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Kikuchi

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(54) **COOKING DEVICE AND COOKING SYSTEM**

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CPC ***H05B 6/062*** (2013.01); *H05B 2213/07* (2013.01)

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CPC F24C 7/083; F24C 7/087; H05B 1/0266; H05B 2213/07; H05B 3/68; H05B 6/062
(Continued)

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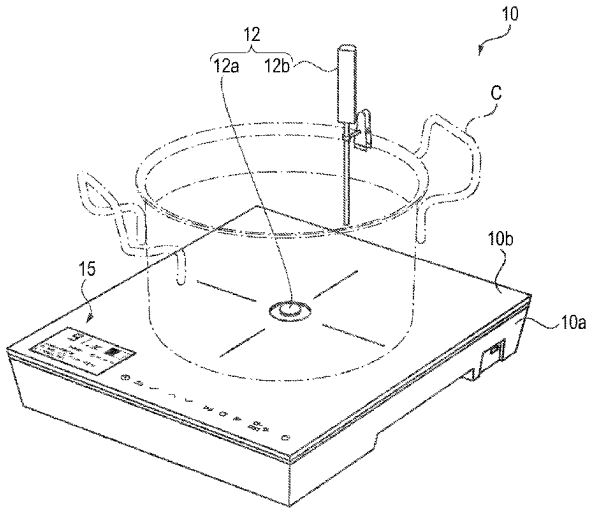
(57) **ABSTRACT**

The present invention makes it possible to easily cook a desired dish by properly controlling heating temperatures of objects to be heated in cookware in accordance with a cooking procedure. The cooking device **10** is provided with: a heating unit **11** for heating cookware C containing objects to be heated such as water, oil, and ingredients; a temperature detection unit **12** for detecting a temperature of the objects to be heated and/or a temperature of a bottom exterior surface of the cookware C; and a control unit **18** for controlling the heating unit **11** on the basis of the temperature detected by the temperature detection unit **12** such that the temperature of the objects to be heated in the cookware C or a surface temperature of a bottom interior surface of the cookware C matches a cooking temperature set in a cooking process included in cooking execution information.

4 Claims, 8 Drawing Sheets



(58) **Field of Classification Search**
USPC 219/627
See application file for complete search history.

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FIG. 1

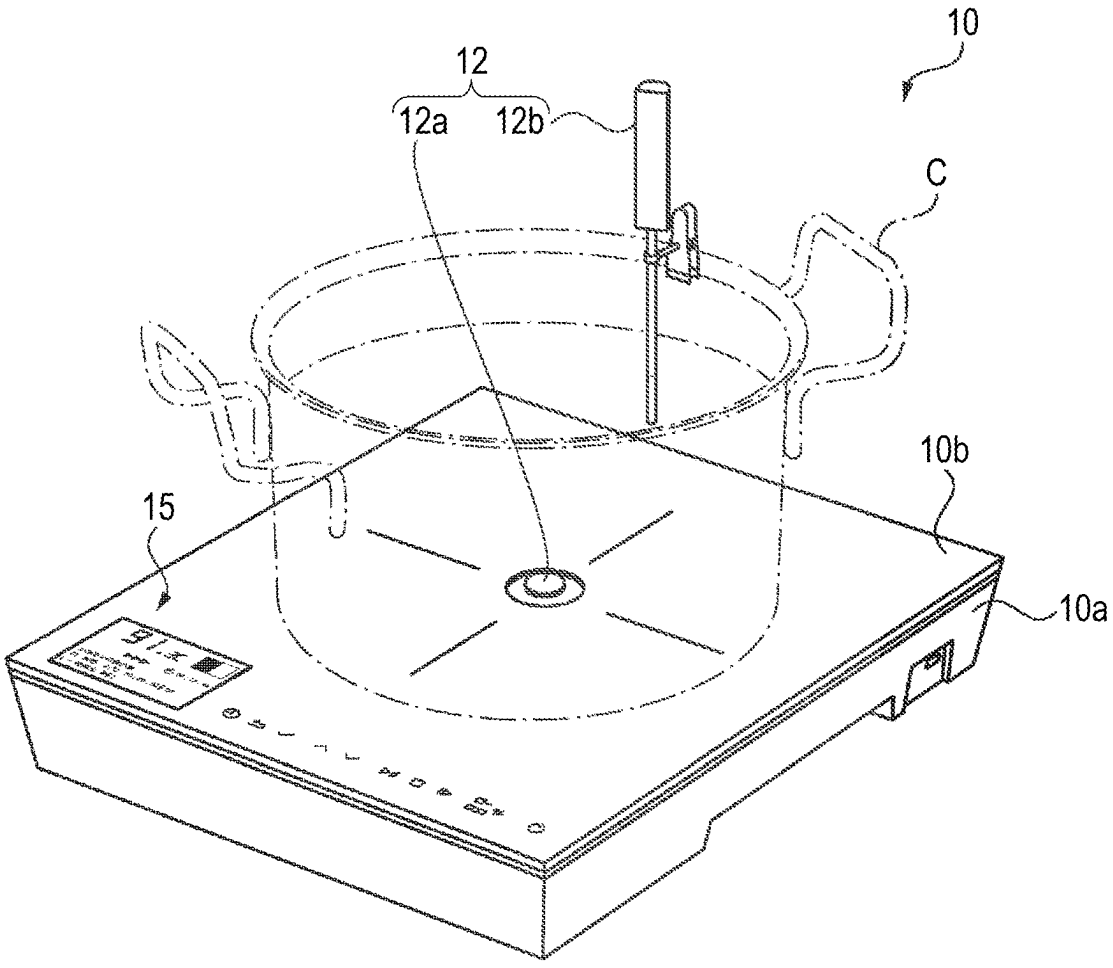


FIG. 2

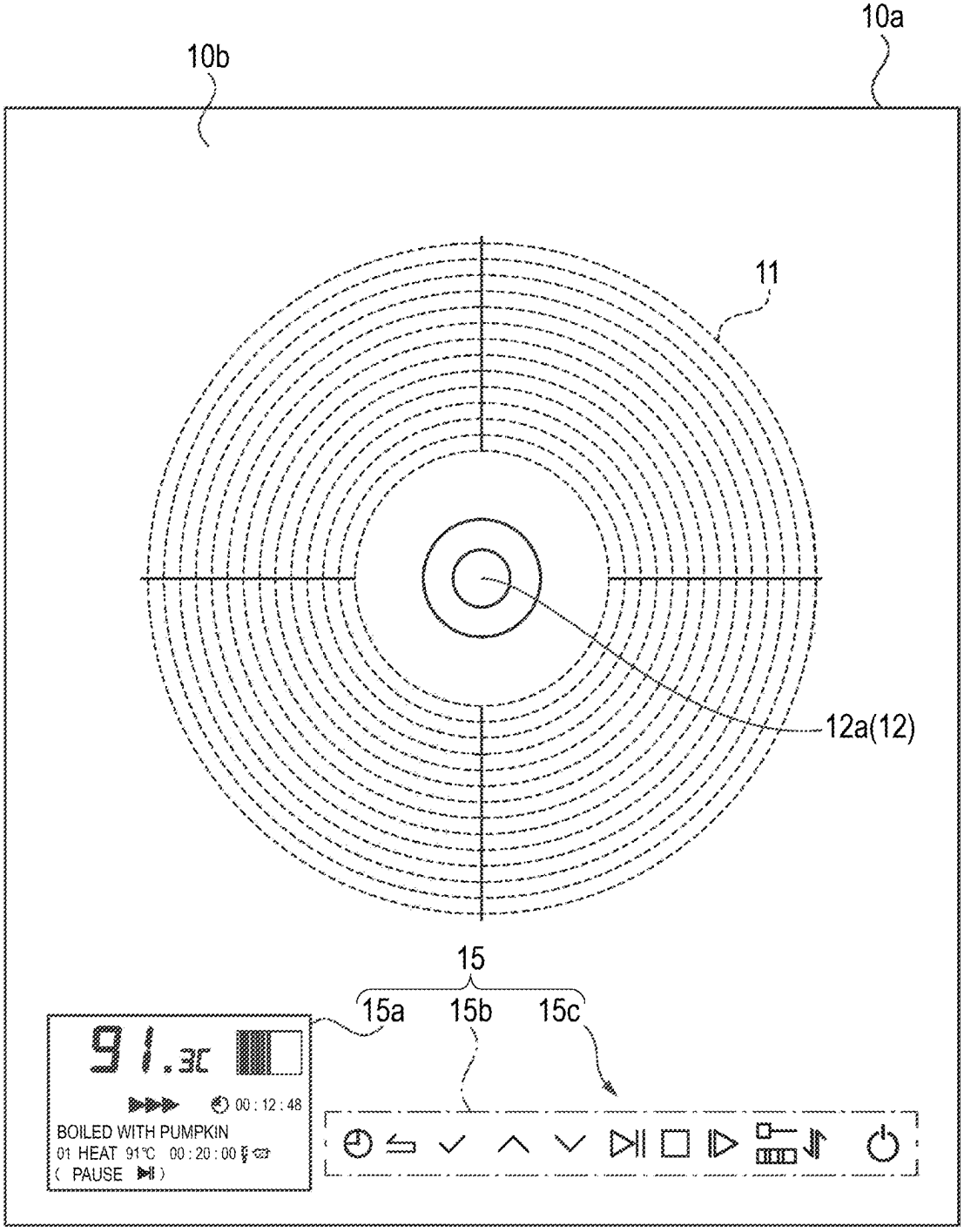
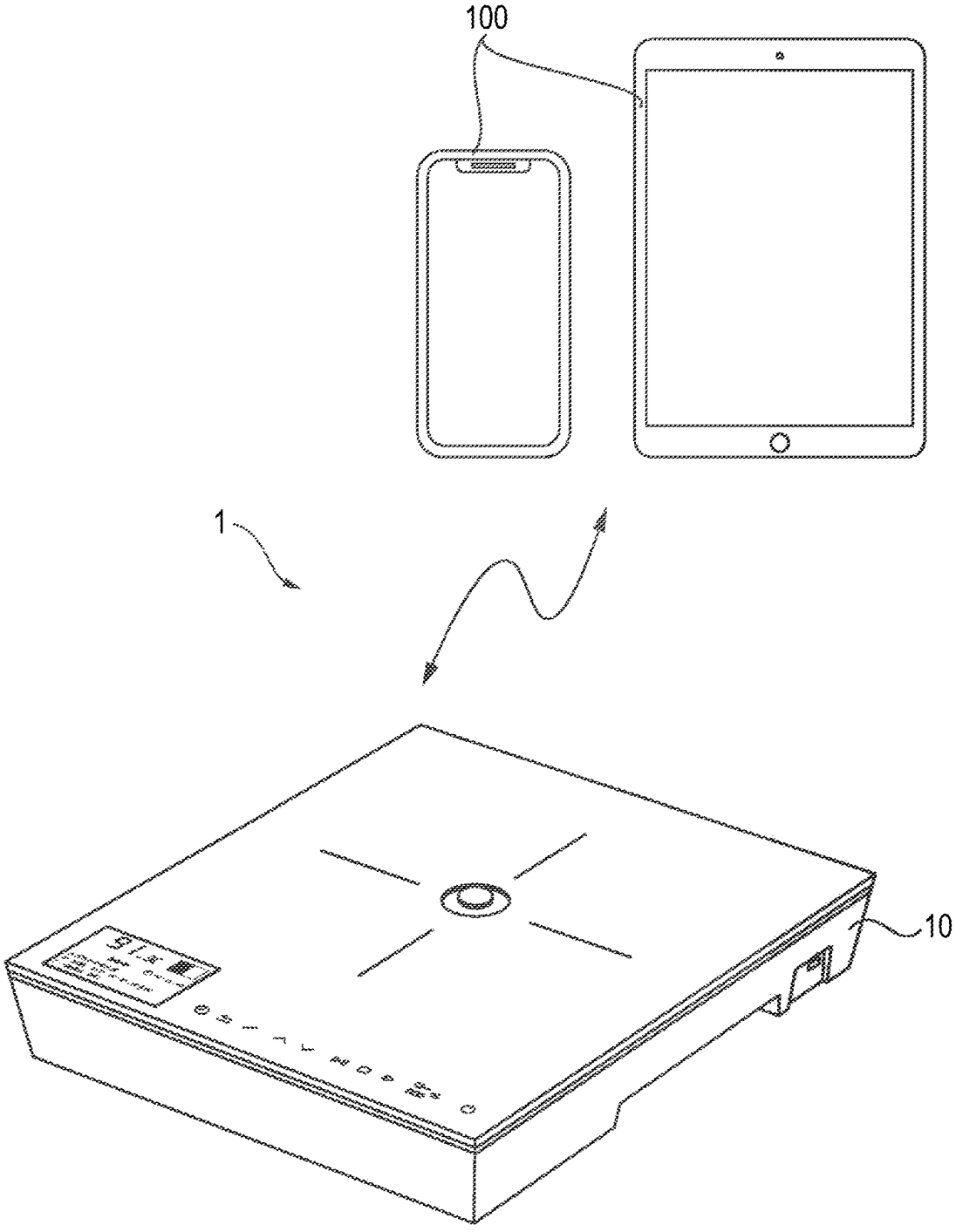

10a
10b
11
12a(12)
15
15a
15b
15c
91.3C
00 : 12 : 48
BOILED WITH PUMPKIN
01 HEAT 91°C 00 : 20 : 00
(PAUSE)

FIG. 3



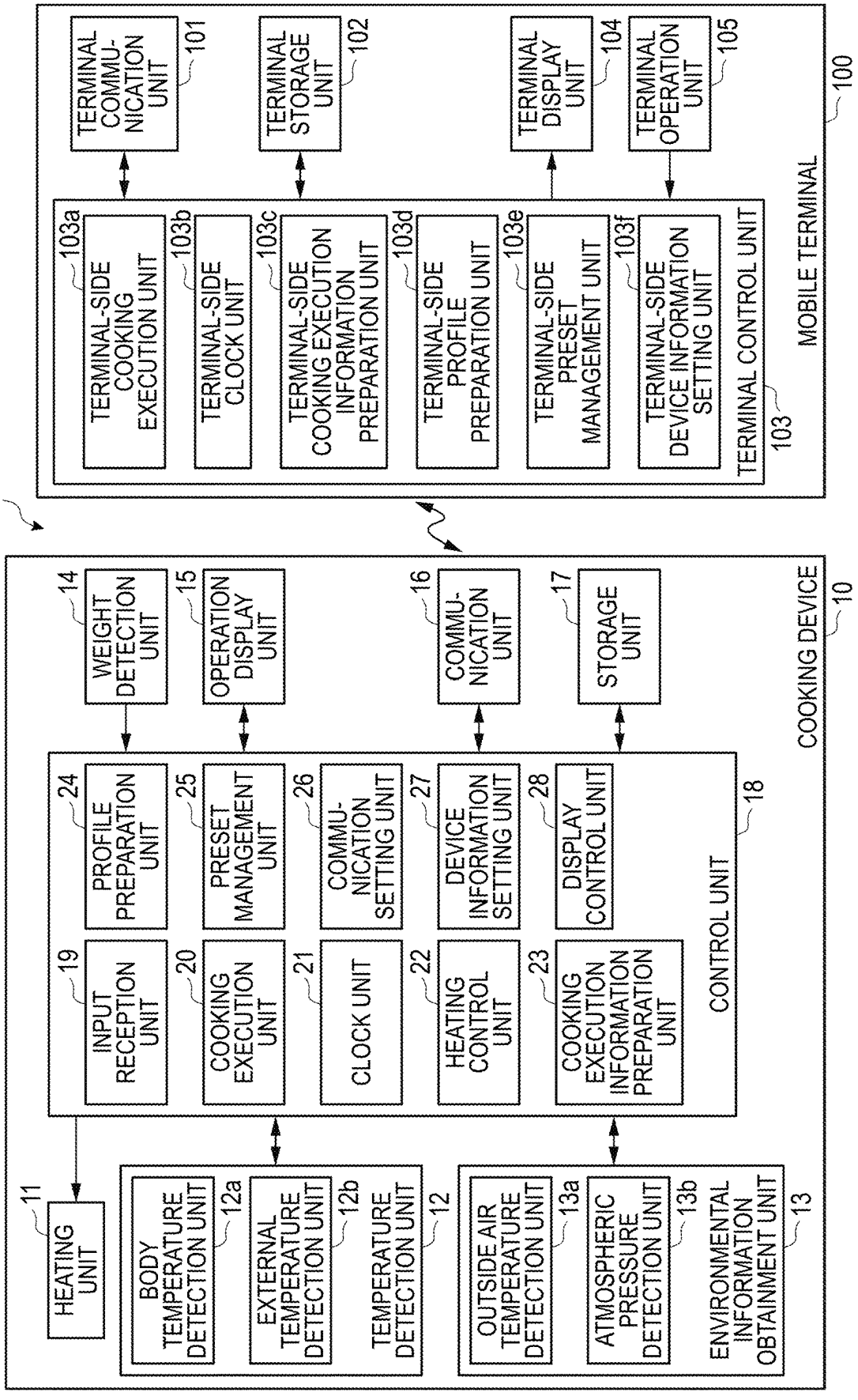

1
MOBILE TERMINAL
100
TERMINAL CONTROL UNIT
103
TERMINAL-SIDE COOKING EXECUTION UNIT
103a
TERMINAL-SIDE CLOCK UNIT
103b
TERMINAL-SIDE COOKING EXECUTION INFORMATION PREPARATION UNIT
103c
TERMINAL-SIDE PROFILE PREPARATION UNIT
103d
TERMINAL-SIDE PRESET MANAGEMENT UNIT
103e
TERMINAL-SIDE DEVICE INFORMATION SETTING UNIT
103f
TERMINAL COMMUNICATION UNIT
101
TERMINAL STORAGE UNIT
102
TERMINAL DISPLAY UNIT
104
TERMINAL OPERATION UNIT
105
COOKING DEVICE
10
CONTROL UNIT
18
INPUT RECEPTION UNIT
19
COOKING EXECUTION UNIT
20
CLOCK UNIT
21
HEATING CONTROL UNIT
22
COOKING EXECUTION INFORMATION PREPARATION UNIT
23
PROFILE PREPARATION UNIT
24
PRESET MANAGEMENT UNIT
25
COMMUNICATION SETTING UNIT
26
DEVICE INFORMATION SETTING UNIT
27
DISPLAY CONTROL UNIT
28
WEIGHT DETECTION UNIT
14
OPERATION DISPLAY UNIT
15
COMMUNICATION UNIT
16
STORAGE UNIT
17
HEATING UNIT
11
TEMPERATURE DETECTION UNIT
12
BODY TEMPERATURE DETECTION UNIT
12a
EXTERNAL TEMPERATURE DETECTION UNIT
12b
ENVIRONMENTAL INFORMATION OBTAINMENT UNIT
13
OUTSIDE AIR TEMPERATURE DETECTION UNIT
13a
ATMOSPHERIC PRESSURE DETECTION UNIT
13b

FIG. 4

FIG. 5

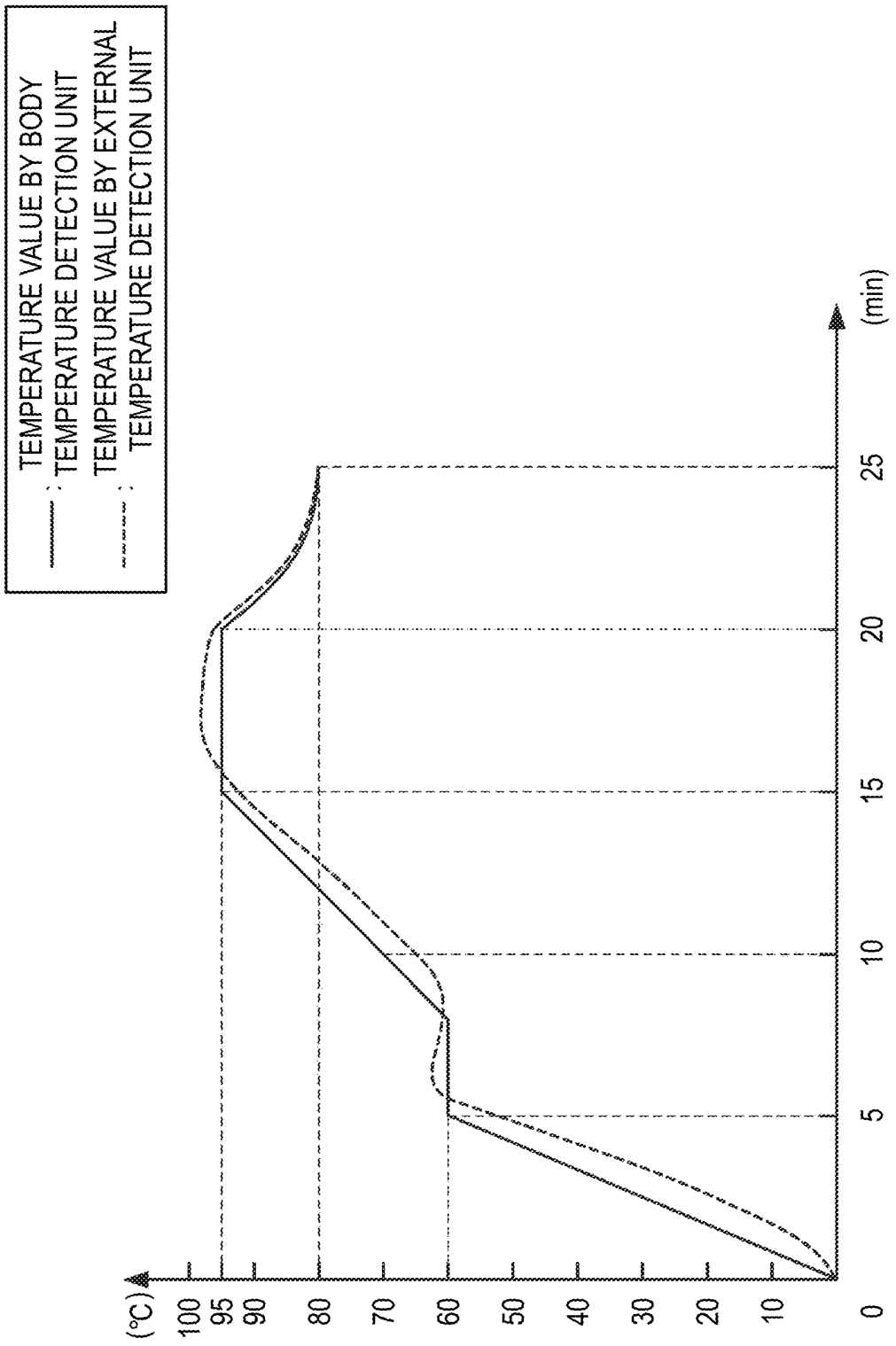

TEMPERATURE VALUE BY BODY TEMPERATURE DETECTION UNIT
TEMPERATURE VALUE BY EXTERNAL TEMPERATURE DETECTION UNIT
(°C)
100
95
90
80
70
60
50
40
30
20
10
0
5
10
15
20
25
(min)

FIG. 6

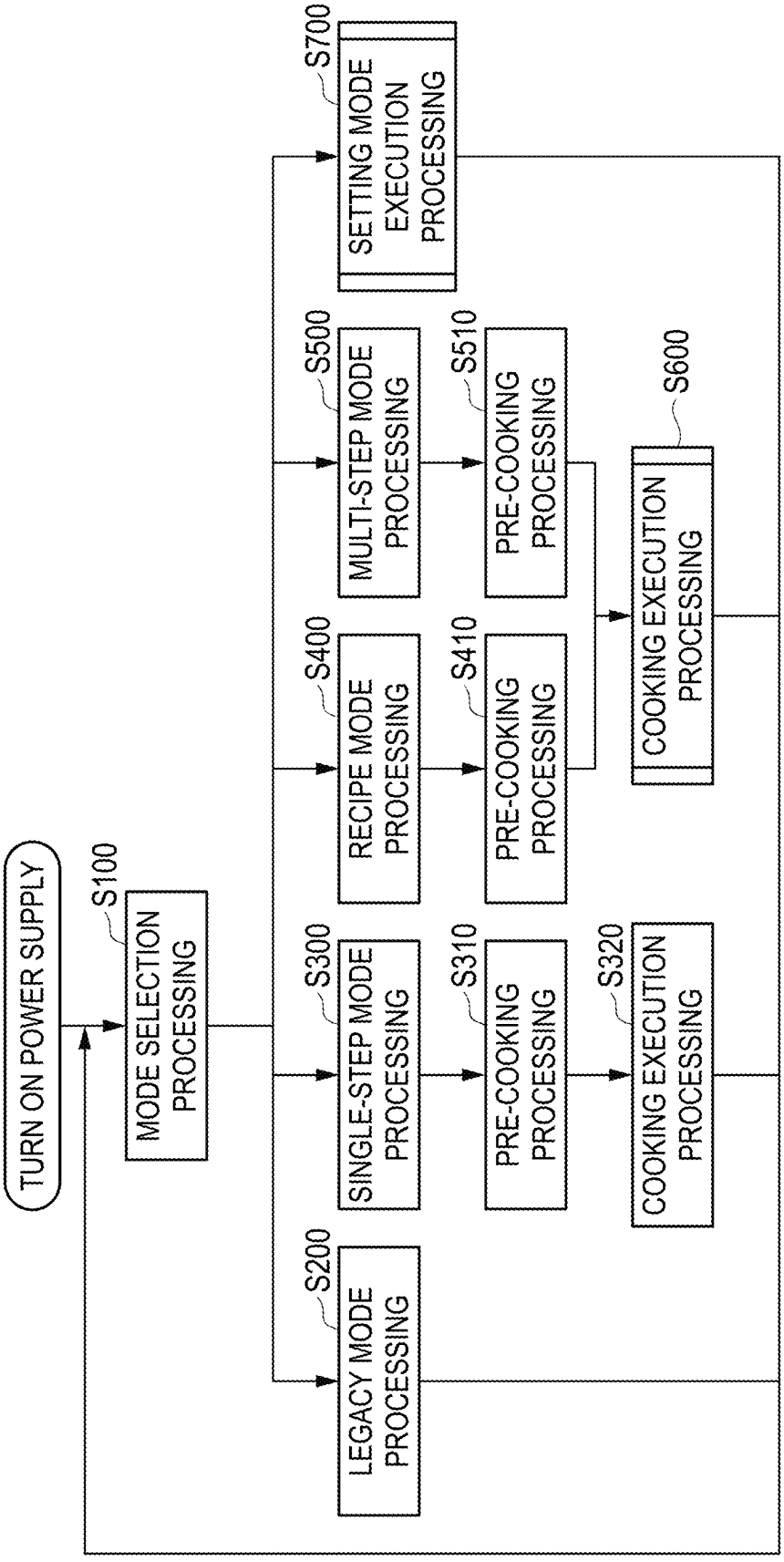

TURN ON POWER SUPPLY
S100
MODE SELECTION PROCESSING
S200
LEGACY MODE PROCESSING
S300
SINGLE-STEP MODE PROCESSING
S310
PRE-COOKING PROCESSING
S320
COOKING EXECUTION PROCESSING
S400
RECIPE MODE PROCESSING
S410
PRE-COOKING PROCESSING
S500
MULTI-STEP MODE PROCESSING
S510
PRE-COOKING PROCESSING
S600
COOKING EXECUTION PROCESSING
S700
SETTING MODE EXECUTION PROCESSING

FIG. 7

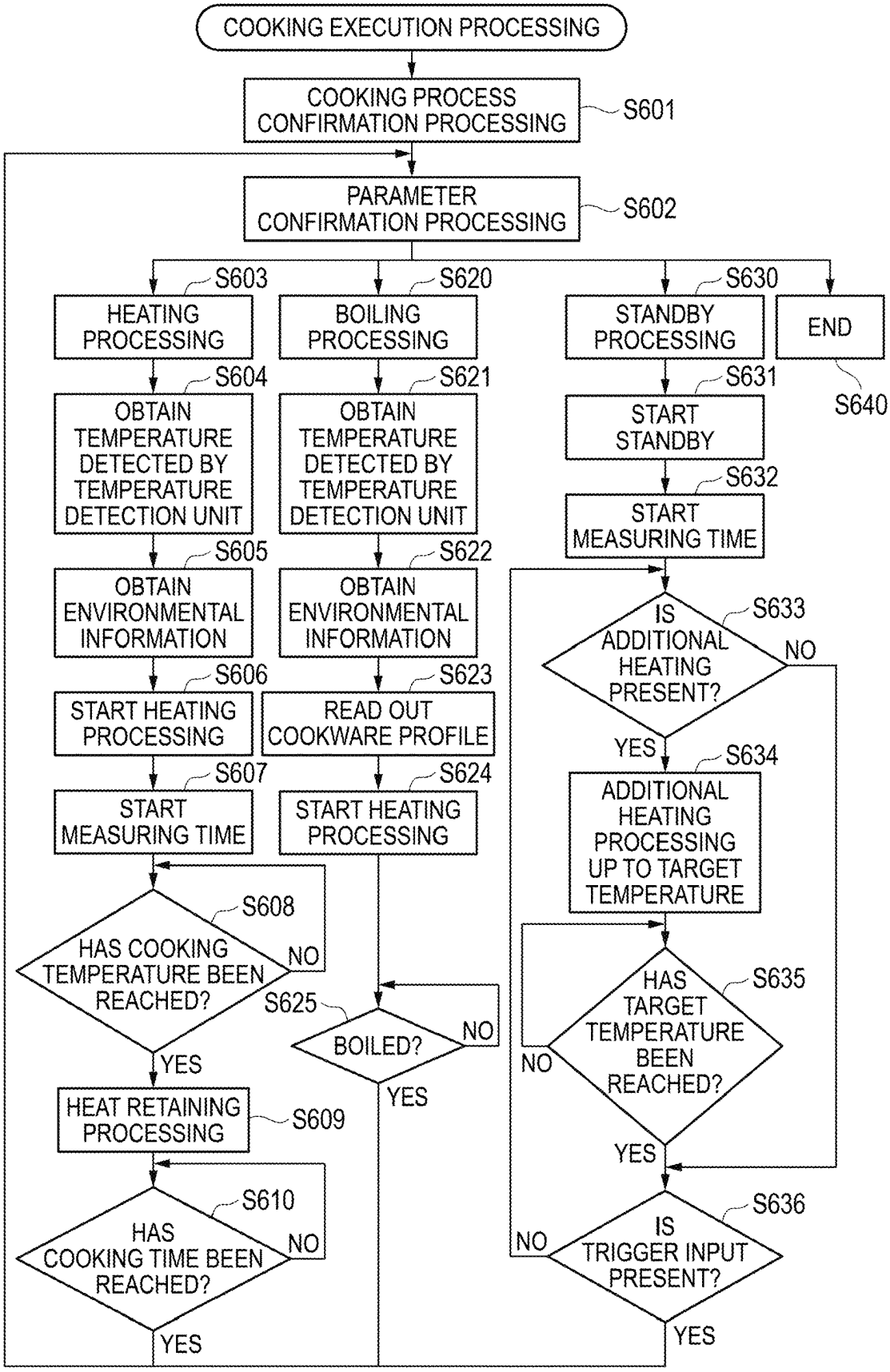
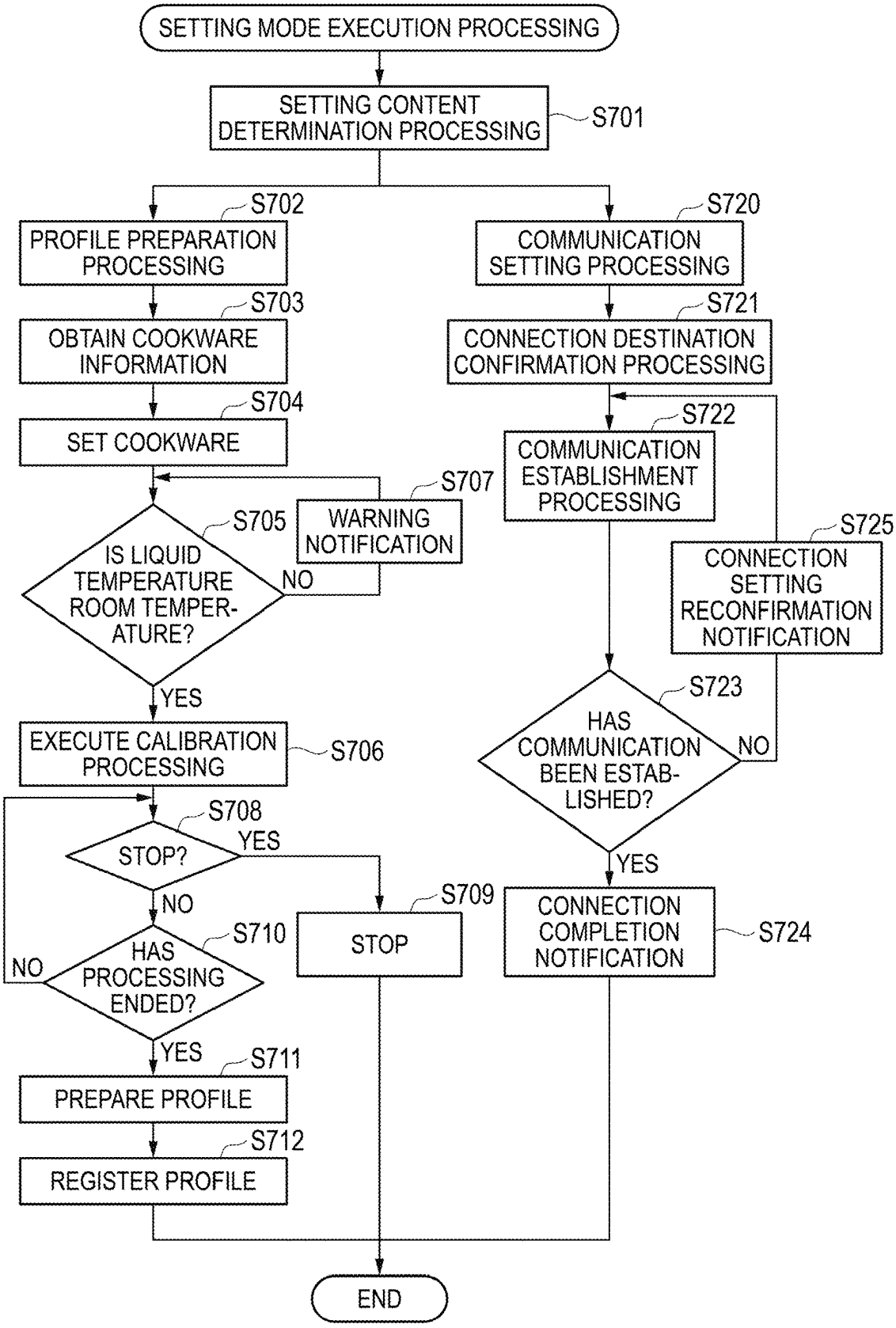

COOKING EXECUTION PROCESSING
COOKING PROCESS CONFIRMATION PROCESSING
S601
PARAMETER CONFIRMATION PROCESSING
S602
S603
HEATING PROCESSING
S604
OBTAIN TEMPERATURE DETECTED BY TEMPERATURE DETECTION UNIT
S605
OBTAIN ENVIRONMENTAL INFORMATION
S606
START HEATING PROCESSING
S607
START MEASURING TIME
S608
HAS COOKING TEMPERATURE BEEN REACHED?
NO
YES
HEAT RETAINING PROCESSING
S609
S610
HAS COOKING TIME BEEN REACHED?
NO
YES
S620
BOILING PROCESSING
S621
OBTAIN TEMPERATURE DETECTED BY TEMPERATURE DETECTION UNIT
S622
OBTAIN ENVIRONMENTAL INFORMATION
S623
READ OUT COOKWARE PROFILE
S624
START HEATING PROCESSING
S625
BOILED?
NO
YES
S630
STANDBY PROCESSING
S631
START STANDBY
S632
START MEASURING TIME
S633
IS ADDITIONAL HEATING PRESENT?
NO
YES
S634
ADDITIONAL HEATING PROCESSING UP TO TARGET TEMPERATURE
S635
HAS TARGET TEMPERATURE BEEN REACHED?
NO
YES
S636
IS TRIGGER INPUT PRESENT?
NO
YES
END
S640

FIG. 8


SETTING MODE EXECUTION PROCESSING
SETTING CONTENT DETERMINATION PROCESSING
S701
S702
PROFILE PREPARATION PROCESSING
S703
OBTAIN COOKWARE INFORMATION
S704
SET COOKWARE
S705
IS LIQUID TEMPERATURE ROOM TEMPER-ATURE?
NO
S707
WARNING NOTIFICATION
YES
EXECUTE CALIBRATION PROCESSING
S706
S708
STOP?
YES
NO
S709
STOP
S710
HAS PROCESSING ENDED?
NO
YES
S711
PREPARE PROFILE
S712
REGISTER PROFILE
S720
COMMUNICATION SETTING PROCESSING
S721
CONNECTION DESTINATION CONFIRMATION PROCESSING
S722
COMMUNICATION ESTABLISHMENT PROCESSING
S725
CONNECTION SETTING RECONFIRMATION NOTIFICATION
S723
HAS COMMUNICATION BEEN ESTAB-LISHED?
NO
YES
CONNECTION COMPLETION NOTIFICATION
S724
END

COOKING DEVICE AND COOKING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is US National Stage of International Patent Application PCT/JP2019/029902, filed Jul. 30, 2019 which claims benefit of priority from Japanese Patent Application JP2019-086496, filed Apr. 26, 2019, the contents of both of which are incorporated herein by reference.

TECHNICAL FIELD

The present invention relates to a cooking device and a cooking system.

BACKGROUND ART

For example, the following Patent Literature 1 discloses an induction heating type cooker in which cookware such as a pot or a frying pan disposed above an induction heating coil is heated by magnetic force lines generated by a current flowing through the induction heating coil.

In a general induction heating type cooker including a device according to Patent Literature 1, for example, a thermal power level is set in stages such as "weak fire, middle fire, strong fire" or "level 1 to level 5", and a user cooks while adjusting thermal power each time during cooking.

CITATION LIST

Patent Literature

Patent Literature 1: JP-A-2005-11670

SUMMARY OF INVENTION

Technical Problem

While cooking, it is very important to manage a temperature of an object to be heated (a liquid such as water or oil, ingredients, or the like) in the cookware. In order to show a technique that a cook has cultivated for many years, it is necessary to control the temperature of the object to be heated in units of 1° C. In addition, a development of cooking science over the past few decades has been remarkable, and many studies on cooking have revealed that a minute difference in heating temperature with respect to the object to be heated has a great influence on taste, texture, nutritional value and the like.

However, in the general induction heating type cooker such as the device according to Patent Literature 1, it is necessary to perform cooking by adjusting the thermal power, and it is very difficult to perform fine temperature management in units of 1° C. This is not limited to the induction heating type cooker, and the same applies to a case where a gas cooker is used.

For this reason, it is desired to develop a cooking device that allows anyone to easily perform strict temperature management on an object to be heated in cookware.

The present invention has been made in view of the above circumstances, and an object of the present invention is to provide a cooking device and a cooking system that can easily cook a desired dish by controlling an object to be heated in cookware to an appropriate temperature according to a cooking content.

Solution to Problem

In order to solve the above-described problems, a cooking device according to the present invention includes: a heating unit configured to heat cookware containing an object to be heated; a temperature detection unit configured to detect at least one of a temperature of the object to be heated and a temperature of an outer surface of a bottom portion of the cookware; and a control unit configured to control the heating unit based on the temperature detected by the temperature detection unit such that a surface temperature of the object to be heated in the cookware or an inner surface of the bottom portion of the cookware matches a cooking temperature set in a cooking process included in cooking execution information.

Preferably, in the cooking device, the temperature detection unit includes at least one of a body temperature detection unit configured to detect the temperature of the outer surface of the bottom portion of the cookware serving as a temperature detection target and an external temperature detection unit configured to directly detect the temperature of the object to be heated contained in the cookware serving as a temperature detection target.

Preferably, in the cooking device, the control unit includes a cooking execution unit configured to execute the cooking process according to a cooking procedure set in advance while controlling the heating unit such that the temperature of the object to be heated in the cookware set as a temperature control target or the surface temperature of the inner surface of the bottom portion of the cookware matches the cooking temperature, and a profile preparation unit configured to prepare a cookware profile for predicting the temperature of the object to be heated by correcting the temperature of the outer surface of the bottom portion of the cookware detected by the body temperature detection unit according to specifications of the cookware, the cookware profile including time-lapse temperature difference information indicating a dynamic relationship of a temperature difference for each elapsed time between the temperature of the outer surface of the bottom portion of the cookware detected by the body temperature detection unit and the temperature of the object to be heated detected by the external temperature detection unit when the cookware is heated in a state where the object to be heated is contained in the cookware. The cooking execution unit predicts the temperature of the temperature control target by correcting the temperature of the outer surface of the bottom portion detected by the body temperature detection unit using the cookware profile of the cookware in use, and controls the heating unit such that the predicted temperature matches the cooking temperature.

Preferably, the cooking device further includes: an environmental information obtainment unit including an outside air temperature detection unit that detects an outside air temperature of a kitchen and an atmospheric pressure detection unit that detects an atmospheric pressure of the kitchen, and configured to obtain the outside air temperature and the atmospheric pressure as environmental information of the kitchen. The control unit controls an output of the heating unit in the cooking process in consideration of the obtained environmental information when the cooking execution information is executed.

A cooking system according to the present invention includes: any above cooking device; and a mobile terminal registered as an owner of the cooking device, wherein the cooking device and the mobile terminal being connected to each other so as to enable bidirectional communication. The

mobile terminal includes a terminal control unit that outputs an initialization execution instruction for causing the cooking device to execute initialization processing. The cooking device executes the initialization processing by the control unit only when the initialization execution instruction is received from the mobile terminal.

Advantageous Effects of Invention

According to the present invention, it is possible to easily cook a desired dish by controlling an object to be heated in cookware to an appropriate temperature according to a cooking content.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a schematic perspective view schematically showing a cooking device according to the present embodiment.

FIG. **2** is a schematic configuration view schematically showing the device in a plan view.

FIG. **3** is a schematic configuration view of a cooking system according to the present embodiment.

FIG. **4** is a functional block diagram of the cooking system according to the present embodiment.

FIG. **5** is a graph showing an example of a temperature locus of a temperature value detected by a body temperature detection unit and a temperature value detected by an external temperature detection unit when calibration processing is performed on cookware whose profile is to be prepared.

FIG. **6** is a flowchart showing an outline of a basic operation of the cooking system according to the present embodiment.

FIG. **7** is a flowchart of cooking execution processing.

FIG. **8** is a flowchart of setting mode execution processing.

DESCRIPTION OF EMBODIMENT

Hereinafter, an embodiment of the present invention will be described in detail with reference to the accompanying drawings. The present invention is not limited by the embodiment, and all other feasible embodiments, examples, operational techniques and the like that can be conceived by those skilled in the art based on the embodiment are all included in the scope of the present invention.

In the following description, terms representing directions (for example, "upper", "lower", "right", "left", "front", "rear" and the like) are used as appropriate in order to facilitate understanding. However, this is for illustration purposes only and these terms are not intended to limit the present invention. The terms indicating these directions mean directions when a cooking device **10** disposed to face a user is viewed from a front side, unless otherwise specified.

[System Configuration]

First, a configuration of a cooking system **1** according to the present embodiment will be described. FIG. **1** is a schematic perspective view schematically showing the cooking device **10** used in the cooking system **1** according to the present embodiment, and FIG. **2** is a schematic configuration diagram schematically showing the cooking device **10** in a plan view.

The cooking device **10** used in the present embodiment is an induction heating type cooker (IH cooking heater) that heats cookware C by performing induction heating generated by applying an alternating current to an induction heating coil disposed below a top plate **10***b*. In addition to the induction heating type cooker, the cooking device **10** may be a gas cooker such as a gas stove capable of electrically adjusting and controlling thermal power of gas.

The cookware C is a utensil such as a pot (including a pressure cooker), a frying pan, a kettle or a cooking plate such as an iron plate with which the cooking device **10** can perform cooking. In the present embodiment, since the cooking device **10** is described as an example of an IH cooking heater, the cookware C is a metal utensil capable of supporting induction heating.

In the cooking device **10**, a body **10***a* is formed in a thin flat plate shape having a substantially rectangular shape in a plan view, and a heating unit **11** is provided on a lower surface side of the top plate **10***b* made of heat-resistant glass serving as a placement surface of the cookware C. The body **10***a* is made of heat-resistant resin or metal. A mark line serving as a mark for placing the cookware C at a correct position when the cookware C is placed is provided on the placement surface of the top plate **10***b*.

The heating unit **11** includes the induction heating coil wound in a spiral shape, and is provided on a lower surface of the top plate **10***b*. When a high-frequency current of a predetermined current amount is supplied to the heating unit **11** from a heating control unit **22** to be described later, magnetic force lines are generated so as to surround the induction heating coil, and the magnetic force lines generate innumerable eddy currents inside the metal cookware C. At a bottom portion of the cookware C, when the eddy currents flow, Joule heat is generated because of electrical resistance of the metal. An object to be heated contained in the cookware C is heated by the Joule heat.

The heating unit **11** may include a magnetic body made of a magnetic material such as ferrite that prevents leakage of magnetic flux generated from the induction heating coil, a magnetic shielding plate that prevents the magnetic force lines generated from the induction heating coil from flowing to a lower side of a base portion, and the like.

The cooking device **10** includes a temperature detection unit **12** including a body temperature detection unit **12***a* that detects a temperature of an outer surface of the bottom portion of the cookware C and an external temperature detection unit **12***b* that directly detects a temperature of a liquid (water or oil) as an object to be heated contained in the cookware C.

The temperature detection unit **12** detects a temperature of a temperature detection target. The temperature detection target of the temperature detection unit **12** is the liquid (water or oil) to be heated in the cookware C or the outer surface of the bottom portion of the cookware C.

The body temperature detection unit **12***a* includes, for example, a temperature sensor such as a thermistor, and is provided at a substantially central portion of the top plate **10***b*. The body temperature detection unit **12***a* detects the temperature of the outer surface of the bottom portion of the cookware C and outputs the detected temperature to a control unit **18** to be described later.

The external temperature detection unit **12***b* includes, for example, a temperature sensor such as a thermistor or a thermocouple, and is installed at an opening end portion of the cookware C. The external temperature detection unit **12***b* includes various communication modules necessary for performing data communication (wired or wireless) with the cooking device **10**. The external temperature detection unit **12***b* directly detects the temperature of the liquid (water or

oil) to be heated contained in the cookware C and outputs the temperature to the control unit **18**.

The cooking device **10** includes an environmental information obtainment unit **13** that obtains, as environmental information, a physical quantity based on an environmental state of a kitchen (a kitchen of a general household, a kitchen of a restaurant, an outdoor campground, or the like) where the user cooks, and a weight detection unit **14** that detects a weight of the cookware C during cooking.

The environmental information obtainment unit **13** obtains the physical quantity based on the environmental state of the kitchen as the environmental information, and outputs the obtained physical quantity to the control unit **18**. The environmental information obtainment unit **13** may include an outside air temperature detection unit **13***a* that detects a temperature of the kitchen (outside air temperature) and an atmospheric pressure detection unit **13***b* that detects an atmospheric pressure of the kitchen. Well-known sensor devices can be appropriately selected and used as the outside air temperature detection unit **13***a* and the atmospheric pressure detection unit **13***b*. In addition to the above configuration, the environmental information obtainment unit **13** may include a humidity detection unit including a humidity sensor capable of detecting a humidity of the kitchen.

The weight detection unit **14** includes, for example, a weight sensor such as a load cell and detects a weight value of the cookware C placed on the top plate **10***b* during cooking below the top plate **10***b* and outputs the weight value to the control unit **18**. The weight detection unit **14** detects the weight value obtained by summing a weight of the cookware C and a weight of ingredients (water, cooking materials, seasonings and the like) contained in the cookware C. The weight value detected by the weight detection unit **14** is used, for example, when executing a cooking process in which an end timing of the process cannot be defined by cooking time, such as a cooking process in which heating is stopped when an amount of moisture in the cookware C decreases to a predetermined amount, or a cooking process in which the thermal power is gradually reduced as the amount of moisture in the cookware C decreases.

In vicinity of a front edge portion of the top plate **10***b* of the cooking device **10**, for example, various display contents before and during cooking are displayed, and an operation display unit **15**, which is operated when performing setting and management of various types of information such as cooking execution instruction and stop, cooking execution information, a cookware profile, and device information, is provided.

The operation display unit **15** includes a display area **15***a* where the various display contents are displayed and an operation area **15***b* where various operation buttons are displayed. The display area **15***a* is an interface that includes, for example, a display device such as a liquid crystal display (LCD) or an organic light-emitting diode (OLED) display and displays the display content based on a display control instruction from the control unit **18**. The operation area **15***b* includes, for example, a touch panel. An operation principle of the touch panel is not particularly limited, but the cooking device **10** according to the present embodiment is often used in a kitchen where water is handled. Therefore, it is preferable to adopt a resistance film method that does not easily interfere with use even if the cooking device **10** gets wet with water.

In the display area **15***a*, "display content before cooking", "display content during cooking", "display content of selection system", "display content of setting system" and the like are displayed.

Examples of the "display content before cooking" include a temperature of a temperature target set in the cooking execution information, a candidate of cooking mode and cooking execution information selected when cooking is performed, cooking time set in the cooking execution information, and a display related to an operation assist for selecting and determining the cooking mode and cooking execution information. Here, the "temperature target" refers to a temperature control target when the cooking execution information is executed. In the present embodiment, the temperature target is a "water temperature" or an "oil temperature", which is a temperature of the object to be heated, or a "surface temperature of an inner surface of the cookware C". That is, when the temperature target of the cooking execution information is set to the "water temperature", the heating unit **11** is controlled such that the "water temperature" matches a cooking temperature set in the cooking process during cooking.

Examples of the "display content during cooking" include a temperature of the temperature target during cooking, the selected cooking execution information, a content of the cooking process being executed in the cooking execution information (an operation pattern, the cooking temperature, the cooking time and the like), and an operation assist display indicating an operation method of pausing during cooking.

Examples of the "display content of selection system" include a real-time temperature of a set temperature target, an indicator of the thermal power, an operation assist display such as selection and determination of a set temperature, a display of a candidate parameter, and the like.

Examples of the "display content of setting system" include a display related to preset management of the cooking execution information, a display related to setting of the cookware profile, a display related to communication setting for establishing (session) communication between the cooking device **10** and a mobile terminal **100**, a display related to the device information (a device name, a connectable user name and the like), a display related to time setting, and the like.

Operation buttons **15***c* used for various operations are displayed in the operation area **15***b*. As shown in FIG. **2**, the operation area **15***b* according to the present embodiment is an area indicated by a one-dot chain line in the drawing, and a plurality of operation buttons **15***c* formed of soft keys are displayed. Examples of the operation button **15***c* shown in FIG. **2** include, in order from a left side in FIG. **2**, a "timer button" operated when the cooking time or the like is set, a "return button" for returning an operation being executed, a "determination button" for determining a selected or set content, "up and down buttons" for sending an item to be set to a next item or a previous item or increasing or decreasing a continuous numerical value such as time and temperature, a "start and pause button" operated when cooking is started and paused, a "stop button" for stopping cooking, a "skip button" for postponing a step in a cooking mode to a next step, and a "sensor switching button" for switching the body temperature detection unit **12***a* or the external temperature detection unit **12***b*. The operation button **15***c* is not limited to a soft switch on the touch panel, and may be a mechanical switch such as a push button.

FIG. **3** is a view showing a schematic configuration of the cooking system **1**. As shown in FIG. **3**, in the cooking system

1, the cooking device **10** described above and a mobile terminal **100** carried by the user are connected so as to be capable of bidirectional communication. In the cooking system **1**, when the user cooks, desired cooking can be performed by operating the operation display unit **15** of the cooking device **10**.

In the cooking system **1**, the mobile terminal **100** has functions that can be operated and set on the operation display unit **15**, such as various setting functions of the cooking device **10** before and during cooking, a function of selecting and instructing execution of the cooking execution information, and a function of preparing and managing the cookware profile to be described later. Therefore, in the cooking system **1**, if communication is established between a communication unit **16** of the cooking device **10** to be described later and a terminal communication unit **101** of the registered mobile terminal **100** carried by an owner or a guest user of the cooking device **10**, the mobile terminal **100** can function as a controller for operating the cooking device **10**. The mobile terminal **100** functioning as the controller will be described in detail later.

Next, a control configuration of the cooking system **1** will be described. FIG. **4** is a functional block diagram of the cooking system **1**. As shown in FIG. **4**, the cooking device **10** includes the communication unit **16**, a storage unit **17** and a control unit **18**. In a configuration of the cooking device **10** shown in FIG. **4**, description of configuration requirements described in the previous section will be omitted.

The communication unit **16** includes various communication modules necessary for performing data communication with the mobile terminal **100**. The communication unit **16** establishes a communication state between the cooking device **10** and the registered mobile terminal **100**, and sets the cooking device **10** and the registered mobile terminal **100** to a state in which bidirectional communication is possible. As a communication method with the mobile terminal **100**, Bluetooth (registered trademark), Wi-Fi (registered trademark), infrared communication, NFC or the like can be used in a case of wireless communication regardless of wired communication or wireless communication.

The storage unit **17** includes a general-purpose storage device such as a nonvolatile memory such as a flash memory. The storage unit **17** stores a cooking execution information database in which preset cooking execution information is organized, a profile database in which cookware profiles for each cookware C are organized, device information of the cooking device **10** set after a start of use of the cooking device **10**, and a control program for performing drive control of units constituting the cooking device **10**.

The cooking execution information database stores recipe execution information, multi-step execution information and single-step execution information, which are the cooking execution information, in a state of being organized by type. The profile database stores, for example, cookware information of the cookware C (for example, information indicating specifications of the cookware C such as a name of the cookware C, a size (a capacity and a diameter) of the cookware C, and a material of the cookware C) and a cookware profile of each cookware C in association with each other.

The control unit **18** includes, for example, a processor such as a central processing unit (CPU), a read only memory (ROM) and a random access memory (RAM), and executes a predetermined control program stored in the storage unit **17** to comprehensively perform various controls related to driving of the cooking device **10**. The control unit **18** includes an input reception unit **19**, a cooking execution unit **20**, a clock unit **21**, a heating control unit **22**, a cooking execution information preparation unit **23**, a profile preparation unit **24**, a preset management unit **25**, a communication setting unit **26**, a device information setting unit **27**, and a display control unit **28**.

The input reception unit **19** receives a control instruction based on a content of an operation performed on the operation display unit **15** or a control instruction from the mobile terminal **100**. Upon receiving the control instruction, the input reception unit **19** outputs the control instruction to an output destination.

Examples of the control instruction received by the input reception unit **19** include a selection instruction of a cooking mode and various parameters before cooking, an instruction before or during cooking (an instruction to start, pause, skip, stop or the like), an instruction at the time of cooking mode preparation or profile preparation (a selection instruction at the time of cooking mode selection, an instruction to set various parameters at the time of cooking mode setting, a condition setting instruction at the time of profile preparation, or the like), an instruction at the time of preset management (a determination instruction to delete, update or initialize an item to be preset), an instruction at the time of communication setting between the cooking device **10** and the mobile terminal **100** (a determination instruction at the time of password input, a determination instruction of a connection method, or the like), and an instruction at the time of device information setting (a determination instruction after setting of a device name, a user name, a time, or the like).

When a "cooking mode" is selected as an operation mode and cooking execution information corresponding to the cooking mode is selected, the cooking execution unit **20** drives the heating control unit **22** to control the heating unit **11**, by appropriately using a temperature value detected by the temperature detection unit **12** (at least one of the body temperature detection unit **12***a* and the external temperature detection unit **12***b*), measured time for each cooking process measured by the clock unit **21**, environmental information obtained by the environmental information obtainment unit **13**, and a cookware profile stored in the storage unit **17**, such that a temperature target set in the cooking execution information matches an appropriate temperature in each cooking process.

While the cooking execution unit **20** is executing the cooking execution information, the cooking execution unit **20** sequentially monitors the temperature value of at least one of the body temperature detection unit **12***a* and the external temperature detection unit **12***b*, and controls a temperature of the predetermined temperature target so as to achieve a set cooking temperature. When the cooking execution unit **20** executes the cooking execution information by using only the temperature detected by the body temperature detection unit **12***a*, the cooking execution unit **20** predicts the temperature of the temperature target by correcting the measured temperature value detected by the body temperature detection unit **12***a* using the cookware profile of the cookware C to be used, and controls the heating unit **11** such that the predicted temperature as the prediction result matches the cooking temperature set in each cooking process. That is, the cooking execution unit **20** adjusts and controls power supplied from the heating control unit **22** to the heating unit **11** using the cookware profile such that the predicted temperature matches the cooking temperature.

When the cooking execution information is executed, the cooking execution unit **20** reflects the environmental infor-

mation obtained by the environmental information obtainment unit **13** and adjusts heating output of the cooking process as necessary. For example, when making a clear consomme soup in French cuisine, fine fire control called "Mijote" (fire control to such an extent that a water surface sways and sometimes foams" is required. However, when an environment of the kitchen changes, for example, when a low atmospheric pressure approaches and an atmospheric pressure decreases, or when cooking is performed at a place whose altitude is relatively high, a boiling point decreases, so that a desired fire control cannot be obtained, and the clear soup may not be obtained due to excessively generated steam bubbles. Therefore, in the cooking device **10** according to the present embodiment, by obtaining the environmental information of the kitchen and reflecting the environmental information in the cooking execution information, fine output control of the heating unit **11** can be performed according to an environmental state of the kitchen particularly when boiling processing is included in the cooking process. Therefore, in the cooking device **10**, output control of the heating unit **11** can also be performed so as to generate an amount of steam bubbles like "Mijote" when making the above clear consomme soup.

The cooking execution unit **20** executes thermal power adjustment processing based on a weight value detected by the weight detection unit **14**, For example, recipe information for making a bouillon in a recipe mode includes a cooking process in which fire is turned off when an amount of water contained in the cookware C changes from 4 L to 2 L. In this case, even if cooking time is simply set, the amount of water may not be a designated amount. However, in the cooking execution unit **20**, since a timing of turning off the tire can be determined based on the weight value detected by the weight detection unit **14**, heating can be continued until the designated amount of water is reached, and the heating can be stopped when the amount of water reaches the predetermined amount. When making the bouillon, it is important to maintain a constant boiling level (a foaming level of steam bubbles) at all times. However, when a constant thermal power is continuously applied by a related-art cooking device, as an amount of water in the object to be heated decreases due to evaporation, the thermal power becomes relatively excessive than initially expected, and a foaming level gradually increases. In contrast, in the cooking execution unit **20**, the heating unit **11** can be controlled so as to gradually decrease the thermal power in proportion to a decrease in the amount of water based on the weight value detected by the weight detection unit **14**, so that a constant foaming level can be maintained until an end of cooking.

When the cooking process of the cooking execution information includes, for example, a process of continuously kneading while maintaining a predetermined temperature, the cooking execution unit **20** can set an upper limit to the temperature value detected by the body temperature detection unit **12***a* in the cooking process and control the heating control unit **22** so as not to exceed the upper limit. For example, when "custard" is cooked as recipe information, a cooking process of continuously kneading a semi-solid material at a constant temperature for a predetermined time is included, but if a temperature of the bottom portion of the cookware C is too high, a part of the material in contact with the bottom portion of the cookware C may burn. Therefore, in the cooking execution unit **20**, an upper limit is set for the temperature value detected by the body temperature detection unit **12***a*, and the heating control unit **22** is controlled such that a temperature of the outer surface of the bottom portion of the cookware C does not exceed the upper limit. Thereby, the cooking device **10** can prevent scorching of the material as compared with cooking using a general cookware, and thus has an effect of remarkably improving convenience.

When executing a cooking process in which "boiling" is selected as the operation pattern, the cooking execution unit **20** controls the heating control unit **22** to obtain appropriate thermal power based on the cookware profile of the cookware C to be used. The cooking execution unit **20** controls the heating control unit **22** using the environmental information obtained by the environmental information obtainment unit **13** in addition to the cookware profile, so that the thermal power of the heating unit **11** can be adjusted with higher accuracy.

Next, cooking based on the cooking execution information executed by the cooking execution unit **20** will be described for each cooking mode. The cooking mode executed by the cooking execution unit **20** includes a "recipe mode", a "multi-step mode", and a "single-step mode" as preset modes. The cooking mode includes a "legacy mode" in which cooking is performed by adjusting the thermal power, which is a general method of using a cooking device.

—Recipe Mode—

The recipe mode is a mode in which temperature control and cooking time control of the cooking device **10** are performed based on recipe information in which a cooking process is set in advance according to a cooking procedure, such as a cooking recipe published by a professional cook, a cooking researcher or the like, or a cooking recipe published by a research and educational institution. When cooking is performed in the recipe mode, the user selects the recipe mode as the cooking mode and selects desired recipe information.

Parameters included in the recipe information include "dish name", "cooking procedure and cooking process of dish", "cooking temperature and cooking time for each cooking process", "presence or absence of standby processing before and after cooking process", "time of standby processing", and the like, and these parameters are appropriately set for each cooking process of dish and combined according to the cooking procedure. When the recipe mode is selected as the cooking mode, the cooking execution unit **20** controls the clock unit **21** and the heating control unit **22** such that the cooking process is sequentially executed according to the recipe information selected together with the recipe mode.

—Multi-Step Mode—

The multi-step mode is a mode in which temperature control and cooking time control of the cooking device **10** are performed according to multi-step execution information obtained by combining a plurality of cooking processes. When cooking is performed in the multi-step mode, the user selects the multi-step mode as the cooking mode, selects desired multi-step execution information, and sets a predetermined parameter. When the multi-step mode is selected as the cooking mode, the cooking execution unit **20** controls the clock unit **21** and the heating control unit **22** such that the cooking process is sequentially executed according to the multi-step execution information set together with the multi-step mode.

—Single-Step Mode—

The single-step mode is a mode in which temperature control and cooking time control of the cooking device **10** are performed according to single-step execution information of one pattern in a cooking process. When cooking is performed in the single-step mode, the user selects the

single-step mode as the cooking mode, selects desired single-step execution information, and sets a predetermined parameter. When the single-step mode is selected as the cooking mode, the cooking execution unit **20** controls the clock unit **21** and the heating control unit **22** such that the cooking process is executed according to the single-step execution information selected together with the single-step mode.

—Legacy Mode—

The legacy mode is a cooking method similar to that of a general cooking device, that is, a mode in which cooking is performed by adjusting thermal power of the heating unit **11** by operating the operation button **15***c* of the operation display unit **15**. When the legacy mode is selected as the cooking mode, the cooking execution unit **20** controls the heating control unit **22** according to an operation instruction from the operation display unit **15**.

The clock unit **21** is, for example, a circuit such as a real time clock (RTC), and has a function as an internal clock that measures time, and a function as a timer that measures time necessary for various types of control such as when cooking is performed and when a cookware profile is set. The clock unit **21** outputs a time measurement end signal after measuring the set time. The time measurement end signal functions as, for example, a trigger for notifying an end of a predetermined cooking process.

The heating control unit **22** includes an inverter circuit, receives power supply from an external power supply (commercial power supply), temporarily rectifies the power into DC pulse power, converts the DC pulse power into a high-frequency AC current of, for example, about 20 to 50 KHz, and supplies the high-frequency AC current to the heating unit **11**. A current amount of the high-frequency AC current supplied from the heating control unit **22** to the heating unit **11** is appropriately controlled according to a cooking process being executed by the cooking execution unit **20** or a profile preparation process being executed by the profile preparation unit **24**.

The cooking execution information preparation unit **23** prepares cooking execution information corresponding to the cooking mode set when the user cooks, based on various parameters set by the user. In the cooking system **1** according to the present embodiment, "multi-step execution information" and "single-step execution information" among preset cooking execution information can be prepared. The cooking execution information preparation unit **23** outputs the prepared cooking execution information to the preset management unit **25**.

—Multi-Step Execution Information—

When preparing the multi-step execution information, the user appropriately sets "operation pattern", "type of temperature detection unit **12** to be used", "type of temperature target", "cooking temperature" and "cooking time" for each cooking process, "trigger setting", "standby processing and standby processing time", "presence or absence of lid", "loop step" and the like as parameters so as to obtain desired multi-step execution information.

The "operation pattern" includes "heating (low temperature)" in which cooking is performed in a range of, for example, 30° C. to 99° C., "heating (high temperature)" in which cooking is performed in a range of, for example, 100° C. to 200° C., "boiling" in which water is boiled, "standby" that is a standby state when another process is performed before and after a cooking process, "loop" in which a predetermined cooking process is repeatedly performed, and "end" in which cooking is ended, and is appropriately set so as to achieve a cooking procedure desired by the user.

As the "type of temperature detection unit **12** to be used", the "body temperature detection unit **12***a*" or the "external temperature detection unit **12***b*" is set as the temperature detection unit **12** to be used during cooking.

As the "type of temperature target", any one of the "water temperature", the "oil temperature" and the "surface temperature of the inner surface of the bottom portion of the cookware C" is set as a temperature target.

As the "cooking temperature", a control temperature of the temperature target for each cooking process is set in the set operation pattern.

As the "cooking time", a duration when the temperature target for each cooking process reaches a predetermined cooking temperature is set in the set operation pattern.

As the "trigger setting", for example, "time" or "predetermined button operation" is set as a trigger for shifting (skipping) to the next cooking process.

As the "standby processing and standby processing time", processings of temporarily waiting a cooking process in order to execute predetermined processing (addition of ingredients, filtering work of ingredients, and the like) during the cooking process to be executed, and time of the standby processing are set.

The "presence or absence of lid" is set when the "heating (low temperature)" is selected as the operation pattern, the "body temperature detection unit **2***a*" is selected as the temperature detection unit to be used, and the "water temperature" or the "oil temperature" is selected as the temperature target. That is, the presence or absence of a lid is set when cooking that requires the lid as a cooking process is performed.

The "loop step" is set for the cooking process repeatedly performed when the "loop" is selected as the operation pattern.

When the multi-step execution information is set, if the "heating (high temperature)" is selected as the operation pattern and the "external temperature detection unit **12***b*" is selected as the temperature detection unit **12** to be used, the "oil temperature" is automatically set as the temperature target. When the "boiling" is selected as the operation pattern, the "water temperature" is automatically set as the temperature target.

When the "standby" is selected as the operation pattern in the cooking process after the "heating" or the "boiling", "additional heating" in which heating is additionally performed after standby can be added to the cooking process. When the "additional heating" is set, a "target temperature" for heating the temperature target to a target temperature, a "trigger" for proceeding to the next step, and the "presence or absence of lid" are set. As the "trigger" for canceling the standby, a time measurement end signal output from the clock unit **21** when set standby time has elapsed or an operation signal when a predetermined operation button (for example, a skip button) is operated is set.

—Single-Step Execution Information—

When preparing the single-step execution information, the user appropriately sets "operation pattern", "type of temperature detection unit **12** to be used", "type of temperature target", "cooking temperature", "cooking time", "trigger setting" and "presence or absence of lid" as parameters so as to obtain desired single-step execution information.

The "operation pattern" includes the "heating (low temperature)", the "heating (high temperature)" and the "boiling" described above, and one of these parameters is set. The "type of temperature detection unit **12** to be used", "type of temperature target", "cooking temperature", "cooking time", "trigger setting" and "presence or absence of lid" are the

same as the parameters set in the multi-step execution information, and parameters corresponding to the selected operation pattern can be set.

When the single-step execution information is set, if the "heating (high temperature)" is selected as the operation pattern and the "external temperature detection unit **12***b*" is selected as the temperature detection unit **12** to be used, "oil temperature" is automatically set as the temperature target. When the "boiling" is selected as the operation pattern, the "water temperature" is automatically set as the temperature target.

When the "setting mode" is selected as the operation mode and "profile preparation processing" is selected as a processing content, the profile preparation unit **24** prepares a cookware profile of the cookware C used by the user. The "cookware profile" is information in which the "cookware information" of the cookware C is associated with "time-lapse temperature difference information" indicating a dynamic relationship of a temperature difference for each elapsed time obtained by temporally observing the temperature difference between a temperature of the outer surface of the bottom portion of the cookware C detected by the body temperature detection unit **12***a* and a temperature of the object to be heated in the cookware C detected by the external temperature detection unit **12***b* when preset calibration processing is executed. The cookware profile is prepared for each cookware C to be used. In the calibration processing executed by the profile preparation unit **24**, operations of a "heating process (a process of performing heating processing on the object to be heated)", a "heat retaining process (a process of retaining heat of the object to be heated at a predetermined temperature)", and a "heat radiating process (a process of stopping the heating processing and radiating heat of the object to be heated)" are executed for the cookware C containing a predetermined amount of liquid (water or oil) serving the object to be heated contained in the cookware C.

As the profile preparation processing by the profile preparation unit **24**, for example, the calibration processing is executed in a state where the object to be heated of about half to ⅔ of a total capacity of the cookware C is contained in the cookware C to be used. When the calibration processing is started, the profile preparation unit **24** obtains a temperature value detected by the body temperature detection unit **12***a* (that is, a measured temperature value of the outer surface of the bottom portion of the cookware C) and a temperature value detected by the external temperature detection unit **12***b* (that is, a measured temperature value of the object to be heated in the cookware C) at predetermined time intervals (for example, every second). The profile preparation unit **24** sequentially observes a temperature difference between the measured temperature value by the body temperature detection unit **12***a* and the measured temperature value detected by the external temperature detection unit **12***b* in each process performed in the calibration processing along the elapsed time of the calibration processing. The profile preparation unit **24** corrects the temperature value (measured temperature value) detected by the body temperature detection unit **12***a* based on the time-lapse temperature difference information obtained from the dynamic relationship of the temperature difference for each elapsed time obtained by the calibration processing, and creates the cookware profile for predicting temperature values of a temperature of the object to be heated in the cookware C and a surface temperature of the inner surface of the bottom portion of the cookware C (that is, the temperature target) based on the corrected measured temperature value.

When executing the calibration processing, if the temperature of the object to be heated contained in the cookware C is equal to or higher than a room temperature (for example, 28° C.), the profile preparation unit **24** notifies the user of a warning since the correct calibration processing cannot be executed. The warning may be displayed on the operation display unit **15** of the cooking device **10** or the terminal display unit **104** of the mobile terminal **100**, or may be notified to the mobile terminal **100** by ringing.

In the cookware C, a temperature difference occurs between the temperature of the outer surface of the bottom portion of the cookware C and the surface temperature of the inner surface of the bottom portion of the cookware C or the temperature of the contained object to be heated (water temperature or oil temperature), depending on, for example, a type of metal material constituting the cookware C and a thickness of the cookware C. When the body temperature detection unit **12***a* is used as the temperature detection unit **12**, the cooking execution unit **20** performs temperature control based on the temperature of the outer surface of the bottom portion of the cookware C, that is, the measured temperature value by the body temperature detection unit **12***a*, and thus an error may occur between the temperature detected by the body temperature detection unit **12***a* and the surface temperature of the inner surface of the bottom portion of the cookware C or the actual temperature of the contained object to be heated. However, in the cooking device **10** according to the present embodiment, since the cookware profile is prepared for each cookware C, the temperature value of the surface temperature of the inner surface of the bottom portion of the cookware C or the object to be heated can be accurately predicted by correcting the measured temperature value detected by the body temperature detection unit **12***a* according to each cookware C to be used, and thus a temperature of the temperature target can be controlled with high accuracy. In particular, since the external temperature detection unit **12***b* cannot be used for cooking with a lid or stir-fried food using a frying pan, it is effective.

FIG. **5** is a graph showing an example of a temperature locus of the temperature value detected by the body temperature detection unit **12***a* and the temperature value detected by the external temperature detection unit **12***b* when the calibration processing is executed on the cookware C whose profile is to be prepared. In the drawing, a solid line indicates the temperature value detected by the body temperature detection unit **12***a* for each elapsed time in the calibration processing, and a dotted line indicates the temperature value detected by the external temperature detection unit **12***b*. In the graph shown in FIG. **5**, a vertical axis represents temperature (° C.) and a horizontal axis represents time (min), and as an example of the calibration processing, the calibration processing is executed in an order of "heating process"→"heat retaining process (60° C.)"→"heating process"→"heat retaining process (95° C.)"→"heat radiating process".

As shown in FIG. **5**, when the calibration processing is executed, a temperature difference occurs between the measured temperature value detected by the body temperature detection unit **12***a* and the measured temperature value detected by the external temperature detection unit **12***b*. As shown in FIG. **5**, the temperature difference between the measured temperature values detected by the temperature detection units changes over time, and is not a constant

temperature difference. For this reason, when temperature correction is executed, it is not possible to uniformly correct the measured temperature value by the body temperature detection unit **12***a*, such as "correcting by lowering (or raising) OO° C.". Therefore, the profile preparation unit **24** compares the measured temperature value by the body temperature detection unit **12***a* with the measured temperature value by the external temperature detection unit **12***b* to correct the measured temperature value by the body temperature detection unit **12***a*, and creates the cookware profile for predicting the temperature of the object to be heated as the temperature target and the surface temperature of the inner surface of the bottom portion of the cookware C based on the measured temperature value of the outer surface of the bottom portion of the cookware C.

The profile preparation unit **24** can execute profile prediction processing of searching a profile database for a cookware profile approximate to the temperature locus of the newly prepared cookware profile, and predicting the temperature locus by superimposing and comparing the cookware profiles. For example, when processing time of the calibration processing is normally set to 20 minutes, the profile preparation unit **24** executes the calibration processing in 10 minutes, which is half of the processing time. At this time, after the calibration processing to be newly prepared ends, the profile preparation unit **24** collates the calibration processing result with the past cookware profile approximate to the processing result. Thereby, the profile preparation unit **24** can predict a temperature locus of the remaining half of the normal calibration processing time, and can shorten profile preparation time.

When the "setting mode" is selected as the operation mode and "preset management processing" is selected as the processing content, the preset management unit **25** executes new registration processing, overwrite processing and deletion processing of preset cooking execution information. The preset management unit **25** executes the above-described processing according to a control instruction related to preset management from the operation display unit **15** or the mobile terminal **100**.

When a structural change in recipe information such as "type of operation pattern", "addition and deletion of cooking process" and "setting of loop step" in the preset recipe information is added, the preset management unit **25** can temporarily register target recipe information as multi-step execution information and execute recipe information change processing of changing a predetermined parameter of the multi-step execution information. Thereby, if the user registers the recipe information as the multi-step execution information, the user can change the content of the cooking process of the recipe information.

Upon receiving an initialization instruction from the mobile terminal **100** registered as the owner, the preset management unit **25** executes initialization processing of initializing various types of information set after the cooking device **10***a* starts to be used, such as the cooking execution information database, the profile database and the device information stored in the storage unit **17**, to restore a factory default state. The initialization processing is executed when an initialization execution instruction that can be output only from the mobile terminal **100** registered as the owner is received. That is, in the cooking system **1** according to the present embodiment, the initialization processing is executed only from the mobile terminal **100** registered as the owner, and the initialization processing is not performed from the mobile terminal **100** and the cooking device **10** registered by the guest.

When the "setting mode" is selected as the operation mode and "communication setting processing" is selected as the processing content, the communication setting unit **26** executes communication establishment processing according to a communication method such that a communication state between the cooking device **10** and the mobile terminal **100** or the external temperature detection unit **12***b* is established. The communication setting unit **26** executes the above-described processing according to a control instruction related to communication setting from the operation display unit **15** or the mobile terminal **100**. When the communication state is established by the communication setting unit **26**, the cooking device **10** can bidirectionally communicate with the mobile terminal **100**. The mobile terminal **100** executes predetermined registration processing on the cooking device **10** in order to establish communication with the cooking device **10**. The mobile terminal **100** carried by the user who is the owner of the cooking device **10** executes the registration processing to become a "mobile terminal registered as the owner" on the cooking device **10**. It is also possible to register a mobile terminal **100** (for example, a mobile terminal carried by a guest user who is authorized as a user serving as an owner) other than the mobile terminal **100** registered as the owner. The mobile terminal **100** registered as the guest user can control the cooking device **10** in various ways as a remote controller for the cooking device **10**. The mobile terminal **100** registered as the guest is in a state where a certain restriction is imposed on a function executable by the mobile terminal **100** registered as the owner.

When communication with the mobile terminal **100** or the external temperature detection unit **12***b* as a connection destination is established, the communication setting unit **26** outputs a connection completion notification indicating that the communication is established. When the communication with the connection destination cannot be established, the communication setting unit **26** outputs a notification (reconfirmation notification) for prompting reconfirmation of a connection setting content. The reconfirmation notification is output to cause the user to reconfirm the setting content when the communication between the cooking device **10** and the connection destination is not established, for example, when a password content is erroneously input, when the device is defective, or when a radio wave state is unstable. The reconfirmation notification of the connection setting content may be displayed on the operation display unit **15** of the cooking device **10** or the terminal display unit **104** of the mobile terminal **100**, or may be notified to the mobile terminal **100** by ringing.

When the "setting mode" is selected as the operation mode and "device information setting processing" is selected as the processing content, the device information setting unit **27** executes processing related to setting and updating of device information. The device information setting unit **27** executes, as the device information setting processing, registration and change processing of a device name of the cooking device **10**, update processing of a control program of the cooking device **10**, user registration processing, time selling and correction processing, time setting processing for turning off a power supply when no operation is performed, temperature display mode (° C./° F.) setting processing, and the like. The device information setting unit **27** executes the above-described processing according to a control instruction related to device selling from the operation display unit **15** or the mobile terminal **100**.

The display control unit **28** causes the display area **15***a* of the operation display unit **15** to display a display content displayed when the cooking device **10** is operated. The display control unit **28** performs, for example, control for switching screens or changing the display content according to a control instruction received by the input reception unit **19**, and control for changing the display content according to a progress status of the cooking execution information executed by the cooking execution unit **20**.

Next, a configuration of the mobile terminal **100** will be described. The mobile terminal **100** is a variety of mobile communication terminals carried by the user, such as a mobile phone, a smartphone or a tablet terminal. The mobile terminal **100** includes the terminal communication unit **101**, a terminal storage unit **102**, a terminal control unit **103**, a terminal display unit **104** and a terminal operation unit **105**.

The terminal communication unit **101** includes various communication modules required for performing data communication with the cooking device **10**. As a communication method with the cooking device **10**, Bluetooth (registered trademark), Wi-Fi (registered trademark), infrared communication, NFC or the like can be used in a case of wireless communication regardless of wired communication or wireless communication.

The terminal storage unit **102** includes, for example, a non-volatile memory such as a flash memory or a general-purpose storage device such as an SD card. The terminal storage unit **102** stores various control programs necessary for causing the mobile terminal **100** to function as a normal mobile communication terminal.

The terminal storage unit **102** stores (installs) a cooking system app for executing various control processing sequences of the cooking device **10** to cause the mobile terminal **100** to function as a remote controller of the cooking device **10**. The cooking system app is downloaded or installed from outside via the terminal communication unit **101**. The terminal storage unit **102** also stores information necessary for driving the cooking device **10** by remote control, such as the cooking execution information database and the profile database stored in the storage unit **17** of the cooking device **10**. The terminal storage unit **102** is not limited to a storage device mounted on the mobile terminal **100**, and a cloud storage such as an external server may be used.

The terminal control unit **103** includes, for example, a processor such as a central processing unit (CPU), a read only memory (ROM) and a random access memory (RAM). The terminal control unit **103** executes various control programs stored in the terminal storage unit **102** so as to function as a normal portable communication terminal based on an operation instruction from the terminal operation unit **105**. The terminal control unit **103** executes processing related to display control, such as control for switching images to be displayed on the terminal display unit **104** or changing the display content based on operation information operated by the terminal operation unit **105**, and control for changing the display content according to the progress status of the cooking execution information executed by the cooking execution unit **20**.

The terminal control unit **103** activates the cooking system app stored in the terminal storage unit **102** to implement functions of respective units constituting the control unit **18** of the cooking device **10**. The mobile terminal **100** can drive and control the cooking device **10** to be controlled according to the processing sequence of the cooking system app. Therefore, the mobile terminal **100** can function as a remote controller that allows the cooking device **10** to be remotely controlled.

When the cooking system app is activated, the terminal control unit **103** includes configurations shown in FIG. **4**. Specifically, the terminal control unit **103** includes a terminal-side cooking execution unit **103***a* that implements a function of the cooking execution unit **20** of the control unit **18**, a terminal-side clock unit **103***b* that implements a function of the clock unit **21** of the control unit **18**, a terminal-side cooking execution information preparation unit **103***c* that implements a function of the cooking execution information preparation unit **23** of the control unit **18**, a terminal-side profile preparation unit **103***d* that implements a function of the profile preparation unit **24** of the control unit **18**, a terminal-side preset management unit **103***e* that in a function of the preset management unit **25** of the control unit **18**, and a terminal-side device information setting unit **103***f* that implements a function of the device information setting unit **27** of the control unit **18**.

When the terminal control unit **103** functions as a remote controller of the cooking device **10**, the terminal control unit **103** transmits a control instruction corresponding to operation information operated by the terminal operation unit **105** to the cooking device **10** via the terminal communication unit **101**, When a cooking temperature of 100° C. or higher is set in the cooking process, the terminal control unit **103** performs control such that an operation from the mobile terminal **100** related to cooking is disabled from a viewpoint of safety.

The terminal-side preset management unit **103***e* outputs an initialization execution instruction for causing the cooking device **10** to execute "initialization processing" of initializing various types of information set after the cooking device **10** starts to be used, such as the cooking execution information database, the profile database and device information stored in the storage unit **17**, to restore a factory default state. The initialization processing can be instructed only from the mobile terminal **100** registered as the owner. Thereby, the cooking device **10** can be prevented from executing unintended initialization processing by another person. When the user transfers the cooking device **10** to another person, the user himself or herself performs the initialization processing using the mobile terminal **100** registered as the owner, and thus there is no concern that personal information of the user stored in the storage unit **17** illegally flows out.

The terminal display unit **104** includes a display device such as a liquid crystal display or an organic EL display. The terminal control unit **103** displays various display contents necessary for driving the mobile terminal **100** in the display area in addition to the display content displayed in conjunction with activation of the cooking system app under the control of the terminal control unit **103**.

The terminal operation unit **105** includes various input devices such as mechanical operation keys such as selection buttons and a user interface (UI) such as a touch panel in which a touch sensor is provided on a display screen of the terminal display unit **104**. If a predetermined operation is performed on the terminal operation unit **105** when the mobile terminal **100** is used as the remote controller of the cooking device **10**, operation information corresponding to the operation content is output to the terminal control unit **103** via the terminal communication unit **101**.

[Processing Operation]

Next, a processing operation of the cooking system **1** described above will be described with reference to FIGS. **6**

to **8**, Each operation described below is presented with step elements in an exemplary order, and is not limited to the presented specific order. Therefore, an order of each of flowcharts shown in FIGS. **6** to **8** can be changed as long as there is no contradiction in a processing result. Each of the following processing is an operation example when the cooking device **10** is mainly operated.

<System Outline Flow>

FIG. **6** is a flowchart showing an outline of a basic operation of the cooking system **1** according to the present embodiment.

As shown in FIG. **6**, when the cooking device **10** is powered on, mode selection processing of selecting "cooking mode" or "setting mode" to be executed by the user as the operation mode is executed (S**100**).

When "legacy mode" in the cooking mode is selected and determined as the operation mode in S**100**, the control unit **18** executes the legacy mode (S**200**). In the legacy mode, the user operates the operation display unit **15** to execute thermal power adjustment processing of setting desired thermal power. When the thermal power adjustment processing is executed, the heating unit **11** of the cooking device **10** is controlled to achieve the thermal power set by the control unit **18**. Then, when the control unit **18** determines that cooking by the user has ended, the processing returns to S**100** again.

When the "single-step mode" in the cooking mode is selected as the operation mode in S**100**, the control unit **18** executes the single-step mode (S**300**). When the single-step mode is executed, the control unit **18** executes pre-cooking processing in the single-step mode (S**310**). In the pre-cooking processing of S**310**, various parameters necessary for executing single-step execution information are selected and set.

Next, upon receiving an input of cooking execution in a state of waiting for the cooking execution after completion of the pre-cooking processing, the control unit **18** starts cooking execution processing of performing cooking according to the set single-step execution information (S**320**). In S**320**, the control unit **18** controls the clock unit **21** and the heating control unit **22** such that the cooking process is executed according to the selected single-step execution information. Then, when the control unit **18** determines that the cooking has ended, the processing returns to S**100** again.

When the "recipe mode" in the cooking mode is selected as the operation mode in S**100**, the control unit **18** executes the recipe mode (S**400**). When the recipe mode is executed, the control unit **18** executes pre-cooking processing in the recipe mode (S**410**).

In the pre-cooking processing of S**410**, various parameters necessary for executing recipe execution information, such as selection and setting of recipe information to be executed and selection of the temperature detection unit **12**, are selected and set. Next, upon receiving an input of cooking execution in a state of waiting for the cooking execution after completion of the pre-cooking processing, the control unit **18** starts cooking execution processing of performing cooking according to the set recipe execution information (S**600**). Details of the cooking execution processing in S**600** will be described later with reference to FIG. **7**.

When the "multi-step mode" in the cooking mode is selected as the operation mode in S**100**, the control unit **18** executes the multi-step mode (S**500**). When the multi-step mode is executed, the control unit **18** executes pre-cooking processing in the multi-step mode (S**510**).

In the pre-cooking process of S**510**, various parameters necessary for executing multi-step execution information are selected and set. Next, upon receiving an input of cooking execution in a state of waiting for the cooking execution after completion of the pre-cooking processing, the control unit **18** starts "cooking execution processing" of performing cooking according to the set multi-step execution information (S**600**). Details of the cooking execution processing in S**600** will be described later with reference to FIG. **7**.

When the "setting mode" is selected as the operation mode in S**100**, "setting mode execution processing" of executing various types of setting processing in according to the selected setting mode is started (S**700**). Details of the setting mode execution processing in S**700** will be described later with reference to FIG. **8**.

<Cooking Execution Processing>

FIG. **7** is a flowchart of the cooking execution processing. As shown in FIG. **7**, when the cooking execution processing is started, the control unit **18** executes cooking process confirmation processing of confirming cooking processes of cooking execution information to be executed (S**601**). In the cooking process confirmation processing, the control unit **18** confirms the number of cooking processes set in the cooking execution information to be executed, an order of the cooking processes, and the like. Next, the control unit **18** executes parameter confirmation processing of confirming parameters of the cooking process to be executed (S**602**). In the parameter confirmation processing, "operation pattern", "temperature target", "cooking temperature", "cooking time", "trigger", "presence or absence of standby processing and standby time", "presence or absence of lid" and the like, which are parameters set in the cooking process to be executed, are confirmed.

In S**602**, when "heating" is set as an operation pattern of the cooking process to be executed, the control unit **18** proceeds to heating processing (S**603**). In the heating processing, "heating (low temperature)" or "heating (high temperature)" is set as the operation pattern, but in any case, the following operation is performed.

In executing the heating processing, the control unit **18** obtains temperatures detected by the temperature detection unit **12**, that is, a temperature of the outer surface of the bottom portion of the cookware C detected by the body temperature detection unit **12***a* and a temperature of the object to be heated contained in the cookware C (water temperature or oil temperature) detected by the external temperature detection unit **12***b* (S**604**). The temperature detected by the external temperature detection unit **12***b* in S**604** is not obtained in S**602** when the cooking process of the cooking execution information to be executed includes a setting parameter of "presence of lid".

Next, the control unit **18** obtains environmental information obtained by the environmental information obtainment unit **13**, that is, an outside air temperature detected by the outside air temperature detection unit **13***a* and an atmospheric pressure of the kitchen detected by the atmospheric pressure detection unit **13***b* (S**605**).

Next, the control unit **18** starts the heating processing of controlling the heating unit **11** in consideration of the environmental information such that a temperature target set in the cooking process matches a set cooking temperature (S**606**). In S**606**, when the heating processing is started, the control unit **18** causes the clock unit **21** to start measuring cooking time (S**607**).

Next, the control unit **18** determines whether a temperature of the temperature target has reached the set cooking

temperature (S608). In S608, when the control unit 18 determines that the temperature of the temperature target has reached the cooking temperature (S608: Yes), the control unit 18 executes heat retaining processing of controlling the heating unit 11 such that a current temperature is maintained (S609).

On the other hand, when the control unit 18 determines that the temperature of the temperature target has not reached the cooking temperature (S608: Not, the control unit 18 continues the heating processing being executed. In S608 and S609, the control unit 18 controls the temperature of the temperature target while sequentially monitoring a temperature value of at least one of the body temperature detection unit 12*a* and the external temperature detection unit 12*b*.

Next, the control unit 18 determines whether the cooking time of the cooking process being executed has been reached (S610). In S610, when the control unit 18 determines that the cooking process being executed has reached the set cooking time (S610: Yes), the processing returns to S602 to proceed to the next cooking process.

On the other hand, when the control unit 18 determines that the cooking process being executed has not reached the set cooking time (S610: No), the control unit 18 continues the heat retaining processing.

In S602, when "boiling" is set as the operation pattern of the cooking process to be executed, the control unit 18 proceeds to boiling processing (S620).

In executing the boiling processing, the control unit 18 obtains temperatures detected by the temperature detection unit 12, that is, a temperature of the outer surface of the bottom portion of the cookware C detected by the body temperature detection unit 12*a* and a temperature of the object to be heated contained in the cookware C (water temperature or oil temperature) detected by the external temperature detection unit 12*b* (S621). The temperature detected by the external temperature detection unit 12*b* in S621 is not obtained in S602 when the cooking process of the cooking execution information to be executed includes the setting parameter of "presence of lid".

Next, the control unit 18 obtains environmental information obtained by the environmental information obtainment unit 13, that is, an outside air temperature detected by the outside air temperature detection unit 13*a* and an atmospheric pressure of the kitchen detected by the atmospheric pressure detection unit 13*b* (S622).

Next, the control unit 18 reads out a cookware profile of the cookware C to be used from the storage unit 17 (S623), and starts heating processing of controlling the heating unit 11 to obtain appropriate thermal power by using the cookware profile in consideration of the environmental information (S624). When heating execution processing is started, the control unit 18 determines whether water in the cookware C has boiled (S625).

In S625, when the control unit 18 determines that the water in the cookware C has boiled (S625: Yes), the processing returns to S602 to proceed to the next cooking process.

On the other hand, when the control unit 18 determines that the water in the cookware C has not boiled (S625: No), the control unit 18 continues the heating processing being performed. In S625, the control unit 18 determines whether boiling has occurred by sequentially monitoring a temperature value of at least one of the body temperature detection unit 12*a* and the external temperature detection unit 12*b*.

In S602, when "standby" is set as the operation pattern of the cooking process to be executed, the control unit 18 proceeds to standby processing (S630).

In executing the standby processing, when the control unit 18 starts the standby processing (S631), the control unit 18 causes the clock unit 21 to start measuring standby time (S632). Next, the control unit 18 determines whether additional heating is set in the cooking process (S633).

In S633, when the control unit 18 determines that the additional heating is set (S633: Yes), the control unit 18 executes additional heating processing by controlling the heating unit 11 so as to achieve a set target temperature (S634). Then, the control unit 18 determines whether the temperature target has reached the target temperature by the additional heating processing (S635).

On the other hand, when it is determined that the additional heating is not set (S633: No), it is determined whether a trigger input for canceling a standby state is present (S636).

In S635, when the control unit 18 determines that the temperature target has reached the target temperature (S635: Yes), the processing proceeds to S636.

In the other hand, when the control unit 18 determines that the temperature target has not reached the target temperature (S635: No), the control unit 18 continues the heating processing being executed.

In S636, when the control unit 18 determines that a set trigger input is present (S635: Yes), the processing returns to S602 to proceed to the next cooking processing.

On the other hand, when the control unit 18 determines that no set trigger input is present (S636: No), the processing returns to S633 again. In S636, the control unit 18 determines whether a time measurement end signal indicating that set standby time has elapsed or an operation signal of a predetermined operation button (for example, a skip button) is input as the trigger input.

The processing of S632 may be executed when an input of the time measurement end signal after elapse of the standby time is set as a trigger, and thus, when "operation of operation button" is set as a trigger of standby release during the standby processing, the processing may pass through this processing.

When "end" is set as the operation pattern of the cooking process to be executed in S602, the control unit 18 ends the processing of the executed cooking execution information (S640). In S640, an end of the processing of the cooking execution information means that a series of cooking processes set in the cooking execution information have ended and the cooking has been completed.

In the cooking execution processing described above, when the temperature detection unit 12 includes only the body temperature detection unit 12*a*, the temperature of the temperature target is predicted by correcting the measured temperature value by the body temperature detection unit 12*a* using the cookware profile to be used, and the heating unit 11 is controlled such that the predicted temperature matches the set cooking temperature. This control is performed in the heating processing (processing of S606 to S610), the boiling processing (processing of S624 and S625), and the standby processing (processing of S633 to S635) described above.

<Setting Mode Execution Processing>

FIG. 8 is a flowchart of the selling mode execution processing. In a processing flow shown in FIG. 8, "profile preparation processing" and "communication setting processing" are described as the setting mode execution processing, but in addition to these, "profile management processing" and the "device information setting processing" may be included.

As shown in FIG. **8**, when the setting mode execution processing is started, the control unit **18** executes determination processing of a content of selected setting processing (S**701**). In S**701**, the control unit **18** determines whether the content of the setting processing is "profile preparation processing" or "communication setting processing".

When the setting processing to be executed is the "profile preparation processing" in S**701**, the control unit **18** proceeds to the profile preparation processing (S**702**).

In executing the profile preparation processing, the control unit **18** obtains cookware information of the cookware C to be used (S**703**). The cookware information includes a name of the cookware C and specification information of the cookware C.

Next, when the cookware C containing a predetermined amount of object to be heated is set in the cooking device **10** (S**704**), the control unit **18** determines whether a temperature of the object to be heated in the set cookware C is a room temperature (S**705**).

In S**705**, when the control unit **18** determines that the temperature of the object to be heated in the cookware C is the room temperature (S**705**: Yes), the control unit **18** executes calibration processing (S**706**).

On the other hand, when the control unit **18** determines that the temperature of the object to be heated in the cookware C is not the normal temperature (S**705**: No), the control unit **18** outputs a warning notification to the user (S**707**), and the processing returns to S**705** again.

In S**706**, the control unit **18** sequentially monitors temperature values by the body temperature detection unit **12***a* and the external temperature detection unit **12***b*, and executes the calibration processing while obtaining a temperature difference between the temperature values for each elapsed time.

Next, it is determined whether a stop instruction is input during execution of the calibration processing (S**708**). In S**708**, when the control unit **18** determines that the stop instruction is input (S**708**: Yes), the control unit **18** stops the calibration processing (S**709**) and ends the processing.

On the other hand, when the control unit **18** determines that the stop instruction is not input (S**708**: No), the control unit **18** determines whether a series of set calibration processing has ended (S**710**).

In S**710**, when the control unit **18** determines that the set calibration processing has ended (S**710**: Yes), the control unit **18** prepares a cookware profile of the target cookware C (S**711**), executes registration processing of the cookware profile (S**712**), and ends the processing.

On the other hand, when the control unit **18** determines that the set calibration processing has not ended (S**711**: No), the control unit **18** continues the calibration processing being executed.

When the setting processing to be executed is the "communication setting processing" in S**701**, the control unit **18** proceeds to the communication setting processing (S**720**). In the communication setting processing, the mobile terminal **100** serving as a connection destination is the mobile terminal **100** on which user registration processing has been performed in advance.

In executing the communication setting processing, the control unit **18** executes processing of confirming the connection destination (the mobile terminal **100** or the external temperature detection unit **12***b*) of the cooking device **10** (S**721**). Next, the control unit **18** executes communication establishment processing of establishing communication between the cooking device **10** and the connection destination (S**722**). In S**722**, the control unit **18** executes, as the communication establishment processing, processing of establishing communication between the cooking device **10** and the external temperature detection unit **12***b* or the mobile terminal **100** as a connection destination according to a communication method therebetween.

Next, the control unit **18** determines whether the communication between the cooking device **10** and the connection destination has been established by the communication establishment processing (S**723**), in S**723**, when the control unit **18** determines that the communication between the cooking device **10** and the connection destination has been established (S**723**: Yes), the control unit **18** outputs a connection completion notification (S**724**), and ends the processing.

On the other hand, when the control unit **18** determines that the communication between the cooking device **10** and the connection destination has not been established (S**723**: No), the control unit **18** outputs a notification for prompting reconfirmation of connection setting (S**725**), and the processing returns to S**722** again.

[Operational Effects]

As described above, in the cooking system **1** according to the present embodiment, the cooking device **10** includes the heating unit **11** that heats the cookware C containing the object to be heated such as water, oil and ingredients, the temperature detection unit **12** that detects at least one of the temperature of the object to be heated and the temperature of the outer surface of the bottom portion of the cookware C, and the control unit **18** that controls the heating unit **11** based on the temperature detected by the temperature detection unit **12** such that the temperature of the object to be heated in the cookware C or the surface temperature of the inner surface of the bottom portion of the cookware C matches the cooking temperature set in the cooking process included in the cooking execution information.

When cooking is performed by executing the cooking execution information, the cooking device **10** according to the present embodiment can perform cooking by controlling the temperature of the object to be heated in the cookware C with high accuracy, instead of cooking by the thermal power as in the related-art device. Therefore, the user can easily cook a dish according to the cooking execution information, for example, a dish based on a cooking recipe provided by a professional cook, without adjusting and controlling the thermal power by the user himself or herself for fine temperature control that is important in cooking.

In the cooking device **10**, the temperature detection unit **12** is configured to include at least one of the body temperature detection unit **12***a* that detects the temperature of the outer surface of the bottom portion of the cookware C serving as the temperature detection target and the external temperature detection unit **12***b* that directly detects the temperature of the object to be heated contained in the cookware C serving as the temperature detection target.

Therefore, the temperature of the object to be heated in the cookware C can be detected using the external temperature detection unit **12***b* in the normal cooking process, and the temperature of the object to be heated in the cookware C can be obtained based on the temperature detected by the body temperature detection unit **12***a* in the cooking process requiring the lid, and the temperature of the object to be heated in the cookware C can be controlled with high accuracy.

In the cooking device **10**, the control unit **18** includes the cooking execution unit **20** that executes the cooking process according to the cooking procedure set in advance while controlling the heating unit **11** such that the temperature of

the object to be heated in the cookware C set as the temperature control target or the surface temperature of the inner surface of the bottom portion of the cookware C matches the set cooking temperature, and the profile preparation unit **24** that prepares the cookware profile for predicting the temperature of the object to be heated by correcting the temperature of the outer surface of the bottom portion of the cookware C detected by the body temperature detection unit **12***a* according to the specifications of the cookware C, the cookware profile including the time-lapse temperature difference information indicating the dynamic relationship of the temperature difference for each elapsed time between the temperature of the outer surface of the bottom portion of the cookware C detected by the body temperature detection unit **12***a* and the temperature of the object to be heated detected by the external temperature detection unit **12***b* when the cookware C is heated in a state where the object to be heated is contained in the cookware C. The cooking execution unit **20** predicts the temperature of the temperature control target by correcting the temperature of the outer surface of the bottom portion of the cookware C detected by the body temperature detection unit **12***a* using the cookware profile of the cookware C in use, and controls the heating unit **11** such that the predicted temperature (the predicted temperature of the temperature control target) matches the cooking temperature.

Thereby, when the temperature (the temperature of the object to be heated or the surface temperature of the inner surface of the bottom portion of the cookware C) of the temperature control target (the temperature target) is predicted based on the temperature of the outer surface of the bottom portion of the cookware C detected by the body temperature detection unit **12***a*, the temperature inside the cookware C can be predicted by correcting the temperature detected by the body temperature detection unit **12***a* using the cookware profile corresponding to the cookware C to be used, so that the control unit **18** can control the temperature of the temperature target with high accuracy.

The cooking device **10** includes the environmental information obtainment unit **13** that obtains the outside air temperature and the atmospheric pressure as the environmental information of the kitchen, the environmental information obtainment unit **13** including the outside air temperature detection unit **13***a* that detects the outside air temperature of the kitchen and the atmospheric pressure detection unit **13***b* that detects the atmospheric pressure of the kitchen. The control unit **18** controls an output of the heating unit **11** in the cooking process in consideration of the obtained environmental information when the cooking execution information is executed.

Thereby, when the cooking device **10** executes the cooking process according to the cooking execution information, the output of the heating unit **11** can be finely adjusted according to the environment of the kitchen, so that the object to be heated in the cookware C and the heating output of the heating unit **11** can be controlled with high accuracy.

The cooking system **1** is a system configured such that the cooking device **10** and the mobile terminal **100** registered as the owner of the cooking device **10** are connected to each other so as to enable bidirectional communication. The mobile terminal **100** includes the terminal control unit **103** that outputs the initialization execution instruction for causing the cooking device **10** to execute the initialization processing. The cooking device **10** executes the initialization processing by the control unit **18** only when the initialization execution instruction is received from the mobile terminal **100**.

Thereby, since the cooking device **10** receives only the initialization execution instruction from the mobile terminal **100** registered by the owner and executes the initialization processing, unintended initialization processing can be prevented from being executed by another person.

[Others]

In the above-described embodiment, the cooking system **1** corresponds to an example of a "cooking system" described in the claims. The cooking device **10** corresponds to an example of a "cooking device" described in the claims. The heating unit **11** corresponds to an example of a "heating unit" described in the claims. The temperature detection unit **12** corresponds to an example of a "temperature detection unit" described in the claims. The body temperature detection unit **12***a* corresponds to an example of a "body temperature detection unit" described in the claims. The external temperature detection unit **12***b* corresponds to an example of an "external temperature detection unit" described in the claims. The environmental information obtainment unit **13** corresponds to an example of an "environmental information obtainment unit" described in the claims. The outside air temperature detection unit **13***a* corresponds to an example of an "outside air temperature detection unit" described in the claims. The atmospheric pressure detection unit **13***b* corresponds to an example of an "atmospheric pressure detection unit" described in the claims. The control unit **18** corresponds to an example of a "control unit" described in the claims. The cooking execution unit **20** corresponds to an example of a "cooking execution unit" described in the claims. The profile preparation unit **24** corresponds to an example of a "profile preparation unit" described in the claims. The mobile terminal **100** corresponds to an example of a "mobile terminal" described in the claims. The terminal control unit **103** corresponds to an example of a "terminal control unit" described in the claims. The cookware C corresponds to an example of a "cookware" described in the claims.

The terms used in the above-described embodiment and the claims should be interpreted as non-limiting terms. For example, the term "include" should be interpreted as "not limited to what is described as include". The term "comprise" should be interpreted as "not limited to what is described as comprise". The term "have" should be interpreted as "not limited to what is described as have".

REFERENCE SIGNS LIST

1 cooking system
10 cooking device (**10***a* body, **10***b* top plate)
11 heating unit
12 temperature detection unit (**12***a* body temperature detection unit, **12***b* external temperature detection unit)
13 environmental information obtainment unit (**13***a* outside air temperature detection unit, **13***b* atmospheric pressure detection unit)
14 weight detection unit
15 operation display unit (**15***a* display area, **15***b* operation area, **15***c* operation button)
16 communication unit
17 storage unit
18 control unit
19 input reception unit
20 cooking execution unit
21 clock unit
22 heating control unit
23 cooking execution information preparation unit
24 profile preparation unit

25 preset management unit
26 communication setting unit
27 device information setting unit
28 display control unit
100 mobile terminal
101 terminal communication unit
102 terminal storage unit
103 terminal control unit (**103***a* terminal-side cooking execution unit, **103***b* terminal-side clock unit, **103***c* terminal-side cooking execution information preparation unit, **103***d* terminal-side profile preparation unit, **103***e* terminal-side preset management unit, **103***f* terminal-side device information setting unit)
104 terminal display unit
105 terminal operation unit
C cookware

The invention claimed is:

1. A cooking device comprising:

a heater configured to heat cookware containing an object to be heated;

a temperature detector including:

a body temperature detector configured to detect a temperature of an outer surface of a bottom portion of the cookware serving as a temperature detection target; and

an external temperature detector configured to directly detect a temperature of the object to be heated contained in the cookware serving as a temperature detection target, the temperature detector being configured to detect at least one of the temperature of the object to be heated and the temperature of the outer surface of the bottom portion of the cookware; and

a controller configured to control the heater based on the temperature detected by the temperature detector such that a temperature of the object to be heated in the cookware or a surface temperature of an inner surface of the bottom portion of the cookware matches a cooking temperature set in a cooking process included in cooking execution information,

wherein the controller is programmed to:

determine time-lapse temperature difference information by temporally observing and recording the temperature difference between the temperature of the outer surface of the bottom portion of the cookware detected by the body temperature detector and the temperature of the object to be heated detected by the external temperature detector;

prepare a cookware profile for predicting the temperature of the object to be heated by correcting the temperature of the outer surface of the bottom portion of the cookware detected by the body temperature detector according to the cookware, the cookware profile including the time-lapse temperature difference information indicating a dynamic relationship of a temperature difference for each elapsed time between the temperature of the outer surface of the bottom portion of the cookware detected by the body temperature detector and the temperature of the object to be heated detected by the external temperature detector when the cookware is heated in a state where the object to be heated is contained in the cookware;

execute the cooking process according to a cooking procedure set in advance while controlling the heater such that the temperature of the object to be heated in the cookware set as a temperature control target or the surface temperature of the inner surface of the bottom portion of the cookware matches the cooking temperature;

correct the temperature of the outer surface of the bottom portion detected by the body temperature detector;

predict the temperature of the temperature control target, based on the corrected temperature of the outer surface of the bottom portion, by using the cookware profile of the cookware in use; and

control the heater such that the predicted temperature matches the cooking temperature.

2. The cooking device according to claim **1**, further comprising:

an outside air temperature detector configured to detect an outside air temperature of a kitchen; and

an atmospheric pressure detector configured to detect an atmospheric pressure of the kitchen, the outside air temperature detector and the atmospheric pressure detector being configured to obtain the outside air temperature and the atmospheric pressure as environmental information of the kitchen,

wherein the controller is configured to control an output of the heater in the cooking process in consideration of the obtained environmental information when the cooking execution information is executed.

3. A cooking system comprising:

a cooking device including:

a heater configured to heat cookware containing an object to be heated;

a temperature detector configured to detect at least one of a temperature of the object to be heated and a temperature of an outer surface of a bottom portion of the cookware;

a storage device configured to store a profile database in which cookware profiles for each cookware are organized, the cookware profiles being applied to predict a temperature of the object by correcting the temperature of the outer surface of the bottom portion of the cookware detected by the temperature detector; and

a controller configured to control the heater based on the temperature detected by the temperature detector such that a temperature of the object to be heated in the cookware or a surface temperature of an inner surface of the bottom portion of the cookware matches a cooking temperature set in a cooking process included in cooking execution information; and

a mobile terminal registered as an owner of the cooking device, the cooking device and the mobile terminal being connected to each other so as to enable bidirectional communication,

wherein the mobile terminal includes a terminal controller configured to output an initialization execution instruction for causing the cooking device to execute initialization processing,

wherein the cooking device executes the initialization processing by the controller only when the initialization execution instruction is received from the mobile terminal,

wherein the cookware profiles contained in the profile database include time-lapse temperature difference information indicating a dynamic relationship of a temperature difference for each elapsed time between the temperature of the outer surface of the bottom portion of the cookware and the temperature of the object to be heated, and

wherein the cookware profiles are determined by temporally observing and recording the temperature difference between the temperature of the outer surface of the bottom portion of the cookware detected by the temperature detector and the temperature of the object to be heated.

4. A cooking device comprising:

a heater configured to heat a cookware containing an object to be heated;

a body temperature detector configured to detect a temperature of an outer surface of a bottom portion of the cookware serving as a temperature detection target;

a controller configured to control the heater based on the temperature detected by the body temperature detector such that a temperature of the object to be heated in the cookware or a surface temperature of an inner surface of the bottom portion of the cookware matches a cooking temperature set in a cooking process included in cooking execution information; and

a storage device configured to store a profile database in which cookware profiles for each cookware are organized, the cookware profiles being applied to predict a temperature of the object by correcting the temperature of the outer surface of the bottom portion of the cookware detected by the body temperature detector,

wherein the controller is configured to:

execute the cooking process according to a cooking procedure set in advance while controlling the heater such that the temperature of the object to be heated in the cookware sets as a temperature control target or the surface temperature of the inner surface of the bottom portion of the cookware matches the cooking temperature;

correct the temperature of the outer surface of the bottom portion detected by the body temperature detector to predict the temperature of the temperature control target by referring the profile database and using a particular cookware profile organized for the cookware in use; and

control the heater such that the predicted temperature matches the cooking temperature,

wherein the cookware profiles contained in the profile database include time-lapse temperature difference information indicating a dynamic relationship of a temperature difference for each elapsed time between the temperature of the outer surface of the bottom portion of the cookware and the temperature of the object to be heated, and

wherein the cookware profiles are determined by temporally observing and recording the temperature difference between the temperature of the outer surface of the bottom portion of the cookware detected by the temperature detector and the temperature of the object to be heated.

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