(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 073 250**
A1

(12) EUROPEAN PATENT APPLICATION

published in accordance with Art. 158(3) EPC

(21) Application number: **82900561.0**

(22) Date of filing: **10.02.82**

Data of the international application taken as a basis:

(86) International application number:
PCT/JP 82/00038

(87) International publication number:
WO 82/03113 (16.09.82 82/22)

(51) Int. Cl.³: **F 24 C 7/08**, H 05 B 6/64

(30) Priority: **02.03.81 JP 30401/81**

(43) Date of publication of application: **09.03.83 Bulletin 83/10**

(84) Designated Contracting States: **DE FR GB NL SE**

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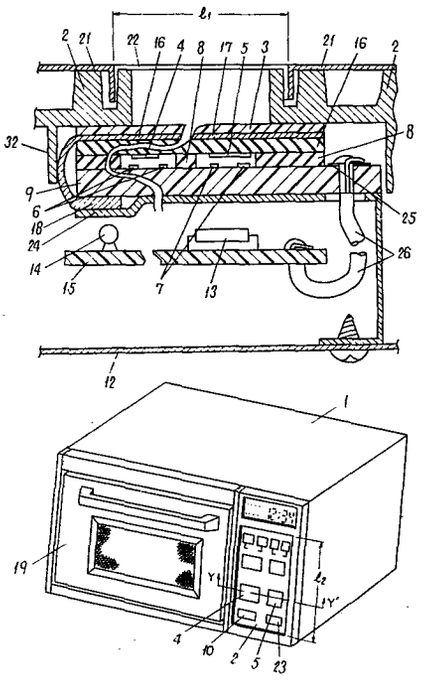
(54) HEAT COOKING DEVICE.

(57) A safety device for a heat cooking device, e.g., an electric oven, an electronic range, etc. Provided on an operation panel (2) in front of a body (1) are: an electronic controller which includes a microcomputer (13) for controlling a heater, e.g., a microwave generator (31); and components forming a keyboard (10) as an input unit, such as components disposed at the front side to be operated from input keys, e.g., cooking keys (4), (5), etc. bonded to a conductive and metallic thin sheet (17) which is grounded through the body (1). Thus, it can prevent the occurrence of a dangerous state due to an abnormal heating operation caused by self-triggering due to an external noise, static electricity, etc.



EP 0 073 250 A1

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SPECIFICATION

TITLE: Heating appliance

TECHNICAL FIELD

This invention relates to an operational panel structure as the input unit of an electronic controller including a microcomputer LSI chip or the like for controlling the heat source of a heating appliance such as an electric oven or microwave oven.

BACKGROUND ART

The conventional heating appliance of the above described type is in the constant danger that it could be self-triggered due to incoming noise, a surge of lightening, noise static electricity, etc. and become operative against the user's will.

The most dangerous aspect of any heating appliance of the above type is that it would start heating inadvertently even in the absence of a heating start instruction to a controller. Under these circumstances, the temperatures of the appliance body and the door rise drastically and the user would burn himself on those portions or the appliance itself would catch a fire and ignite surrounding inflammables such as a curtain.

In addition, unloaded heating in a microwave oven results in increasing the quantity of microwave radiations

leaking from the periphery of the door and shortening the life of power unit components such as a magnetron.

With the recent remarkable advance in the electronic controller technology using microcomputers, microcomputer-aided appliances are in widespread use. However, the microcomputers have the disadvantage that they are very susceptible to static electricity and surge current. A conventional heating appliance as shown in Fig. 7 includes in an operational panel 2 at the front of its main body 1 an ornamental plate 3, cook keys 4 and 5, cook key switches 6 and 7 and a board A9 carrying insulating spacers 8 and the cook key switches 6 and 7, and the ornamental plate 3, the cook keys 4 and 5, the cook key switches 6 and 7, the insulating spacers 8 and the board A9 together constitute a keyboard 10. A metallic back plate 11 is disposed in contact with the board A9 and electrically connected to a chassis 12. Another board B 15 is provided which carries a microcomputer 13 responsive to signals from input keys such as the cook keys 4 and 5, electronic components 14 and the like. When the conventional heating appliance is manually actuated, static charge on the operator's body may be conveyed to the reinforcing back plate 11 so that the back plate 11 serves as an antenna to feed current to the cook switches 6 and 7 and so forth in the keyboard 10 and send an error signal to the microcomputer 13, the electronic components 14 and the like on the board B 15. Such error signal would lead to a danger-

ous situation such as destruction of the microcomputer 13, electronic components 14 and so forth and an overheated condition in a variety of parts in the main body 1. While, of course, safety is usually taken into consideration in the design of an electronic circuit including the microcomputer 13 and a software contained in the microcomputer 13, the microcomputer 13 would perform faulty operations or be destroyed and display tubes would provide an erroneous display in the case of an appliance having such display tubes. Furthermore, the appliance would oscillate inadvertently. A more reliable fail-safe device is an important development objective.

DISCLOSURE OF THE INVENTION

Accordingly, it is an object of the present invention to provide a heating appliance wherein an electronic controller including a microcomputer LSI chip and the like for controlling a heat source of the appliance is prevented from conducting faulty operation due to static electricity charged on the operator's body or surge current by providing an electrically conductive, metallic thin sheet in tight contact with a component or components constituting a keyboard mounted on a front operational panel as an input device for the controller, the metallic sheet being earthed via an appliance main body or chassis.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing the appearance of a heating appliance according to an embodiment of the present invention; FIg. 2 is a cross sectional side view of the appliance; Fig. 3 is a cross sectional view of part of the appliance taken on the line Y-Y'; Fig. 4 is a circuit diagram of a control circuit of the appliance; Figs. 5 and 6 are cross sectional views of part of a heating appliance according to another embodiment of the present invention; and Fig. 7 is a cross sectional vies of part of an operational panel in a conventional heating appliance.

BEST MODE FOR CARRYING OUT THE INVENTION

Referring to Figs. 1 to 4, there is illustrated a heating appliance constructed according to an embodiment of the present invention, wherein a metallic thin sheet 17 is bonded between an insulating sheet 16 and an ornamental plate 3 which are components of a keyboard 10 and is provided with a grounding conductor 18 extending from its one end and leading to the ground via a chassis 12.

In Figs. 1 and 2, a door 19 is provided to freely open across a front opening in the main body 1. A heating chamber 20 is defined within the main body 1. An operational panel 2 is disposed at the front of the main body 1 and on one side of the door, 19 which

panel is made of an insulating material such as plastic and environed by an operational panel framework 21. As seen in Fig. 3, the keyboard 10 is disposed at the back of the operational panel 2 to extend over an aperture 22. Within keyboard 10 there are provided a plurality of input keys comprised of conductive material typically carbon peast, that is, cook keys 4 and 5 and a cook start key 23. The above-mentioned keyboard 10 comprises said ornamental plate 3 which is exposed to the operator's fingers, the electrically conductive metallic sheet 17 typically made of aluminum foil or stainless steel foil, preferably a material of high tensile strength, and adhesively secured between the ornamental plate 3 and the insulating sheet 16, the insulating sheet 16, the plurality of input keys bonded to the insulating sheet 16, a plastic board A9 carrying switches 6 and 7 disposed in juxtaposition with said input keys, for example, cook keys 4 and 5, and an insulating spacer 8 for spacing the board A9 from the insulating sheet 16. The grounding conductor 18 extending from the one end of the metallic thin sheet 17 as an integral unit is bent around the board A9 and electrically connected to the board A9 and a stepped portion 24 of a metallic back plate 11 disposed behind the board A9 and leading to the chassis 12 in the main body 1.

The shape of said electrically conductive metallic sheet 17 will be described in further detail. It is desirable from safe points of view that the bonding area

of the sheet 17 be greater than the area of the aperture 22 in the operational panel 21 as seen in Fig. 3. In other words, the width of the sheet is larger than ℓ_1 in Fig. 3 and the vertical length thereof is larger than ℓ_2 in Fig. 1. It is necessary that the sheet 17 be positioned closer to the operation surface than the cook keys 4 and 5. These area and position relationships obviate the possibility of faulty operation because the cook keys 4 and 5 are electrically isolated from the exposed surface of the sheet 17 even when part of the operator's body comes into contact with the operational panel framework 21 or the ornamental plate 3 in actuating the keyboard manually from the front.

In cases where the operational panel framework 21 is not used, safety can be guaranteed by bonding the sheet 17 having an area greater than the area of the board A5 in the above specified position.

Although in the embodiment of Fig. 3 the sheet is sandwiched between the stepped portion 24 of the back plate 11 and the board A9, it is obvious that it may be interposed directly between the back plate 11 and the board without using the stepped portion.

Further, provided that as in the above embodiment, the ornamental plate 3 and the insulating sheet 16 are substantially equal in size and the sheet 17 is equal in size to these components as well, the sheet may be bonded more easily and lends itself better to mass

production.

Unlike the above illustrated embodiment, the sheet 17 may be bonded betwen the insulating sheet 16 and the cook keys 4 and 5.

The reference numeral 25 represents a pad on which wires connected to the switches 6 and 7 associated with the cook keys 4 and 5 are concentrated, and lead wires 26 leading from the pad 25 are connected to the electronic control device including the microcomputer 13, electronic components 14 and so forth mounted on a board B 15.

When a food is put in the heating chamber 20 in the main body 1 of the above described and illustrated heating appliance and the door 19 is closed, the door switches 27 and 28 shown in Fig. 4 are closed. Then, as the cook key 4 or 5 and the cook start key 23 in the keyboard 10 are actuated, the microcomputer 13 operates so that a contact 30 of a relay 29 is closed and a high frequency generator 31 oscillates to generate high frequency waves.

It is evident from the foregoing description concerning the embodiment that, even if the keyboard 10 is actuated with the finger of the operator carrying static electricity, any error signal is never conveyed to the microcomputer 13, the electronic components 14 and so forth mounted on the board B 15 by way of the operational panel framework 21 because the operational panel framework 21 is made of an electrically insulating material. In addition, in the event that static electricity is

discharged from the operator's body, an error signal is not fed to the microcomputer 13, the electronic components 14 and so forth on the board B 15 and the appliance is free from any safety problem because the grounding conductor 18 extending from the metallic sheet 17 made of the aluminum or stainless foil and constituting the keyboard 10 is in electric contact with the back plate 11 grounded via the chassis 12 in the main body 1.

It is further possible to reduce the overall thickness of the keyboard 10 because the grounding conductor 18 extending from the sheet 17 and so forth is a metallic sheet such as an aluminum foil or a stainless steel sheet rather than a conductive rubber member or the like. The respective sheets constituting the keyboard 10, for example, the sheet 17 and the insulating sheet 16, are more desirable for mass production than those made of rubber because the former may be roll-shaped and can be easily printed and bonded. This of course leads to low profile and compactness of the operational panel region.

The operator may depress the input keys on the keyboard 10 almost as lightly as in the case where the keyboard is not provided with the sheet 17 and more lightly than in the case of a rubber-made keyboard, as if the keyboard were not provided with the sheet 17. Thus, the ease of operation is not affected in the least.

It is generally known that static electricity which may be charged on the human body is as high as of the

order of about 10 to 15 KV, though it depends on weather conditions, the potential at the human body with respect to the ground, kinds of clothes, etc. While an aluminum deposited film does not perform its duty for this reason, the thin metallic sheet made of aluminum foil or stainless steel foil as in the embodiment achieves its purpose successfully even in the presence of such high voltage.

In the case where an electrically conductive metal layer is vacuum-deposited on each of the insulating sheet 16 and the ornamental plate 3, the problem occurs that the deposited conductive layer is strained on repeated operation of the input keys in the keyboard 10 and is eventually cracked or broken, thus failing to ensure satisfactory conductivity. However, the sheet 17 of metal foil has a high tensile strength and is thus excellent in durability and shock resistance.

Moreover, in the event that the ornamental plate 3 is damaged for any reason, the provision of the sheet 17 prevents low voltage electric shocks in advance and assures a greater degree of safety.

The above described advantages are also available in an alternative embodiment as illustrated in Fig. 5, wherein a grounding conductor 18 extending from one end of the sheet 17 lies sandwiched between a rib 32 of the operational panel 2 and a bent portion 33 of the back plate 11 and held in electric contact with the back plate 11 for grounding purposes. This structure is easier to assemble

and more suitable for mass production than the embodiment shown in Fig. 3.

As seen in Fig. 6, the grounding conductor 18 of the sheet 17 may be forced against the back plate 11 and held in electric contact with the back plate 11 for grounding purposes by means of a resilient leaf spring 34 spot-welded to the back plate 11, in which case the above described advantages may be similarly expected. With this arrangement, the leaf spring 34 absorbs erros in assembling the keyboard so that the grounding conductor 18 is secured more tightly in electric contact with the back plate 11.

INDUSTRIAL APPLICABILITY

As described hereinbefore, the heating appliance embodying the present invention is such that the electrically conductive metallic thin sheet is dispoed at the keyboard of the operational panel actuatable by the human body or the like and is grounded via the chassis or a portion of the main body. This arrangement prevents a faulty operation of the electric electronic controller including the microcomputer due to the static electricity accumulated on the human body or the like or a surge current and assures an increased degree of safety.

CLAIMS:

1. A heating appliance comprising a heating chamber defined in its main body, a heating means for heating the interior of said heating chamber, a controller including a microcomputer for controlling said heating means, an operational panel disposed at the front of said main body and made of electrically insulating material and a keyboard disposed on said operational panel and having a plurality of input keys, characterized in that an electrically conductive metallic thin sheet is interposed between an ornamental plate and an insulating sheet constituting said keyboard or between said insulating sheet and said input keys and grounded via a portion of said main body.

2. A heating appliance according to Claim 1 wherein said electrically conductive metallic thin sheet is integrally provided with a grounding conductor for electric connection to a chassis of said main body.

3. A heating appliance according to Claim 2 wherein one end of said grounding conductor of said sheet is forced against a board A for said keyboard by means of a back plate and said back plate is grounded via the chassis of said main body.

4. A heating appliance according to Claim 3 wherein said grounding conductor is sandwiched between said back plate and a rib of said operational panel.

5. A heating appliance according to Claim 3 wherein said

grounding conductor is forced against said operational panel by means of a leaf spring secured to said back plate.

Fig. 1

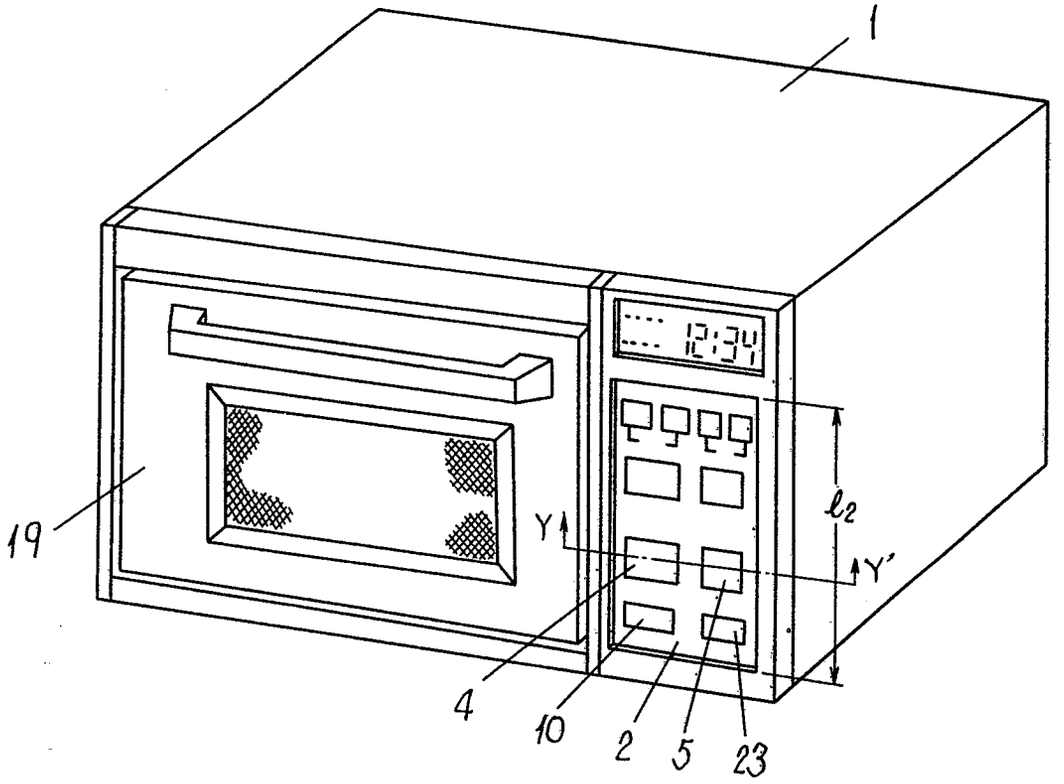


Fig. 2

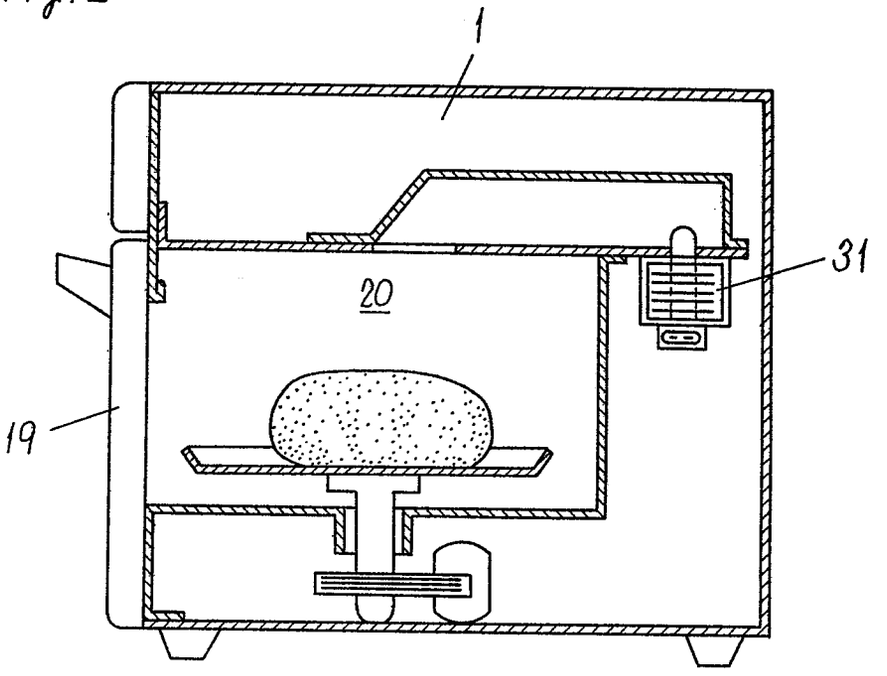


Fig. 3

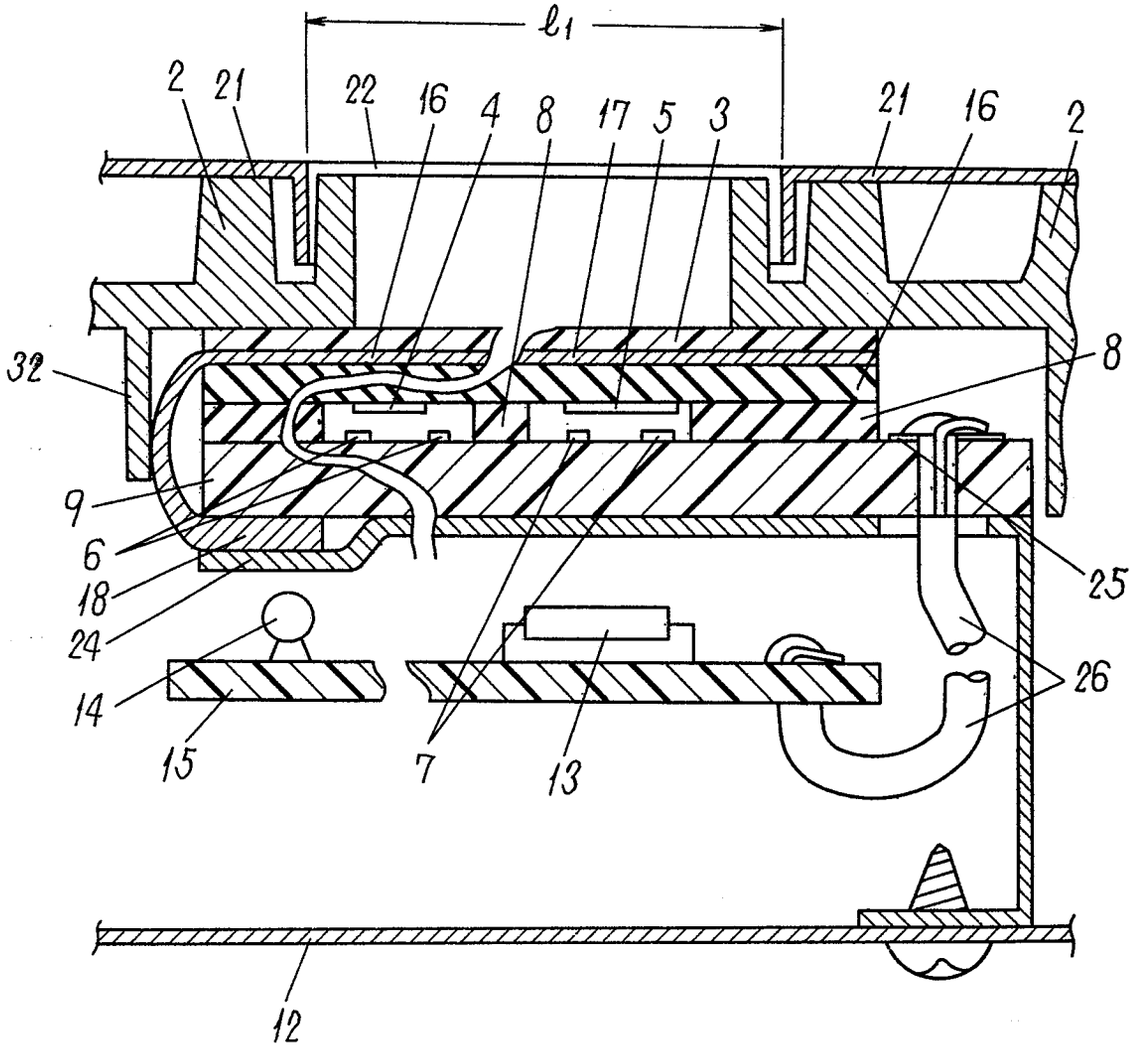
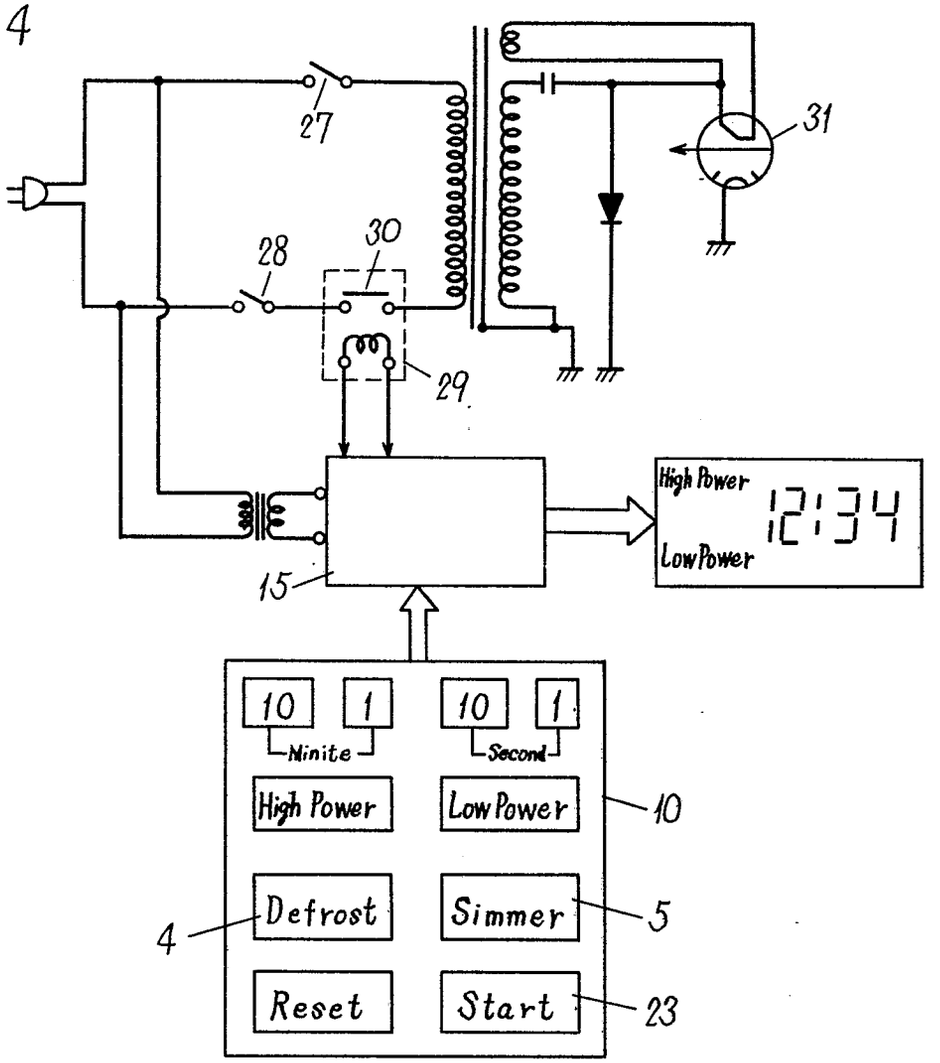


Fig. 4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28
30
29
High Power
12:34
Low Power
15
10
1
10
1
Minite
Second
High Power
Low Power
10
Defrost
Simmer
5
4
Reset
Start
23

Fig. 5

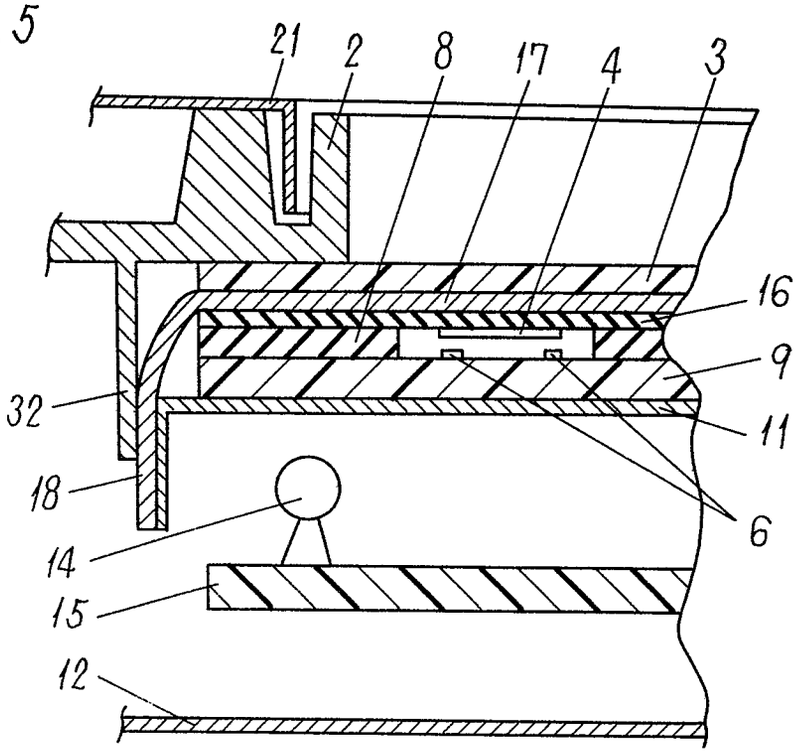
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Fig. 6

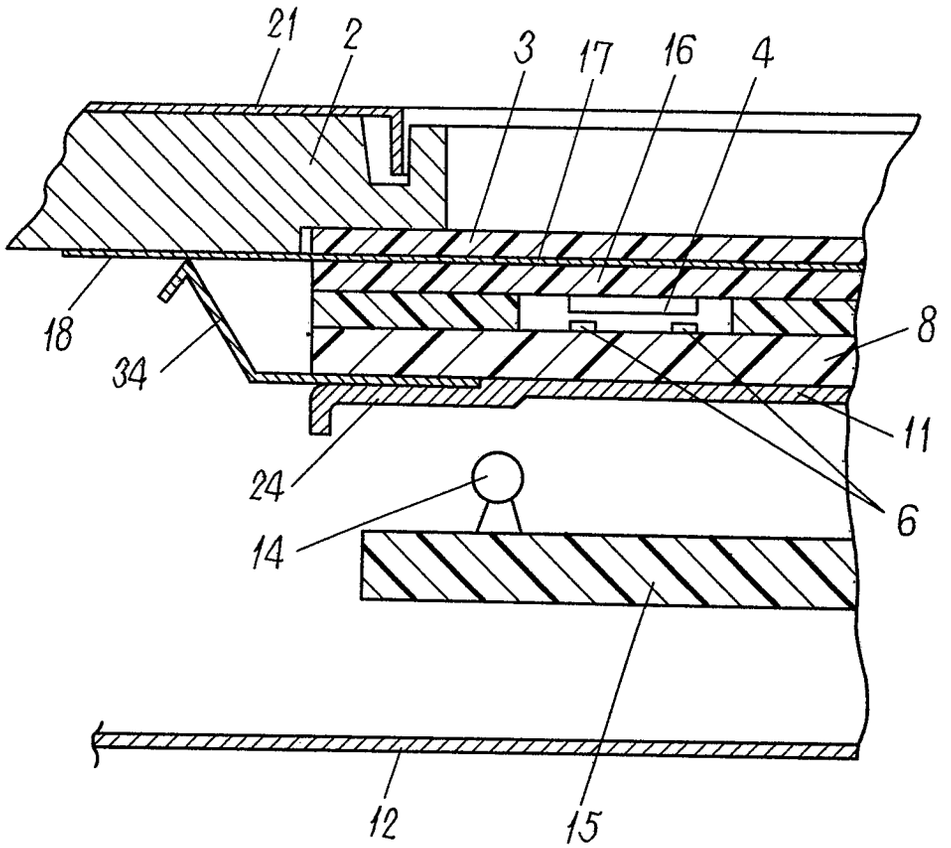
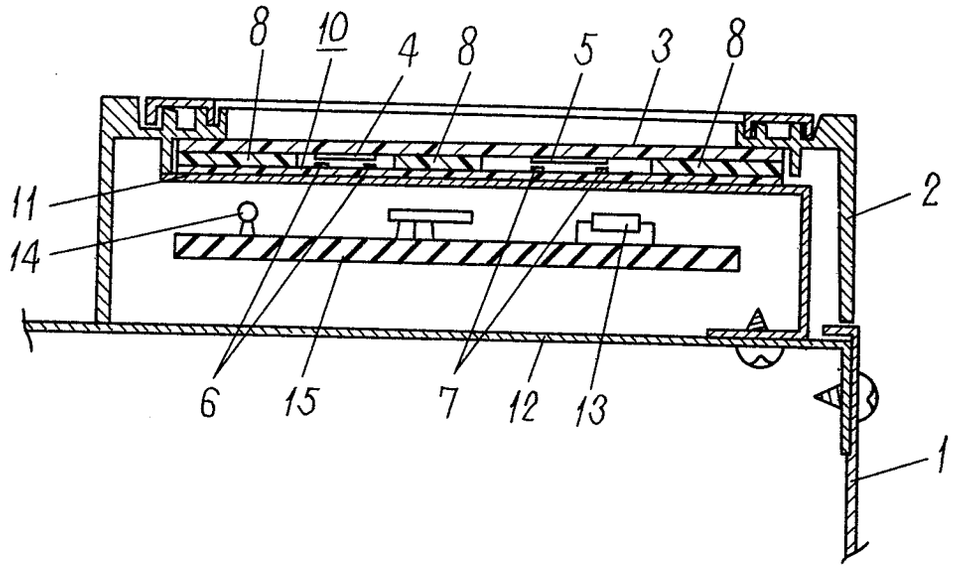


Fig. 7



LIST OF REFERENCE NUMBERS IN THE DRAWINGS

1·····Main body

2·····Operational panel

3·····Ornamental plate

4,5·····Cook key

6,7·····Cook key switch

8·····Insulating spacers

9·····Board A

10·····Keyboard

11·····Back plate

12·····Chassis

13·····Microcomputer

14·····Electronic component

15·····Board B

16·····Insulating sheet

17·····Sheet

18·····Grounding sheet

19·····Door

20·····Heating chamber

21·····Operational panel framework

22·····Area of the aperture of the operational panel

23·····Cook start key

24·····Stepped portion of the back plate

25·····Pad

26·····Lead wire

27,28····· Door switch

29····· Relay

30····· Contact of the relay

31····· High frequency generator

32····· Rib of the operatioal panel

33····· Bent portion of the back plate

34····· Resilient leaf spring

INTERNATIONAL SEARCH REPORT

International Application No PCT/JP82/00038 0073250

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 3

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.^{3} F24C 7/08, H05B 6/64

II. FIELDS SEARCHED

Minimum Documentation Searched 4

Classification System	Classification Symbols
I P C	F24C 7/08, F24C 7/02, H05B 6/64

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched 5

Jitsuyo Shinan Koho	1926 - 1982
Kokai Jitsuyo Shinan Koho	1971 - 1982

III. DOCUMENTS CONSIDERED TO BE RELEVANT 14

Category *	Citation of Document, 16 with indication, where appropriate, of the relevant passages 17	Relevant to Claim No. 18
X	Denshi Zairyo, Vol. 16, No. 9, September, 1977 (Tokyo) Takazume Masabumi "Katei Denki eno MYCOM Donyu, Donyurei 1, Denshi Range" P.57-60, Especially see P.59-60	1 - 5

* Special categories of cited documents: 15

"A" document defining the general state of the art

"E" earlier document but published on or after the international filing date

"L" document cited for special reason other than those referred to in the other categories

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but on or after the priority date claimed

"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

"X" document of particular relevance

IV. CERTIFICATION

Date of the Actual Completion of the International Search 2	Date of Mailing of this International Search Report 2
May 10, 1982 (10.05.82)	May 17, 1982 (17.05.82)
International Searching Authority 1	Signature of Authorized Officer 20
Japanese Patent Office	