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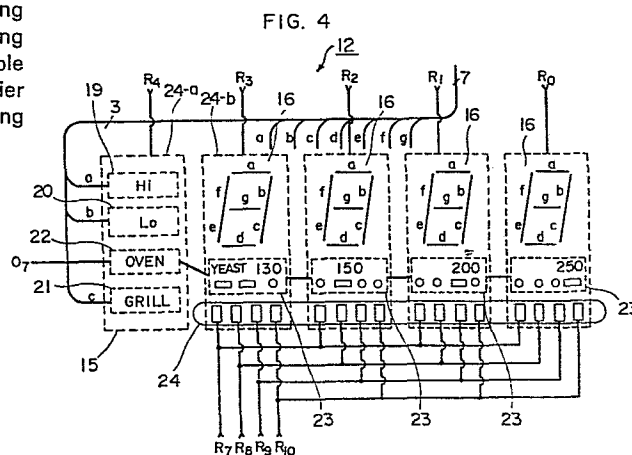
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## (54) **HEATING STATE INDICATOR FOR HEAT COOKING OVEN USING MULTICOLOR FLUORESCENT.**

(57) In this heat cooking oven, a cooking mode indicator (15) indicates heat or microwave cooking mode, a temperature scale indicator (23) indicates the set cooking temperature, a temperature indicator (24) indicates the present cooking temperature, and a time indicator (16) indicates the cooking time. The variety of information is indicated in multiple colors in one multicolor fluorescent display tube to be easier to see and read without error in a microwave heat cooking oven having a heater.



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## DESCRIPTION

## TITLE OF THE INVENTION

APPARATUS FOR DISPLAYING HEATING CONDITION OF  
HEATING COOKER USING MULTICOLORED FLUORESCENT DISPLAY  
TUBE

## 1 TECHNICAL FIELD

This invention relates to means for displaying  
the heating condition of a heating cooking apparatus such  
as a microwave oven.

## 5 BACKGROUND ART

With the progress of the semiconductor technology,  
many microcomputer-applied products are now being made  
in the field of domestic appliances, too. The field  
of heating apparatus is also not an exception, and  
10 many microcomputer-applied products have appeared in  
this field so far. On the other hand, however, the  
procedure for manipulation of such an apparatus seems  
to become more complex. In the field of domestic ap-  
pliances, ease of manipulation and clear visibility of  
15 display are especially required.

In an apparatus such as a so-called composite  
oven which is an integral combination of a microwave oven  
and an ordinary oven, it is necessary to apply the  
output power level and cooking time as input information  
20 in the case of cooking with the microwave oven and

1 to apply the oven internal temperature and time as  
input information in the case of cooking with the ordinary  
oven. In the practical use of such an apparatus, it  
seems that many of the users have had the feeling of  
5 perplexity in spite of the digital display of the  
heating condition. That is, when a single display tube  
is used to display both of the temperature and the time,  
the user is unable to see the temperature when the  
display tube is displaying the time. This applies also  
10 to the converse case.

Although both of the temperature and the time  
can be simultaneously displayed by providing two display  
tubes, this results in various problems including an  
increase in the cost and a large space occupied by the  
15 display part.

Referring to Fig. 1, microwave generated from  
a magnetron 1 is guided by a waveguide 2 to be absorbed  
by a foodstuff placed in a heating cavity 3. An electric  
heater 4 is provided in the heating cavity 3 to heat  
20 the interior of the heating cavity 3 for oven cooking.  
On the other hand, a fluorescent display tube has a  
structure as shown in Figs. 2A and 2B, and thermions  
emitted from a cathode 5 are accelerated by a positive  
voltage applied across grids 6 and anodes 7 to stimulate  
25 and cause fluorescence of a fluorescent paint 8 coated  
on the anodes 7. The voltage is selectively applied  
across the grids 6 and the anodes 7 so as to display  
desired figures, characters, symbols and graphics.

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1           Fig. 3 shows an example of a control panel  
in which two fluorescent display tubes are used. One of  
the fluorescent display tubes 9 includes a cooking mode  
display part 10 and a time display part 11, and the  
5 other fluorescent display tube 13 provides a temperature  
display part 14. Because of the provision of two fluorescent display tubes, the control part has been  
complex resulting in poor controllability.

#### DISCLOSURE OF THE INVENTION

10           It is an object of the present invention to  
provide a heating cooking apparatus in which a single  
multicolored fluorescent display tube is employed to  
clearly visibly display both of the temperature and the  
time and which is satisfactorily controllable.

15           An embodiment of the present invention will  
be described hereinunder with reference to the drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a partly cut-away, front elevation  
view of a composite microwave oven.

20           Figs. 2A and 2B are a sectional view and a  
partly sectional, perspective view showing the structure  
of a prior art fluorescent display tube.

Fig. 3 is a front elevation view of part of  
a control part of a heating apparatus using a plurality  
25 of fluorescent display tubes.

Fig. 4 is a connection diagram of individual

1 segments of a multicolored fluorescent display tube in  
an embodiment of the heating cooking apparatus of the  
present invention.

Fig. 5 is a display pattern diagram of the  
5 multicolored fluorescent display tube.

Fig. 6 is a diagram showing the temperature  
display part and its light emission timing.

Fig. 7 is a circuit diagram of one embodiment  
of the heating cooking apparatus of the present invention.

10 Fig. 8 is a display pattern diagram showing  
another structure of the multicolored display tube.

Fig. 9 is a circuit diagram of another embodi-  
ment of the present invention.

Fig. 10 is a diagram showing the relation be-  
15 tween the anode voltage and the luminance of the fluores-  
cent display tube.

Fig. 11 is a display pattern diagram of the  
multicolored fluorescent display tube when the color is  
changed for each of the heating parameters.

20 Fig. 12 is an external perspective view  
of the composite microwave oven.

#### BEST MODE FOR CARRYING OUT THE INVENTION

Fig. 4 shows a connection pattern of a single  
multicolored fluorescent display tube 12 which includes  
25 therein a cooking mode display part 15, a time display  
part 16, a temperature display part 24 and a temperature  
scale display part 23. In the multicolored fluorescent

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1 display tube 12 above described, a fluorescent paint  
whose fluorescent color is green is coated on characters  
"Hi" 19 (a display indicating a high microwave out-  
put), "Lo" 20 (a display indicating a low microwave  
5 output), "GRILL" 21 (cooking by a heater subsequent  
to cooking with a high microwave output), and segments  
of individual digits, and a fluorescent paint  
whose color is red is coated on characters "OVEN" 22  
(cooking by the heater) and segments of the temperature  
10 scale display part 23 and temperature display part 24.  
The cathode of "OVEN" 22 and the cathode of the temper-  
ature scale display part 23 are connected within the  
display tube. Therefore, when the "OVEN" mode is  
selected, the "OVEN" display part 22 and the temperature  
15 scale display part 23 emit light simultaneously so that  
the purpose of demanding the temperature input can also  
be attained.

When now a positive voltage is applied to  
the multicolored fluorescent display tube 12 through a  
20 terminal  $O_7$  and a terminal  $R_4$  connected to a grid 24-a,  
"OVEN" 22 luminesces in red. On the other hand, when  
the positive voltage is applied through the terminal  $O_7$   
and a terminal  $R_3$  connected to a grid 24-b, "YEAST 120"  
luminesces in red. Similarly, by sequentially energizing  
25 through terminals  $R_2$  and  $O_7$ , terminals  $R_1$  and  $O_7$ , and  
terminals  $R_0$  and  $O_7$  at a high speed, the human eye  
recognizes as if all of the "OVEN" display 22 and the  
temperature scale display part 23 are luminant as shown

1 in Fig. 5. The temperature display segments are  
controlled by signal conductors extending from terminals  
 $R_7 - R_{10}$  and signal conductors extending from terminals  
 $R_3 - R_{\phi}$ . Fig. 6 shows the timing chart of output voltage  
5 levels at the terminals  $R_0 - R_3$  and terminals  $R_7 - R_{10}$   
when "200°C" is displayed. The fluorescent paint whose  
color is red is also coated on the anode segments of  
the temperature scale. Fig. 7 shows one form of an  
electrical circuit used for the practice of the present  
10 invention.

A microcomputer 25 controls this systems.  
Current supply to the electric heater 4 is controlled  
by a triac 26 which is turned on-off by an output terminal  
 $R_5$  of the microcomputer 25 and an electronic circuit  
15 27. For controlling the internal temperature of the  
heating cavity 3, a thermistor 28, output terminals  
 $R_{11} - R_{15}$  of the microcomputer 25, a D-A converter 29  
and a comparator 30 sense the temperature, and, on the  
basis thereof, the microcomputer 25 judges as to whether  
20 or not its output should appear at the terminal  $R_5$ .

On the other hand, excitation of the magnetron  
1 is controlled by turning on and off the primary side  
of a high-voltage transformer 32 by an output terminal  
 $R_6$  of the microcomputer 25 and an electronic circuit  
25 31. As soon as the primary side is closed, a high voltage  
is induced in the secondary side thereby exciting the  
magnetron 1. When the heater 4 is selected as the  
heating source, the temperature scale luminescens in red.

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- 1 No luminescence occurs when the magnetron 1 is selected.  
The grid voltage for a multicolored fluorescent display  
tube 33 is sequentially supplied from terminals  $R_3 - R_{\phi}$   
of the microcomputer 25, and the anode voltage is  
5 supplied in parallel from terminals  $O_0 - O_7$ .

When a temperature key 35 is depressed after  
selection of "OVEN" by a cooking mode key 34, the number  
of times of depression or the duration of depression  
is counted to display the set temperature. After depres-  
10 sion of a time key 36, a start key 37 is depressed.  
The signal output from the microcomputer 25 is control-  
led so that, with the rise of the internal temperature of  
the oven, the segments corresponding to the present  
internal temperature make flashing, and, thus, both of  
15 the set temperature and the present temperature are  
displayed on the same temperature display part. Alter-  
natively, for the display of the set temperature, the  
segments corresponding to that temperature only are  
turned on or make flashing so as to display the oven  
20 internal temperature in the form of a bar.

Fig. 8 illustrates that a status part indicat-  
ing the cooking condition is additionally disposed  
above the time display part. The color of light emitted  
from that part differs from those of the other display  
25 parts and differs also from that of the figure display  
part. Fig. 9 shows a circuit for driving the fluorescent  
display tube above described. Output voltages from  
terminals  $R_{16} - R_{20}$  and terminals  $O_8 - O_{11}$  are raised by



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1 drivers 39 and 40 before being applied to the multi-  
colored fluorescent display tube. This is because the  
luminous efficacy differs depending on fluorescent  
paints as shown in Fig. 10, and it is therefore neces-  
5 sary to increase the luminance of a paint having a  
poor luminous efficacy. Fig. 11 shows another example  
in which the display parts emit different colors cor-  
responding to the heating parameters. For example, "Hi"  
and "Lo" indicating the cooking condition under micro-  
10 wave heating as well as the cooking time display figures  
emit green light, while "OVEN" and "GRILL" indicating  
the cooking condition under heating with the heater  
as well as the temperature display part emit red light,  
so that the cooking condition can be identified at  
15 a glance.

#### INDUSTRIAL APPLICABILITY

As described hereinbefore, according to the  
present invention, a single multicolored fluorescent  
display tube is employed to display in plural colors the  
20 cooking condition under microwave heating, the cooking  
condition under heating with the heater, the time  
setting and the temperature setting. Therefore, the  
present invention can provide a heating cooking apparatus  
in which the display is clearly visible and can be  
25 read without any error and which is free from mal-  
handling.

## CLAIMS

1. A heating cooking apparatus comprising a plurality of heating means for cooking an object to be heated by heating the same, a control part controlling these heating means, input means for applying to said control part a plurality of data including selection of the heating means, heating temperature and heating time, and a multicolored display tube capable of simultaneously displaying said plural data applied from said input means.
2. A heating cooking apparatus according to Claim 1, wherein said multicolored display tube displays different colors corresponding to the plural heating means respectively.
3. A heating cooking apparatus according to Claim 1, wherein, when the heating means requiring temperature display is selected, the color displaying that mode is the same as that of the temperature display.
4. A heating cooking apparatus according to Claim 1, wherein the voltage applied across the grids and the anodes of said multicolored display tube is changed for each of the emitted colors.
5. A heating cooking apparatus according to Claim 1, wherein the heating time is digitally displayed, and the heating temperature is analogly displayed in a bar form.

FIG. 1

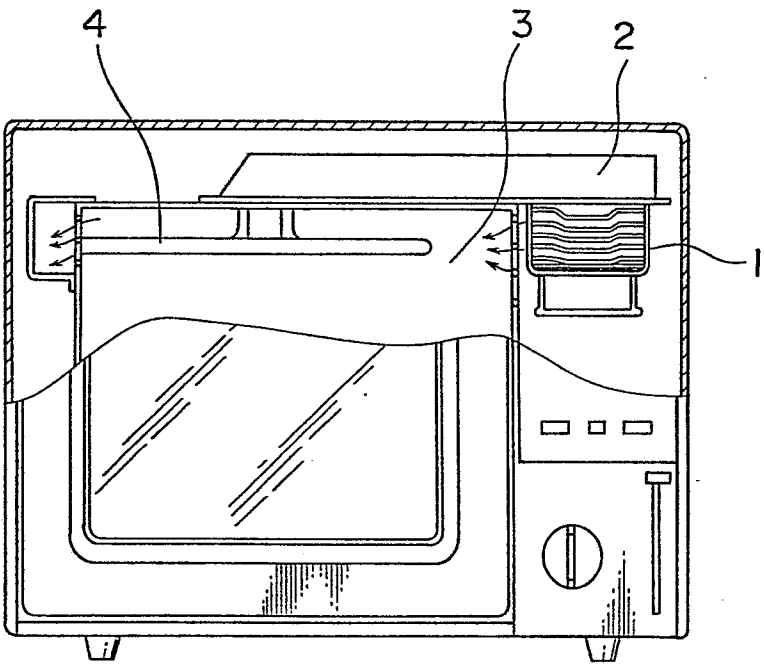


FIG. 2A

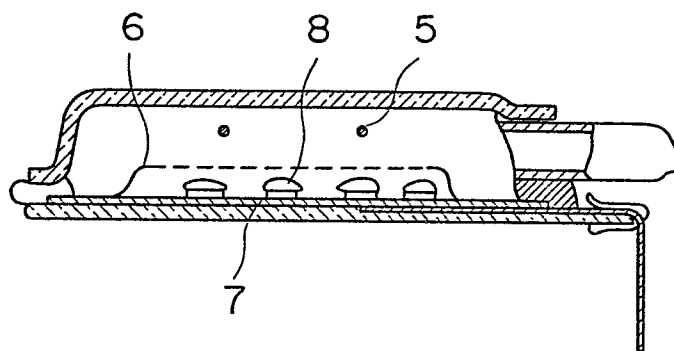


FIG. 2B

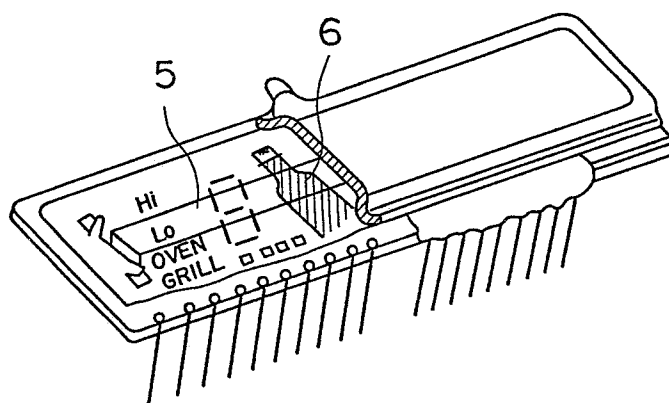


FIG. 3

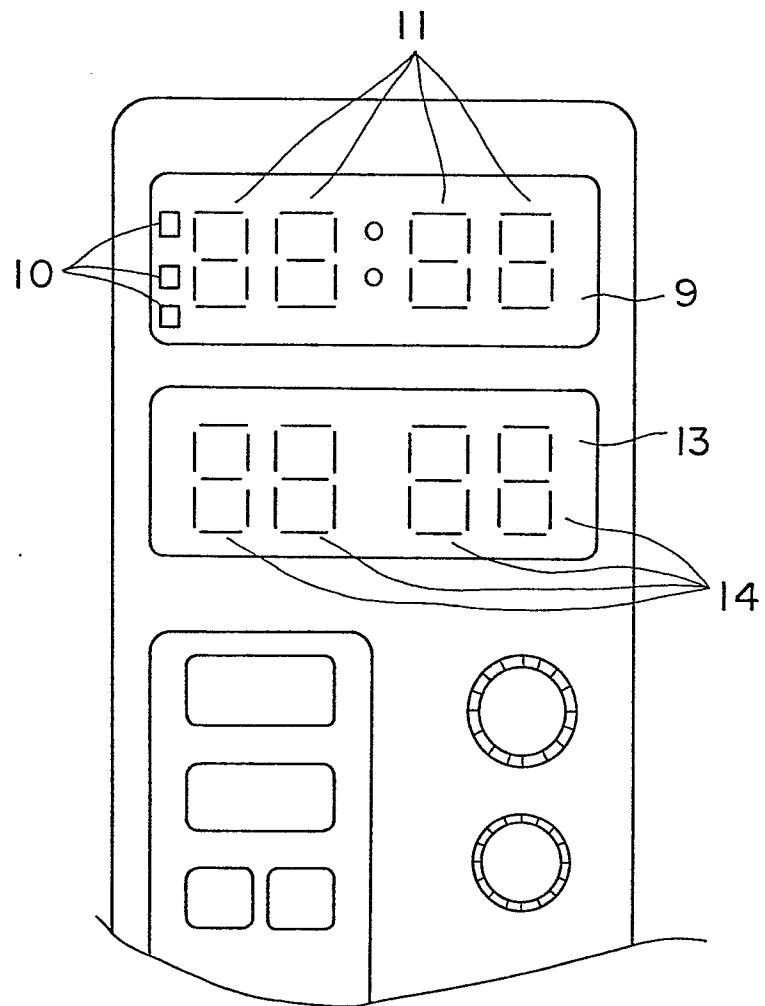


FIG. 4

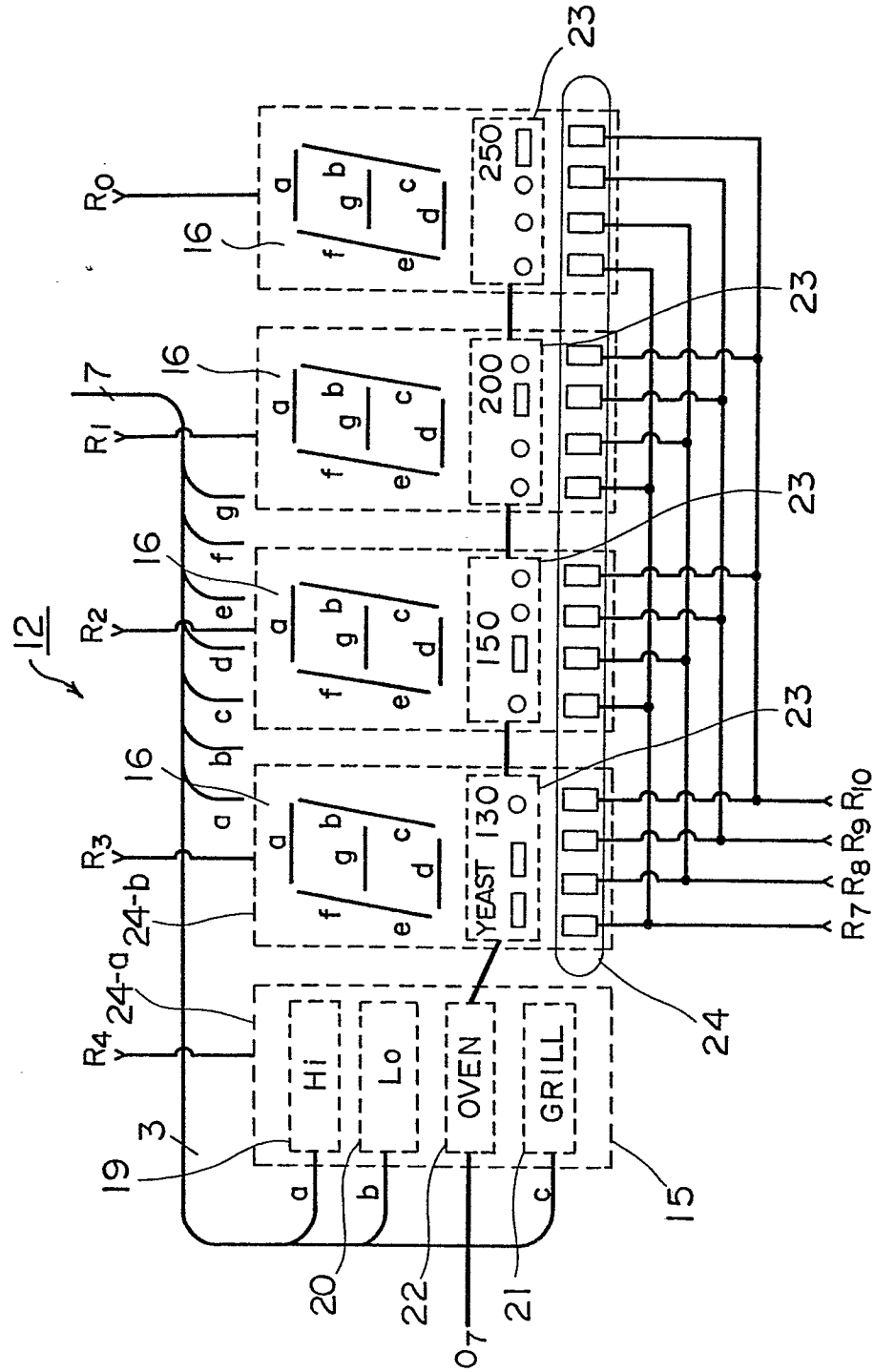


FIG. 5

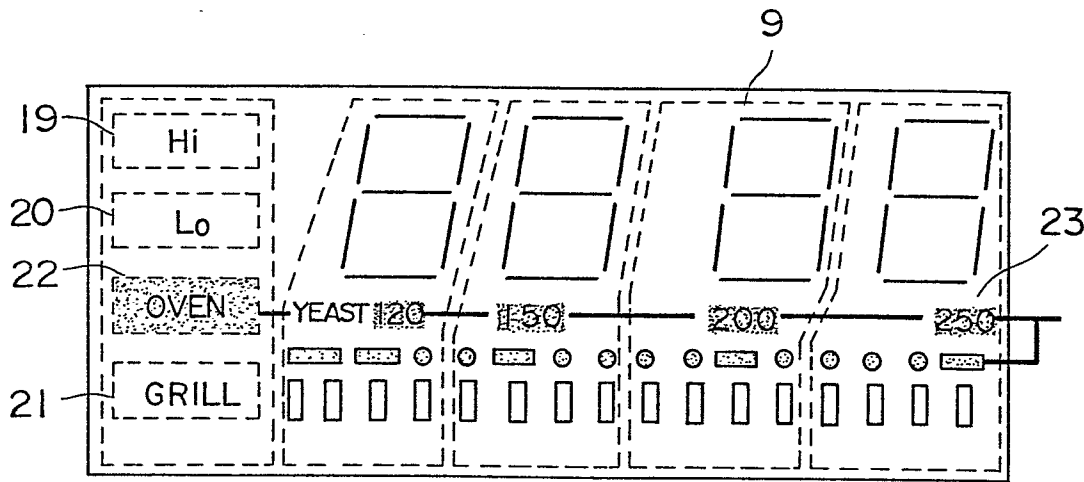
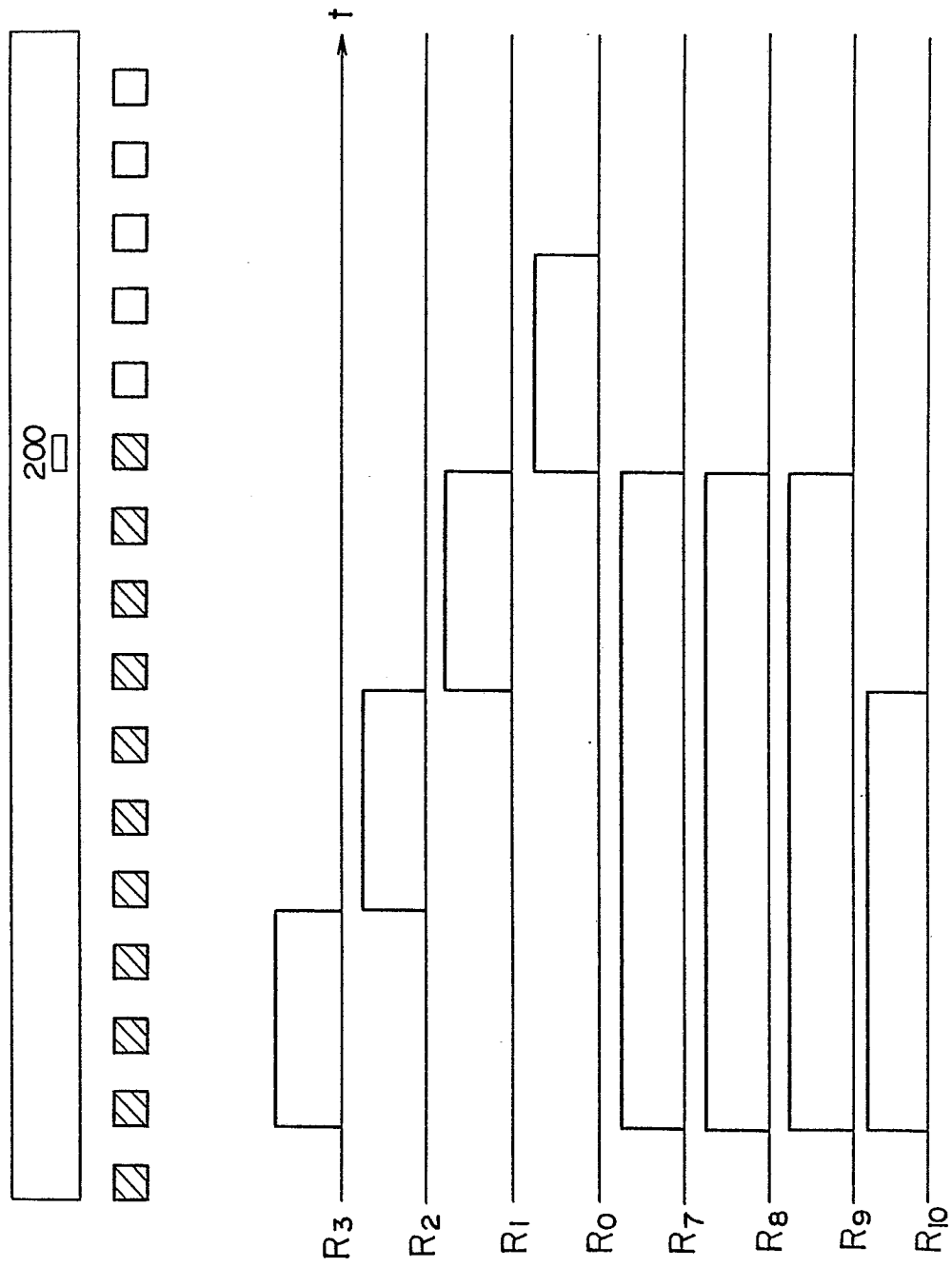


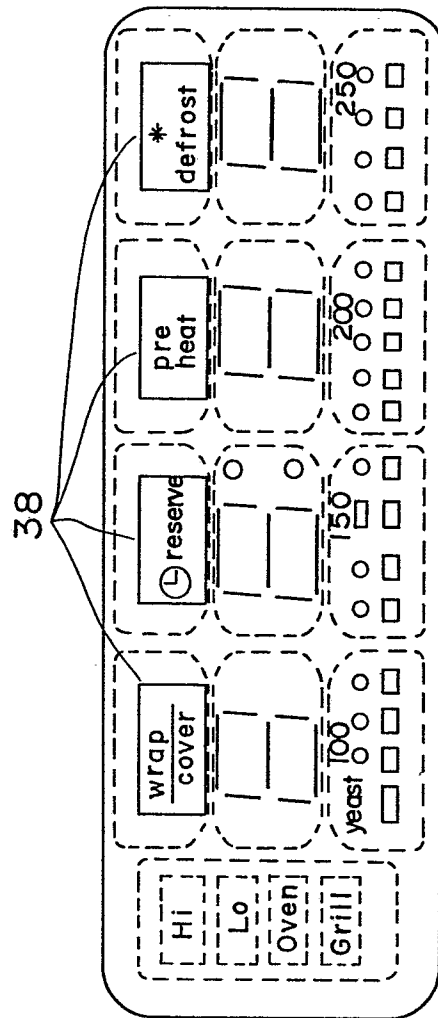
FIG. 6





Micro - computer

FIG. 8



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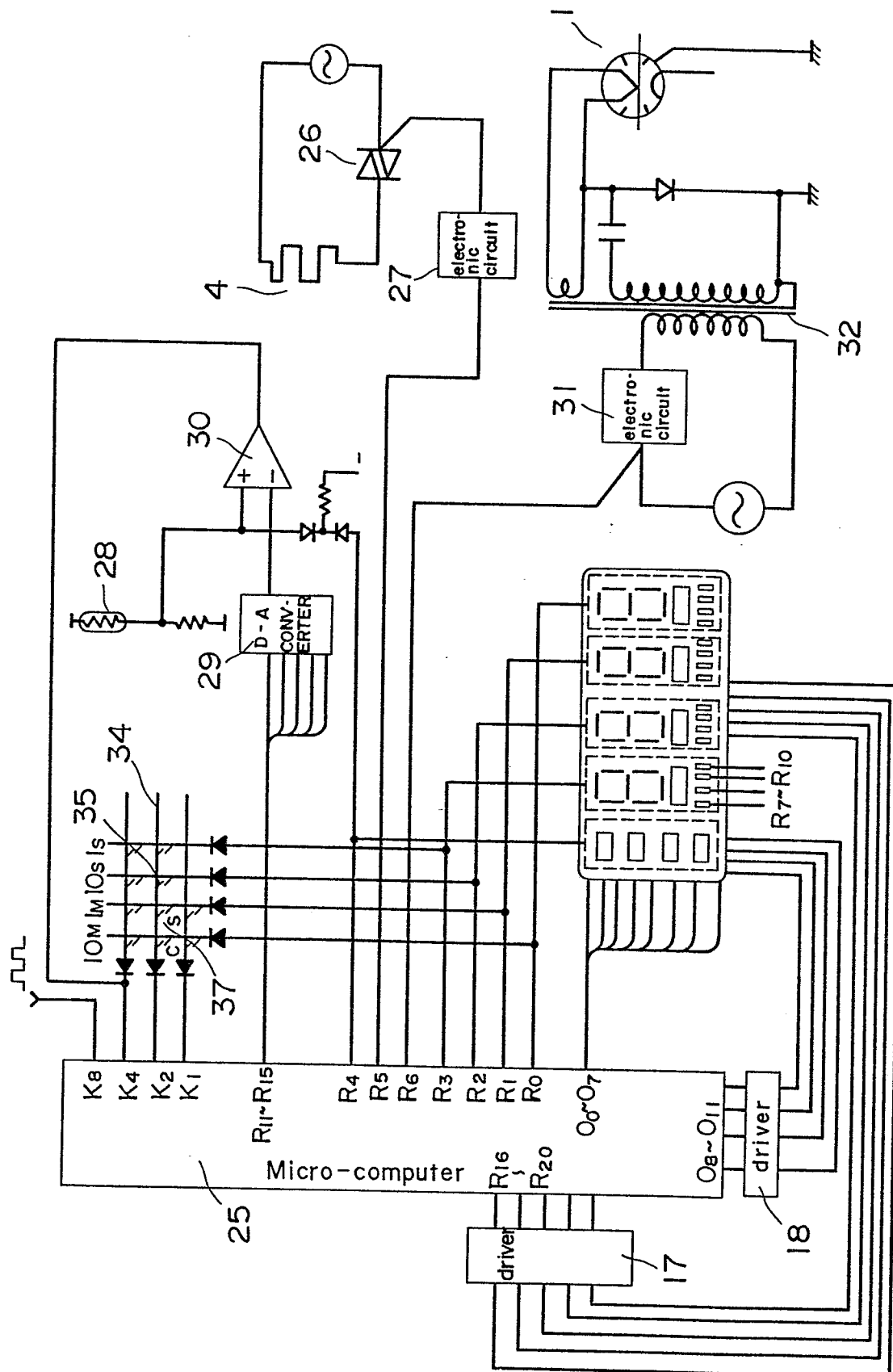


FIG. 10

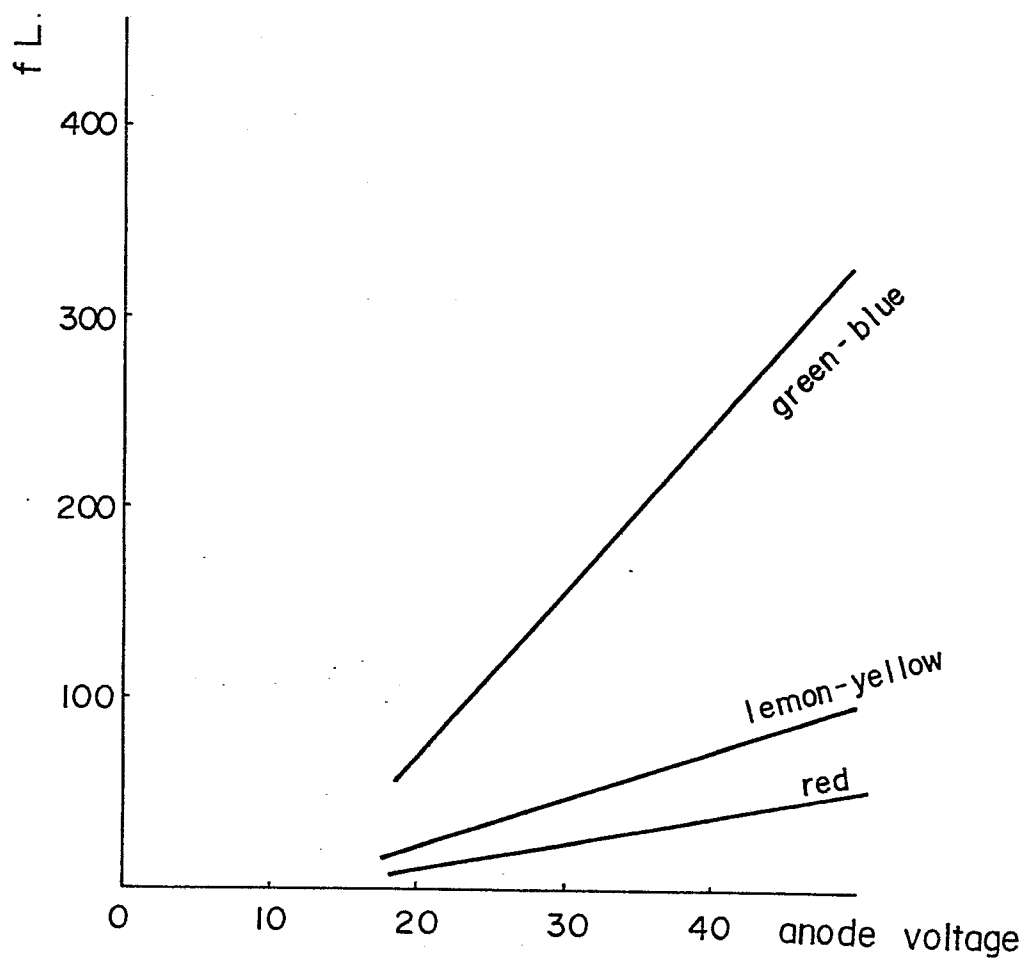


FIG. 11

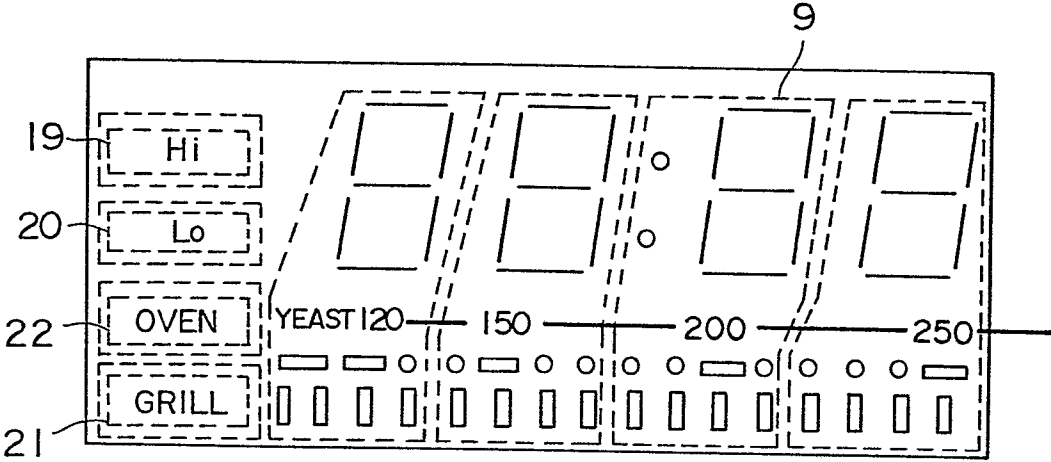
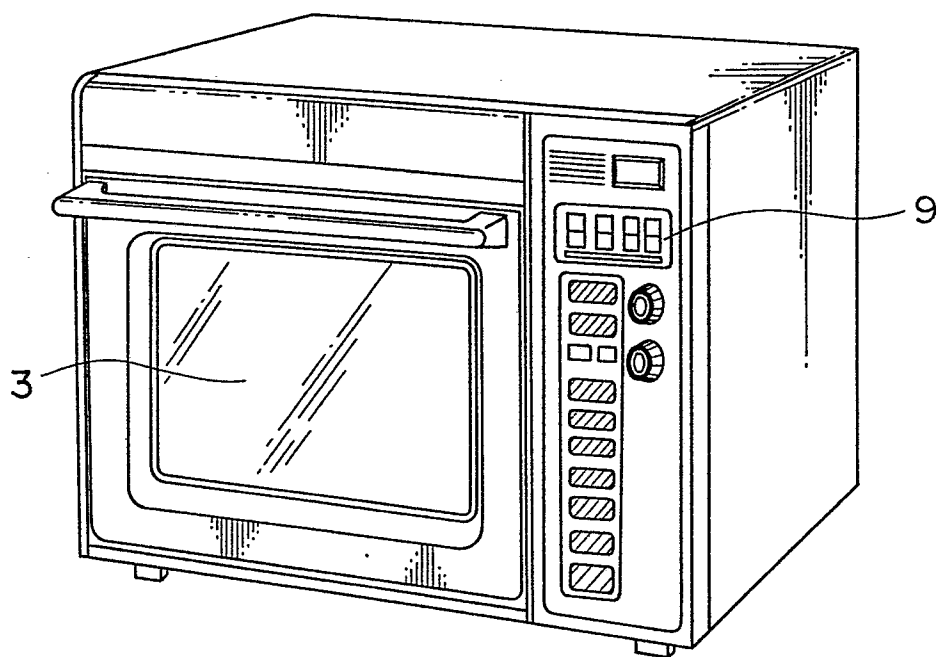


FIG. 12



## List of Reference Numerals in the Drawings:

- 1 ... magnetron
- 2 ... waveguide
- 3 ... heating cavity
- 4 ... electric heater
- 5 ... cathode
- 6 ... grid
- 7 ... anode
- 8 ... fluorescent paint
- 9 ... fluorescent display tube
- 10 ... cooking mode display part
- 11 ... time display part
- 12 ... multicolored fluorescent display tube
- 13 ... fluorescent display tube
- 14 ... temperature display part
- 15 ... cooking mode display part
- 16 ... time display part
- 17 ... driver
- 18 ... driver
- 19 ... Hi
- 20 ... Lo
- 21 ... GRILL
- 22 ... OVEN
- 23 ... temperature scale display part
- 24 ... temperature display part
- 24a ... grid
- 24b ... grid
- 25 ... microcomputer

- 26 ... triac
- 27 ... electronic circuit
- 28 ... thermistor
- 29 ... D-A converter
- 30 ... comparator
- 31 ... electronic circuit
- 32 ... high-voltage transformer
- 33 ... multicolored fluorescent display tube
- 34 ... cooking mode key
- 35 ... temperature key
- 36 ... time key
- 37 ... start key



## INTERNATIONAL SEARCH REPORT

International Application No

PCT/JP81/00199 0057729

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int. Cl. <sup>3</sup> F24C15/00		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched *		
Classification System	Classification Symbols	
I P C	F24C1/02, F24C1/04, F24C7/02, F24C7/08, F24C15/00, G09F9/30, G09F9/33, H01J31/10, H01J31/12	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched *		
Kokai Jitsuyo Shinan Koho		1971 - 1980
Kokai Tokkyo Koho		1971 - 1980
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>		
Category *	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>
Y	JP,A, 55- 17006 55. 2. 6	1 - 2
Y	JP,A, 54- 69684 54. 6. 4	1 - 2
Y	JP,U, 55-103679 55. 7.19	1 - 3
Y	JP,A, 53-116098 53.10.11	1 - 2
Y	JP,U, 55- 51892 55. 4. 5	1 - 4
Y	JP,U, 53- 29270 53. 3.13	1 - 4
Y	JP,A, 54-156778 54.12.11	1 - 5
Y	JP,A, 54-148573 54.11.20	1 - 5
<p>* Special categories of cited documents: <sup>15</sup></p> <p>"A" document defining the general state of the art</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document cited for special reason other than those referred to in the other categories</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but on or after the priority date claimed</p> <p>"T" later document published on or 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</p> <p>"X" document of particular relevance</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search *	Date of Mailing of this International Search Report *	
November 4, 1981 (4.11.81)	November 16, 1981 (16.11.81)	
International Searching Authority <sup>1</sup>	Signature of Authorized Officer <sup>20</sup>	
Japanese Patent Office		