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(54) Grill/convection microwave oven and convection cooking method thereof

(57) An improved grill/convection microwave oven and a convection cooking method thereof which are capable of simultaneously operating a convection heater and a grill heater in the convection cooking mode without using a damper system, for thus reducing the number of parts of the system, whereby it is possible to reduce the fabrication cost, which includes a grill heater and convection heater for a cooking operation, a magnetron for a microwave cooking, a cooking compartment for cooking food therein, a circulation motor for circulating heat generated by the convection heater, an oven lamp, a turntable motor, and a fan motor connected parallel with the circulation motor and controlled by one relay, and an air duct communicating with a cooking compartment air inlet, so that an air is introduced by the fan motor, and cools the magnetron, and then the thusly cooled air is introduced into the cooking compartment.

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a grill/convection microwave oven and a convection cooking method thereof, and in particular to an improved grill/convection microwave oven and a convection cooking method thereof which are capable of simultaneously operating a convection heater and a grill heater in the convection cooking mode without using a damper system, for thus reducing the number of parts of the system, whereby it is possible to reduce the fabrication cost.

2. Description of the Conventional Art

Figure 1 is a perspective diagram illustrating the construction of a conventional microwave oven.

The conventional microwave oven includes a microwave oven main body 50, and a door 60 hinged to a portion of the microwave oven main body 50 for opening/closing the microwave oven main body 50.

A cooking compartment 1 is formed in a portion within the microwave oven main body 50. A driving section 2 having a magnetron 7 disposed in a portion of a vertical plate 3 which partitions the cooking compartment 1 is formed in another portion within the microwave oven main body 50, and a fan 6 disposed in a wall of the microwave oven main body 50.

An air duct 9 is arranged within the microwave oven main body 50 for introducing air in cooperation with the fan 6 and for guiding the thusly introduced air into the cooking compartment 1 through a cooking compartment inlet 15 as shown in Figure 3. The air duct 9 is opened/closed by a damper 16.

In addition, a high voltage transformer 8 is disposed below the magnetron 7, and an air inlet 5 is formed in a wall of the microwave oven main body 50 having the driving section 2 therein.

In addition, a convection heater 11 is disposed at a periphery of the vertical plate 3 inside the driving section 2. A grill heater 18 is disposed in the upper wall of the cooking compartment 1. Air inlets 20 are formed in the upper wall of the cooking compartment 1, and air outlets 21 are formed in the upper wall of the cooking compartment 1.

In the drawings, reference numeral la denotes an insulator for reducing a wall heat loss of the cooking compartment 1, 4 denotes a lower plate arranged in the bottom of the cooking compartment 1, 4a denotes a discharge port formed in the lower plate 4, 10 denotes a ventilation duct, 13 denotes a circulation fan, 14 denotes a chamber, and 14a denotes a chamber cover, and reference character "CM" denotes a circulation motor, "FM" denotes a fan motor, and "SL" denotes a solenoid.

The air flow in the conventional microwave oven will now be explained. When the convection heater 11 is operated, air, as shown in Figure 2, is introduced into the cooking compartment 1 through the air inlets 20, and then is discharged to the outside through the air outlets 21.

When an electric power is supplied to the solenoid SL, the damper 16 blocks the cooking compartment inlet 15, so that external cool air can not be introduced into the cooking compartment 1 through the air duct 9.

In addition, in the cooking mode of using microwaves generated by the magnetron 7, as shown in Figure 3, the air is introduced through the air inlet 5 formed in a wall of the microwave oven main body 50, and is introduced into the cooking compartment 1 through the air duct 9. After the air is circulated inside the cooking compartment 1, the air is discharged to the outside through the ventilation duct 10.

The convection heater 11 has an output capacity of 1500W, and the grill heater has an output capacity of 1200W. As shown in Figure 4, the oven lamp, turntable motor, and fan motor are controlled by a relay RL3. A relay RL4 controls the circulation motor CM.

The operation of the conventional microwave oven will now be explained.

First, as shown in Figure 5, when an electric power is supplied to the microwave oven, it is judged whether which cooking mode is performed among the convection cooking mode and the microwave cooking mode.

Thereafter, when the convection cooking mode is selected, the relays RL2 and RL4 are turned on, and then the convection heater 11 and the circulation motor CM are operated. In addition, the relay RL3 is turned on, and then the oven lamp OL, the turntable motor TTM, and the fan motor FM are operated.

When an electric power is supplied, the solenoid SL is operated, and the damper 16 is closed, for thus blocking an introduction of the air. Heat generated by the convection heater 11 is circulated in the cooking compartment 1 in cooperation with the circulation motor CM and the fan 13.

Here, in the convection cooking mode, since the relay RL1 remains turned-off, and the magnetron 7 does not work.

In addition, in the case of the microwave cooking mode, when the relay RL3 is turned on, the oven lamp OL, the turntable motor TTM, and the fan motor FM are operated. When the relay RL1 is turned on, the magnetron 7 is operated, for thus generating microwaves.

At this time, since the relays RL2, RL4, and RL5 remain turned-off, the convection heater 11, the grill heater 18, and the circulation fan motor CM are not operated.

In the microwave cooking mode, since the damper 16 is opened, heated air is forcibly discharged through air outlets 12 in cooperation with cool air introduced into the cooking compartment 1.

However, the conventional microwave oven has disadvantages in that since the expensive convection

heater 11 having an output capacity of 1500W is used for the convection cooking as a heat generation source, the fabrication cost of the microwave oven is increased.

In addition, the conventional microwave oven has the following problems. Namely, since it is impossible to increase the temperature in the cooking compartment 1 up to 250°C by using only the convection heater 11 having the output capacity of 1500W, in the convection cooking mode, the solenoid SL must be additionally used, and the cooking compartment inlet 15 must be blocked by a damper 16, so that an external cool air can not be introduced into the cooking compartment 1, for thus increasing the temperature in the cooking compartment 1.

Furthermore, since the output capacity of the convection heater 11 is small, the cooking time is long.

Moreover, since the solenoid SL, the damper 16, and the relay RL4 for controlling the circulation motor CM are additionally used in the system, the fabrication cost of the products are increased.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a grill/convection microwave oven and a convection cooking method thereof which overcomes the problems encountered in the conventional art.

It is another object of the present invention to provide a grill/convection microwave oven and a convection cooking method thereof which are capable of simultaneously operating a convection heater and a grill heater in the convection cooking mode without using a damper system, for thus reducing the number of parts of the system, whereby it is possible to reduce the fabrication cost.

To achieve the above objects, there is provided a grill/convection microwave oven which includes a grill heater and convection heater for a cooking operation, a magnetron for a microwave cooking, a cooking compartment for cooking food therein, a circulation motor for circulating heat generated by the convection heater, an oven lamp, a turntable motor, and a fan motor connected parallel with the circulation motor and controlled by one relay, and an air duct communicating with a cooking compartment air inlet, so that an air is introduced by the fan motor, and cools the magnetron, and then the thusly cooled air is introduced into the cooking compartment.

To achieve the above objects, there is provided a convection cooking method using a grill/convection microwave oven, which includes the steps of a first step in which a relay is turned on after a convection cooking mode is selected, and an oven lamp, a turntable motor, a fan motor, and a circulation motor are operated, a second step in which another relay is turned on, and then a convection heater and a grill heater are simultaneously turned on, and a third step in which the air heated by the convection heater and the grill heater are circulated in a cooking compartment by a circulation fan driven by a circulation motor, and then the cooking operation is performed.

Additional advantages, objects and features of the invention will become more apparent from the description which follows.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

Figure 1 is a perspective diagram illustrating the construction of a conventional microwave oven;

Figure 2 is a side cross-sectional diagram illustrating a cooking compartment of a conventional microwave oven;

Figure 3 is a side cross-sectional diagram illustrating an inner structure of and an air flow in a conventional microwave oven;

Figure 4 is a circuit diagram illustrating a conventional microwave oven;

Figure 5 is a flow chart of an operation of a conventional microwave oven;

Figure 6 is a side cross-sectional diagram illustrating an inner structure of a microwave oven according to the present invention;

Figure 7 is a side cross-sectional diagram illustrating an inner structure of a microwave oven according to the present invention;

Figure 8 is a circuit diagram illustrating a microwave oven according to the present invention; and

Figure 9 is a flow chart of an operation of a microwave oven according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Figure 6 is a side cross-sectional diagram illustrating an inner structure of a microwave oven according to the present invention, and Figure 7 is a side cross-sectional diagram illustrating an inner structure of a microwave oven according to the present invention.

As shown therein, in the present invention, the damper and the solenoid are not used compared to the conventional art. In addition, an insulator is not used for insulating a cooking compartment 101.

In addition, as shown in Figures 6 through 8, a circulation motor CM for circulating heat generated by a convection heater 130 is connected parallel with an oven lamp OL, a turntable TTM, and a fan motor FM, so that a relay RL13 controls the circulation motor CM. In addition, inlets 115 formed in a wall of a cooking compartment 101 always communicate with an air duct 109 through which air, which cooled a magnetron 107, is introduced.

Here, the convection heater 130 has an output capacity of 850W through 950W. A grill heater 131 has an

output capacity of 1200W. In this embodiment of the present invention, the convection heater 130 preferably has an output capacity of 950W.

In addition, the circulation motor CM is connected parallel with the oven lamp OL, the turntable TTM, and the fan motor FM, so that a heat circulation is performed in the convection cooking mode, for thus preventing a dew formation on the inner surfaces of the door 102 and the cooking compartment 101.

The operation of the grill/convection microwave oven according to the present invention will now be explained with reference to the accompanying drawings.

First, as shown in Figure 9, when an electric power is supplied to the system, it is judged whether the cooking mode is a convection cooking mode or a microwave cooking mode. As a result, the cooking operation is performed based on the selected cooking mode.

If the convection cooking mode is selected, as shown in Figure 8, the relay RL13 is turned on, and then the oven lamp OL, the turntable motor TTM, the fan motor FM, and the circulation motor CM are operated. Thereafter, when the relays RL12 and RL15 are turned on, the convection heater 130 and the grill heater 131 are turned on at the same time.

In addition, a heat circulation is performed by the circulation fan 113 in capacity of 2150W, and then the convection cooking is performed in high capacity.

The output capacity of 2150W is generated by a combination of the convection heater 30 having an output capacity of 950W and the grill heater 131 having an output capacity of 1200W.

There may occur a small amount of heat loss due to air introduction and discharge. However, since a high output capacity of 2150W is generated in the system, the temperature in the cooking compartment 101 is increased up to 250°C in short time.

In addition, if the microwave cooking mode is selected, the relay RLII is turned on, and then the magnetron 107 is operated, for thus generating microwaves. Thereafter, the relay RL13 and the relay RLII are turned on at the same time, and then the oven lamp OL, the turntable motor TTM, the fan motor FM, and the circulation motor CM are operated, for thus performing the microwave cooking mode.

As shown in Figure 7, a small amount of air is introduced and discharged together with vapor through air inlets 115 and discharge outlets 112 formed in a wall of the cooking compartment 101 which communicate with the air duct 109, and the circulation fan 113 circulates the air in the cooking compartment 101, for thus preventing a dew formation on the inner surfaces of the door 102 and the cooking compartment 101.

In addition, the circulation motor CM urges a heated air circulation during the operation of the convection cooking, and circulates the air in the cooking compartment 101 in the microwave cooking mode, for thus preventing a dew formation on the inner surfaces of the door 102 and the cooking compartment 101.

In the drawings, reference numeral 120 denotes air inlets, 121 denotes air outlets, 114 denotes a chamber, 114a denotes a chamber cover, and 106 denotes a fan disposed in a driving section.

As described above, the grill/convection microwave oven and a convection cooking method thereof according to the present invention are directed to simultaneously driving the convection heater having an output capacity of 850W ~ 950W and the grill heater having an output capacity of 1200W, for thus achieving a desired output convection cooking mode.

Therefore, the cooking time can be shortened, and food taste can be improved, and it is possible to reduce the output capacity of the convection heater below 1000W, for thus reducing the fabrication cost.

In addition, it is possible to perform a desired convection cooking operation, and the damper, the solenoid, and the insulation for insulating the cavity are not used compared to the conventional art, for thus reducing the fabrication cost of the products and the fabrication error, whereby it is possible to increase the reliability of the products.

Furthermore, in the microwave cooking mode, since the dew formation on the inner surfaces of the door and the cooking compartment can be prevented by driving the circulation motor, the driving relay is not necessary, for thus reducing the fabrication cost of the system.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as recited in the accompanying claims.

Claims

1. A grill/convection microwave oven, comprising:

   a grill heater and convection heater for a cooking operation;
   a magnetron for a microwave cooking;
   a cooking compartment for cooking food therein;
   a circulation motor for circulating heat generated by the convection heater;
   an oven lamp, a turntable motor, and a fan motor connected parallel with the circulation motor and controlled by one relay; and
   an air duct communicating with a cooking compartment air inlet, so that an air is introduced by the fan motor, and cools the magnetron, and then the thusly cooled air is introduced into the cooking compartment.

2. The grill/convection microwave oven of claim 1, wherein said convection heater has an output capacity of below 1000W.

3. The grill/convection microwave oven of claim 1, wherein said circulation motor performs a heat circulation operation in the convection cooking mode, and circulates the air in the cooking compartment in the microwave cooking mode, for thus preventing a dew formation on inner surfaces of a door and the cooking compartment.

4. The convection cooking method using a grill/convection microwave oven, comprising the steps of:

a first step in which a relay is turned on after a convection cooking mode is selected, and an oven lamp, a turntable motor, a fan motor, and a circulation motor are operated;
a second step in which another relay is turned on, and then a convection heater and a grill heater are simultaneously turned on; and
a third step in which the air heated by the convection heater and the grill heater are circulated in a cooking compartment by a circulation fan driven by a circulation motor, and then the cooking operation is performed.

FIG.1

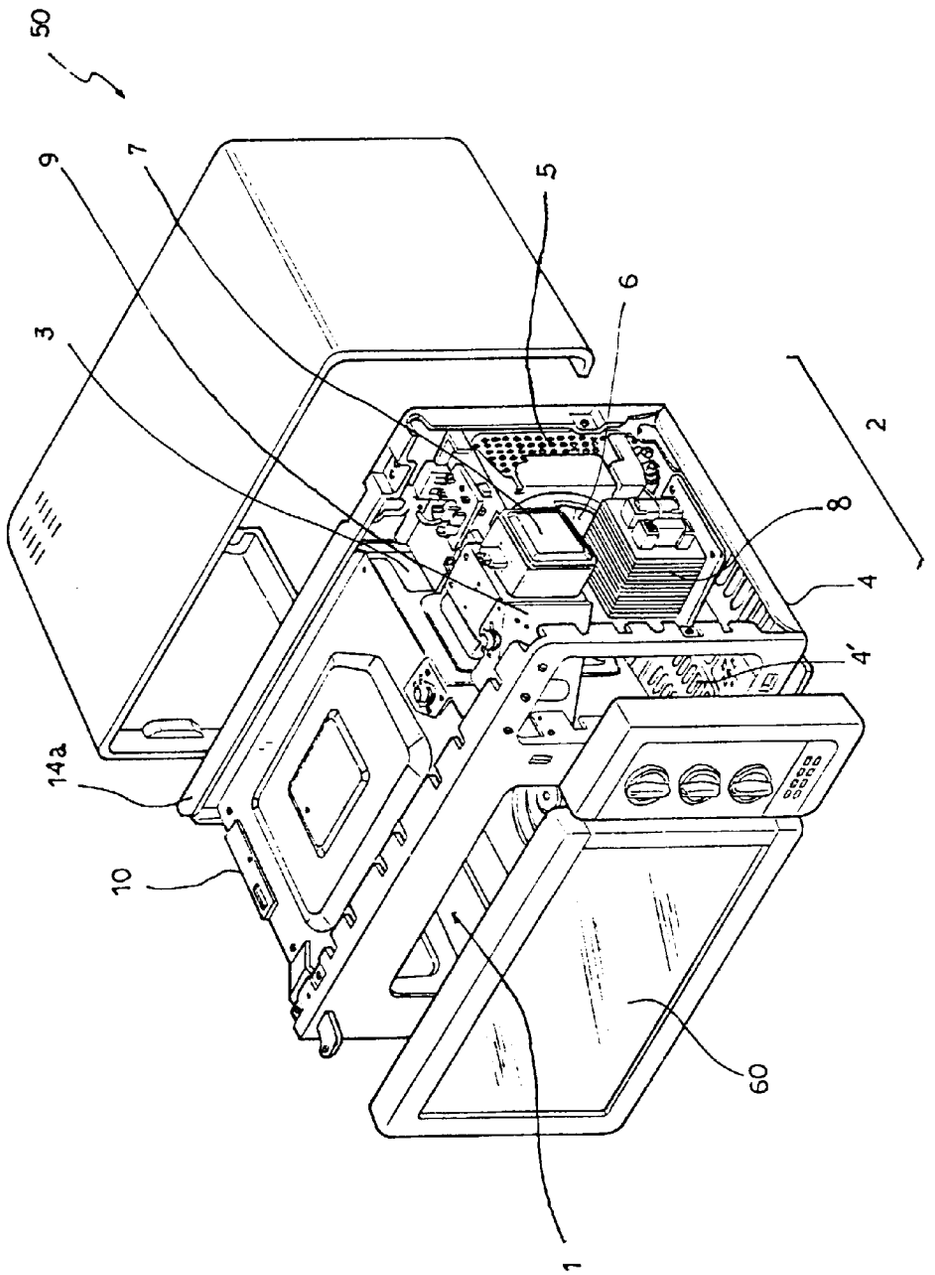


FIG.2

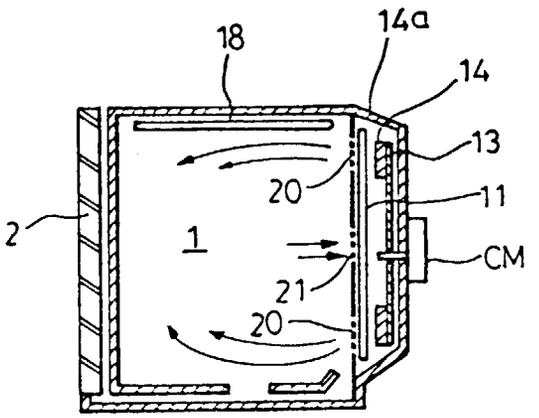

18
14a
14
13
20
11
2
1
CM
21
20

FIG.3

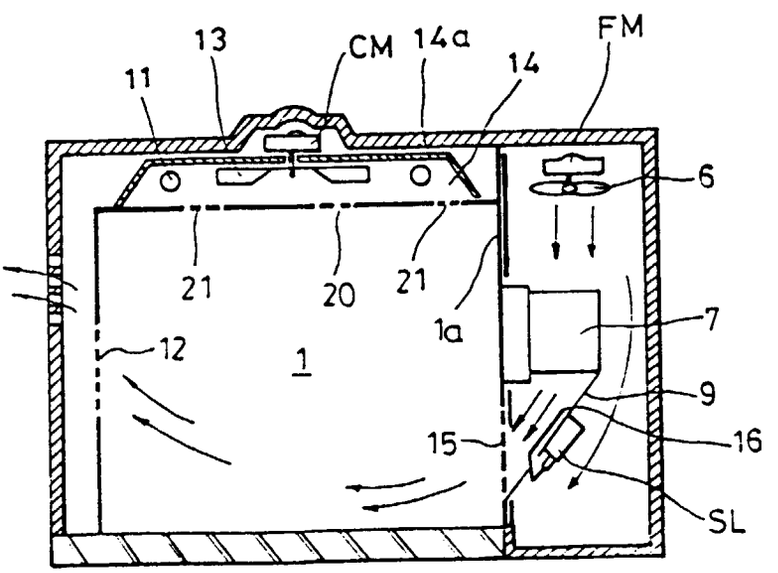

13
CM
14a
FM
11
14
6
21
20
21
1a
7
12
1
9
15
16
SL

FIG.4

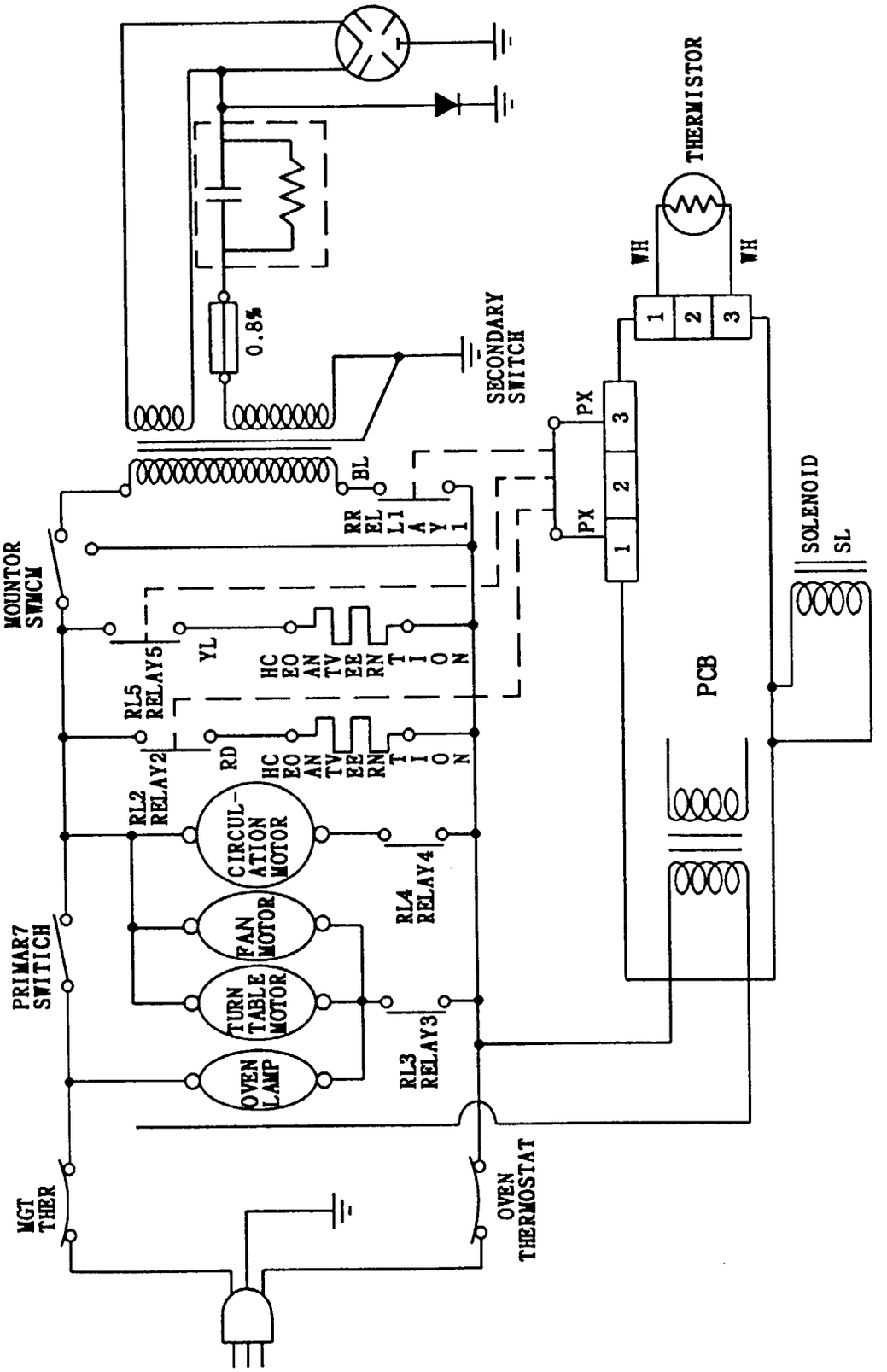

THERMISTOR
WH
WH
1
2
3
PX
PX
SECONDARY SWITCH
0.8%
BL
RR EL L1 A Y 1
SOLENOID SL
PCB
MOUNTOR SWICH
RL5 RELAY5
YL
HC EO AN TV EE RN T I O N
RL2 RELAY2
RD
CIRCUL-ATION MOTOR
FAN MOTOR
TURN TABLE MOTOR
OVEN LAMP
RL4 RELAY4
RL3 RELAY3
PRIMAR7 SWITICH
MGT THER
OVEN THERMOSTAT

FIG.5

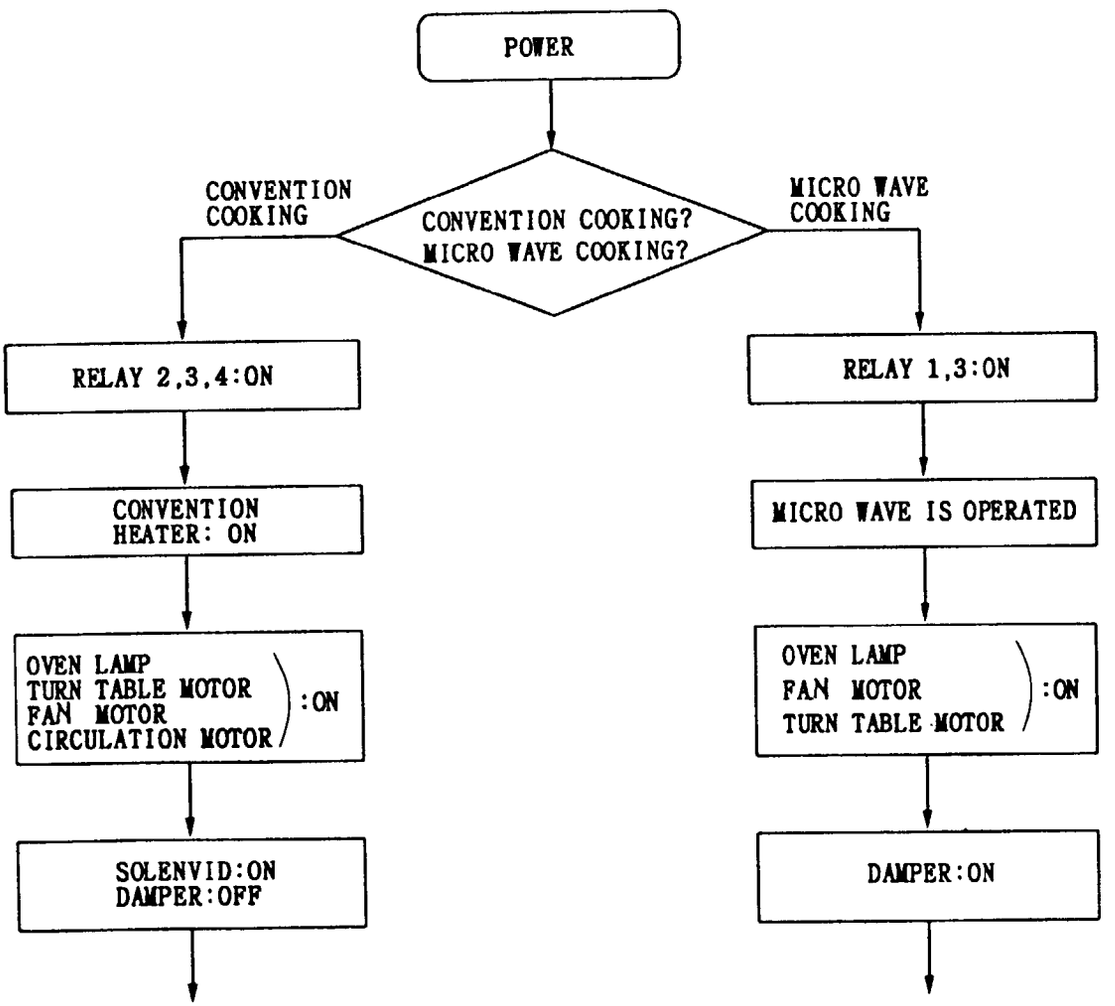

POWER
CONVENTION COOKING?
MICRO WAVE COOKING?
CONVENTION COOKING
MICRO WAVE COOKING
RELAY 2,3,4:ON
CONVENTION HEATER: ON
OVEN LAMP
TURN TABLE MOTOR
FAN MOTOR
CIRCULATION MOTOR
:ON
SOLENVID:ON
DAMPER:OFF
RELAY 1,3:ON
MICRO WAVE IS OPERATED
OVEN LAMP
FAN MOTOR
TURN TABLE MOTOR
:ON
DAMPER:ON

FIG.6

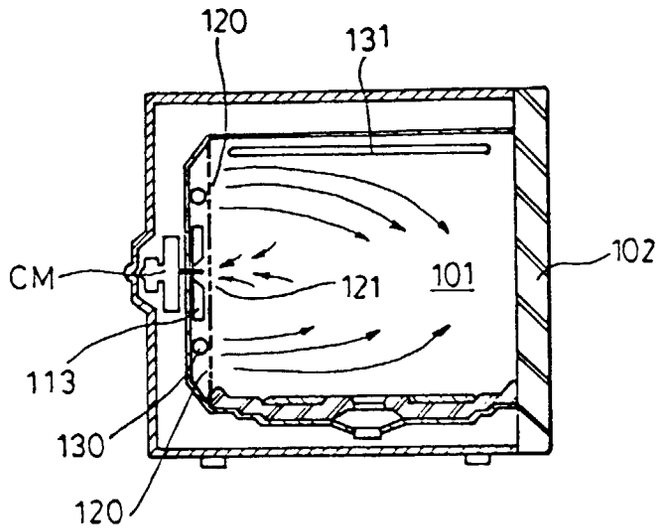

120
131
CM
121
101
102
113
130
120

FIG.7

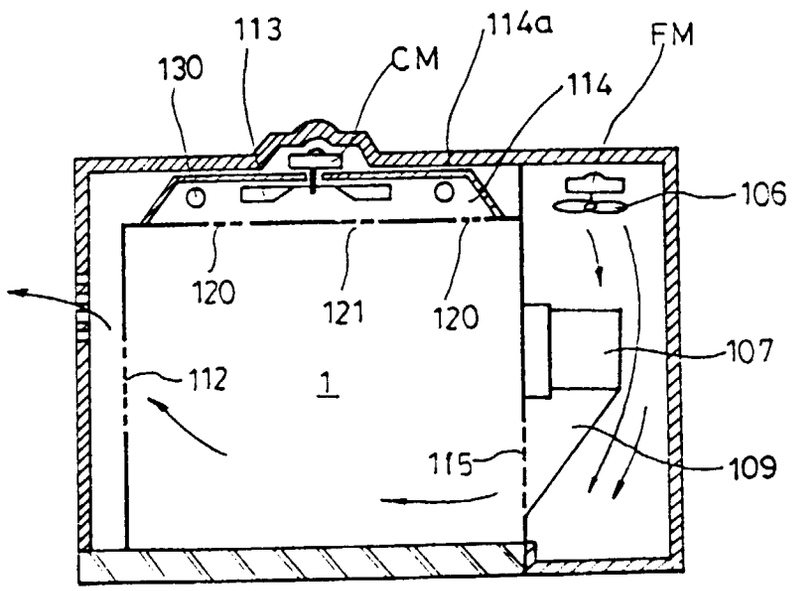
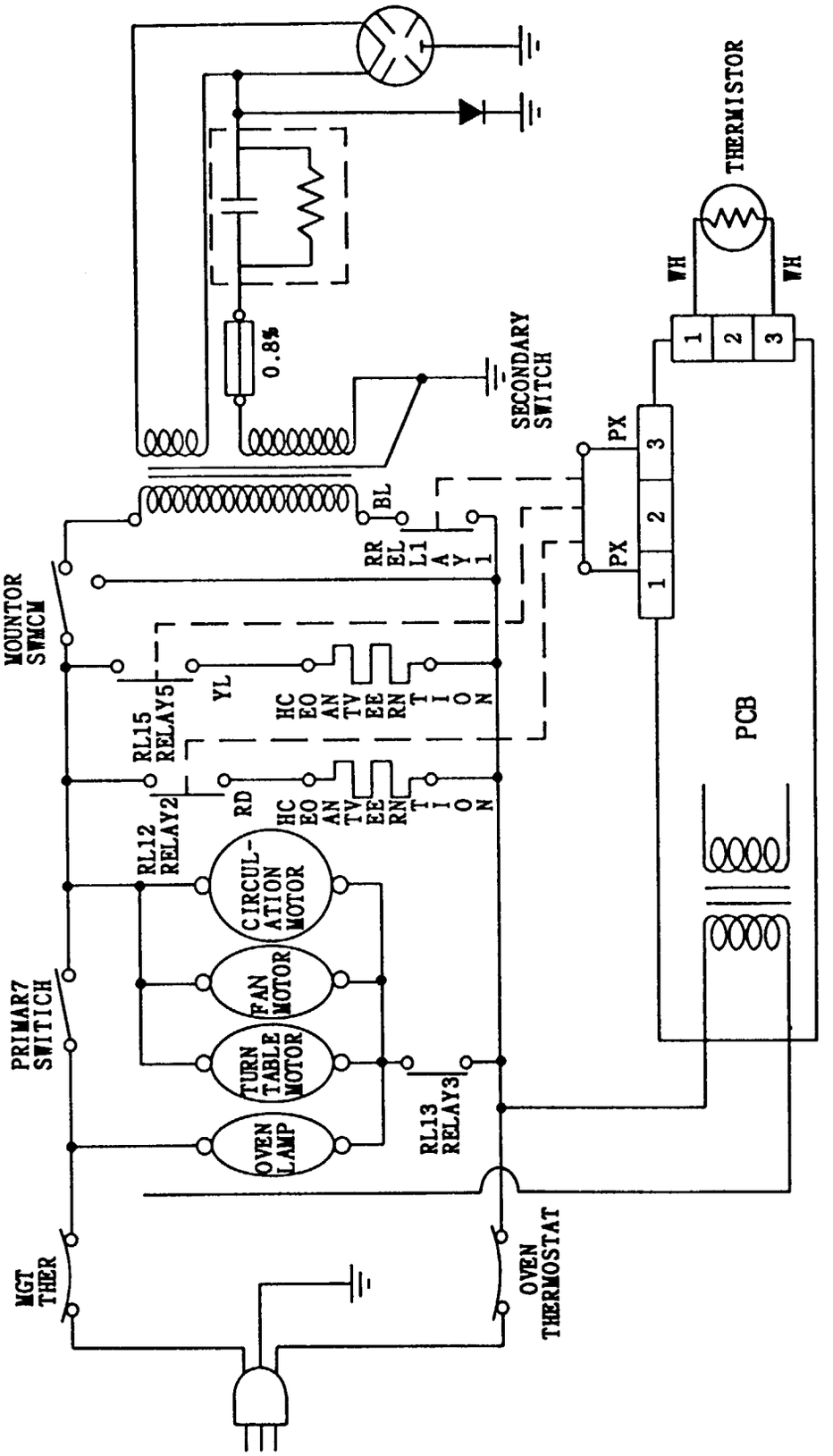

113
130
CM
114a
114
FM
106
120
121
120
107
112
1
115
109

FIG.8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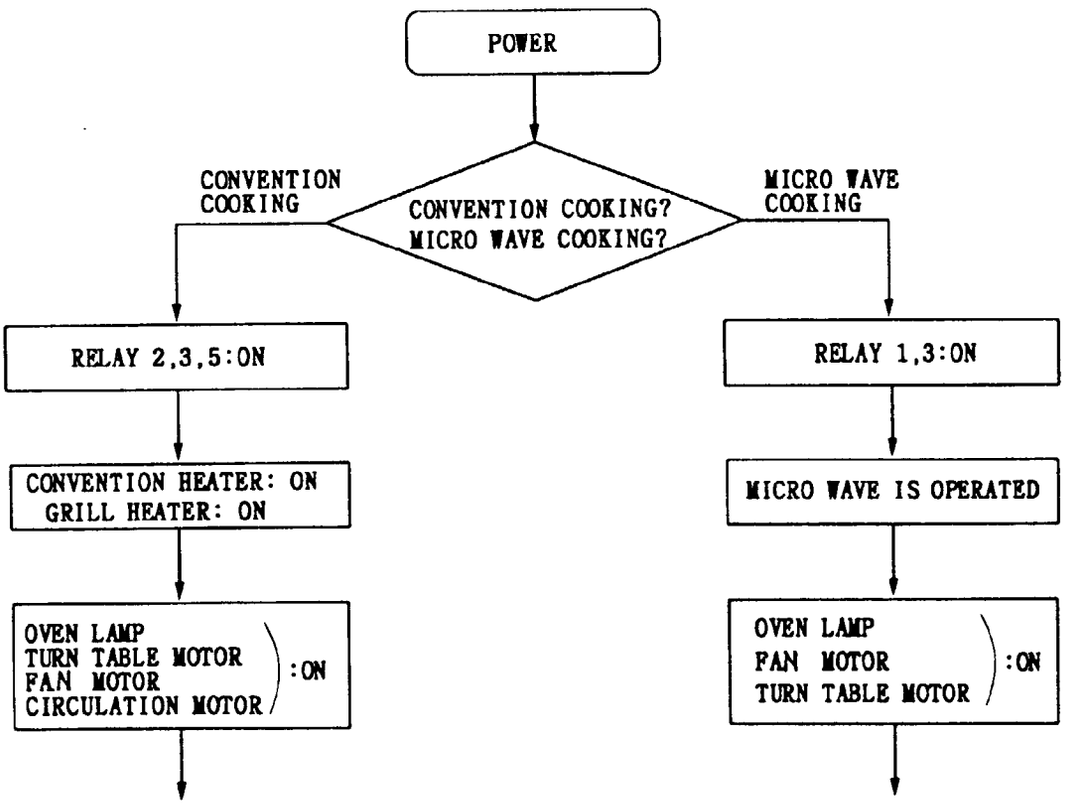
WH
1
2
3
PX
PX
PX
0.85
SECONDARY SWITCH
BL
RR EL L1 A Y 1
MOUNTOR SWMCM
RL15 RELAY5
YL
HC EO AN TV EE RN T I O N
RL12 RELAY2
RD
HC EO AN TV EE RN T I O N
CIRCUL-ATION MOTOR
FAN MOTOR
TURN TABLE MOTOR
OVEN LAMP
RL13 RELAY3
PRIMARY SWITICH
MGT THER
OVEN THERMOSTAT
PCB

FIG.9


POWER
CONVENTION COOKING?
MICRO WAVE COOKING?
CONVENTION COOKING
MICRO WAVE COOKING
RELAY 2,3,5:ON
CONVENTION HEATER: ON
GRILL HEATER: ON
OVEN LAMP
TURN TABLE MOTOR
FAN MOTOR
CIRCULATION MOTOR
:ON
RELAY 1,3:ON
MICRO WAVE IS OPERATED
OVEN LAMP
FAN MOTOR
TURN TABLE MOTOR
:ON