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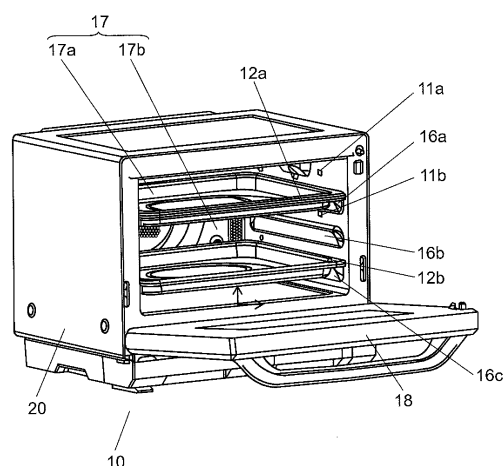
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(54) **HEATING COOKING DEVICE**

(57) A heating cooker (10) according to the present invention includes: a cavity (17) in which an object to be heated is accommodated; a cooking tray (12a) disposed in the inside of the cavity for accommodating the object to be heated thereon; a tray receiver (16a) mounted on a side wall of the cavity and detachably supports the cooking tray; first and second illumination holes (11a, 11b) formed in the side wall above and below the tray receiver; and an illumination device disposed outside the cavity for illuminating spaces above and below the cooking tray through the first illumination hole and the second illumination hole respectively. The illumination device includes: an LED; and a reflector which covers the first illumination hole and the second illumination hole from the outside of the cavity, and surrounds the LED. According to the present invention, with the use of the LED having stronger directivity than an incandescent electric lamp, every corner of both the upper space and the lower space of the cavity defined by the cooking tray can be illuminated.

FIG. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to a heating cooker, and more particularly to an inside illumination device of a cavity which uses a light emitting diode (hereinafter referred to as an LED).

BACKGROUND ART

[0002] In a general-type heating cooker, to enable a user to see the inside of a cavity during cooking, an illumination for the cavity is provided. Conventionally, an incandescent electric lamp is used as an illumination in the inside of a cavity of a heating cooker, and the incandescent electric lamp is disposed outside a side wall of the cavity (refer to PTL 1, for example).

[0003] FIG. 5 is a perspective view showing a conventional heating cooker which uses an incandescent electric lamp as an inside illumination in the same manner as the above-mentioned PTL 1.

[0004] As shown in FIG. 5, in heating cooker 101, the inside of cavity 103 is divided into a plurality of stages by cooking tray 102a and cooking tray 102b both of which are made of metal. Heating cooker 101 includes illumination hole 105 outside cavity 103 and at a height of cooking tray 102a so as to illuminate objects to be cooked which are respectively placed on cooking tray 102a on an upper side and cooking tray 102b on a lower side using one incandescent electric lamp 104.

[0005] However, in the above-mentioned heating cooker, one of spaces in two stages cannot acquire sufficient brightness, and there has been a case where an object to be cooked in such a space is hard to be visible.

[0006] Further, partitioned spaces in the cavity are narrow and hence, light of the incandescent electric lamp hardly reach every corner of the cavity whereby it is difficult for the incandescent electric lamp to illuminate the whole cooking tray.

[0007] Recently, along with the spreading use of LEDs, the use of an LED has been proposed also for the inside illumination of a heating cooker (refer to PTL 2, for example).

Citation List

Patent Literatures

[0008]

PTL 1: Unexamined Japanese Utility Model Publication No. H03-127103

PTL 2: Unexamined Japanese Patent Publication No. H05-164331

SUMMARY OF THE INVENTION

[0009] The present invention is provided for overcoming the above-mentioned conventional drawbacks, and it is an object of the present invention to provide a heating cooker which is configured such that every corner of both upper and lower spaces defined by a cooking tray can be illuminated using an LED for the inside illumination of a cavity through an illumination hole formed in a side wall of the cavity.

[0010] To overcome the above-mentioned conventional drawbacks, a heating cooker of the present invention includes: a cavity accommodating an object to be heated; a cooking tray disposed inside the cavity for receiving the object to be heated thereon; a tray receiver mounted on a side wall of the cavity for detachably supporting the cooking tray; first and second illumination holes formed in the side wall above and below the tray receiver respectively; and at least one illumination device disposed outside the cavity for illuminating upper and lower spaces above and below the cooking tray through two illumination holes respectively.

[0011] The illumination device includes: an LED; and a reflector which covers the first illumination hole and the second illumination hole from the outside of the cavity, and surrounds the LED.

[0012] According to the heating cooker of the present invention, with the use of the LED having stronger directivity than an incandescent electric lamp, every corner of both the upper space and the lower space of the cavity defined by the cooking tray can be illuminated and hence, visibility of a food can be enhanced compared to a conventional heating cooker.

BRIEF DESCRIPTION OF DRAWINGS

[0013]

FIG. 1 is a perspective view of a heating cooker according to an exemplary embodiment of the present invention.

FIG. 2 is a perspective view showing a mounting position of an illumination device used in the heating cooker according to the exemplary embodiment.

FIG. 3 is a perspective view of the illumination device used in the heating cooker according to the exemplary embodiment.

FIG. 4 is a cross-sectional view of the illumination device used in the heating cooker according to the exemplary embodiment.

FIG. 5 is a perspective view of a conventional heating cooker.

DESCRIPTION OF EMBODIMENT

[0014] A heating cooker of a first aspect according to the present invention includes: a cavity accommodating an object to be heated; a cooking tray disposed inside

the cavity for receiving the object to be heated thereon; a tray receiver mounted on a side wall of the cavity for detachably supporting the cooking tray; first and second illumination holes formed in side walls above and below the tray receiver respectively; and at least one illumination device disposed outside the cavity for illuminating upper and lower spaces above and below the cooking tray through the first and second illumination holes respectively.

[0015] The illumination device includes: an LED; and a reflector which covers the first illumination hole and the second illumination hole from the outside of the cavity, and surrounds the LED.

[0016] According to this aspect of the present invention, with the use of the LED having stronger directivity than an incandescent electric lamp, every corner of both the upper space and the lower space of the cavity defined by the cooking tray can be illuminated and hence, visibility of a food can be enhanced compared to a conventional heating cooker.

[0017] A heating cooker of a second aspect according to the present invention is, in the first aspect, characterized in that the illumination device further includes: an LED printed circuit board having an LED; and a casing which accommodates the LED printed circuit board, the reflector is formed of a surrounding wall of a recessed portion formed on the casing, and the LED printed circuit board is mounted on the casing such that the LED is positioned on a bottom of the recessed portion of the casing. According to this aspect, a quantity of light incident on the inside of the cavity through the illumination holes can be increased.

[0018] The heating cooker of a third aspect according to the present invention is, in the second aspect, characterized in that an angle made by a reflector below the LED and the LED printed circuit board is set larger than an angle made by a reflector above the LED and the LED printed circuit board. According to this aspect, every corner of a plurality of spaces in the cavity defined by the cooking tray can be illuminated brightly.

[0019] The heating cooker of a fourth aspect according to the present invention is, in the first aspect, characterized in that the reflector has a pale color. According to this aspect, reflectance of light on the reflector can be enhanced.

[0020] A preferred exemplary embodiment of a heating cooker according to the present invention is described in detail with reference to the drawings hereinafter. The present invention is not limited by this exemplary embodiment.

[0021] FIG. 1 is a perspective view of a heating cooker according to the exemplary embodiment of the present invention. As shown in FIG. 1, heating cooker 10 is a microwave having an oven function, and has cavity 17 for accommodating a food which is an object to be heated in the back side of an opening and for cooking by heating.

[0022] Cavity 17 has five surfaces consisting of a ceiling, a bottom surface, a rear wall, a left side wall, and a

right side wall. The outside of cavity 17 is covered by external cover 20. On the opening formed on a front surface of cavity 17, door 18 is rotatably mounted using a lower side of the opening as the axis of rotation.

[0023] Hereinafter, the explanation of the heating cooker will be made by assuming a side where cavity 17 opens as a front side, a deep end of cavity 17 as a rear side, a right side as viewed in the direction toward a rear side from a front side as a right side, and a left side as viewed in the direction toward a rear side from a front side as a left side.

[0024] On each of left and right side walls of cavity 17, there are mounted three pairs of tray receivers (tray receiver 16a, tray receiver 16b and tray receiver 16c in order from above) which support metal-made cooking trays to receive a food which is an object to be heated thereon.

[0025] On the right side wall of cavity 17, illumination hole 11a which constitutes a first illumination hole and illumination hole 11b which constitutes a second illumination hole are formed at positions above and below tray receiver 16a and closer to the opening of cavity 17 than the rear wall of cavity 17 respectively.

[0026] Illumination hole 11a and illumination hole 11b are disposed so as to face upper space 17a above cooking tray 12a and lower space 17b below cooking tray 12a respectively when cooking tray 12a is placed on tray receiver 16a.

[0027] FIG. 2 is a perspective view of the heating cooker according to the exemplary embodiment in a state where external cover 20 is removed.

[0028] As shown in FIG. 2, illumination device 30a and illumination device 30b are mounted on the heating cooker such that illumination device 30a and illumination device 30b respectively cover illumination hole 11a and illumination hole 11b formed at the positions closer to the opening of cavity 17 than rear wall of cavity 17, from the outside of the right side wall of cavity 17.

[0029] When cooking tray 12a is placed on tray receiver 16a as shown in FIG. 1, upper space 17a above cooking tray 12a is illuminated by illumination device 30a, and lower space 17b below cooking tray 12a is illuminated by illumination device 30b.

[0030] Window 19 is mounted on door 18 and hence, a user can observe the inside of cavity 17 through window 19 during cooking.

[0031] Illumination device 30a and illumination device 30b have substantially the same structure and hence, only illumination device 30a will be described hereinafter.

[0032] FIG. 3 and FIG. 4 are a perspective view and a cross-sectional view of the illumination device used in the heating cooker according to the exemplary embodiment, respectively.

[0033] As shown in FIG. 3, illumination device 30a includes: LEDs 15; LED printed circuit board 14 on which LEDs 15 are mounted; and casing 13 which accommodates LED printed circuit board 14 therein.

[0034] Casing 13 is disposed outside the right side wall

of cavity 17. Casing 13 has oppositely facing surface 13a which oppositely faces an outer surface of the right side wall of cavity 17. Oppositely facing surface 13a is surrounded by side wall 13b of casing 13.

[0035] A recessed portion is formed on oppositely facing surface 13a in the vicinity of the center of oppositely facing surface 13a. A through hole is formed in a bottom of the recessed portion of oppositely facing surface 13a so as to expose LEDs 15. Reflector 13c is formed on the recessed portion of oppositely facing surface 13a such that reflector 13c surrounds LEDs 15.

[0036] LED printed circuit board 14 is mounted on the bottom of the recessed portion of oppositely facing surface 13a. Accordingly, illumination device 30a has the space where LED 15 is mounted in the inside of casing 13. The space is surrounded by LED printed circuit board 14, side wall 13b and oppositely facing surface 13a. Casing 13, particularly, reflector 13c has a pale color such as white or gray.

[0037] As shown in FIG. 4, an angle made by LED printed circuit board 14 and reflector 13c differs depending on a location. In the exemplary embodiment, angle 22a made by reflector 13c above LED 15 and LED printed circuit board 14 is an approximately right angle, and angle 22b made by reflector 13c below LED 15 and LED printed circuit board 14 is larger than angle 22a.

[0038] With a provision of reflector 13c, an amount of light incident on the inside of cavity 17 through illumination hole 11a can be increased.

[0039] Further, when cooking tray 12a is placed on tray receiver 16a, light reflected on reflector 13c above LED 15 is directed to a region of cooking tray 12a close to illumination hole 11a (that is, a region of cooking tray 12a on a right end), while light reflected on reflector 13c below LED 15 is directed to a region of cooking tray 12a remote from illumination hole 11a (that is, a region of cooking tray 12a on a left end).

[0040] As a result, according to the exemplary embodiment, with respect to the lateral direction of cooking tray 12a, it is possible to illuminate a wide region with light emitted from LED 15.

[0041] Also with respect to the longitudinal direction of the cavity, in the same manner as described above, an angle made by LED printed circuit board 14 and reflector 13c differs depending on a location. That is, an angle made by reflector 13c in front of LED 15 and LED printed circuit board 14 is an approximately right angle in the same manner as angle 22a, and an angle made by reflector 13c behind LED 15 and LED printed circuit board 14 is larger than angle 22a in the same manner as angle 22b.

[0042] This is because, as described previously, illumination hole 11a is provided at the position closer to the opening than the rear wall of cavity 17 is.

[0043] Due to such a constitution, light reflected on reflector 13c in front of LED 15 is directed to a region of cooking tray 12a on a rear end, and light reflected on reflector 13c behind LED 15 is directed to a region of

cooking tray 12a on a front end.

[0044] According to the exemplary embodiment, a wide region can be illuminated with light emitted from LED 15 also with respect to the longitudinal direction of cooking tray 12a.

[0045] In this manner, with the use of LED having stronger directivity than an incandescent electric lamp, every corner of upper and lower spaces of cavity defined by the cooking tray can be illuminated and hence, visibility of a food can be enhanced compared to a conventional heating cooker.

[0046] With respect to illumination device 30b, a distance between illumination hole 11b and the bottom surface of cavity 17 or a distance between illumination hole 11b and cooking tray 12b when cooking tray 12b is placed on tray receiver 16c differs from the case of illumination device 30a. Accordingly, an angle of reflector 13c is selected by taking into account the difference.

[0047] As other advantages acquired by the exemplary embodiment, the following advantages are listed.

[0048] In the exemplary embodiment, due to the existence of the inner space of illumination device 30a, heat in cavity 17 is hardly directly transferred to LEDs 15 and hence, safety of a product is secured.

[0049] Casing 13, particularly reflector 13c has a pale color and hence, reflectance of light can be enhanced.

[0050] Hereinafter, an example of a cooking operation of heating cooker 10 having the above-mentioned constitution is simply explained.

[0051] Heating cooker 10 is a microwave having an oven function. Heating cooker 10 cooks an object to be heated in cavity 17 with the supply of at least one of microwave, radiation heat, hot air, and steam into cavity 17. For this end, heating cooker 10 includes a microwave generating part, an upper heater unit, a convection heater unit, and a steam generating part not shown in the drawing.

[0052] The microwave generating part supplies a microwave generated by a magnetron disposed below the bottom surface of cavity 17 to the inside of the cavity 17 from below. The upper heater unit is a sheath heater mounted on the ceiling of cavity 17, and heats the inside of cavity 17 from above by a radiation heat. The convection heater unit circulates hot air in the inside of cavity 17 through a hole formed in the rear wall of cavity 17 by a heater and a fan mounted on a deep end of the rear wall of the cavity 17.

[0053] For example, when a butter-enriched roll is baked using heating cooker 10, heating cooker 10 operates an oven function for operating only the convection heater unit. In this oven function, due to hot air supplied from the convection heater unit, a plurality pieces of small-round bread dough placed on cooking tray 12a and cooking tray 12b respectively mounted on tray receiver 16a and tray receiver 16c are uniformly heated.

[0054] In the midst of heating, every corner of upper space 17a above cooking tray 12a is illuminated with light emitted from illumination device 30a, and every corner

of lower space 17b below cooking tray 12a is illuminated with light emitted from illumination device 30b. Accordingly, a user can visually recognize the degree of baking even when bread dough is placed on cooking tray 12a and a left corner of cooking tray 12a remote from illumination device 30a and illumination device 30b.

[0055] In the exemplary embodiment, illumination hole 11a and illumination hole 11b are respectively disposed above and below tray receiver 16a at an uppermost stage out of three tray receivers mounted on the right side wall. However, the present invention is not limited to such a constitution, and it is sufficient that a plurality of spaces in cavity 17 defined by one or more cooking trays can be illuminated.

[0056] For example, four illumination holes in total may be disposed between the ceiling and three tray receivers of cavity 17 and a bottom surface of cavity 17. The illumination holes may be formed in the left side wall instead of the right side wall, or the illumination holes may be formed in both left and right side walls.

[0057] In the exemplary embodiment, illumination hole 11a and illumination hole 11b are formed at positions closer to the opening than the rear wall of cavity 17. However, illumination hole 11a and illumination hole 11b may be formed at positions closer to the rear wall than the opening of cavity 17.

[0058] In this case, for example, an angle made by reflector 13c behind LED 15 and LED printed circuit board 14 may be set to an approximately right angle in the same manner as angle 22a, and an angle made by reflector 13c in front of LED 15 and LED printed circuit board 14 may be set to an angle larger than angle 22a in the same manner as angle 22b.

[0059] In the same manner, illumination hole 11a and illumination hole 11b may be disposed at the positions where a distance between illumination hole 11a and illumination hole 11b and the opening of cavity 17 is equal to a distance between illumination hole 11a and illumination hole 11b and the rear wall of cavity 17. In this case, an angle made by reflector 13c in front of LED 15 and LED printed circuit board 14 and an angle made by reflector 13c behind LED 15 and LED printed circuit board 14 may be set equal to each other.

[0060] That is, with respect to the longitudinal direction of cavity 17, by properly setting an angle made by reflector 13c and LED printed circuit board 14 corresponding to the positions of illumination hole 11a and illumination hole 11b, the substantially same advantageous effects as the exemplary embodiment can be acquired.

[0061] However, even when a height at which illumination hole 11a is disposed is higher or lower than a height at which illumination hole 11b is disposed in the exemplary embodiment, a state that the illumination device 30a illuminates cooking tray 12a from above is not changed. Accordingly, with respect to the vertical direction of cavity 17, regardless of the setting position of illumination hole 11a, an angle made by reflector 13c below LED 15 and LED printed circuit board 14 is always

set larger than an angle made by reflector 13c above LED 15 and LED printed circuit board 14.

[0062] Further, in this embodiment, two illumination devices each including one casing and one LED printed circuit board are provided to first illumination hole 11a and second illumination hole 11b respectively. However, two illumination devices according to the exemplary embodiment may be formed of one casing and one LED printed circuit board.

[0063] That is, in such a constitution, two recessed portions each having a reflector are formed in one casing, and each of two LEDs mounted on one LED printed circuit board is exposed from a bottom of the corresponding recessed portion. Due to such a constitution, the number of parts and manufacturing man-hours can be reduced and hence, a manufacturing cost is reduced according to the exemplary embodiment.

INDUSTRIAL APPLICABILITY

[0064] As has been explained in detail heretofore, according to the present invention, with the use of an LED having stronger directivity than an incandescent electric lamp, every corner of upper and lower spaces of a cavity defined by a cooking tray can be illuminated and hence, visibility of a food can be enhanced compared to a conventional heating cooker.

[0065] Accordingly, the present invention is applicable to an oven, a microwave having an oven function, and the like for household use or business use where cooking is performed in a state where the inside of a cavity is defined by a cooking tray.

REFERENCE MARKS IN THE DRAWINGS

[0066]

12a, 12b, 102a, 102b: cooking tray
 10, 101: heating cooker
 11a, 11b, 105: illumination hole
 13: casing
 13a: opposedly facing surface
 13b: side wall
 13c: reflector
 14: LED printed circuit board
 15: LED
 16a, 16b, 16c: tray receiver
 17, 103: cavity
 17a: upper space
 17b: lower space
 18: door
 19: window
 20: external cover
 30a, 30b: illumination device
 104: incandescent electric lamp

Claims

1. A heating cooker comprising:

a cavity accommodating an object to be heated; 5
 a cooking tray disposed inside the cavity for receiving the object to be heated thereon;
 a tray receiver mounted on a side wall of the cavity for detachably supporting the cooking tray; 10
 a first illumination hole formed in the side wall above the tray receiver;
 a second illumination hole formed in the side wall below the tray receiver; and
 at least one illumination device disposed outside 15
 the cavity for illuminating spaces above and below the cooking tray through the first illumination hole and the second illumination hole respectively,
 wherein the illumination device includes: 20
 an LED; and
 a reflector which covers the first illumination hole and the second illumination hole from the outside of the cavity, and surrounds the 25
 LED.

2. The heating cooker according to claim 1, wherein the illumination device further comprises:

an LED printed circuit board having the LED; and 30
 a casing for accommodating the LED printed circuit board,
 the reflector is an surrounding wall of a recessed portion formed on the casing, and 35
 the LED printed circuit board is mounted on the casing such that the LED is positioned on a bottom of the recessed portion of the casing.

3. The heating cooker according to claim 2, wherein an angle made by the reflector below the LED and the LED printed circuit board is set larger than an angle made by the reflector above the LED and the LED printed circuit board. 40

4. The heating cooker according to claim 1, wherein the reflector has a pale color. 45

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FIG. 1

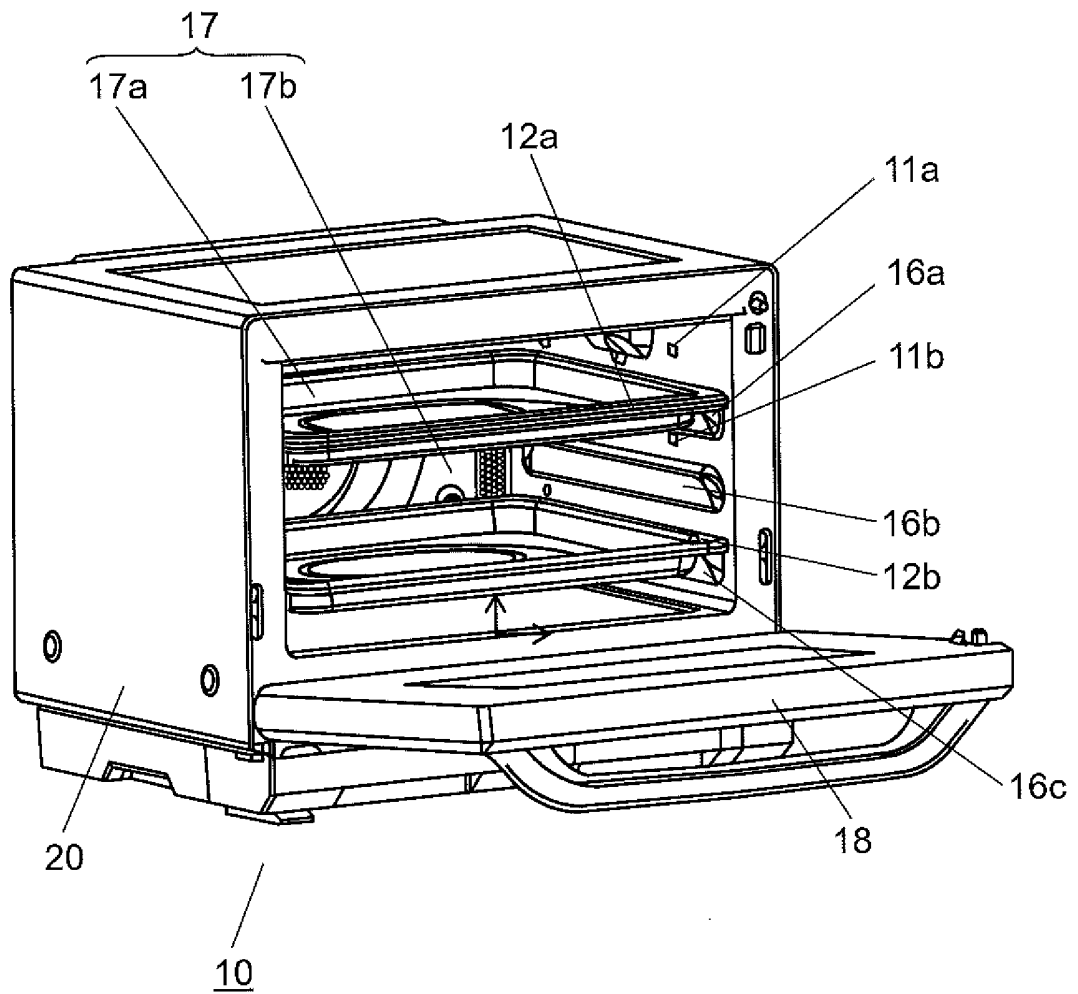


FIG. 2

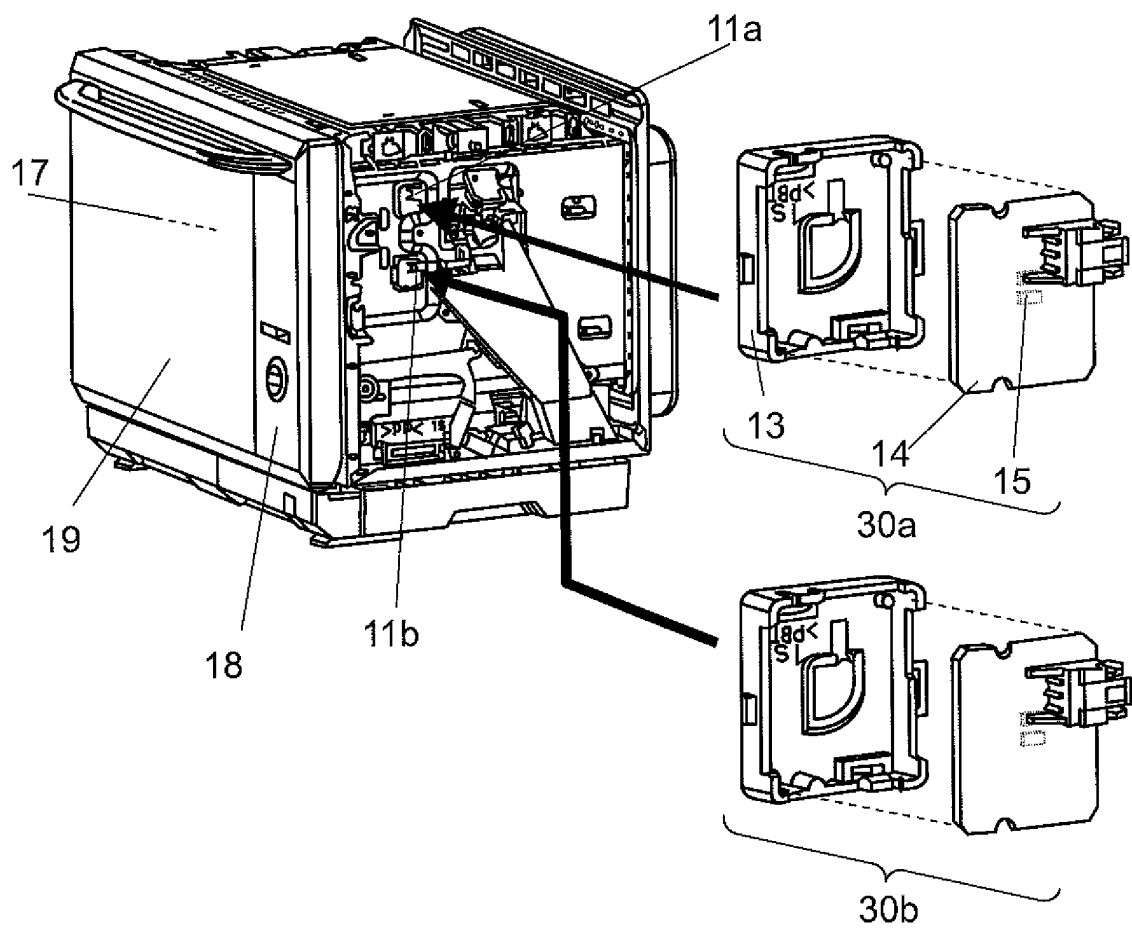


FIG. 3

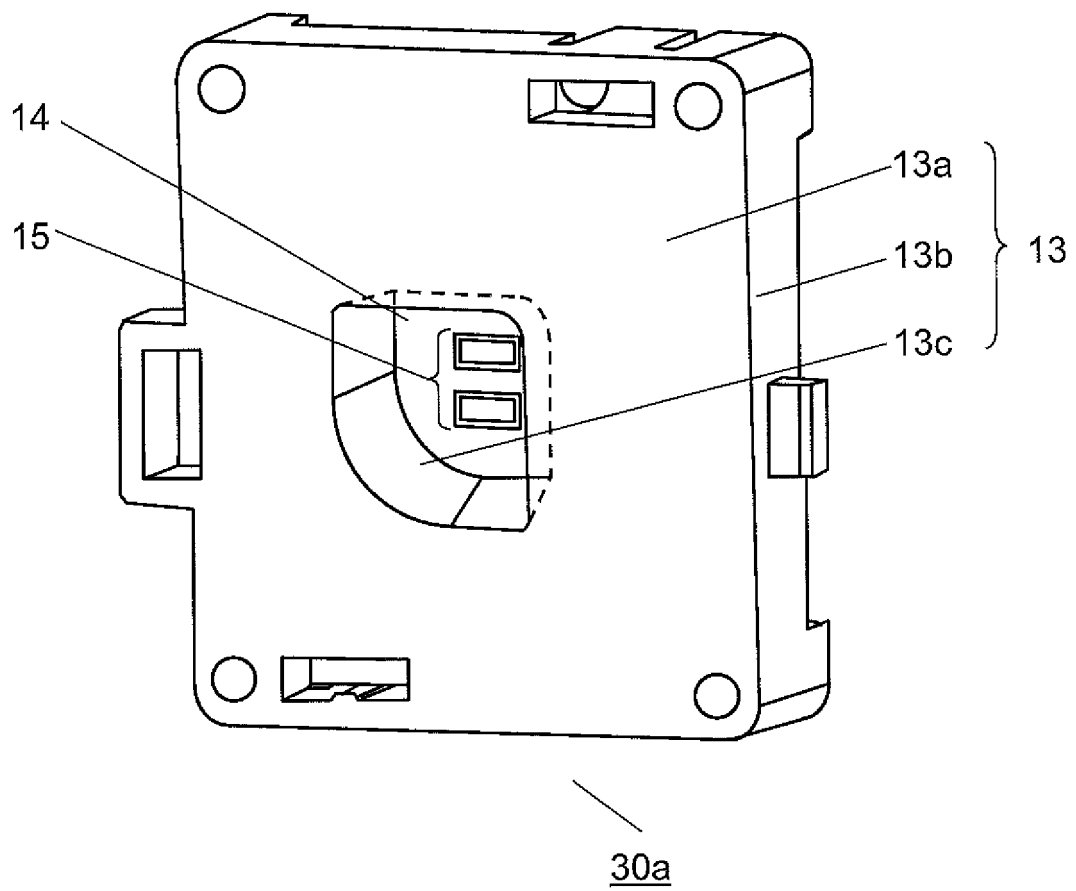


FIG. 4

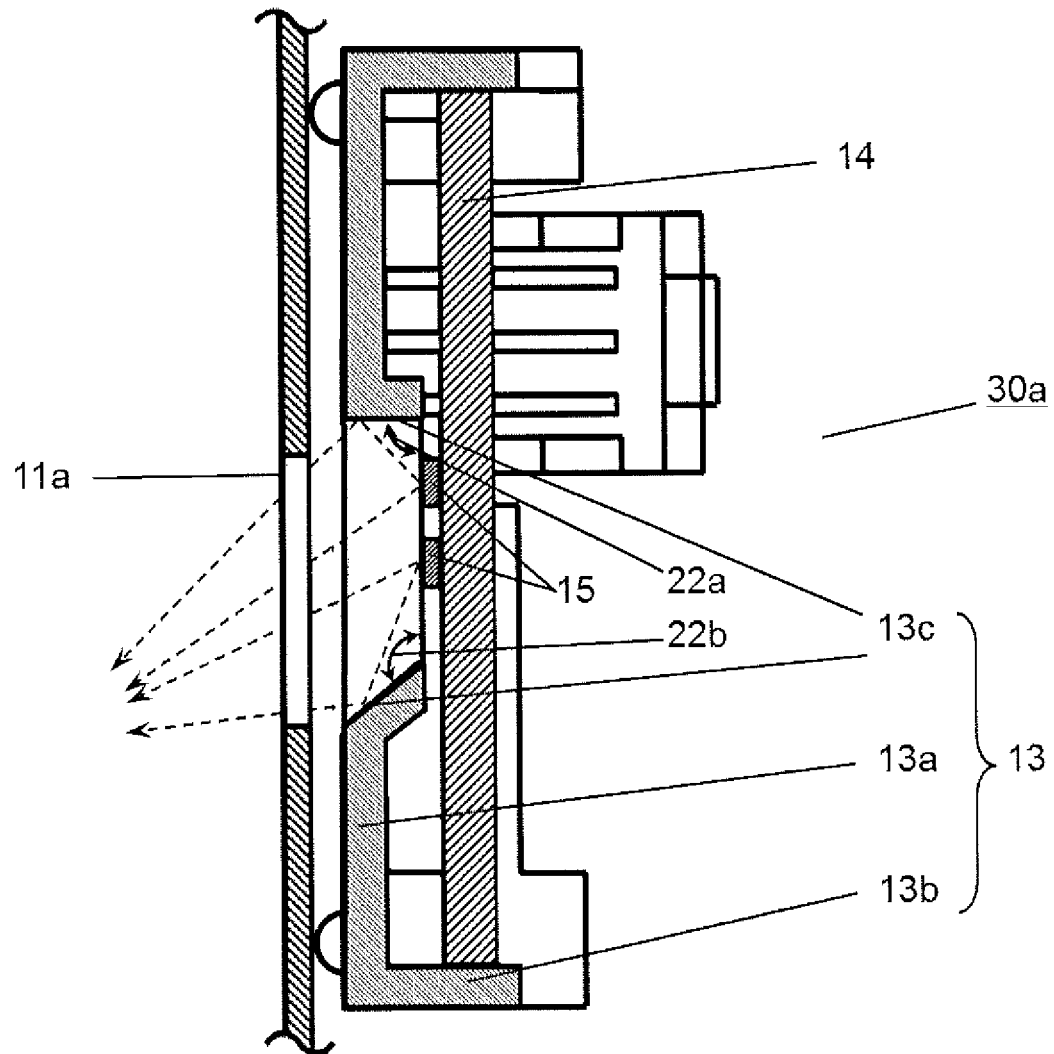
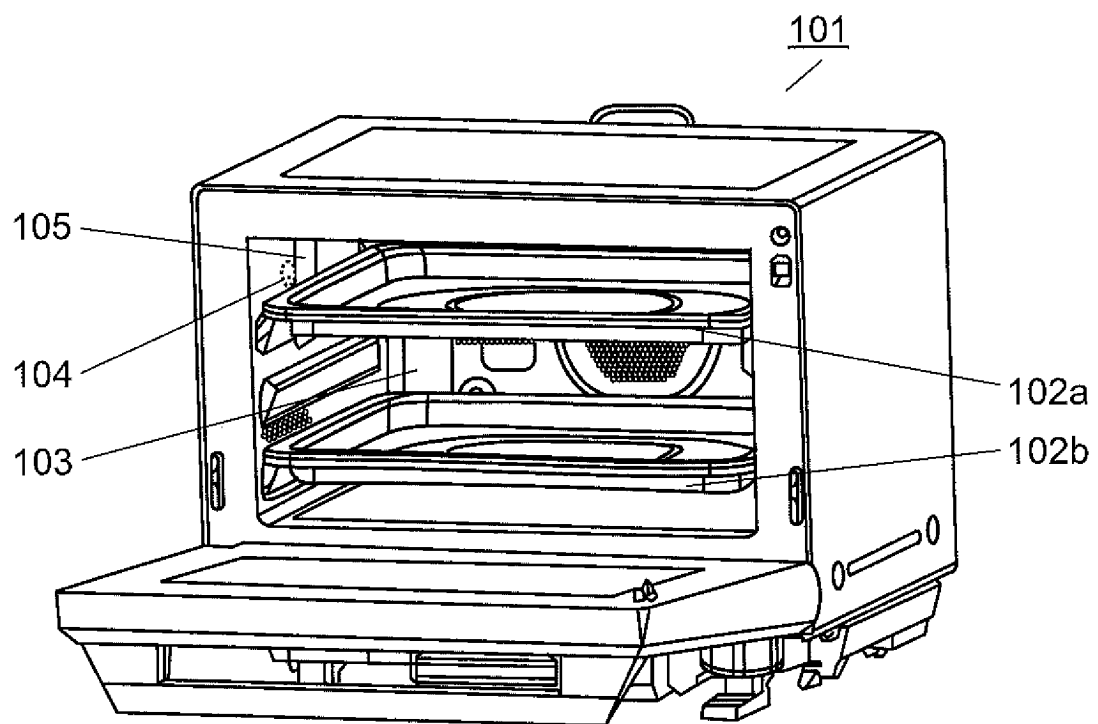


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/000850

A. CLASSIFICATION OF SUBJECT MATTER

F24C7/02(2006.01) i, F24C15/18(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)

F24C7/02, F24C15/18

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 1996-2014

Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

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.
Y	JP 2005-98601 A (Hitachi Hometec, Ltd.), 14 April 2005 (14.04.2005), fig. 2, 4 (Family: none)	1-4
Y	JP 2011-179740 A (Sharp Corp.), 15 September 2011 (15.09.2011), fig. 4 (Family: none)	1-4
Y	JP 2004-220997 A (Nisshin Steel Co., Ltd.), 05 August 2004 (05.08.2004), paragraph [0028] (Family: none)	4

☒ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

14 March, 2014 (14.03.14)

Date of mailing of the international search report

25 March, 2014 (25.03.14)

Name and mailing address of the ISA/
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Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/000850

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 047504/1980 (Laid-open No. 148513/1981) (Sanyo Electric Co., Ltd.), 09 November 1981 (09.11.1981), fig. 2 (Family: none)	1-4

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- JP H05164331 B [0008]