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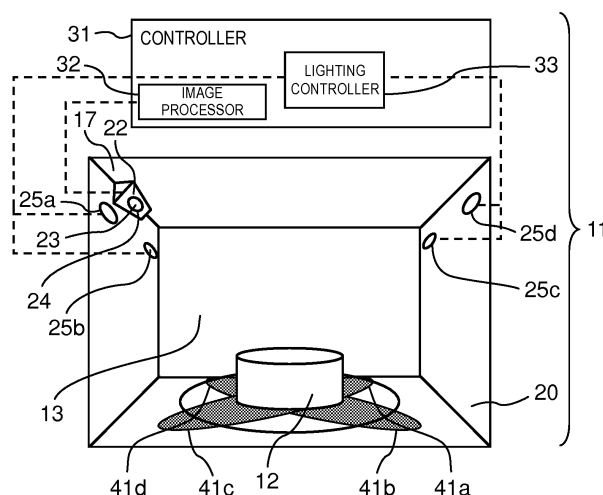
(54)

HEATING COOKER

(57)

A cooking device includes image capturing unit (23) that captures an image of an inside of heating chamber (13), a plurality of lighting units (25a to 25d) that apply light to the inside of heating chamber (13), lighting controller (33) that controls the plurality of lighting units (25a to 25d), and image processor (32) that specifies an image of food (12) in an image captured by image capturing unit (23). Each of the plurality of lighting units (25a to 25d) is disposed in a position substantially facing another of the plurality of lighting units (25a to 25d).

FIG. 1



Description

TECHNICAL FIELD

[0001] The present disclosure relates to a cooking device that heats food and the like.

BACKGROUND ART

[0002] Conventionally, some cooking devices of this type are provided with an image capturing unit that images an inside of a heating chamber such that a condition of food and the like serving as an object to be heated can be confirmed. In a conventional cooking device, image processing is performed based on an image captured by the image capturing unit, and the condition of food is determined (see, for example, PTL 1).

[0003] In the conventional cooking device, in a case where a computer is attempted to distinguish food serving as an object to be heated in the heating chamber from the other objects when the computer processes an image obtained by photographing the food by using the image capturing unit, it may be difficult for the computer that performs image processing to distinguish the food from the other objects, although a difference between the food and the other objects is obvious through human eyes. As an example, the computer fails to correctly distinguish food from a shadow of the food.

[0004] As an example, in the case of fermentation of bread, when both bread dough and a shadow of the bread dough are erroneously recognized to be bread dough, an increase in volume of the bread dough that is caused by fermentation may be incorrectly recognized due to the shadow of the bread dough.

[0005] In the case of baking of bread, when both bread dough and a shadow of the bread dough are erroneously recognized to be bread dough, a computer may determine that the bread dough has been browned. This is because a shadow is generally darker than bread dough. In this case, the bread dough may be erroneously recognized to be initially browned due to the shadow of the bread dough, although the bread dough has not yet been baked.

Citation List

Patent Literature

[0006] PTL 1: Unexamined Japanese Patent Publication No. 2001-272045

SUMMARY OF THE INVENTION

[0007] In view of the conventional problems described above, the present disclosure provides a cooking device that is capable of accurately recognizing a size and a shape of an object to be heated in a state where an influence of a shadow of the object to be heated is reduced

as much as possible.

[0008] Specifically, a cooking device according to an exemplary embodiment of the present disclosure includes a heating chamber that houses an object to be heated, an image capturing unit that captures an image of an inside of the heating chamber, a plurality of lighting units that emits light to the inside of the heating chamber, a lighting controller that controls the plurality of lighting units, and an image processor that specifies an image of the object to be heated in an image captured by the image capturing unit. Each of the plurality of lighting units is disposed in a position substantially facing another of the plurality of lighting units.

[0009] In the configuration above, by simultaneously turning on the plurality of lighting units that emits light to an inside of the heating chamber, the object to be heated is irradiated with light from a plurality of directions different from each other. Accordingly, a shadow can be made more light-colored in comparison with a case where a single lighting unit illuminates the object to be heated, and an object to be cooked can be correctly distinguished from a shadow.

[0010] By employing the configuration above, from among the plurality of lighting units, one lighting unit at a time can be turned on, and the other lighting units can be turned off such that a prescribed number of images including the object to be heated and a shadow of the object to be heated that corresponds to a number of lighting units can be acquired. The object to be heated is indicated in all of these images, but a shadow generated by a specified lighting unit of the plurality of lighting units only appears in an image when the specified lighting unit is in the ON state. This enables food to be correctly distinguished from a shadow of the food.

[0011] By employing the configuration above, food serving as the object to be heated in the heating chamber is recognized in a state where an influence of a shadow is minimized. By doing this, even when the food serving as the object to be heated increases or decreases in volume during cooking, an increase or decrease ratio or an increase or decrease amount can be correctly determined, and the object to be heated can be appropriately cooked.

BRIEF DESCRIPTION OF DRAWINGS

[0012]

FIG. 1 illustrates a general configuration of a principal part of a cooking device according to a first exemplary embodiment of the present disclosure.

FIG. 2 illustrates a general configuration of a principal part of a cooking device according to a second exemplary embodiment of the present disclosure.

FIG. 3 illustrates a general configuration of a principal part of a cooking device according to a third exemplary embodiment of the present disclosure.

FIG. 4 illustrates a general configuration of a principal part of a cooking device according to a fourth exemplary embodiment of the present disclosure.

pal part of the cooking device according to the third exemplary embodiment of the present disclosure.

FIG. 5 illustrates a general configuration of a principal part of the cooking device according to the third exemplary embodiment of the present disclosure.

DESCRIPTION OF EMBODIMENTS

[0013] A cooking device according to an exemplary embodiment of the present disclosure includes a heating chamber that houses an object to be heated, an image capturing unit that captures an image of an inside of the heating chamber, a plurality of lighting units that emit light to the inside of the heating chamber, a lighting controller that controls the plurality of lighting units, and an image processor that specifies an image of the object to be heated in an image captured by the image capturing unit. In the cooking device according to an exemplary embodiment of the present disclosure, each of the plurality of lighting units is disposed in a position substantially facing another of the plurality of lighting units.

[0014] In the configuration above, each of the plurality of lighting units is disposed in a position substantially facing another of the plurality of lighting units, namely, in a position substantially facing another of the plurality of lighting units across a position in which the object to be heated is placed in the heating chamber. Therefore, a shadow generated due to the application of light of a specified lighting unit to the object to be heated is made more light-colored to a certain degree by a lighting unit that is disposed in a position substantially facing the specified lighting unit, and this enables the shadow to be easily distinguished from the object to be heated.

[0015] In a cooking device according to an exemplary embodiment of the present disclosure, the lighting controller may be configured to cause light to be emitted to the inside of the heating chamber by one of the plurality of lighting units that is disposed in a position substantially facing at least another lighting unit.

[0016] In the configuration above, the lighting controller controls lighting of the lighting units while regarding a specified lighting unit and another lighting unit that is disposed in a position substantially facing the specified lighting unit to be a single system. As an example, when lighting on a side of the image capturing unit is made bright and lighting of a lighting unit that is disposed in a substantially facing position is made dark, in a case where plural items of food overlap each other, a shadow of an item of food that is located on a front side when viewed from the side of the image capturing unit overlaps an item of food that is located on a rear side, but a ratio is reduced at which an image of a shadow of the item of food that is located on the rear side is captured by the image capturing unit. In contrast, when lighting on the side of the image capturing unit is made dark and lighting of a lighting unit that is disposed in a substantially facing position is made bright, in a case where plural items of food overlap each other, a ratio is reduced at which a shadow of an

item of food that is located on a front side when viewed from the side of the image capturing unit overlaps an item of food that is located on a rear side, but an image of a shadow of the item of food that is located on the rear side is captured by the image capturing unit. By repeating the control described above, the plural items of food can be easily distinguished from a shadow.

[0017] In a cooking device according to an exemplary embodiment of the present disclosure, the plurality of lighting units may include four lighting units. In this case, in the cooking device according to an exemplary embodiment of the present disclosure, the lighting controller may be configured to cause all of the four lighting units to emit light. In the configuration above, the lighting controller simultaneously controls the four lighting units to emit light such that the four lighting units emit light at the same illuminance, and this enables each shadow to become more light-colored. The lighting controller can associate a specified lighting unit with a shadow by turning on one of the four lighting units and turning off the other lighting units. This enables food to be easily distinguished from a shadow.

[0018] In a cooking device according to an exemplary embodiment of the present disclosure, the plurality of lighting units may be disposed in such a way that light that is emitted to the inside of the heating chamber is indirect light.

[0019] In the configuration above, the object to be heated is not irradiated with direct light, and the lighting units are disposed in positions substantially facing each other such that a shadow becomes more light-colored. These result in a further more light-colored shadow. This enables the object to be heated to be easily distinguished from a shadow.

[0020] A cooking device according to an exemplary embodiment of the present disclosure may include a heating chamber that houses food, an image capturing unit that captures an image of an inside of the heating chamber, a lighting unit that emits light to the inside of the heating chamber, and an image processor that specifies an image of the food in an image captured by the image capturing unit. The lighting unit may be disposed so as to emit indirect light to the inside of the heating chamber.

[0021] This configuration is different from the configuration described above in that a plurality of lighting units do not always need to be disposed in positions substantially facing each other. When light from the lighting unit illuminating an object to be heated is indirect light, a shadow of the object to be heated becomes remarkably light-colored in comparison with a case where the object to be heated is irradiated with direct light. Accordingly, even when the plurality of lighting units are not disposed in positions substantially facing each other, an effect that is similar to an effect exhibited in a case where the plurality of lighting units are disposed in positions substantially facing each other or a certain effect can be exhibited.

[0022] A cooking device according to an exemplary

embodiment of the present disclosure may include a lighting chamber that converts light from a light source of the lighting unit into indirect light.

[0023] In general, indirect light is generated according to a method in which direct light is applied, for example, to at least one of a ceiling and a wall inside a heating chamber and reflected light from the at least one of the ceiling and the wall is applied to an object to be heated. However, in this method, it is difficult to reduce an amount of direct light that is applied to the object to be heated to an ignorable amount. In contrast, by employing the configuration above of the present disclosure, only indirect light is applied to the inside of the heating chamber, and the object to be heated can easily be only irradiated with the indirect light.

[0024] A cooking device according to an exemplary embodiment of the present disclosure may include a reflector that converts light from a light source of the lighting unit into indirect light.

[0025] This configuration is different from the configuration above in which the lighting chamber is provided. A lighting unit is provided in a heating chamber. Light from the lighting unit is reflected by the reflector, and is also reflected by at least one of a ceiling and a wall, and the reflected light is applied to an object to be heated. This enables the object to be heated to be irradiated with indirect light. By employing this method, the lighting chamber does not need to be provided, and spatial efficiency is improved. Of course, a cooking device according to an exemplary embodiment of the present disclosure may be configured to be provided with the reflector in addition to the lighting chamber such that indirect light is generated by the reflector.

(First exemplary embodiment)

[0026] FIG. 1 illustrates a general configuration of a principal part of a cooking device according to a first exemplary embodiment of the present disclosure.

[0027] As illustrated in FIG. 1, cooking device 11 includes heating chamber 13 in which food 12 serving as an object to be heated is housed. Cooking device 11 includes a heating source (a heating unit) (not illustrated) such as a heater, a magnetron, or a steam generator. Cooking device 11 is configured in such a way that controller 31 described later controls the drive of the heating source and the object to be heated is heated and cooked.

[0028] In the present exemplary embodiment, heating chamber 13 has a substantially rectangular parallelepiped shape, and image capturing unit 23 is provided on side wall surface 20 or ceiling 17 of heating chamber 13. Image capturing unit 23 is covered with inclined surface 22, and is fixed to heating chamber 13. Image capturing unit 23 captures an image of an inside of heating chamber 13 through through-hole 24 provided on inclined surface 22. Image capturing unit 23 is set in such a way that an imaging center direction of image capturing unit 23 faces downward by an appropriate angle with respect to a hor-

izontal direction, and food 12 becomes a subject within a field of view.

[0029] Cooking device 11 includes a plurality of lighting units. In the present exemplary embodiment, the plurality of lighting units are configured by lighting units 25a, 25b, 25c, 25d. Lighting unit 25a, 25b, 25c, 25d is configured, for example, by a light-emitting diode (LED). In cooking device 11, each of lighting units 25a, 25b, 25c, 25d, is configured to be disposed in a position substantially facing another of lighting units 25a, 25b, 25c, 25d. The substantially facing position refers to a position in which each of lighting units 25a, 25b, 25c, 25d substantially faces another of lighting units 25a, 25b, 25c, 25d across a position in which the object to be heated is placed (for example, a center of a bottom surface of heating chamber 13) in a plan view at a time when heating chamber 13 is viewed from above. As an example, in the present exemplary embodiment, lighting units 25a, 25b, 25c, 25d are respectively provided on front sides and rear sides of upper sides of right-hand side wall surface 20 and left-hand side wall surface 20. The front sides and the rear sides correspond to vicinities of four corners of ceiling 17 of heating chamber 13. In this example, in cooking device 11, lighting unit 25a and lighting unit 25c are provided in positions facing each other across a center of heating chamber 13 in which food 12 serving as the object to be heated is placed. Similarly, in cooking device 11, lighting unit 25b and lighting unit 25d are provided in positions facing each other across the center of heating chamber 13.

[0030] Controller 31 of cooking device 11 is configured using a microcomputer (not illustrated) that includes, for example, a central processing unit (CPU), a graphics processing unit (GPU), a memory, an input and output interface, and the like. Controller 31 includes image processor 32 and lighting controller 33. Image processor 32 is electrically connected to image capturing unit 23, and performs processing for specifying an image of food 12 from image data of the inside of heating chamber 13 that has been captured and acquired by image capturing unit 23. Lighting controller 33 is electrically connected to lighting units 25a to 25d serving as the plurality of lighting units, and as an example, lighting controller 33 changes a lighting level of lighting units 25a to 25d, and controls the plurality of lighting units (lighting units 25a to 25d) to be turned on and off.

[0031] In the configuration above, each of lighting units 25a to 25d is disposed in a position substantially facing another of the plurality of lighting units. Therefore, a shadow generated due to the application of light of a specified lighting unit of lighting units 25a to 25d to food 12 is made more light-colored to a certain degree by a lighting unit (a lighting unit other than the specified lighting unit from among lighting units 25a to 25d) that substantially faces the specified lighting unit (any of lighting units 25a to 25d).

[0032] As an example, shadow 41b generated due to the application of light of lighting unit 25b to food 12 is made more light-colored to a certain degree by lighting

unit d that substantially faces lighting unit 25b across the center of heating chamber 13 in which food 12 is placed.

[0033] As described above, a shadow becomes more light-colored, and this enables food 12 to be distinguished relatively easily from a shadow of food 12.

[0034] When lighting controller 33 controls lighting unit 25a to be turned on and controls lighting units 25b, 25c, 25d to be turned off, food 12 and shadow 41a are indicated in image data of the inside of heating chamber 13 that has been captured and acquired by image capturing unit 23, as illustrated in FIG. 1.

[0035] When lighting controller 33 controls lighting unit 25b to be turned on and controls lighting units 25a, 25c, 25d to be turned off, food 12 and shadow 41b are indicated in the image data of the inside of heating chamber 13 that has been captured and acquired by image capturing unit 23, as illustrated in FIG. 1.

[0036] When lighting controller 33 controls lighting unit 25c to be turned on and controls lighting units 25a, 25b, 25d to be turned off, food 12 and shadow 41c are indicated in the image data of the inside of heating chamber 13 that has been captured and acquired by image capturing unit 23.

[0037] When lighting controller 33 controls lighting unit 25d to be turned on and controls lighting units 25a, 25b, 25c to be turned off, food 12 and shadow 41d are indicated in the image data of the inside of heating chamber 13 that has been captured and acquired by image capturing unit 23.

[0038] Food 12 is indicated in all of these pieces of image data, but each of shadows 41a to 41d of food 12 is only indicated in any one of these images. By utilizing this, food 12 can be specified.

[0039] As described above, in cooking device 11 according to the present exemplary embodiment, food 12 serving as an object to be heated in heating chamber 13 is recognized in a state where an influence of a shadow is minimized. Accordingly, even when food 12 increases or decreases in volume during cooking, an increase or decrease ratio or an increase or decrease amount of food 12 can be correctly determined, and heating and cooking that are suitable for cooking of the object to be heated can be performed.

[0040] An example in which heating and cooking that are suitable for an object to be heated can be performed is fermentation of bread. Examples of a method for confirming whether fermentation of bread has been completed include a method in which it is considered that fermentation has been completed when an area of bread dough when viewed through eyes increases to about several times an area before fermentation. In cooking device 11 according to the present exemplary embodiment, bread and a shadow of the bread can be correctly distinguished from each other, and an imaging area of only the bread can be correctly recognized. Stated another way, an area of the shadow is not erroneously recognized as a portion of an area of the bread, and therefore whether fermentation has been completed can be correctly de-

termined, and delicious bread can be baked.

[0041] In cooking device 11 according to the present exemplary embodiment, food 12 inside heating chamber 13 is recognized in a state where an influence of a shadow is minimized. Therefore, even when food 12 changes in color during cooking, a color of the food (an object to be cooked) serving as an object to be heated can be correctly determined, and heating and cooking that are suitable for cooking of the object to be heated can be performed.

[0042] Another example in which heating and cooking that are suitable for cooking of an object to be heated can be performed by cooking device 11 according to the present exemplary embodiment is cooking for baking cookies. Examples of a method for confirming whether baking of cookies has been completed include a method in which it is considered that baking has been completed when surfaces of cookies have a color desired by a cook. According to the present exemplary embodiment, the cookies and shadows of the cookies can be correctly distinguished from each other, and colors of only the surfaces of the cookies can be correctly recognized. Stated another way, a color of the shadow is not erroneously recognized as colors of some cookies, and therefore whether baking has been completed can be correctly determined, and delicious cookies can be baked.

(Second exemplary embodiment)

[0043] FIG. 2 illustrates a general configuration of a principal part of a cooking device according to a second exemplary embodiment of the present disclosure.

[0044] In the second exemplary embodiment of the present disclosure, a case is described where food 12 and food 12a are housed in heating chamber 13 of cooking device 11, as illustrated in FIG. 2. Cooking device 11 according to the second exemplary embodiment of the present disclosure has the same basic structure as a basic structure of cooking device 11 according to the first exemplary embodiment. Therefore, in the description below of cooking device 11 according to the second exemplary embodiment of the present disclosure, only a difference from cooking device 11 according to the first exemplary embodiment is described, the same components and the same functions are denoted by the same reference marks, and detailed description of the same components and the same functions are omitted.

[0045] As illustrated in FIG. 2, when food 12 and food 12a are housed in heating chamber 13 of cooking device 11, shadow 41e generated due to the application of light of lighting unit 25a to food 12 may overlap food 12a. In this case, it is difficult for a microcomputer that configures image processor 32 to determine whether a portion of food 12a has been browned or whether shadow 41e overlaps food 12a.

[0046] Control performed by lighting controller 33 in this case is described below by using, as an example, the application of light of lighting unit 25a and lighting unit

25c that are disposed in positions substantially facing each other.

[0047] In cooking device 11 according to the present exemplary embodiment, lighting controller 33 is configured to simultaneously control lighting unit 25a and lighting unit 25c that are disposed in positions substantially facing each other in such a way that lighting inside the heating chamber is adjusted to have a desired brightness. In addition, lighting controller 33 is configured to control lighting unit 25a and lighting unit 25c that are disposed in positions substantially facing each other so as to have different brightness such that darkness of a shadow generated due to the application of light of lighting unit 25a and lighting unit 25c is controlled. As an example, lighting controller 33 controls lighting unit 25c so as to have an appropriate illuminance by turning off lighting unit 25a or faintly turning on lighting unit 25a. By doing this, shadow 41e of food 12 is not indicated in image data that has been captured by image capturing unit 23, or is hardly visually recognized.

[0048] As described above, lighting controller 33 simultaneously controls lighting unit 25a and lighting unit 25c that are disposed in positions substantially facing each other in such a way that lighting inside the heating chamber has a desired brightness. Simultaneous control facilitates control performed by lighting controller 33, and an effect whereby a shadow is made more light-colored can be efficiently exhibited. Lighting unit 25a and lighting unit 25c do not need to apply light during completely the same time period. The scope of the present disclosure includes, for example, a case where lighting unit 25a and lighting unit 25c are controlled in such a way that lighting unit 25a and lighting unit 25c start or finish applying light at different timings, for example, by lighting unit 25c starting applying light later than lighting unit 25a but lighting unit 25a and lighting unit 25c simultaneously apply light during a certain time period such that darkness of a shadow generated due to the application of light of lighting unit 25a or lighting unit 25c changes.

[0049] Lighting controller 33 can acquire correct contours of food 12 and food 12a by controlling lighting unit 25a and lighting unit 25c that are disposed in positions substantially facing each other so as to apply light at brightness different from each other.

[0050] Control performed by lighting controller 33 on a plurality of lighting units has been described above by using lighting unit 25a and lighting unit 25c as an example. However, the plurality of lighting units are not limited to lighting unit 25a and lighting unit 25c, and similar control is performed on lighting unit 25b and lighting unit 25d.

(Third exemplary embodiment)

[0051] FIG. 3 illustrates a general configuration of a principal part of a cooking device according to a third exemplary embodiment of the present disclosure. FIG. 4 illustrates a general configuration of a principal part of the cooking device according to the third exemplary em-

bodiment of the present disclosure. FIG. 5 illustrates a general configuration of a principal part of the cooking device according to the third exemplary embodiment of the present disclosure.

[0052] The third exemplary embodiment of the present disclosure has the same basic structure as basic structures of cooking devices 11 according to the first exemplary embodiment and the second exemplary embodiment that have been described above. Therefore, in the description below of cooking devices 3 according to the third exemplary embodiment of the present disclosure, only a difference from cooking devices 11 according to the first exemplary embodiment and the second exemplary embodiment is described, the same components and the same functions are denoted by the same reference marks, and detailed description of the same components and the same functions are omitted.

[0053] In cooking device 3 according to the third exemplary embodiment of the present disclosure, a plurality of lighting units are respectively disposed in lighting chambers that are provided in end parts inside heating chamber 13 and that are provided in positions facing each other across a position in which an object to be heated is placed. As an example, as illustrated in FIG. 3, lighting units 25a, 25c that configure the plurality of lighting units are respectively disposed in lighting chambers 14a, 14b that are provided in end parts inside heating chamber 13 and that are provided in positions facing each other across a position in which an object to be heated is placed. Stated another way, in cooking device 3 according to the present exemplary embodiment, lighting units 25a, 25c are disposed in such a way that food 12 is not irradiated with direct light from lighting units 25a, 25c. In the configuration above, light that is applied to food 12 is indirect light, and a shadow generated due to the application of light of lighting units 25a, 25c becomes more light-colored. FIG. 3 illustrates an example in which lighting chambers 14a, 14b are provided on sides of side wall surfaces 20. Lighting units 25b, 25d are omitted in FIG. 3 in order to simplify description.

[0054] As illustrated in FIG. 4, cooking device 3 according to the present exemplary embodiment may be configured in such a way that lighting chamber 14 is provided on an upper side of ceiling 17 of heating chamber 13, lighting units 25a, 25c serving as lighting units are provided in lighting chamber 14, and lighting units 25a, 25c illuminate an inside of heating chamber 13 through lighting through-hole 26 that is provided in ceiling 17 of heating chamber 13. By employing the configuration above, a ratio of light that is applied to food 12 from above increases, and a shadow generated due to the application of light of lighting units 25a, 25c is expected to become more light-colored in comparison with a configuration in which lighting units 25a, 25c are disposed in lighting chambers 14a, 14b that are provided on the sides of side wall surfaces 20, as illustrated in FIG. 3.

[0055] As illustrated in FIG. 5, reflectors 15a, 15b may be respectively provided in a position between lighting

unit 25a and an object to be heated and in a position between lighting unit 25c and the object to be heated in order to generate indirect light inside heating chamber 14. In the configuration above, lighting units 25a, 25c exist inside heating chamber 13, and there is an advantage wherein illuminance of heating chamber 13 can be set to be higher in comparison with a configuration in which indirect light is generated by using lighting chamber 14, 14a, 14b.

[0056] In the first exemplary embodiment to the third exemplary embodiment described above of the present disclosure, an example has been described in which a plurality of lighting units are configured by four lighting units, lighting units 25a, 25b, 25c, 25d. However, the plurality of lighting units according to the present disclosure may be configured by five or more lighting units.

[0057] The present disclosure is not to be construed as excluding that cooking device 3, 11 includes a lighting unit other than the plurality of lighting units. Stated another way, cooking device 3, 11 may include a lighting unit that is not disposed in a position facing any of the plurality of lighting units across a position in which an object to be heated is placed. In this case, the lighting unit that is not included in the plurality of lighting units may be configured not to be a target for irradiation control performed by lighting controller 33 and to be functionally and constitutively independent of the plurality of lighting units. The lighting unit other than the plurality of lighting units may be configured to apply light to the inside of heating chamber 13, or may be provided in cooking device 3, 11 for another purpose.

INDUSTRIAL APPLICABILITY

[0058] As described above, the present disclosure provides a cooking device that is capable of distinguishing an object to be heated from a shadow so as to perform heating and cooking that are suitable for cooking of the object to be heated. Accordingly, the present disclosure is widely applicable, for example, to a cooking device that heats and cooks food or the like that serves as the object to be heated regardless of a cooking device for household use or a cooking device for commercial use.

REFERENCE MARKS IN THE DRAWINGS

[0059]

3, 11: cooking device
12, 12a: food (object to be heated)
13: heating chamber
14, 14a, 14b: lighting chamber
15a, 15b: reflector
17: ceiling
20: side wall surface
22: inclined surface
23: image capturing unit
24: through-hole

25a, 25b, 25c, 25d: lighting unit (lighting unit)

26: lighting through-hole

32: image processor

33: lighting controller

41a: shadow of food 12 that is generated by lighting unit 25a

41b: shadow of food 12 that is generated by lighting unit 25b

41c: shadow of food 12 that is generated by lighting unit 25c

41d: shadow of food 12 that is generated by lighting unit 25d

15 Claims

1. A cooking device comprising:

a heating chamber that houses an object to be heated;
an image capturing unit that captures an image of an inside of the heating chamber;
a plurality of lighting units that apply light to the inside of the heating chamber;
a lighting controller that controls the plurality of lighting units; and
an image processor that specifies an image of the object to be heated in an image captured by the image capturing unit,
wherein each of the plurality of lighting units is disposed in a position substantially facing another of the plurality of lighting units.

2. The cooking device according to claim 1, wherein the lighting controller causes at least one lighting unit and another lighting unit that is disposed in a position substantially facing one of the at least one lighting unit of the plurality of lighting units to emit the light to the inside of the heating chamber.

3. The cooking device according to claim 1 or 2, wherein the plurality of lighting units include four lighting units, and the lighting controller is configured to control the four lighting units to apply light.

4. The cooking device according to any one of claims 1 to 3, wherein the plurality of lighting units are disposed in a manner that an indirect light is applied to the inside of the heating chamber.

5. A cooking device comprising:

a heating chamber that houses an object to be heated;
an image capturing unit that captures an image

of an inside of the heating chamber;
a lighting unit that applies light to the inside of
the heating chamber; and
an image processor that specifies an image of
the object to be heated in an image captured by
the image capturing unit,
wherein the lighting unit is disposed in a manner
that an indirect light is applied to the inside of
the heating chamber.

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6. The cooking device according to claim 4 or 5, further
comprising a lighting chamber that converts the light
that is applied from the lighting unit into indirect light.

7. The cooking device according to claim 4 or 5, further
comprising a reflector that converts the light that is
applied from the lighting unit into indirect light.

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FIG. 1

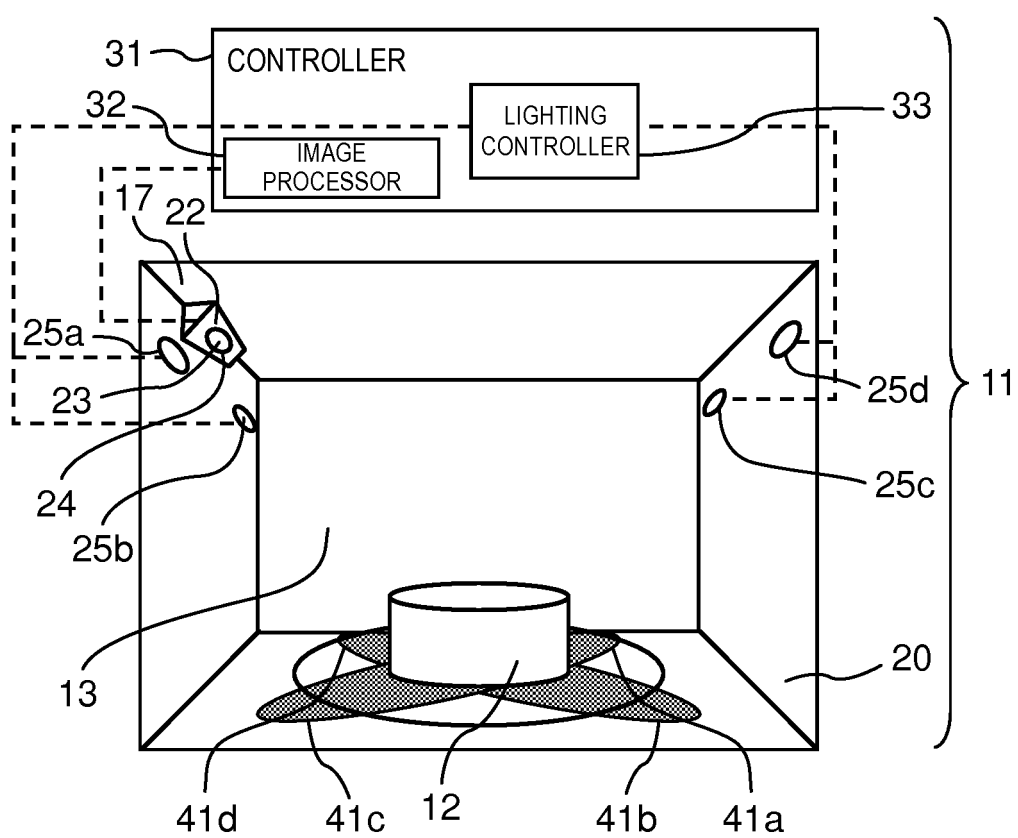


FIG. 2

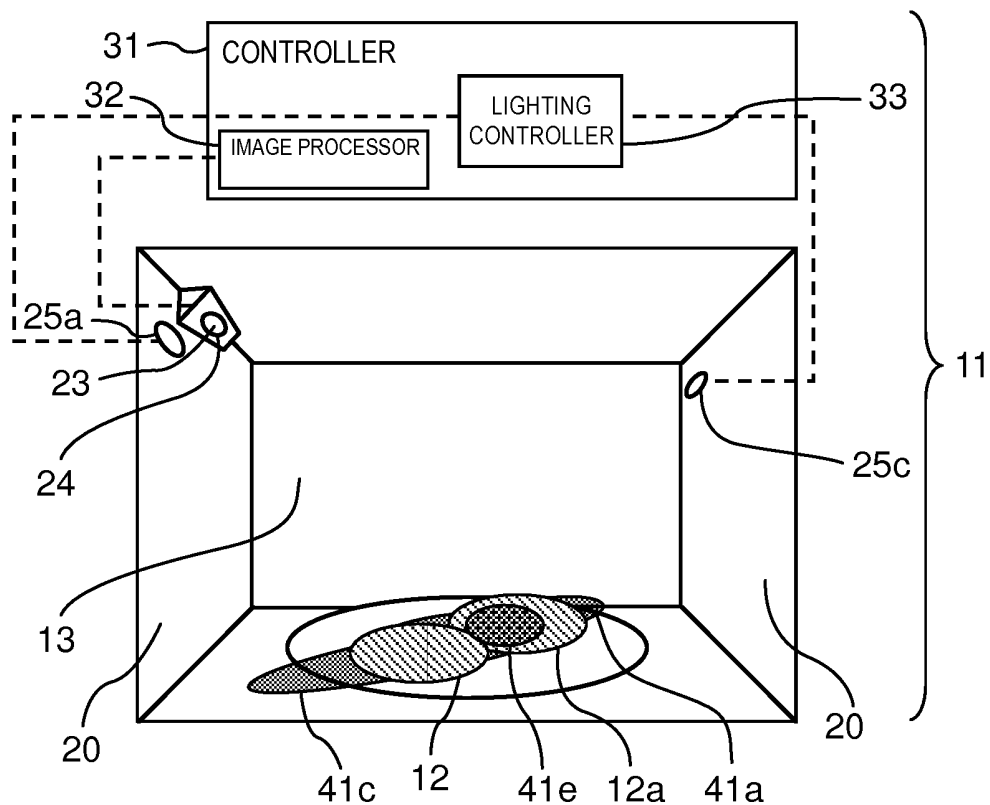


FIG. 3

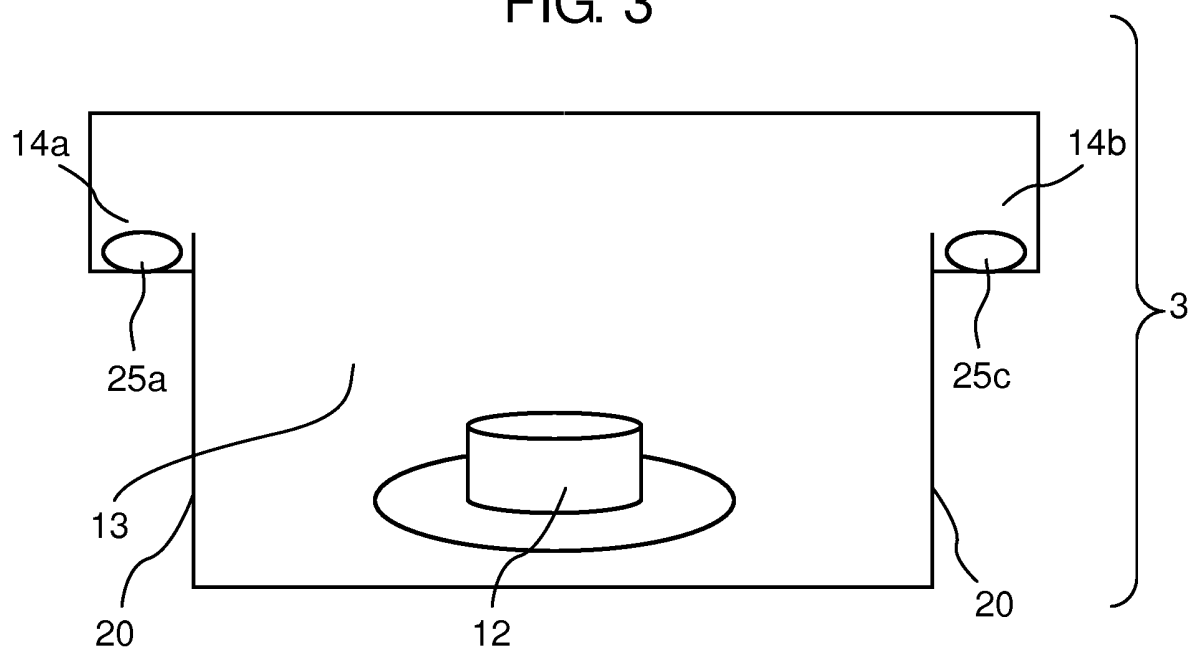


FIG. 4

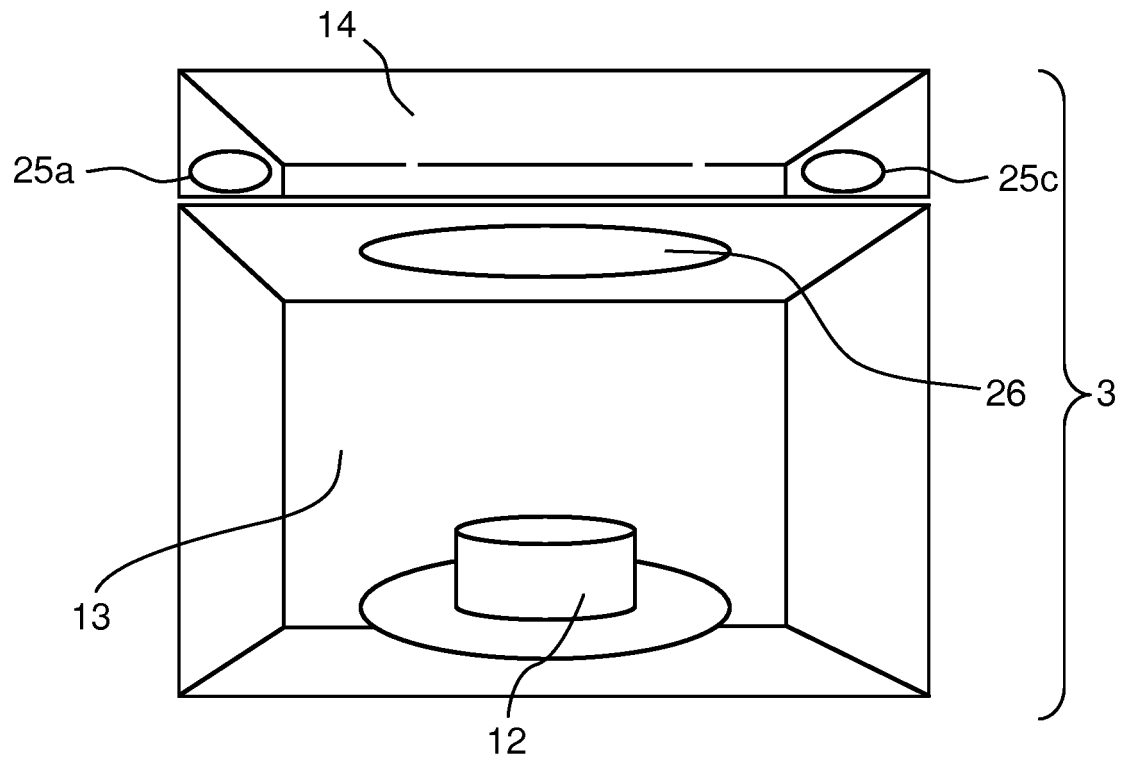
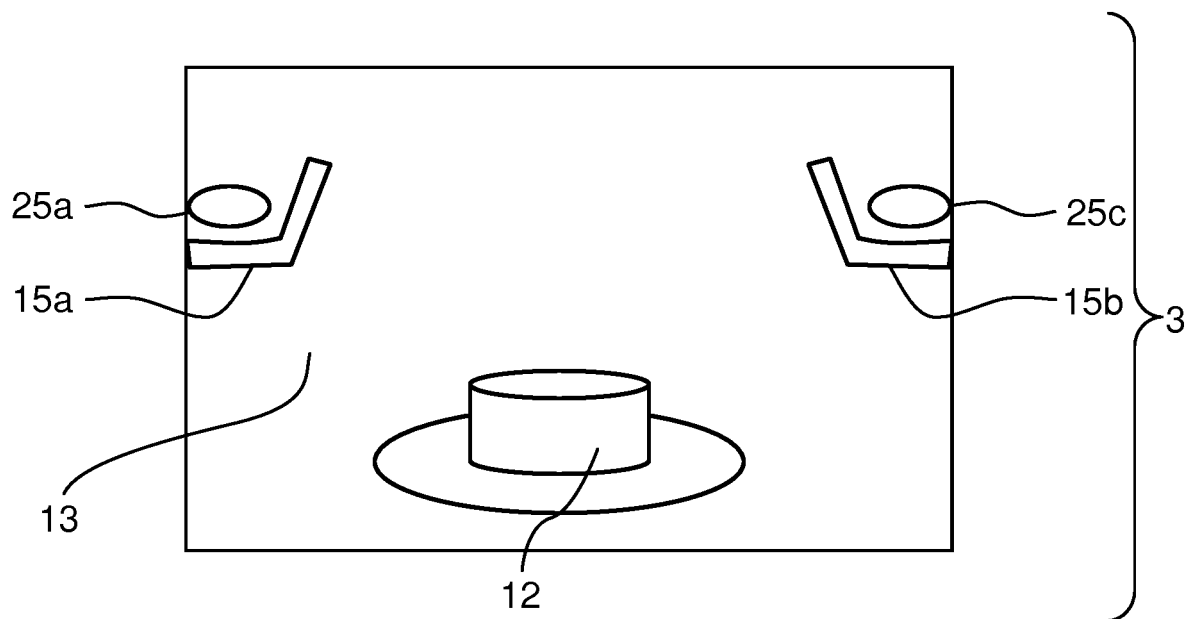


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/012235

A. CLASSIFICATION OF SUBJECT MATTER

F24C7/02(2006.01)i, F24C7/08(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, F24C7/08, F24C15/18, H05B6/64

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 1996-2017
 Kokai Jitsuyo Shinan Koho 1971-2017 Toroku Jitsuyo Shinan Koho 1994-2017

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 63-259327 A (Matsushita Electric Industrial Co., Ltd.), 26 October 1988 (26.10.1988), page 2, upper left column, line 5 to upper right column, line 18; fig. 6	1-7
Y	US 2014/0061188 A1 (LIU, Gang), 06 March 2014 (06.03.2014), fig. 7	1-4
Y	US 2012/0170247 A1 (GENERAL ELECTRIC CO.), 05 July 2012 (05.07.2012), fig. 1	1-4
Y	JP 2002-257359 A (Paloma Industries, Ltd.), 11 September 2002 (11.09.2002), paragraphs [0021], [0029]	4-7

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

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"&" document member of the same patent family

Date of the actual completion of the international search
24 May 2017 (24.05.17)Date of mailing of the international search report
06 June 2017 (06.06.17)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2017/012235

JP 63-259327 A	1988.10.26	US 4868357 A
US 2014/0061188 A1	2014.03.06	(Family: none)
US 2012/0170247 A1	2012.07.05	(Family: none)
JP 2002-257359 A	2002.09.11	(Family: none)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2001272045 A [0006]