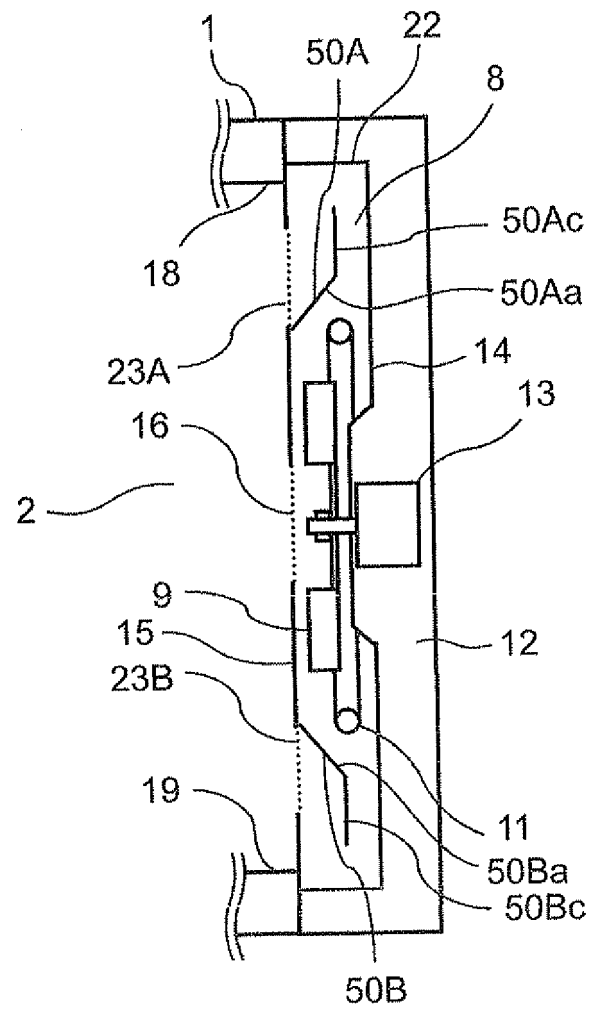


Fig.6

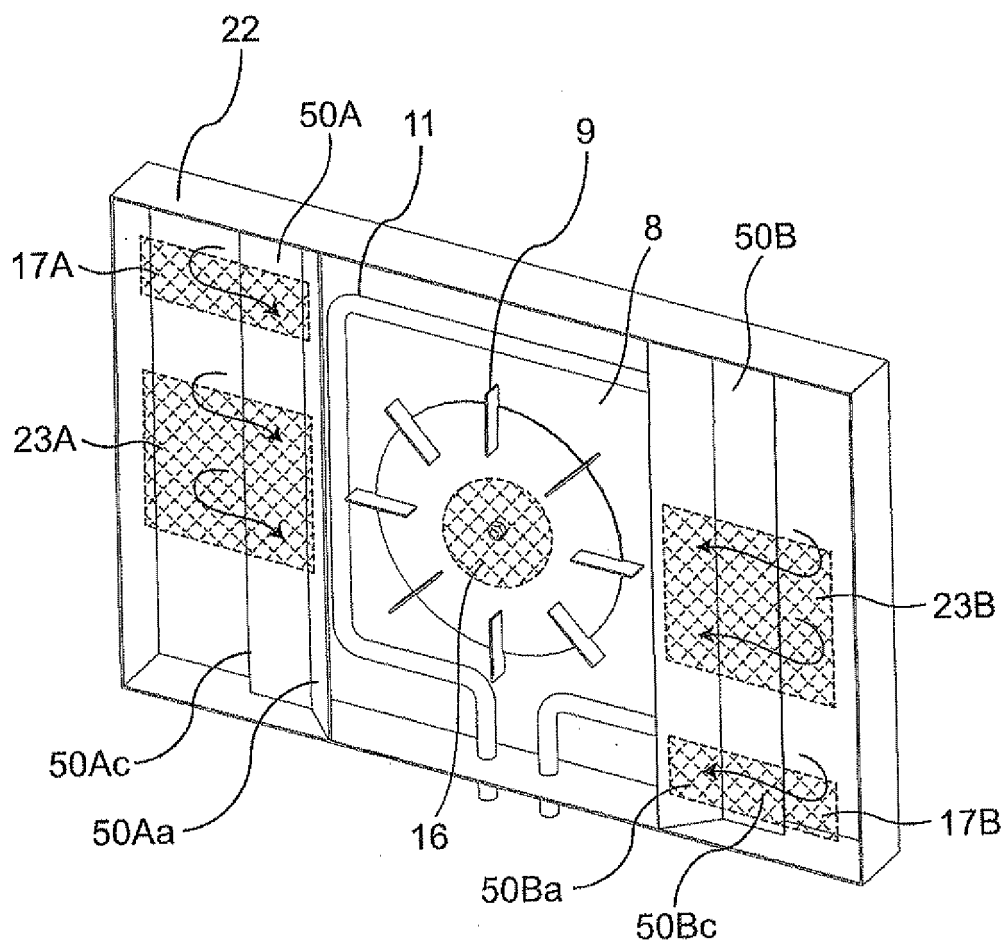


Fig. 7A

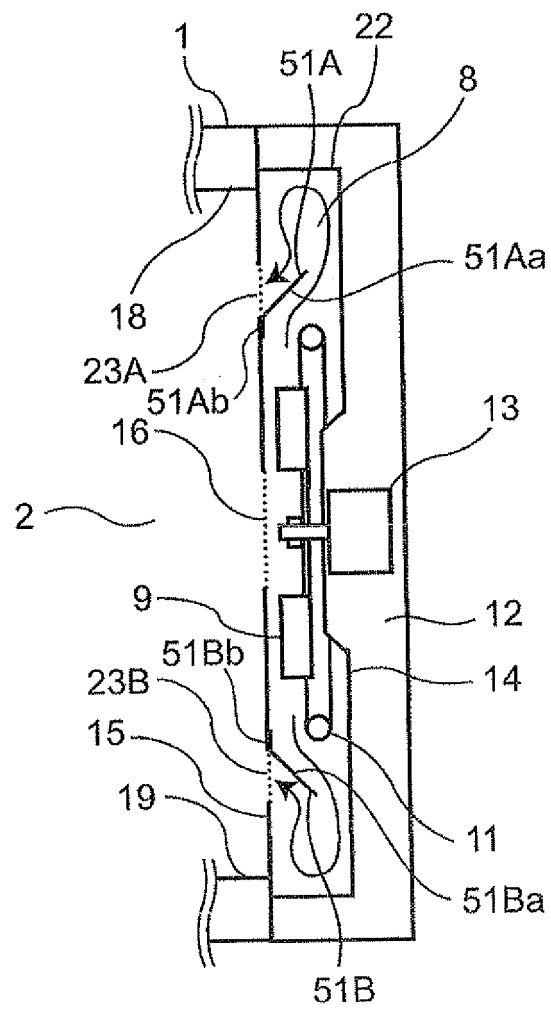


Fig. 7B

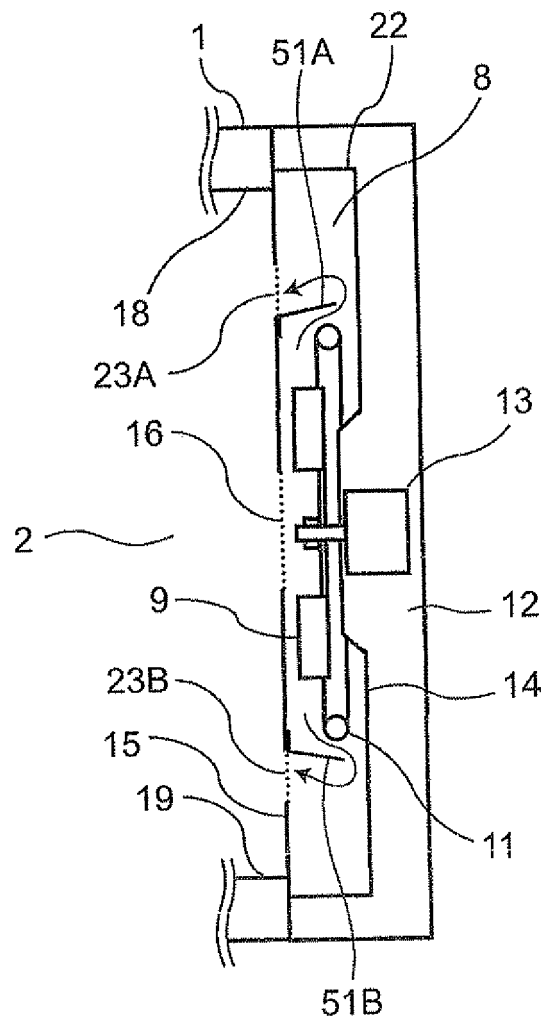


Fig.8

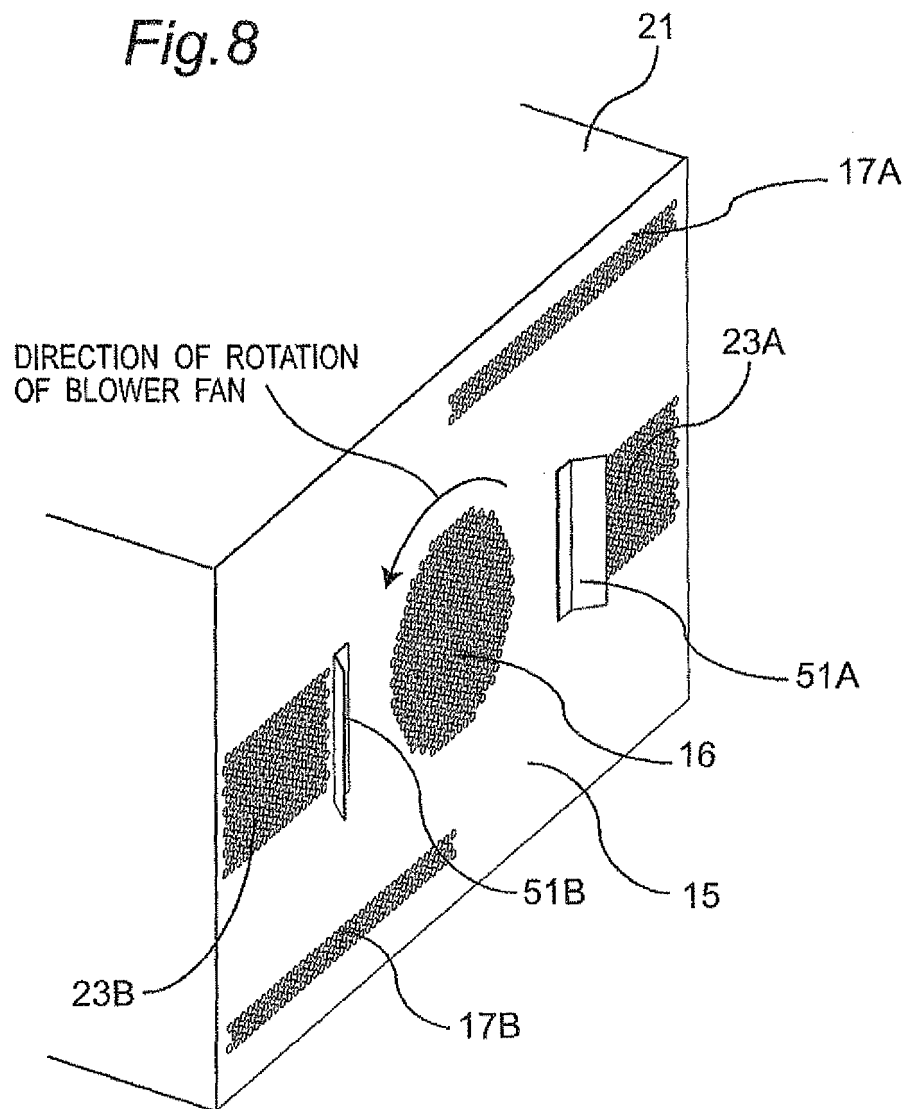


Fig.9

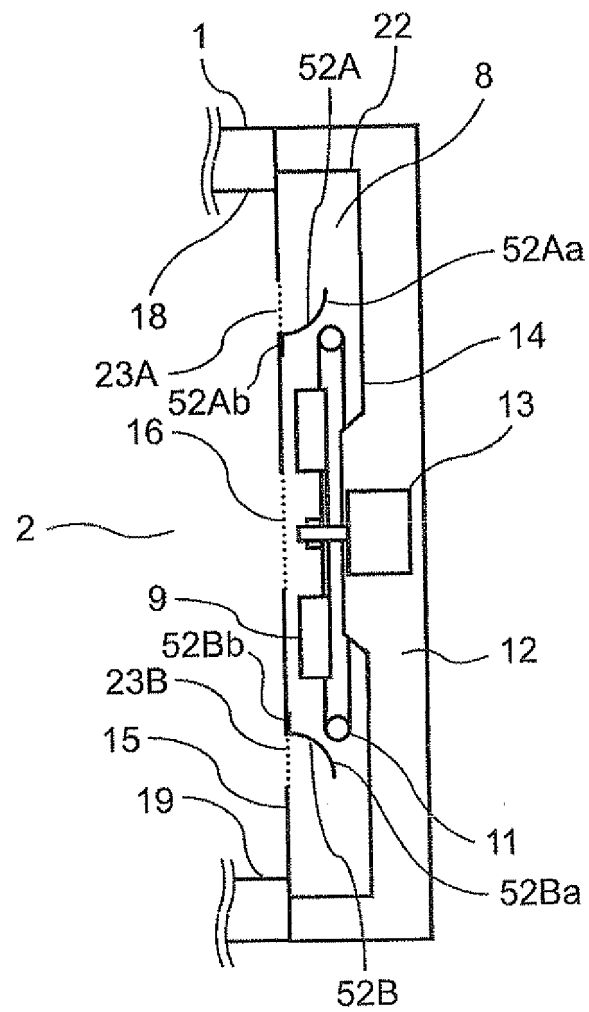


Fig. 10

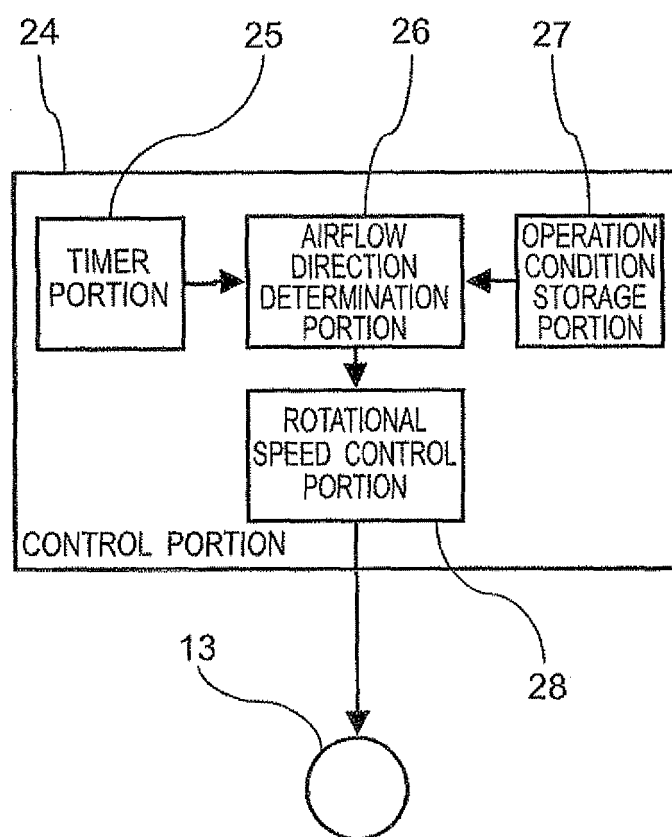


Fig. 11

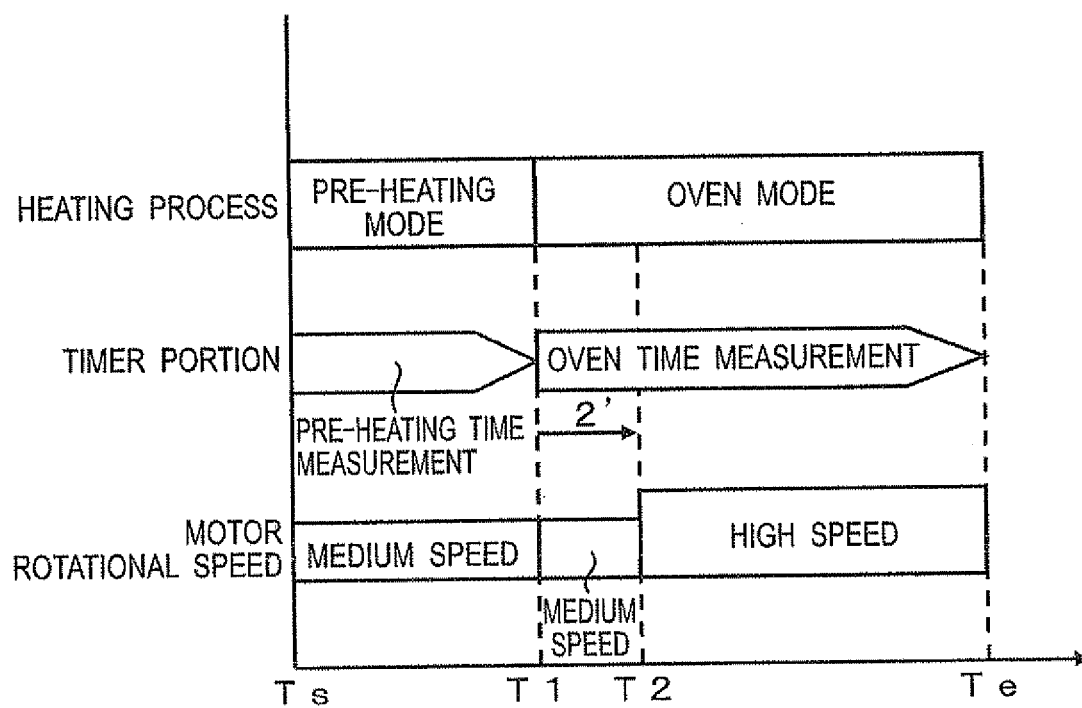


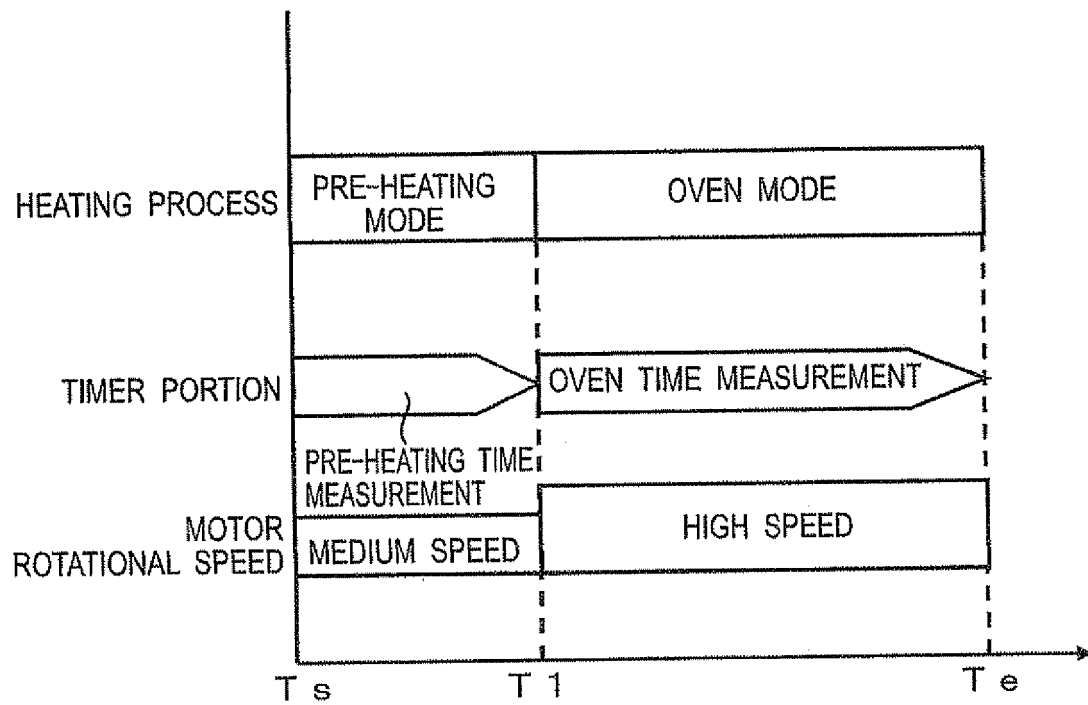
Fig. 12

Fig. 13

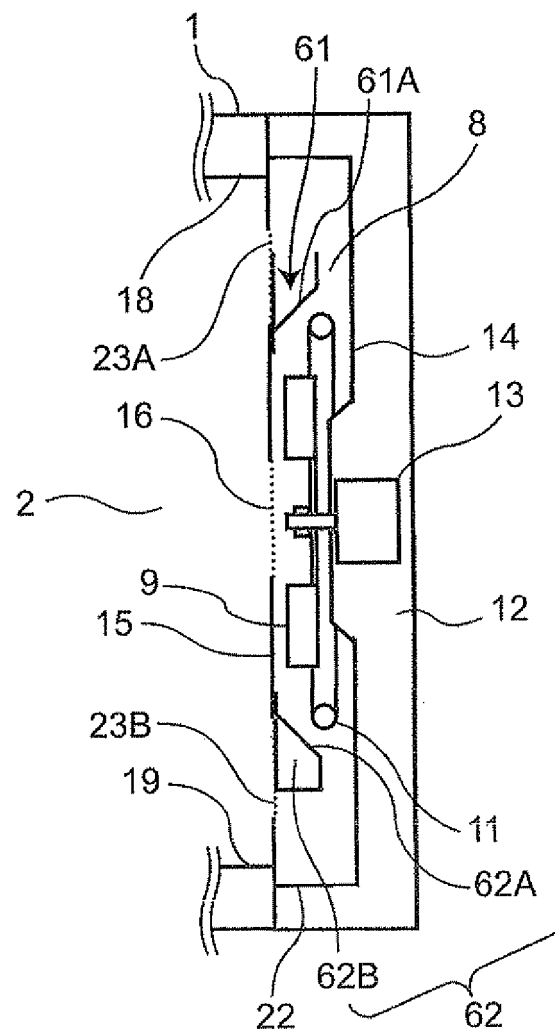


Fig. 14

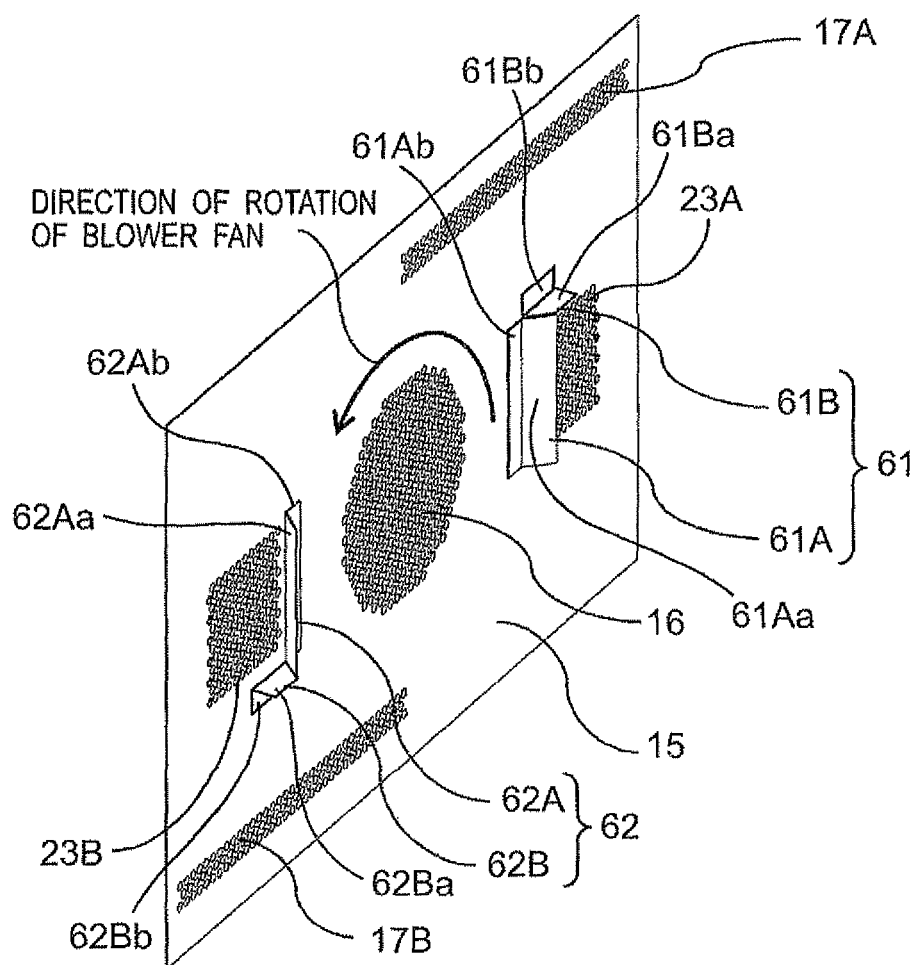


Fig. 15

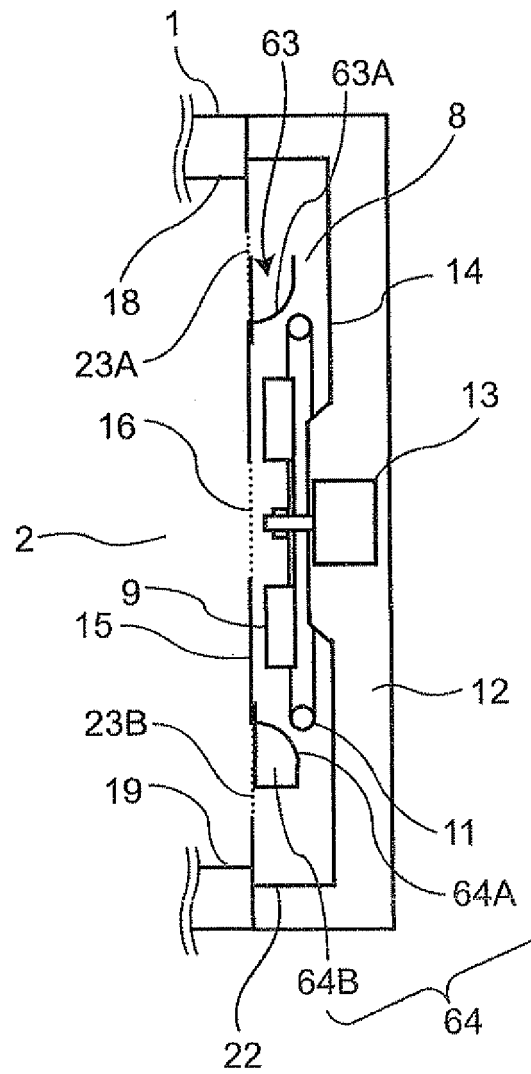


Fig. 16

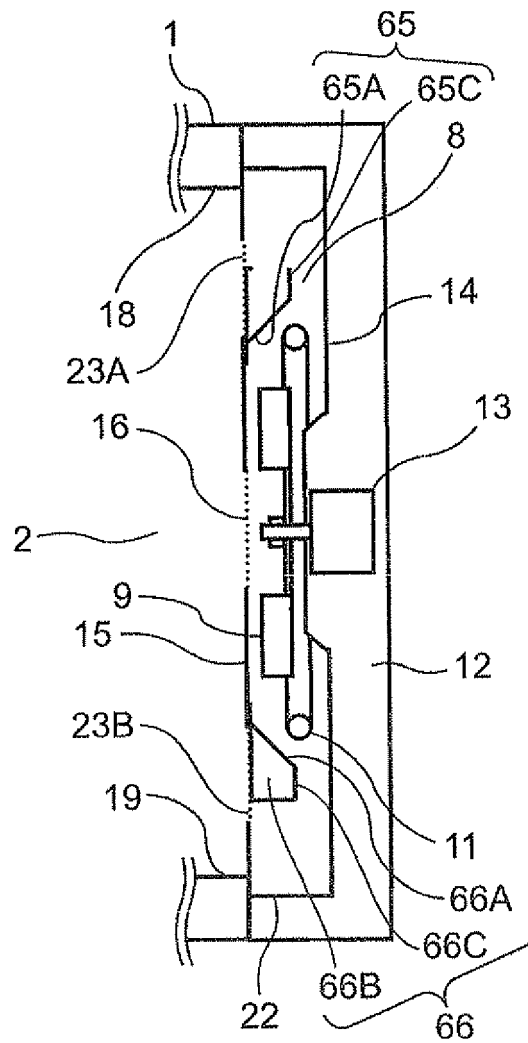


Fig.17

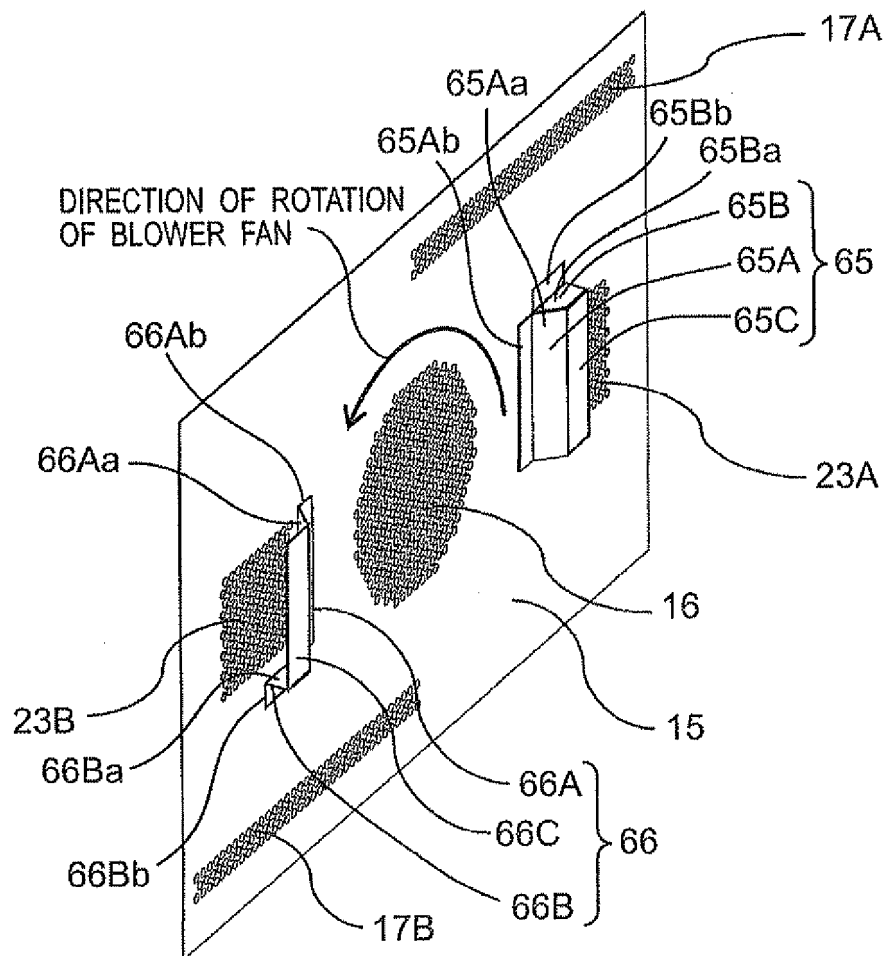


Fig. 18

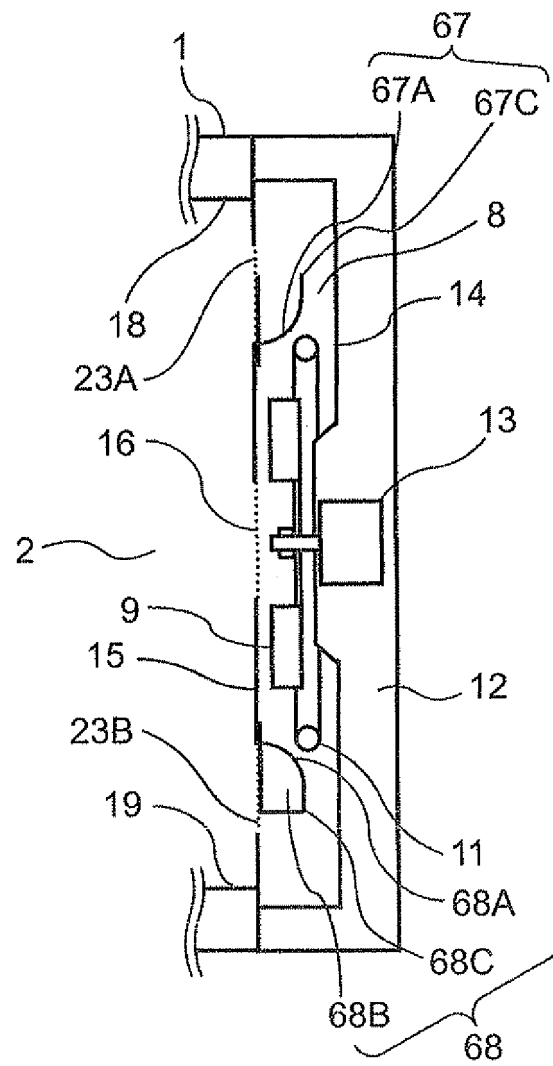
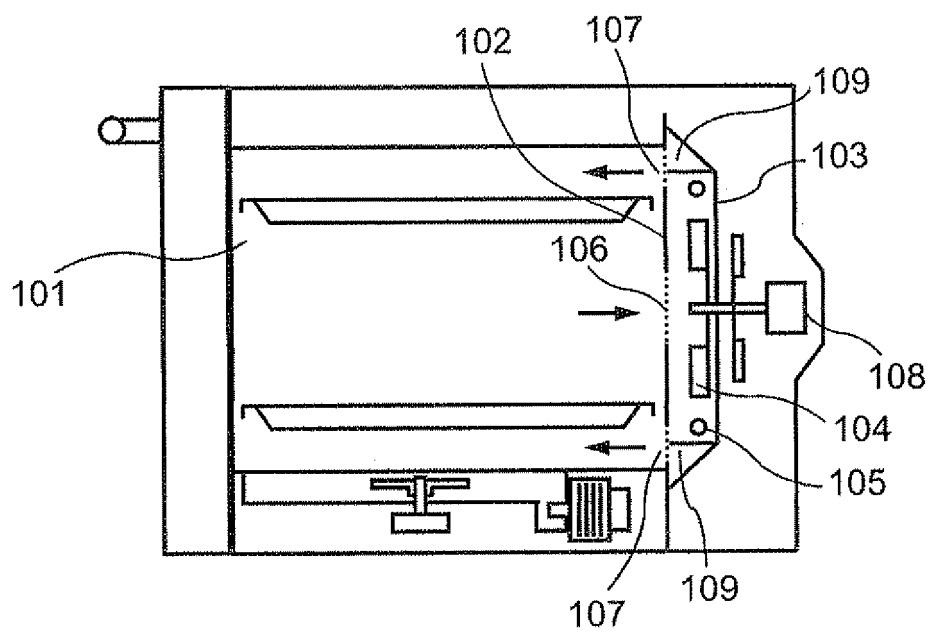


Fig. 19



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/000190

A. CLASSIFICATION OF SUBJECT MATTER

F24C1/00 (2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24C1/00

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2011

Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

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	JP 8-200684 A (Toshiba Corp.), 06 August 1996 (06.08.1996), entire text (Family: none)	1, 2

☐ 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

"I" 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

04 April, 2011 (04.04.11)

Date of mailing of the international search report

12 April, 2011 (12.04.11)

Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

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

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

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

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

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

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

This International Searching Authority found multiple inventions in this international application, as follows:
(See extra sheet.)

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

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1 and 2.

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/000190

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

The common matter of the inventions of claims 1 - 15 is "a heating apparatus comprising: a heating chamber for housing an object to be heated; and a heat source chamber adapted to communicate with said heating chamber by a suction inlet and a plurality of discharge outlets formed in a partition between the heat source chamber itself and said heating chamber, wherein said heat source chamber is equipped therein with an air blowing section for establishing an air flow, a heating section for heating said air flow, and passage forming sections for forming passages, in which the air flow heated by said heating section is moved in a direction toward the face confronting said partition, so that the air flow is circulated through at least a portion of the space in said heat source chamber and is then blown out from at least one of said discharge outlets toward the center of said heating chamber".

However, the search has revealed that the common matter is not novel, since it was disclosed in the whole description (Family: none) of JP 8-200684 A (Toshiba Corp.), 6 August 1996 (06.08.1996).

As a result, this common matter is not the special technical feature within the meaning of PCT Rule 13.2, second sentence, since the matter makes no contribution over the prior art.

Hence, there is no matter common to all the inventions of claims 1 - 15.

No technical relationship within the meaning of PCT Rule 13 can be seen between those different inventions, since there exists no other common matter which can be considered as a special technical feature within the meaning of PCT Rule 13.2, second sentence.

Hence, it is apparent that the inventions of claims 1 - 15 do not comply with the requirement of unity of invention.

International Searching Authority has admitted that the invention of this patent application is as follows.

First Invention: Invention of claims 1 and 2

A heating apparatus "comprising: a heating chamber for housing an object to be heated; and a heat source chamber adapted to communicate with said heating chamber by a suction inlet and a plurality of discharge outlets formed in a partition between the heat source chamber itself and said heating chamber, wherein said heat source chamber is equipped therein with an air blowing section for establishing an air flow, a heating section for heating said air flow, and passage forming sections for forming passages, in which the air flow heated by said heating section is moved in a direction toward the face confronting said partition, so that the air flow is circulated through at least a portion of the space in said heat source chamber and is then blown out from at least one of said discharge outlets toward the center of said heating chamber", and "wherein said passage forming sections are arranged in an air passage from said heating section to said discharge outlets". (continued to next extra sheet)

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Second Invention: Invention of claims 1, 3 and 4

A heating apparatus "comprising: a heating chamber for housing an object to be heated; and a heat source chamber adapted to communicate with said heating chamber by a suction inlet and a plurality of discharge outlets formed in a partition between the heat source chamber itself and said heating chamber, wherein said heat source chamber is equipped therein with an air blowing section for establishing an air flow, a heating section for heating said air flow, and passage forming sections for forming passages, in which the air flow heated by said heating section is moved in a direction toward the face confronting said partition, so that the air flow is circulated through at least a portion of the space in said heat source chamber and is then blown out from at least one of said discharge outlets toward the center of said heating chamber", "wherein said passage forming sections have guide surfaces for moving the air flows heated by said heating section, toward the faces opposed to said partition, so that the air flows having moved toward the faces opposed to said partition by said guide surfaces are made to circulate through at least a partial space in said heat source chamber and then to contact with the back faces of said guide surfaces, until the air flows are blown out from said discharge outlets", and "wherein said air blowing section is a centrifugal fan for sucking the air in said heating chamber from the suction inlet of said partition and discharging the air in the centrifugal direction, and is equipped with said heating section enclosing the outer circumference of said air blowing section".

Third Invention: Invention of claims 1, 3 and 5

A heating apparatus "comprising: a heating chamber for housing an object to be heated; and a heat source chamber adapted to communicate with said heating chamber by a suction inlet and a plurality of discharge outlets formed in a partition between the heat source chamber itself and said heating chamber, wherein said heat source chamber is equipped therein with an air blowing section for establishing an air flow, a heating section for heating said air flow, and passage forming sections for forming passages, in which the air flow heated by said heating section is moved in a direction toward the face confronting said partition, so that the air flow is circulated through at least a portion of the space in said heat source chamber and is then blown out from at least one of said discharge outlets toward the center of said heating chamber", "wherein passage forming sections have guide surfaces for moving the air flows heated by said heating section, toward the faces opposed to said partition, so that the air flows moved toward the faces opposed to said partition by said guide surfaces are made to circulate through at least a partial space in said heat source chamber and then to contact with the back faces of said guide surfaces, until the air flows are blown out from said discharge outlets", and "wherein said guide surfaces are equipped in at least their portions with the inclined surfaces which are inclined at a predetermined angle with respect to the axial direction of the rotation axis of said air blowing section". (continued to next extra sheet)

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International application No.

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Fourth Invention: Invention of claims 1, 3 and 6

A heating apparatus "comprising: a heating chamber for housing an object to be heated; and a heat source chamber adapted to communicate with said heating chamber by a suction inlet and a plurality of discharge outlets formed in a partition between the heat source chamber itself and said heating chamber, wherein said heat source chamber is equipped therein with an air blowing section for establishing an air flow, a heating section for heating said air flow, and passage forming sections for forming passages, in which the air flow heated by said heating section is moved in a direction toward the face confronting said partition, so that the air flow is circulated through at least a portion of the space in said heat source chamber and is then blown out from at least one of said discharge outlets toward the center of said heating chamber", "wherein passage forming sections have guide surfaces for moving the air flows heated by said heating section, toward the faces opposed to said partition, so that the air flows moved toward the faces opposed to said partition by said guide surfaces are made to circulate through at least a partial space in said heat source chamber and then to contact with the back faces of said guide surfaces, until the air flows are blown out from said discharge outlets", and "wherein said guide surfaces are curved at least partially thereof".

Fifth Invention: Invention of claims 1, 3 and 7

A heating apparatus "comprising: a heating chamber for housing an object to be heated; and a heat source chamber adapted to communicate with said heating chamber by a suction inlet and a plurality of discharge outlets formed in a partition between the heat source chamber itself and said heating chamber, wherein said heat source chamber is equipped therein with an air blowing section for establishing an air flow, a heating section for heating said air flow, and passage forming sections for forming passages, in which the air flow heated by said heating section is moved in a direction toward the face confronting said partition, so that the air flow is circulated through at least a portion of the space in said heat source chamber and is then blown out from at least one of said discharge outlets toward the center of said heating chamber", "wherein said passage forming sections have guide surfaces for moving the air flows heated by said heating section, toward the faces opposed to said partition, so that the air flows having moved toward the faces opposed to said partition by said guide surfaces are made to circulate through at least a partial space in said heat source chamber and then to contact with the back faces of said guide surfaces, until the air flows are blown out from said discharge outlets", and "wherein said guide surfaces are so formed at a predetermined distance from said discharge outlets as to cover at least the entire ties of said discharge outlets". (continued to next extra sheet)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/000190

Sixth Invention: Invention of claims 1, 3 and 8

A heating apparatus "comprising: a heating chamber for housing an object to be heated; and a heat source chamber adapted to communicate with said heating chamber by a suction inlet and a plurality of discharge outlets formed in a partition between the heat source chamber itself and said heating chamber, wherein said heat source chamber is equipped therein with an air blowing section for establishing an air flow, a heating section for heating said air flow, and passage forming sections for forming passages, in which the air flow heated by said heating section is moved in a direction toward the face confronting said partition, so that the air flow is circulated through at least a portion of the space in said heat source chamber and is then blown out from at least one of said discharge outlets toward the center of said heating chamber", "wherein said passage forming sections have guide surfaces for moving the air flows heated by said heating section, toward the faces opposed to said partition, so that the air flows having moved toward the faces opposed to said partition by said guide surfaces are made to circulate through at least a partial space in said heat source chamber and then to contact with the back faces of said guide surfaces, until the air flows are blown out from said discharge outlets", and "wherein said guide surfaces are equipped in at least their portions with the inclined surfaces which are inclined at a predetermined angle with respect to the axial direction of the rotation axis of said air blowing section, so that the direction of the air flows to be blown from said discharge outlets is changed by varying the angle of said inclined surfaces".

Seventh Invention: Invention of claims 1, 3 and 9

A heating apparatus "comprising: a heating chamber for housing an object to be heated; and a heat source chamber adapted to communicate with said heating chamber by a suction inlet and a plurality of discharge outlets formed in a partition between the heat source chamber itself and said heating chamber, wherein said heat source chamber is equipped therein with an air blowing section for establishing an air flow, a heating section for heating said air flow, and passage forming sections for forming passages, in which the air flow heated by said heating section is moved in a direction toward the face confronting said partition, so that the air flow is circulated through at least a portion of the space in said heat source chamber and is then blown out from at least one of said discharge outlets toward the center of said heating chamber", "wherein said passage forming sections have guide surfaces for moving the air flows heated by said heating section, toward the faces opposed to said partition, so that the air flows having moved toward the faces opposed to said partition by said guide surfaces are made to circulate through at least a partial space in said heat source chamber and then to contact with the back faces of said guide surfaces, until the air flows are blown out from said discharge outlets", and "wherein the direction of the air flows to be blown from said discharge outlets is changed by varying the number of rotations of said air blowing section". (continued to next extra sheet)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/000190

Eighth Invention: Invention of claims 1, 10, and 12 - 15

A heating apparatus "comprising: a heating chamber for housing an object to be heated; and a heat source chamber adapted to communicate with said heating chamber by a suction inlet and a plurality of discharge outlets formed in a partition between the heat source chamber itself and said heating chamber, wherein said heat source chamber is equipped therein with an air blowing section for establishing an air flow, a heating section for heating said air flow, and passage forming sections for forming passages, in which the air flow heated by said heating section is moved in a direction toward the face confronting said partition, so that the air flow is circulated through at least a portion of the space in said heat source chamber and is then blown out from at least one of said discharge outlets toward the center of said heating chamber", and "wherein said passage forming sections are constituted to include: a longitudinal passage forming section having guide surfaces for moving the air flows heated by said heating section, toward the faces opposed to said partition, so that the air flows having moved toward the faces opposed to said partition by said guide surfaces are made to circulate through at least a partial space in said heat source chamber and then to contact with the back faces of said guide surfaces, until the air flows are blown out from said discharge outlets; and a transverse passage forming section disposed downstream of said discharge outlets in the flowing direction of the air flows established by said air blowing section, and having weir faces arranged to block the air flows partially from said air blowing section and to blow out the same from said discharge outlets."

Ninth Invention: Invention of claims 1, 11, and 12 - 15

A heating apparatus "comprising: a heating chamber for housing an object to be heated; and a heat source chamber adapted to communicate with said heating chamber by a suction inlet and a plurality of discharge outlets formed in a partition between the heat source chamber itself and said heating chamber, wherein said heat source chamber is equipped therein with an air blowing section for establishing an air flow, a heating section for heating said air flow, and passage forming sections for forming passages, in which the air flow heated by said heating section is moved in a direction toward the face confronting said partition, so that the air flow is circulated through at least a portion of the space in said heat source chamber and is then blown out from at least one of said discharge outlets toward the center of said heating chamber", and "wherein said passage forming sections are constituted to include: a longitudinal passage forming section having guide surfaces for moving the air flows heated by said heating section, toward the faces opposed to said partition, so that the air flows having moved toward the faces opposed to said partition by said guide surfaces are made to circulate through at least a partial space in said heat source chamber and then to contact with the back faces of said guide surfaces, until the air flows are blown out from said discharge outlets; a transverse passage forming section disposed downstream of said discharge outlets in the flowing direction of the air flows established by said air blowing section, and having weir faces arranged to block the air flows partially from said air blowing section and to blow out the same from said discharge outlets; and a ceiling passage forming section having a ceiling face for covering said discharge outlets at a predetermined spacing from said discharge outlets, thereby to connect said longitudinal passage forming section and said transverse passage forming section."

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- JP H7111256 B [0003] [0011]
- JP 2006071124 A [0003] [0012]
- JP H6347041 B [0010] [0013]
- JP 2004353922 A [0010] [0014]

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- Variations of Hand Scanner. Patent Company Publication [0015]