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## (54) Heating apparatus.

(57) A heating apparatus such as microwave ovens includes a heater (15) for heating food and a control device (4) for controlling the heater (15). The control device (4) includes a calendar section (6b) storing at least data of the name of a present month sequentially renewed with lapse of time, a heating information storing section (7a) storing a number of pieces of heating information about heating degrees of foods to be cooked, the pieces of heating information taking values different from one another with respect to a plurality of months, and a heating control section (7b) selecting one of the pieces of heating information in accordance with the name of the present month whose data is stored in the calendar section (6b) and controlling the heater (15) so that the heating degree indicated by the selected heating information is established.

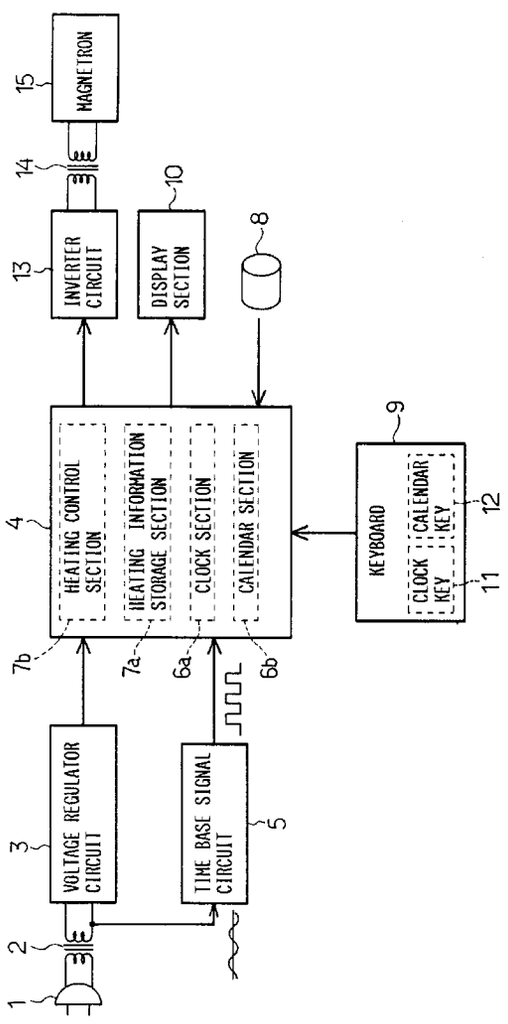


FIG.1

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This invention relates to a heating apparatus such as microwave ovens wherein food is heated to be cooked, and more particularly to such a heating apparatus wherein a degree of heating to the food is automatically selected.

In conventional microwave ovens, for example, data of heating period, heating power or heating temperature constants in accordance with kind of food are previously stored in a storage section of a heating control device. When a cooking menu is selected on a keyboard, the high frequency heating operation is controlled based on the stored constant corresponding to the selected food. Accordingly, the food can be heated to a suitable temperature just by selection of the kind of the food to be cooked.

However, edible temperatures of some food such as saké, a Japanese alcoholic beverage made from fermented rice or milk differ in seasons. The heating period is set uniformly in accordance with the kind of the food in the above-described conventional microwave ovens. Accordingly, for example, when milk is heated with the conventional microwave oven, the heated milk is felt too hot in summer while too lukewarm in winter. Thus, some food heated with the conventional microwave ovens are disadvantageously unfit to be eaten.

Therefore, an object of the present invention is to provide a heating apparatus wherein the temperature of food to be heated can be controlled in accordance with seasons.

In accordance with an aspect of the present invention, a heating apparatus comprising heating means for heating food and control means for controlling the heating means, is characterized in that the control means comprises a calendar section storing at least data of the name of a present month sequentially renewed with lapse of time, a heating information storing section storing a number of pieces of heating information about heating degrees of foods to be cooked, the pieces of heating information taking values different from one another with respect to a plurality of months, and a heating control section selecting one of the pieces of heating information in accordance with the name of the present month whose data is stored in the calendar section and controlling the heating means so that the heating degree indicated by the selected heating information is established.

When information about the kind of the food to be cooked is input to the control means, one of the pieces of heating information in accordance with the name of the present month indicated by the calendar section is selected by the control means. The heating period or the heating power of the heating means is controlled based on the selected heating information. Consequently, the food can be heated to the temperature or the condition suitable for the present season.

The heating information may preferably include information of a heating period of time.

The heating means may preferably comprise an inverter circuit delivering a high frequency voltage, a step-up transformer stepping up the high frequency voltage delivered from the inverter circuit, and a magnetron driven by an output voltage of the step-up transformer.

Furthermore, the heating apparatus may comprise a keyboard provided with a manually operated member for adjusting the name of the month whose data is to be stored in the calendar section.

The invention will be described, merely by way of example, with reference to the accompanying drawings in which:

FIG. 1 is a block diagram showing an electrical arrangement of a microwave oven in accordance with the present invention;

FIGS. 2a to 2c are views of a calendar section for explaining a procedure for setting the year, month and day;

FIGS. 3a to 3g are views of the calendar section displaying the set year, month and day:

FIGS. 4a and 4b are views of a clock section for explaining a procedure for setting time;

FIGS. 5a to 5e are views of the calendar section displaying time;

FIG. 6 is a flowchart for explaining the operation of a control section; and

FIG. 7 is a graph showing heating periods of milk in respective months.

One embodiment in which the invention is applied to a microwave oven will be described with reference to the drawings. Referring first to FIG. 1 illustrating an overall electrical arrangement of the microwave oven, a plug 1 connected to a commercial power source is further connected through a power transformer 2 to a voltage regulator circuit 3 including a rectifier circuit. An ac voltage stepped down by the power transformer 2 is applied to the voltage regulator circuit 3. The voltage applied to the voltage regulator circuit 3 is rectified by the rectifier circuit to a dc power, which dc power is supplied to a control section 4 serving as control means and various circuits.

A time base signal circuit 5 is connected to the secondary side of the power transformer 2. Time pulses are delivered by the time base signal circuit 5 in synchronism with the cycle of the commercial ac power supply voltage. For example, the time pulses at the frequency of 50 Hz are delivered when the power supply frequency is at 50 Hz.

An operation panel (not shown) includes a time adjusting knob 8, a keyboard 9 and a liquid crystal display

section 10. When the time adjusting knob 8 is manually operated, an operation signal in accordance with its volume of turning is supplied to the control section 4. Also, when each of clock key 11 and calendar key 12 is turned on or off, an operation signal in accordance with "on" or "off" operation of each key is supplied to the control section 4. Display contents in accordance with a display output from the control section 4 is displayed on the liquid crystal display section 10.

An inverter circuit 13 is provided with a switching element (not shown) and delivers, form its output terminal, a high frequency voltage obtained as the result of switching action of the switching element. The output terminal of the inverter circuit 13 is coupled via a high frequency transformer 14 to a high frequency heating circuit or magnetron 15 serving as heating means. The high frequency heating circuit 15 starts its oscillation in the condition that the high frequency voltage is delivered from the inverter circuit 13, thereby generating high frequency waves.

The control section 4 comprises a central processing unit (CPU) and is operated in accordance with a program whose data is stored in a memory (not shown). The control section 4 also includes a clock section 6a performing a timing operation based on the time pulses input from the time base signal circuit 5, a calendar section 6b which is subject to the clock section 6a to deliver calendar information. The control section 4 further includes a heating information storing section 7a and a heating control section 7b. In the heating information storing section 7a are stored information about heating degrees of food, for example, operation periods of the magnetron 15, heating power values, factors determining the heating degrees or the like in the form of a heating information table. The operating period of the heating means is controlled by the heating control section 7b based on the heating information read from the heating information storing section 7a. TABLE 1 shows pieces of information stored in the heating information storing section 7a in the embodiment. The information shown in TABLE 1 contains optimum operation periods of the magnetron 15 for cooking a plurality of foods in the seasons each having three successive months. The heating information table shown in TABLE 1 also contains standard operation periods of the magnetron 15 regardless of the seasons.

TABLE 1

| | HEATING PERIOD OF TIME (SECOND) | | | | |
|---|---|---|---|---|---|
| MONTH<br>MENU | 3-5 | 6-8 | 9-11 | 12-2 | Standard |
| A glass of milk (200 cc) | 120 | 100 | 120 | 140 | 120 |
| Two glasses of milk | 210 | 180 | 210 | 250 | 210 |
| Three glasses of milk | 310 | 270 | 310 | 350 | 310 |
| 180 milliliter of heated saké | 55 | 40 | 55 | 80 | 55 |
| 360 milliliter of heated saké | 100 | 80 | 100 | 140 | 100 |
| 540 milliliter of heated saké | 150 | 130 | 150 | 200 | 150 |
| 150 g of soup | 120 | 100 | 120 | 140 | 120 |
| 300 g of soup | 240 | 200 | 240 | 280 | 240 |
| 600 g of soup | 370 | 310 | 370 | 430 | 370 |

FIG. 7 shows a necessary continuous operation period of the magnetron 15 when the information of one of the continuous operation periods of the magnetron 15 for milk is read out and converted to that for 0.4 litter of milk. In this example the target heating temperature is 65°C in the standard heating period of 210 sec.

The operation of the microwave oven will be described. The clock section 6a and the calendar section 6b of the control section 4 are reset when the microwave oven is supplied with electric power. These clock and calendar sections 6a, 6b are set to respective initial values in the following manner. That is, when the calendar key 12 at the keyboard 9 is manually operated as shown in FIG. 2a, the numeral, "1990" are displayed on the liquid crystal display section 10 and subsequently, the letter, "Y" representative of "year" is flashed as shown in FIG. 3a. When the time adjusting knob 8 is turned as shown in FIG. 2a, the numeral displayed on the liquid crystal display section 10 is increased or decreased depending upon an amount and a direction of turning of

the time adjusting knob 8. In the case where the year is set to "1991," the time adjusting knob 8 is turned until the year, "1991" is displayed on the liquid crystal display section 10 as shown in FIG. 3b. Subsequently, when the calendar key 12 is operated as shown in FIG. 2b, the numeral "1" is displayed and then, the letter, "M" representative of "month" is flashed on the display section 10 as shown in FIG. 3c. In the case where the month is set to "10" or "October," the time adjusting knob 8 is turned as shown in FIG. 2b until the numeral, "10" is displayed on the display section 10 as shown in FIG. 3d. Then, when the calendar key 12 is operated as shown in FIG. 2c, the numeral "01" is displayed on the display section 10 following the numeral "10" indicative of the month and the letter, "D" representative of "day" is flashed as shown in FIG. 3e. In the case where the day is set to "27," the time adjusting knob 8 is turned as shown in FIG. 2c so that the numeral "27" is displayed on the display section 10 as shown in FIG. 3f. Then, the setting of the present date is completed when the calendar key 12 is operated in the condition that the numeral, "10" indicative of the month and the numeral, "27" indicative of the day are on display. Subsequently, the phrase, "clock display" is displayed on the display section 10 for the clock adjustment as shown in FIG. 3g.

The clock key 11 is operated after completion of the above-mentioned date setting as shown in FIG. 4a. An abbreviation "A.M." and the numeral "12" are displayed and the letter "H" indicative of "hour" is flashed on the display section 10 as shown in FIG. 5a. When the hour is set to "P.M. 5," the time adjusting knob 8 is turned so that the abbreviation "P.M." and the numeral "5" are displayed on the display section 10 as shown in FIG. 5b. In this condition, when the clock key 11 is operated as shown in FIG. 4b, the numeral "00" is displayed with "5 P.M." and the letter, "M" indicative of "minute" is flashed on the display section 10. When the minute is set to "15," the time adjusting knob 8 is turned so that the numeral "15" is displayed on the display section 10 as shown in FIG. 5d. Then, the clock key 11 is operated as shown in FIG. 4b so that the setting of the present time or initial value is completed.

When the present date, "27th October 1991" is set by operation of the calendar key 12, the control section 4 operates so that "1991," "10" and "27" are stored in year, month and day storage areas of the calendar section 6b respectively. Furthermore, when the present time, "5:15 P.M." is set by operation of the clock key 11, the control section 4 operates so that the numeral "17" indicative of "5 P.M." and "15" are stored in hour and minute storage areas of the clock section 6a respectively.

Contents stored in the clock section 6a and the calendar section 6b are sequentially renewed every time a predetermined number of the time pulses are continuously input to the control section 4 from the time base signal circuit 5. More specifically, the time pulse delivered from the time base signal circuit 5 to the control section 4 has a cycle in accordance with the commercial ac power supply frequency. The control section 4 determines that one second elapses when fifty time pulses are continuously input to the control section 4 in the case that the power supply frequency is at 50 Hz or when sixty time pulses are continuously input to the control section 4 in the case that the power supply frequency is at 60 Hz, thereby increasing by "1" the data stored in the second storage area of the clock section 6a. The control section 4 determines that one minute elapsed when data in the second storage area of the clock section 6a reaches 60. The data in the second storage area is reset and the data of the minute storage area is increased by "1." Furthermore, the control section 4 determines that one hour elapsed when the data of the minute storage area reaches 60. The data of the minute storage area is then reset and the data of the hour storage area is increased by "1."

When the data of the hour storage area reaches "24" as the result of renewal of the data, the control section 4 operates to reset the hour storage area and to renew the data of the calendar section 6b. More specifically, the control section 4 is arranged to store data of calendars for a plurality of years and to renew the data of day, month and year storage areas of the calendar section 6b in accordance with the data of the calendars. As the result of the above-described operations, data of the present time is stored in the clock section 6a and data of the present date is stored in the calendar section 6b of the control section 4.

The present time whose data is stored in the clock section 6a is displayed on the display section 10 when the present date is set, so that a user can confirm the present time on the display 10. Furthermore, upon operation of the calendar key 11, the present date whose data is stored in the calendar section 6b is displayed on the display 10 for five minutes, so that the user can confirm the present date.

The control section 4 operates to control the operation period of the inverter circuit 13 based on the data of the present date stored in the calendar section 6b when one cooking menu is selected by the operation of the selecting key on the keyboard 9. The case where milk is heated will be described. Referring to FIG. 6, the control section 4 advances from step S1 to step S2 upon selection of milk as an object to be heated. At step S2 the control section 4 inputs the data of the present month from the calendar section 6b and further inputs the data of the heating period corresponding to the input present month from the heating period information table stored in the heating information storing section 7a as shown in TABLE 1. In this case the heating period necessary for heating 0.4 lit. of milk is set to the standard value of 210 seconds in the spring between March and may and the autumn between September and November, as shown in TABLE 1. Furthermore, the heating

period is set to a period longer than 210 seconds in winter between December and February and to a period shorter than 210 seconds in the summer between June and August. Accordingly, the control section 4 operates so that the milk is heated for the period of time set as described above, at step S4. The heated milk is at 65°C as the standard temperature in the spring and autumn, at the temperature higher than the standard temperature in the winter, and at the temperature lower than the standard temperature in the summer.

In accordance with the above-described embodiment, the operating period of the inverter circuit 13, that is, the operating period of the magnetron 15 is determined based on the data of the present month (season) stored in the calendar section 6b. Consequently, the food can be heated so as to have the temperature suitable for the season. Thus, although the food is heated for the same period of time irrespective of the seasons in the prior art, the food can be heated to the temperature in accordance with the season in the present invention.

When the calendar function of the control section 4 is interrupted for some reason or other, heating the food is performed based on the standard mode in the heating information table as shown in TABLE 1 and accordingly, the food is heated in the same degree of heating irrespective of the season.

Although a plurality of heating periods are set in accordance with the seasons in the foregoing embodiment, they may be set in accordance with the months. Furthermore, the heating power may be varied in accordance with the season instead of the heating period. Additionally, the invention may be applied to a cooking range with both oven and grill functions.

The foregoing disclosure and drawings are merely illustrative of the principles of the present invention and are not to be interpreted in a limiting sense. The only limitation is to be determined from the scope of the appended claims.

## Claims

1. A heating apparatus comprising heating means (15) for heating food and control means (4) for controlling the heating means (15), characterized in that the control means (4) comprises a calendar section (6b) storing at least data of the name of a present month sequentially renewed with lapse of time, a heating information storing section (7a) storing a number of pieces of heating information about heating degrees of foods to be cooked, the pieces of heating information taking values different from one another with respect to a plurality of months, and a heating control section (7b) selecting one of the pieces of heating information in accordance with the name of the present month whose data is stored in the calendar section (6b) and controlling the heating means (15) so that the heating degree indicated by the selected heating information is established.

2. A heating apparatus according to claim 1, further characterized in that the heating information includes information of heating period of time.

3. A heating apparatus according to claim 1, further characterized in that the heating means (15) comprises an inverter circuit (13) delivering a high frequency voltage, a step-up transformer (14) stepping up the high frequency voltage delivered from the inverter circuit (13), and a magnetron (15) driven by an output voltage of the step-up transformer (14).

4. A heating apparatus according to claim 1, further characterized by a keyboard (9) provided with a manually operated member (11,12) for adjusting the name of the month whose data is to be stored in the calendar section (6b).

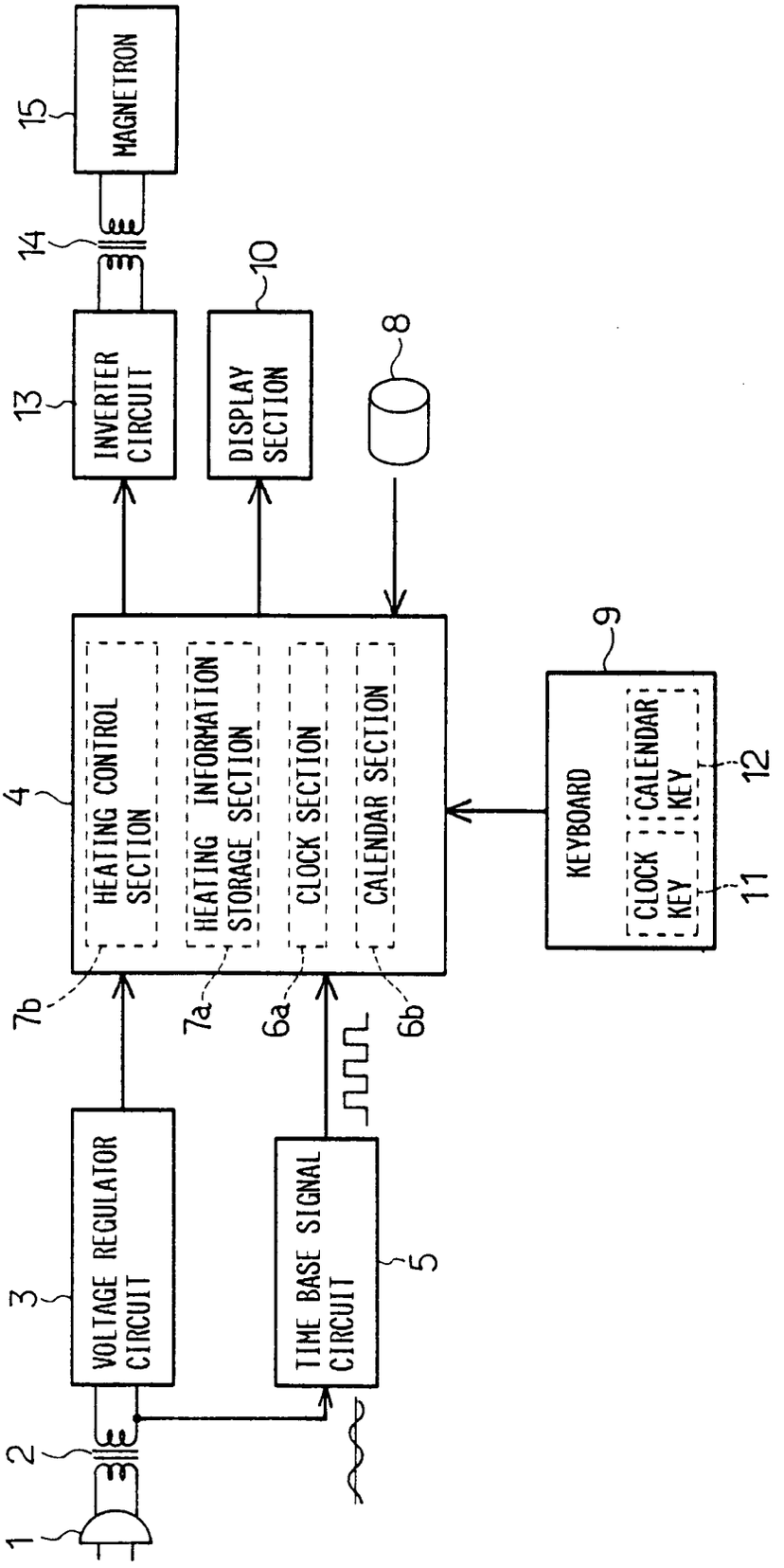

MAGNETRON
15
14
INVERTER CIRCUIT
13
DISPLAY SECTION
10
8
HEATING CONTROL SECTION
HEATING INFORMATION STORAGE SECTION
CLOCK SECTION
CALENDAR SECTION
4
7b
7a
6a
6b
KEYBOARD
9
CLOCK KEY
CALENDAR KEY
12
11
VOLTAGE REGULATOR CIRCUIT
3
TIME BASE SIGNAL CIRCUIT
5
2
1

FIG.1

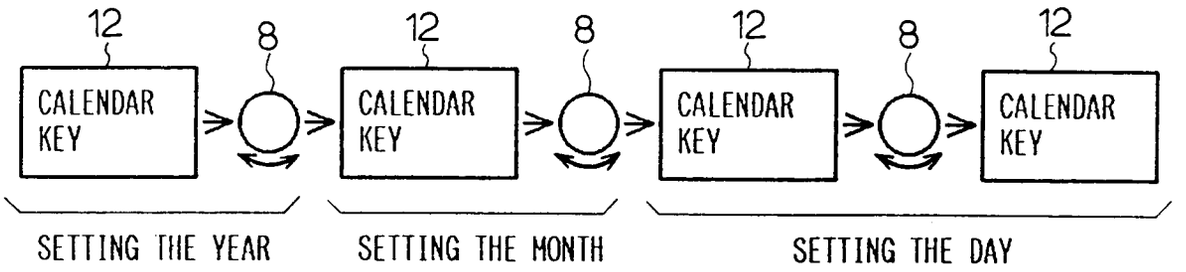



FIG.2a FIG.2b FIG.2c

FIG.3a

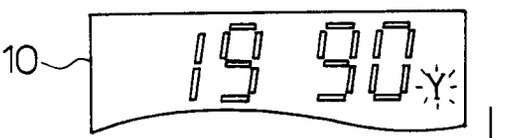



FIG.3b

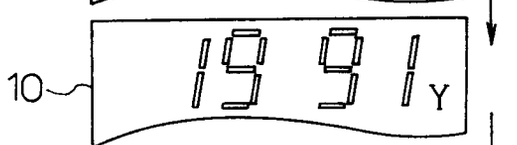



FIG.3c

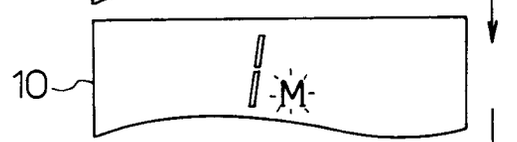



FIG.3d

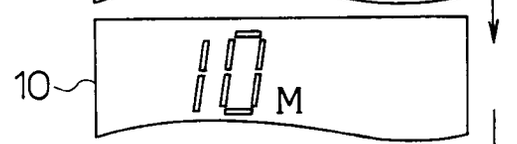



FIG.3e


FIG.3f

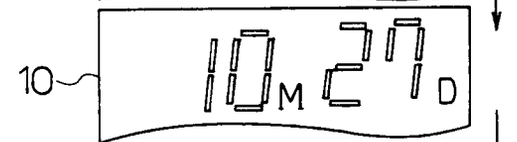
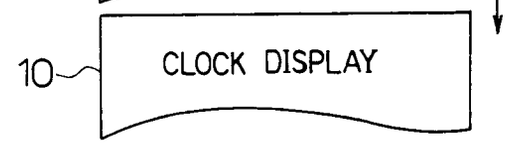



FIG.3g



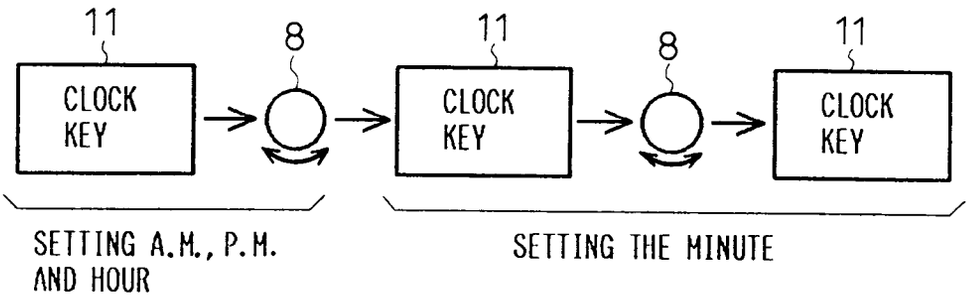



FIG.4a FIG.4b

FIG.5a

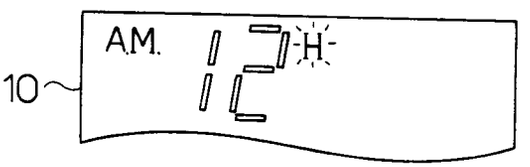



FIG.5b

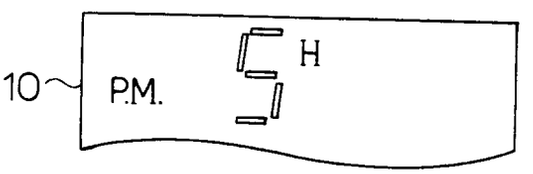



FIG.5c

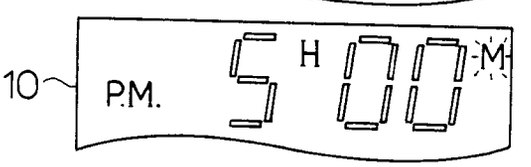



FIG.5d

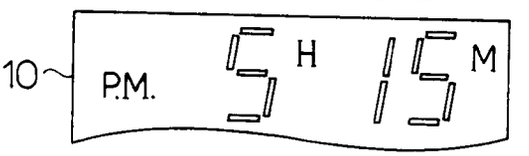
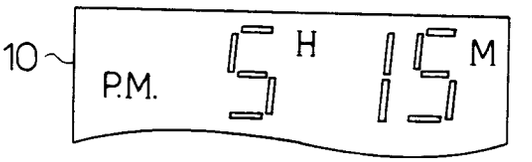



FIG.5e



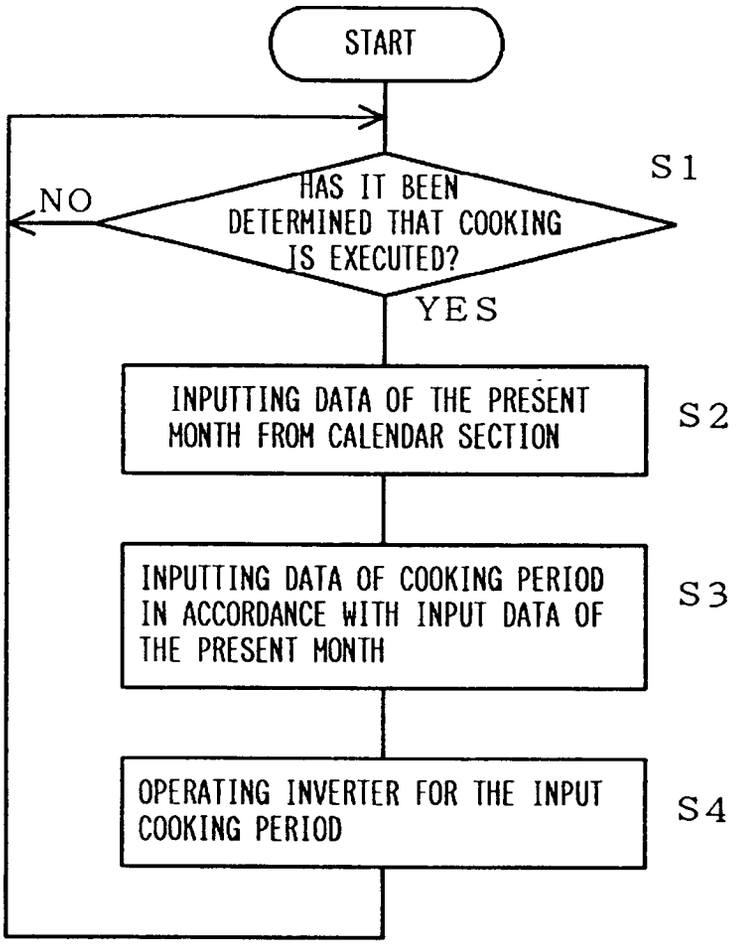

START
HAS IT BEEN DETERMINED THAT COOKING IS EXECUTED?
S1
NO
YES
INPUTTING DATA OF THE PRESENT MONTH FROM CALENDAR SECTION
S2
INPUTTING DATA OF COOKING PERIOD IN ACCORDANCE WITH INPUT DATA OF THE PRESENT MONTH
S3
OPERATING INVERTER FOR THE INPUT COOKING PERIOD
S4

FIG.6

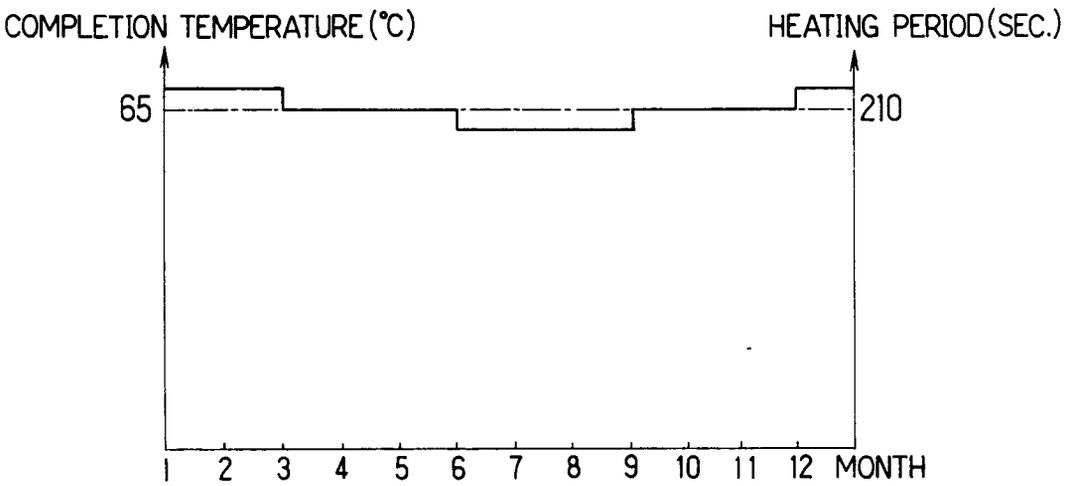

COMPLETION TEMPERATURE (°C)
HEATING PERIOD (SEC.)
65
210
1 2 3 4 5 6 7 8 9 10 11 12 MONTH

FIG. 7