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(54) **INHALATION DEVICE, BASE MATERIAL, AND CONTROL METHOD**

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(52) **U.S. Cl.**

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(57) **ABSTRACT**

An inhalation device including: a heating unit that heats a base material containing an aerosol source and generates aerosol; and a control unit that controls operation of the heating unit on the basis of a temperature setting specifying time-series transition of a target temperature, which is a target value of the temperature of the heating unit, wherein the temperature setting includes a temperature increasing period where the temperature of the heating unit is increased from an initial temperature, which is the temperature of the heating unit at start of heating, to a predetermined temperature, and the control unit controls the length of the temperature increasing period on the basis of the initial temperature.

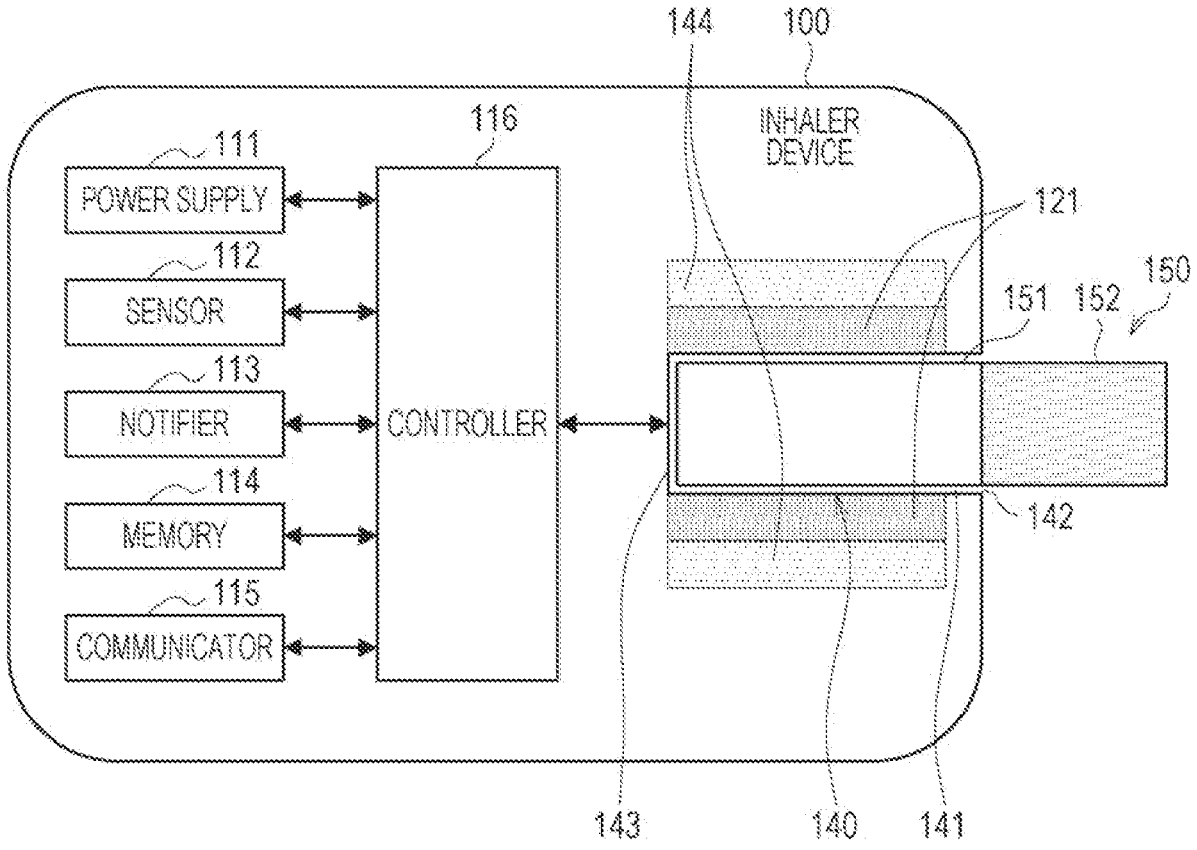


FIG. 1

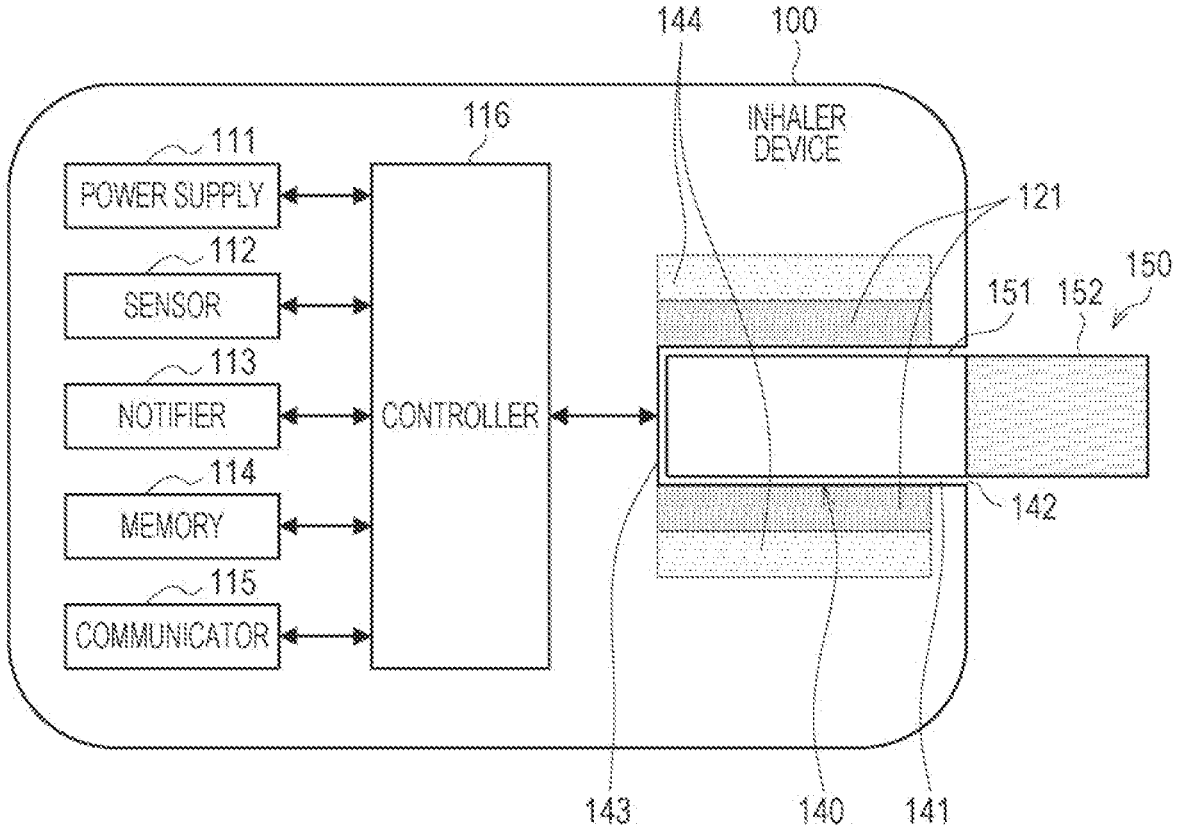

144
100
INHALER DEVICE
116
111
POWER SUPPLY
112
SENSOR
113
NOTIFIER
114
MEMORY
115
COMMUNICATOR
CONTROLLER
121
151
152
150
142
143
140
141

FIG. 2

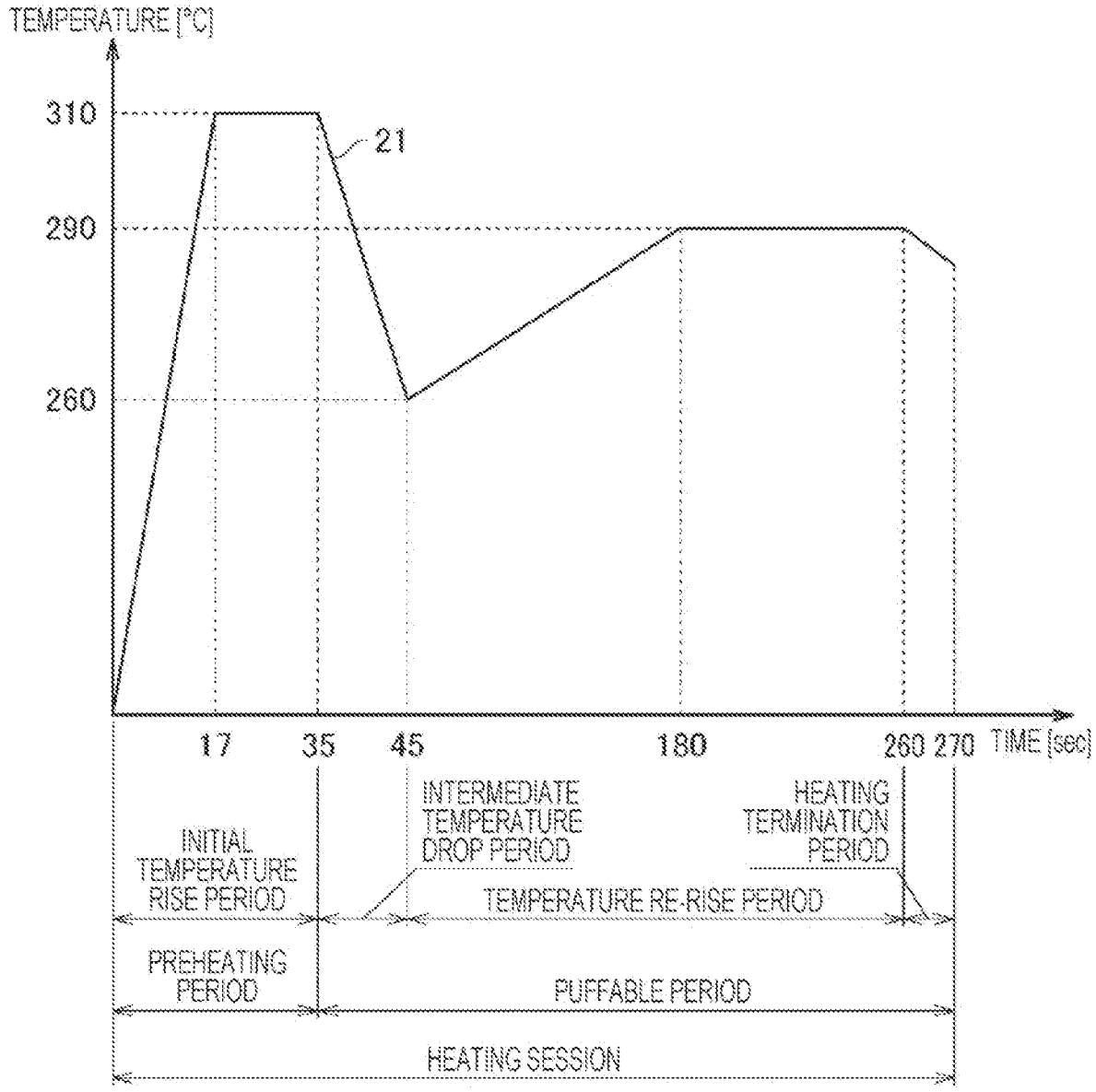

TEMPERATURE [°C]
310
290
260
21
17
35
45
180
260
270
TIME [sec]
INITIAL TEMPERATURE RISE PERIOD
INTERMEDIATE TEMPERATURE DROP PERIOD
HEATING TERMINATION PERIOD
TEMPERATURE RE-RISE PERIOD
PREHEATING PERIOD
PUFFABLE PERIOD
HEATING SESSION

FIG. 3

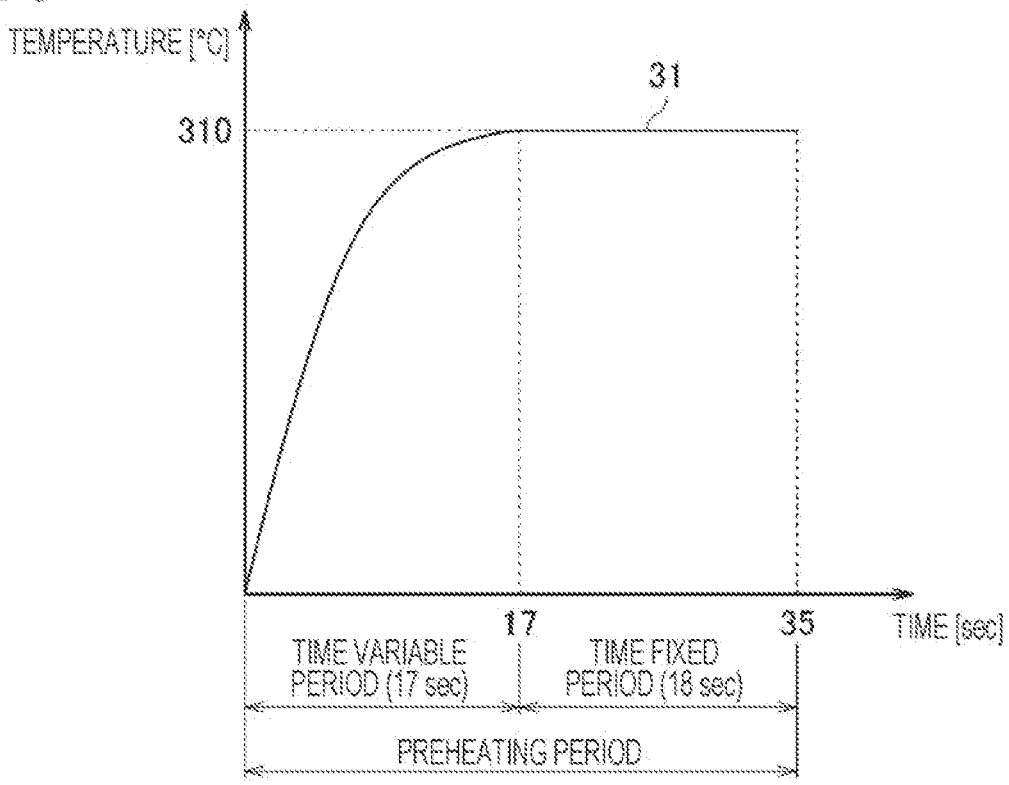

TEMPERATURE [°C]
310
31
17
35
TIME [sec]
TIME VARIABLE PERIOD (17 sec)
TIME FIXED PERIOD (18 sec)
PREHEATING PERIOD

FIG. 4

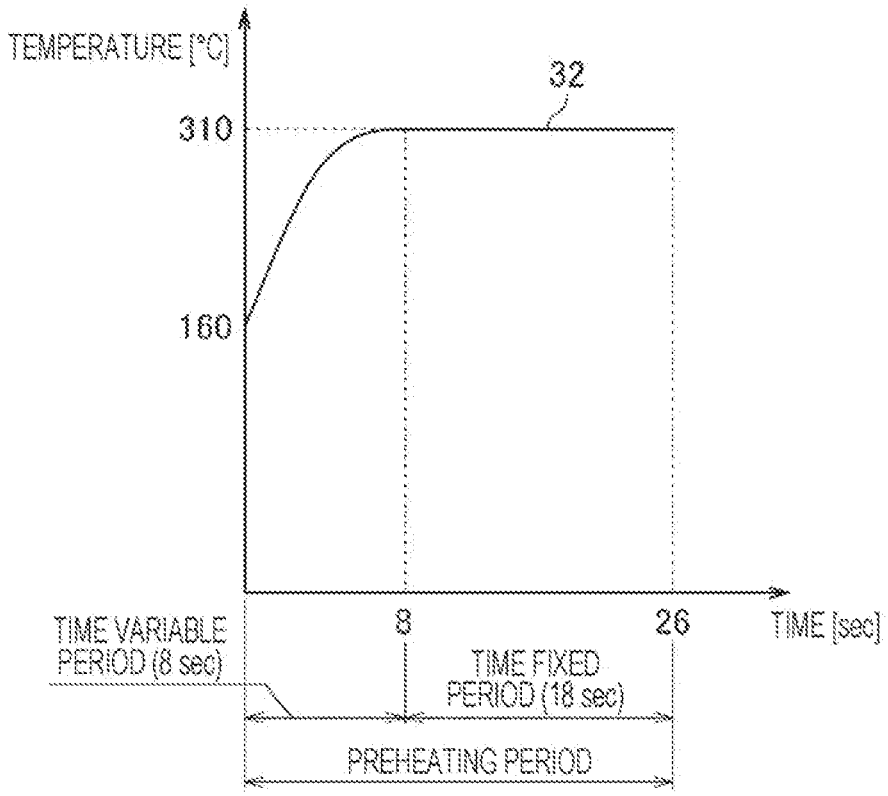

TEMPERATURE [°C]
310
160
32
8
26
TIME [sec]
TIME VARIABLE PERIOD (8 sec)
TIME FIXED PERIOD (18 sec)
PREHEATING PERIOD

FIG. 5

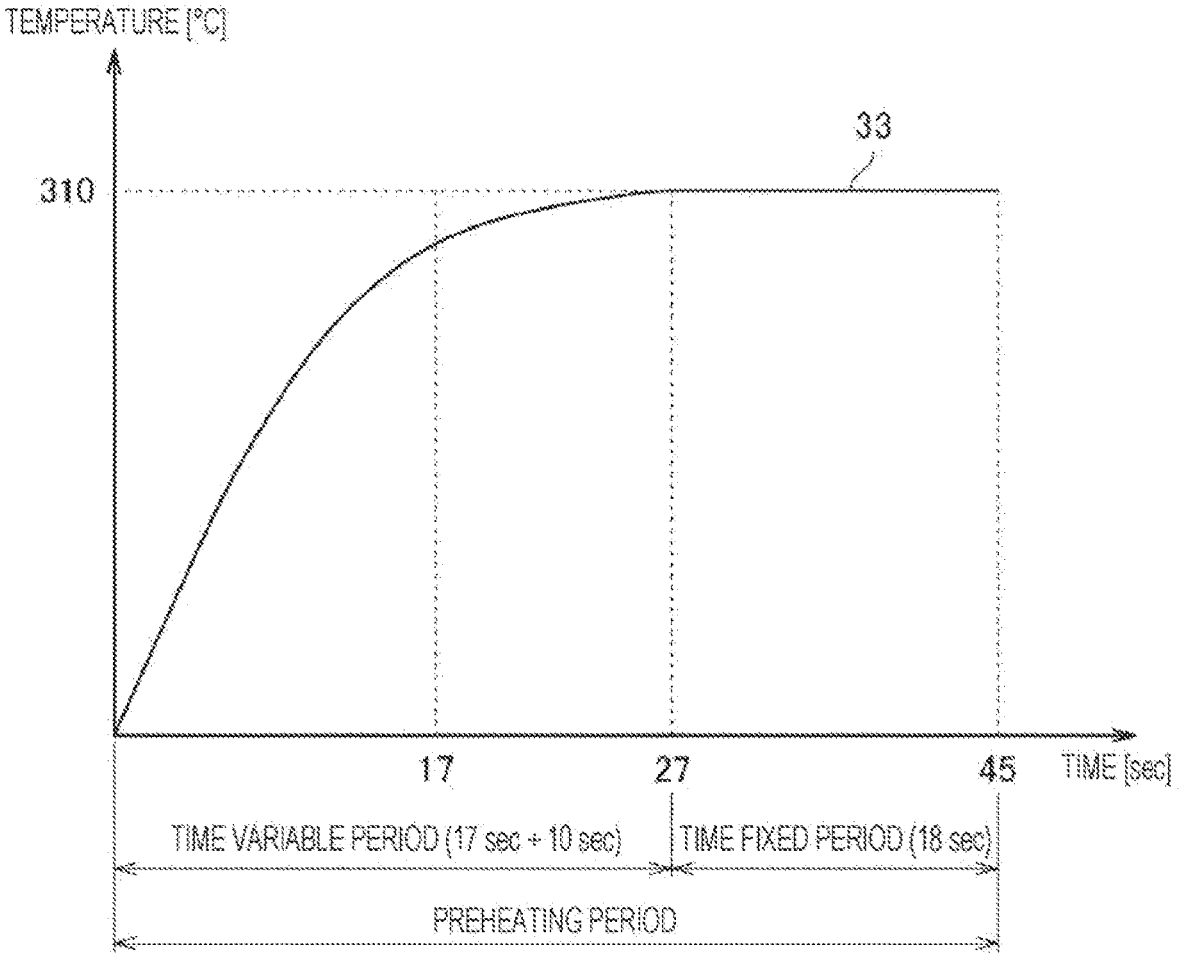

TEMPERATURE [°C]
310
33
17
27
45
TIME [sec]
TIME VARIABLE PERIOD (17 sec + 10 sec)
TIME FIXED PERIOD (18 sec)
PREHEATING PERIOD

FIG. 6

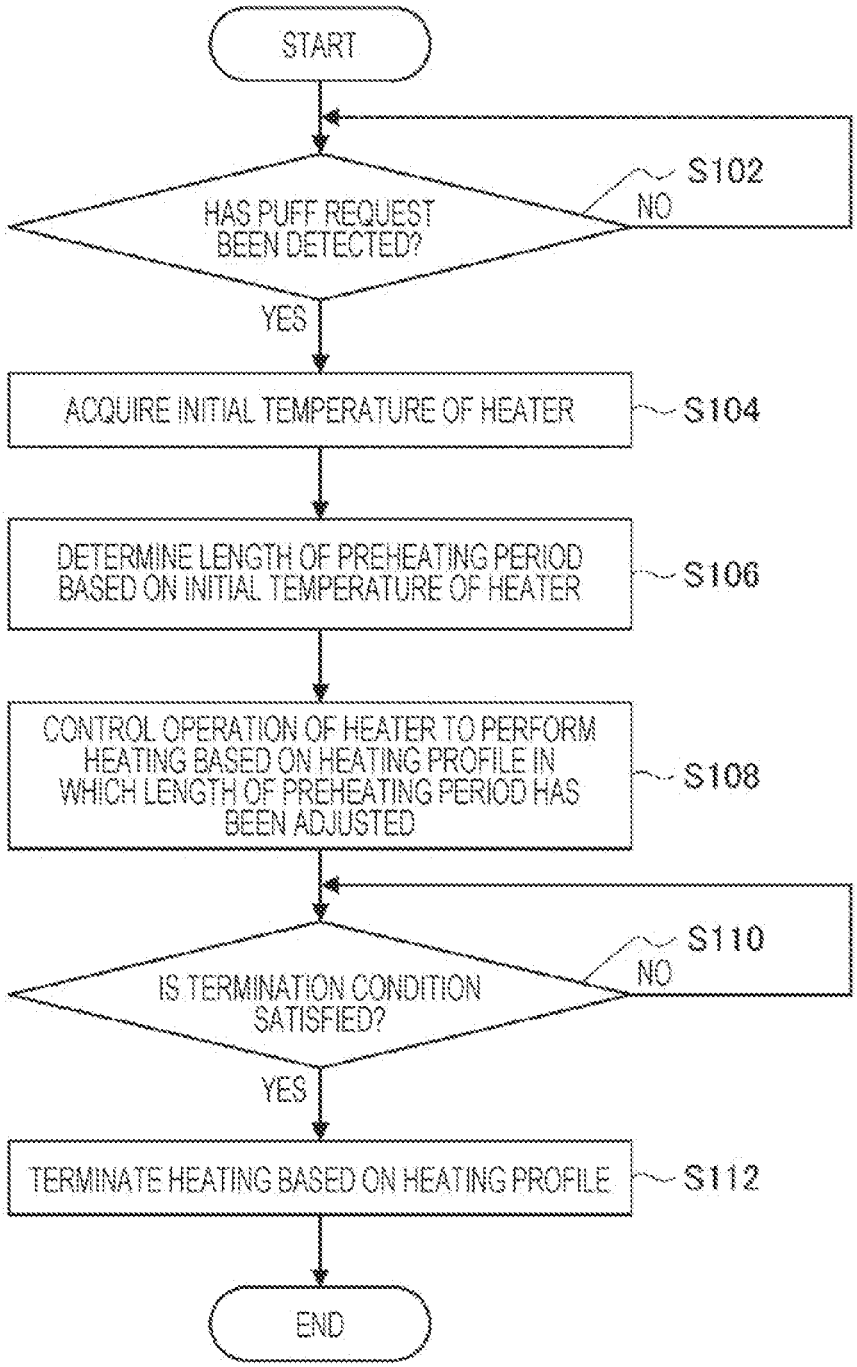

START
HAS PUFF REQUEST BEEN DETECTED?
S102
NO
YES
ACQUIRE INITIAL TEMPERATURE OF HEATER
S104
DETERMINE LENGTH OF PREHEATING PERIOD BASED ON INITIAL TEMPERATURE OF HEATER
S106
CONTROL OPERATION OF HEATER TO PERFORM HEATING BASED ON HEATING PROFILE IN WHICH LENGTH OF PREHEATING PERIOD HAS BEEN ADJUSTED
S108
IS TERMINATION CONDITION SATISFIED?
S110
NO
YES
TERMINATE HEATING BASED ON HEATING PROFILE
S112
END

FIG. 7

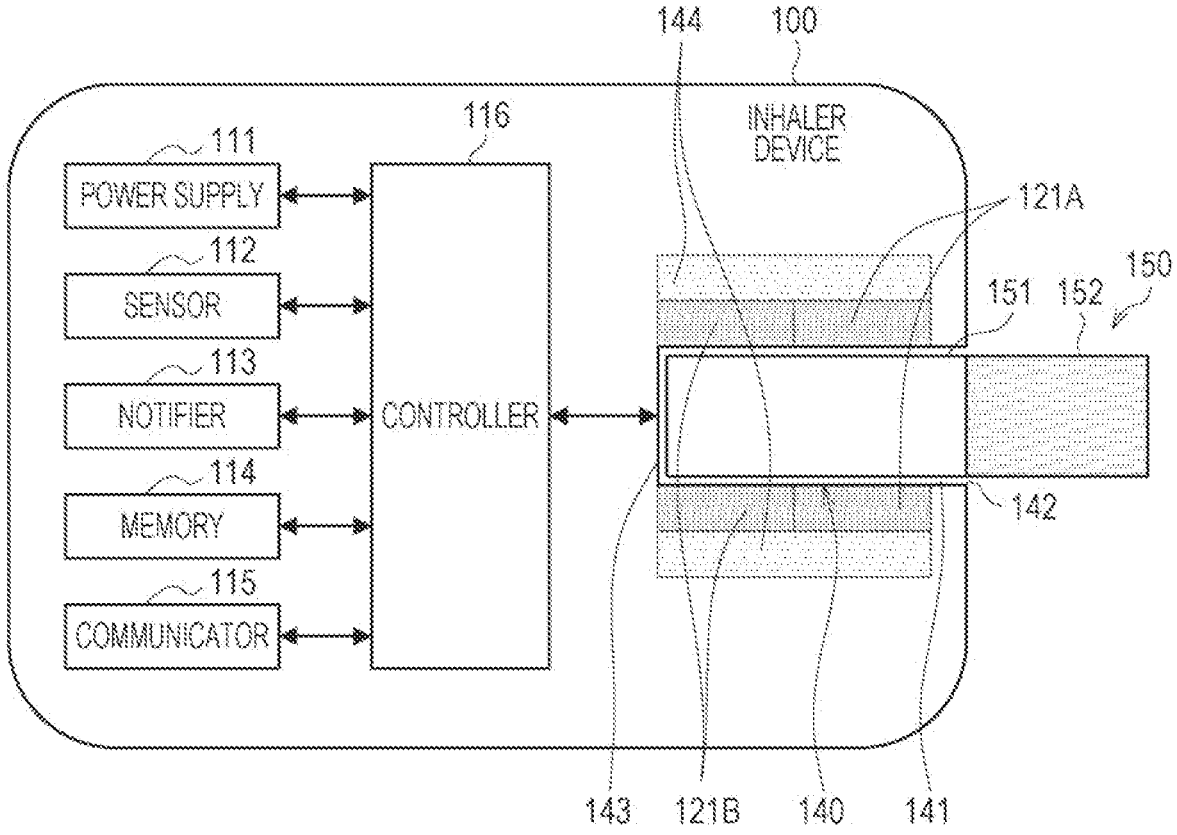
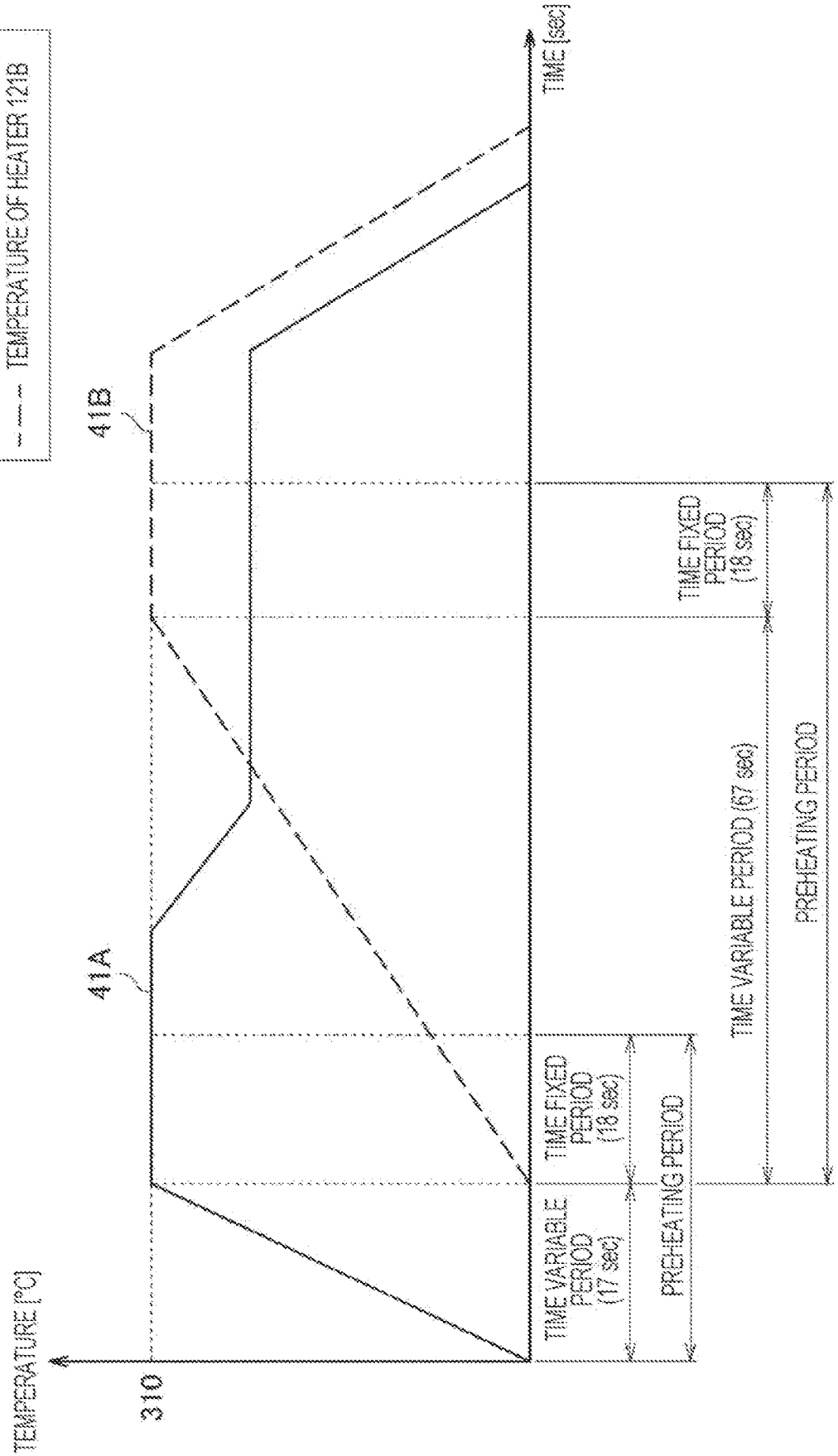

144
100
INHALER DEVICE
116
111
POWER SUPPLY
112
SENSOR
113
NOTIFIER
114
MEMORY
115
COMMUNICATOR
CONTROLLER
121A
151
152
150
142
143
121B
140
141

FIG. 8


TEMPERATURE OF HEATER 121A
TEMPERATURE OF HEATER 121B
TIME [sec]
41B
41A
TEMPERATURE [°C]
310
TIME VARIABLE PERIOD (17 sec)
TIME FIXED PERIOD (18 sec)
PREHEATING PERIOD
TIME VARIABLE PERIOD (67 sec)
TIME FIXED PERIOD (18 sec)
PREHEATING PERIOD

INHALATION DEVICE, BASE MATERIAL, AND CONTROL METHOD

CROSS REFERENCES TO RELATED APPLICATIONS

[0001] This application is a Continuation of PCT International Application No. PCT/JP2021/040039, filed on Oct. 29, 2021, which is hereby expressly incorporated by reference into the present application.

TECHNICAL FIELD

[0002] The present invention relates to an inhaler device, a substrate, and a control method.

BACKGROUND ART

[0003] Inhaler devices, such as e-cigarettes and nebulizers, that generate material to be inhaled by a user are widespread. For example, an inhaler device generates an aerosol having a flavor component imparted thereto, by using a substrate including an aerosol source for generating the aerosol, a flavor source for imparting the flavor component to the generated aerosol, and the like. A user is able to enjoy the flavor by inhaling the aerosol having the flavor component imparted thereto, which is generated by the inhaler device. An action of a user inhaling an aerosol will be hereinafter also referred to as a puff or a puff action.

[0004] Typically, an inhaler device generates an aerosol by heating a substrate. The quality of user experience is greatly affected by the temperature at which the substrate is heated, and thus techniques have been developed to achieve appropriate temperature control. Patent Literature 1 listed below discloses a technique of controlling, based on the temperature of a heater at the start of heating, the temperature rising speed of the heater during a period from the start of heating until puffing becomes possible.

CITATION LIST

Patent Literature

[0005] Patent Literature 1: WO 2019/186668 A1

SUMMARY OF INVENTION

Technical Problem

[0006] However, the technique disclosed in Patent Literature 1 has only a short history since its development, and has room for improvement from various viewpoints.

[0007] Accordingly, the present invention has been made in view of the above issue, and an object of the present invention is to provide a mechanism capable of further improving the quality of user experience regarding an inhaler device.

Solution to Problem

[0008] To solve the above issue, according to an aspect of the present invention, there is provided an inhaler device including a heater configured to heat a substrate including an aerosol source to generate an aerosol; and a controller configured to control, based on a temperature setting defining a time-series transition of a target temperature, the target temperature being a target value of a temperature of the heater, an operation of the heater. The temperature setting includes a temperature rise period during which the temperature of the heater is raised from an initial temperature to a predetermined temperature, the initial temperature being the temperature of the heater at start of heating. The controller is configured to control, based on the initial temperature, a length of the temperature rise period.

[0009] The temperature rise period may be composed of a first period having a length that is variable and a second period following the first period and having a length that is fixed. The controller may be configured to control, based on the initial temperature, the length of the first period.

[0010] The controller may be configured to shorten the first period as the initial temperature increases and lengthen the first period as the initial temperature decreases.

[0011] The controller may be configured to change, based on the temperature of the heater in the first period, the length of the first period determined based on the initial temperature.

[0012] The controller may be configured to terminate the first period and switch to the second period, in response to the temperature of the heater reaching the predetermined temperature at an end of the first period whose length is determined based on the initial temperature.

[0013] The controller may be configured to extend the first period in response to the temperature of the heater not reaching the predetermined temperature at an end of the first period whose length is determined based on the initial temperature.

[0014] The controller may be configured to extend, by a time corresponding to the initial temperature, the first period whose length is determined based on the initial temperature.

[0015] The controller may be configured to stop the operation of the heater in response to the temperature of the heater not reaching the predetermined temperature at an end of the extended first period.

[0016] The controller may be configured to terminate the first period and switch to the second period, in response to the temperature of the heater reaching the predetermined temperature before an end of the first period whose length is determined based on the initial temperature.

[0017] The inhaler device may include a plurality of the heaters. The controller may be configured to perform control such that first periods in a plurality of the temperature settings for the plurality of heaters have respective lengths that are different from each other.

[0018] The controller may be configured to make the first period in the temperature setting for the heater disposed on an upstream side among the plurality of heaters longer than the first period in the temperature setting for the heater disposed on a downstream side among the plurality of heaters.

[0019] The controller may be configured to control the operation of the heater such that the temperature of the heater is raised from the initial temperature to the predetermined temperature in the first period and that the temperature of the heater is maintained at the predetermined temperature in the second period.

[0020] The temperature rise period may be a period from the start of heating to when inhalation of the aerosol by a user becomes possible.

[0021] The controller may be configured to control, based on the temperature of the heater in the temperature rise period, the length of the temperature rise period.

[0022] The controller may be configured to control, based on an elapsed time from termination of preceding heating that is based on the temperature setting, the length of the temperature rise period.

[0023] To solve the above issue, according to another aspect of the present invention, there is provided a substrate that includes an aerosol source and that is to be heated by an inhaler device to generate an aerosol. The inhaler device includes a heater configured to heat the substrate including the aerosol source to generate the aerosol; and a controller configured to control, based on a temperature setting defining a time-series transition of a target temperature, the target temperature being a target value of a temperature of the heater, an operation of the heater. The temperature setting includes a temperature rise period during which the temperature of the heater is raised from an initial temperature to a predetermined temperature, the initial temperature being the temperature of the heater at start of heating. The controller is configured to control, based on the initial temperature, a length of the temperature rise period.

[0024] To solve the above issue, according to another aspect of the present invention, there is provided a control method for controlling an inhaler device including a heater configured to heat a substrate including an aerosol source to generate an aerosol. The control method includes controlling, based on a temperature setting defining a time-series transition of a target temperature, the target temperature being a target value of a temperature of the heater, an operation of the heater. The temperature setting includes a temperature rise period during which the temperature of the heater is raised from an initial temperature to a predetermined temperature, the initial temperature being the temperature of the heater at start of heating. The controlling of the operation of the heater includes controlling, based on the initial temperature, a length of the temperature rise period.

Advantageous Effects of Invention

[0025] As described above, according to the present invention, there is provided a mechanism capable of further improving the quality of user experience regarding an inhaler device.

BRIEF DESCRIPTION OF DRAWINGS

[0026] FIG. **1** is a schematic diagram of an inhaler device according to a configuration example.

[0027] FIG. **2** is a graph showing an example of the transition of the temperature of a heater in a case where temperature control is performed based on the heating profile shown in Table 1.

[0028] FIG. **3** is a graph showing an example of the transition of the temperature of the heater in a preheating period.

[0029] FIG. **4** is a graph showing an example of the transition of the temperature of the heater in a case where the control of the length of a time variable period shown in Table 2 is performed.

[0030] FIG. **5** is a graph showing an example of the transition of the temperature of the heater in a case where the control of the length of a time variable period shown in Table 2 is performed.

[0031] FIG. **6** is a flowchart illustrating an example of a flow of a process executed by the inhaler device according to the present embodiment.

[0032] FIG. **7** is a schematic diagram of a configuration example of an inhaler device according to a modification.

[0033] FIG. **8** is a graph showing an example of the transition of the temperature of the heater in a case where the control of the length of a time variable period shown in Table 3 and Table 4 is performed.

DESCRIPTION OF EMBODIMENTS

[0034] Hereinafter, a preferred embodiment of the present invention will be described in detail with reference to the accompanying drawings. In the specification and the drawings, structural elements having substantially the same functional configuration are denoted by the same reference signs, and a duplicate description will be omitted.

<1. Configuration Example>

[0035] An inhaler device generates material to be inhaled by a user. In the example described below, the material generated by the inhaler device is an aerosol. Alternatively, the material generated by the inhaler device may be gas.

[0036] FIG. **1** is a schematic diagram of the inhaler device according to a configuration example. As illustrated in FIG. **1**, an inhaler device **100** according to the present configuration example includes a power supply **111**, a sensor **112**, a notifier **113**, a memory **114**, a communicator **115**, a controller **116**, a heater **121**, a holder **140**, and a heat insulator **144**.

[0037] The power supply **111** stores electric power. The power supply **111** supplies electric power to the structural elements of the inhaler device **100** under the control of the controller **116**. The power supply **111** may be a rechargeable battery such as a lithium ion secondary battery.

[0038] The sensor **112** acquires various items of information regarding the inhaler device **100**. In an example, the sensor **112** may be a pressure sensor such as a microphone condenser, a flow sensor, or a temperature sensor, and acquire a value generated in accordance with the user's inhalation. In another example, the sensor **112** may be an input device that receives information input by the user, such as a button or a switch.

[0039] The notifier **113** provides information to the user. The notifier **113** may be a light-emitting device that emits light, a display device that displays an image, a sound output device that outputs sound, or a vibration device that vibrates.

[0040] The memory **114** stores various items of information for operation of the inhaler device **100**. The memory **114** may be a non-volatile storage medium such as flash memory.

[0041] The communicator **115** is a communication interface capable of communication in conformity with any wired or wireless communication standard. Such a communication standard may be, for example, Wi-Fi (registered trademark) or Bluetooth (registered trademark).

[0042] The controller **116** functions as an arithmetic processing unit and a control circuit, and controls the overall operations of the inhaler device **100** in accordance with various programs. The controller **116** includes an electronic circuit such as a central processing unit (CPU) or a microprocessor, for example.

[0043] The holder **140** has an internal space **141**, and holds a stick substrate **150** in a manner partially accommodated in the internal space **141**. The holder **140** has an opening **142** that allows the internal space **141** to communicate with outside. The holder **140** holds the stick substrate **150** that is inserted into the internal space **141** through the opening **142**.

For example, the holder **140** may be a tubular body having the opening **142** and a bottom **143** on its ends, and may define the pillar-shaped internal space **141**. The holder **140** also has a function of defining a flow path of air supplied to the stick substrate **150**. An air inlet hole, which is an inlet of air to the flow path, is disposed in the bottom **143**, for example. On the other hand, an air outlet hole, which is an outlet of air from the flow path, is the opening **142**.

[0044] The stick substrate **150** includes a substrate **151** and an inhalation port **152**. The substrate **151** includes an aerosol source. In the present configuration example, the aerosol source is not limited to a liquid, and may be a solid. The stick substrate **150** held by the holder **140** includes the substrate **151** at least partially accommodated in the internal space **141** and the inhalation port **152** at least partially protruding from the opening **142**. When the user inhales with the inhalation port **152** protruding from the opening **142** in his/her mouth, air flows into the internal space **141** through the air inlet hole (not illustrated), and the air and an aerosol generated from the substrate **151** reach inside the mouth of the user.

[0045] The heater **121** heats the aerosol source to atomize the aerosol source and generate the aerosol. In the example illustrated in FIG. **1**, the heater **121** has a film-like shape and surrounds the outer circumference of the holder **140**. Subsequently, heat produced from the heater **121** heats the substrate **151** of the stick substrate **150** from the outer circumference, generating the aerosol. The heater **121** produces heat when supplied with electric power from the power supply **111**. In an example, the electric power may be supplied in response to the sensor **112** detecting a start of the user's inhalation and/or an input of predetermined information. Subsequently, the supply of the electric power may be stopped in response to the sensor **112** detecting an end of the user's inhalation and/or an input of predetermined information.

[0046] The heat insulator **144** prevents heat from transferring from the heater **121** to the other structural elements. For example, the heat insulator **144** may be a vacuum heat insulator or an aerogel heat insulator.

[0047] The configuration example of the inhaler device **100** has been described above. The inhaler device **100** is not limited to the above configuration, and may be configured in various ways as exemplified below.

[0048] In an example, the heater **121** may have a blade-like shape, and may be disposed so that the heater **121** protrudes from the bottom **143** of the holder **140** toward the internal space **141**. In this case, the heater **121** having the blade-like shape is inserted into the substrate **151** of the stick substrate **150** and heats the substrate **151** of the stick substrate **150** from its inside. In another example, the heater **121** may be disposed so that the heater **121** covers the bottom **143** of the holder **140**. In still another example, the heater **121** may be implemented as a combination of two or more selected from a first heater that covers the outer circumference of the holder **140**, a second heater having the blade-like shape, and a third heater that covers the bottom **143** of the holder **140**.

[0049] In another example, the holder **140** may include an opening/closing mechanism that at least partially opens and closes an outer shell defining the internal space **141**. Examples of the opening/closing mechanism include a hinge. In addition, the holder **140** may accommodate the stick substrate **150** while sandwiching the stick substrate **150** inserted into the internal space **141** by opening and closing the outer shell. In this case, the heater **121** may be at the sandwiching position of the holder **140** and may produce heat while pressing the stick substrate **150**.

[0050] In addition, means for atomizing the aerosol source is not limited to heating by the heater **121**. For example, the means for atomizing the aerosol source may be induction heating.

[0051] The inhaler device **100** and the stick substrate **150** cooperate with each other to generate an aerosol to be inhaled by the user. Thus, the combination of the inhaler device **100** and the stick substrate **150** may be regarded as an aerosol generation system.

<2. Technical Features>

(1) Heating Profile

[0052] The controller **116** controls the operation of the heater **121**, based on a temperature setting. The control of the operation of the heater **121** is implemented by controlling supply of electric power from the power supply **111** to the heater **121**. The temperature setting is information defining a time-series transition of a target temperature, which is a target value of the temperature of the heater **121**. Hereinafter, such a temperature setting is also referred to as a heating profile.

[0053] The controller **116** controls the temperature of the heater **121** such that the transition of the temperature (hereinafter also referred to as an actual temperature) of the heater **121** becomes similar to the transition of the target temperature defined in the heating profile. The heating profile is typically designed to optimize the flavor that a user tastes when the user inhales an aerosol generated from the stick substrate **150**. Thus, controlling of supply of electric power to the heater **121** based on the heating profile makes it possible to optimize the flavor that the user tastes.

[0054] The heating profile includes one or more combinations of a target temperature and information indicating a timing at which the target temperature is to be reached. The controller **116** controls the temperature of the heater **121** while switching the target temperature in accordance with the elapse of time from the start of heating based on the heating profile. Specifically, the controller **116** controls the temperature of the heater **121**, based on the difference between a current actual temperature and a target temperature corresponding to the elapsed time from the start of heating based on the heating profile. The temperature control of the heater **121** can be implemented by, for example, known feedback control. The feedback control may be, for example, proportional-integral-differential controller (PID controller). The controller **116** may cause electric power from the power supply **111** to be supplied to the heater **121** in the form of pulses generated by pulse width modulation (PWM) or pulse frequency modulation (PFM). In this case, the controller **116** is capable of controlling the temperature of the heater **121** by adjusting the duty ratio or frequency of electric power pulses in the feedback control. Alternatively, the controller **116** may perform simple ON/OFF control in the feedback control. For example, the controller **116** may execute heating by the heater **121** until the actual temperature reaches the target temperature, stop heating by the heater **121** in response to the actual temperature reaching the target temperature, and execute heating by the heater **121** again in response to the actual temperature becoming lower

than the target temperature. In addition, the controller **116** may adjust a voltage in the feedback control.

[0055] The temperature of the heater **121** can be quantified by, for example, measuring or estimating the electric resistance value of the heater **121** (more accurately, a heating resistor constituting the heater **121**). This is because the electric resistance value of the heating resistor changes according to the temperature. The electric resistance value of the heating resistor can be estimated by, for example, measuring the amount of voltage drop in the heating resistor. The amount of voltage drop in the heating resistor can be measured by a voltage sensor that measures a potential difference applied to the heating resistor. In another example, the temperature of the heater **121** can be measured by a temperature sensor, such as a thermistor, installed near the heater **121**.

[0056] A period from the start to the end of the process of generating an aerosol using the stick substrate **150** will be hereinafter also referred to as a heating session. In other words, the heating session is a period during which supply of electric power to the heater **121** is controlled based on the heating profile. The start of the heating session is a timing at which heating based on the heating profile is started. The end of the heating session is a timing at which a sufficient amount of aerosol is no longer generated. The heating session includes a first preheating period and a latter puffable period. The puffable period is a period during which a sufficient amount of aerosol is estimated to be generated. The preheating period is a period from the start of heating to the start of the puffable period. The heating performed in the preheating period is also referred to as preheating.

[0057] The heating profile may include a plurality of periods having, set therein, target temperatures different from each other. Temperature control may be performed such that a target temperature set in a certain period is reached at a certain timing in the period, or temperature control may be performed such that the target temperature is reached at the end of the period. In any case, it is possible to change the temperature of the heater **121** in a manner similar to the transition of the target temperature defined in the heating profile.

[0058] An example of the heating profile is shown in Table 1 below.

TABLE 1

Example of heating profile

Period	Elapsed time from start of heating	Target temperature
Initial temperature rise period	0 sec. to 17 sec.	310° C.
	17 sec. to 35 sec.	310° C.
Intermediate temperature drop period	35 sec. to 45 sec.	260° C.
Temperature re-rise period	45 sec. to 180 sec.	290° C.
	180 sec. to 260 sec.	290° C.
Heating termination period	Thereafter	—

[0059] A description will be given of the transition of the temperature of the heater **121** in a case where the controller **116** performs temperature control in accordance with the heating profile shown in Table 1, with reference to FIG. **2**. FIG. **2** is a graph showing an example of the transition of the temperature of the heater **121** in a case where temperature control is performed based on the heating profile shown in Table 1. The horizontal axis of this graph represents time (seconds). The vertical axis of this graph represents the temperature of the heater **121**. The line **21** in this graph indicates the transition of the temperature of the heater **121**. As illustrated in FIG. **2**, the temperature of the heater **121** changes in a manner similar to the transition of the target temperature defined in the heating profile.

[0060] As shown in Table 1, the heating profile includes an initial temperature rise period at the beginning. The initial temperature rise period is a period during which the temperature of the heater **121** rises from an initial temperature. The initial temperature is the temperature of the heater **121** at the start of heating. As illustrated in FIG. **2**, in the initial temperature rise period, the temperature of the heater **121** reaches 310° C. after 17 seconds from the start of heating, and is maintained at 310° C. until after 35 seconds from the start of heating. Accordingly, it is estimated that the temperature of the stick substrate **150** reaches a temperature at which a sufficient amount of aerosol is generated. Because the temperature rapidly rises to 310° C. immediately after the start of heating, preheating can be finished early, and the puffable period can be started early. In FIG. **2**, the initial temperature rise period and the preheating period coincide with each other, but these periods do not have to coincide with each other.

[0061] As shown in Table 1, the heating profile includes an intermediate temperature drop period that follows the initial temperature rise period. The intermediate temperature drop period is a period during which the temperature of the heater **121** drops. As illustrated in FIG. **2**, in the intermediate temperature drop period, the temperature of the heater **121** drops from 310° C. to 260° C. from 35 seconds to 45 seconds after the start of heating. In this period, supply of electric power to the heater **121** may be stopped. Even in this case, a sufficient amount of aerosol is generated by the remaining heat of the heater **121** and the stick substrate **150**. Here, if the heater **121** is maintained at a high temperature, the aerosol source included in the stick substrate **150** is rapidly consumed, which may cause deterioration of flavor, such as excessively strong flavor tasted by the user. In this regard, the intermediate temperature drop period provided in the middle makes it possible to avoid such deterioration of flavor and improve the quality of puff experience of the user.

[0062] As shown in Table 1, the heating profile includes a temperature re-rise period that follows the intermediate temperature drop period. The temperature re-rise period is a period during which the temperature of the heater **121** rises. As illustrated in FIG. **2**, in the temperature re-rise period, the temperature of the heater **121** rises from 260° C. to 290° C. from 45 seconds to 180 seconds after the start of heating, and is maintained at 290° C. until after 260 seconds from the start of heating. If the temperature of the heater **121** is continuously decreased, the temperature of the stick substrate **150** is also decreased. Thus, the amount of aerosol generated reduces, and the flavor tasted by the user may be deteriorated. In addition, as the heating profile progresses toward the end, the remaining amount of the aerosol source included in the stick substrate **150** decreases, and thus the amount of aerosol generated tends to reduce even if heating is continued at the same temperature. In this regard, re-rise of the temperature and an increase in the amount of aerosol generated in the latter half of the heating profile make it possible to compensate for a decrease in the amount of aerosol generated caused by a decrease in the remaining amount of the aerosol source. Accordingly, even in the latter

half of the heating profile, it is possible to prevent deterioration of the flavor that the user tastes.

[0063] As shown in Table 1, the heating profile includes a heating termination period at the end. The heating termination period is a period that follows the temperature re-rise period, and is a period during which heating is not performed. A target temperature need not necessarily be set. As illustrated in FIG. **2**, the temperature of the heater **121** decreases from 260 seconds after the start of heating. The supply of electric power to the heater **121** may be terminated after 260 seconds from the start of heating. Even in this case, a sufficient amount of aerosol is generated for a while by the remaining heat of the heater **121** and the stick substrate **150**. In the example illustrated in FIG. **2**, the puffable period, that is, the heating session, terminates after 270 seconds from the start of heating.

[0064] The user may be notified of the timing at which the puffable period starts and the timing at which the puffable period terminates. Furthermore, the user may be notified of a timing that is a predetermined time before the puffable period terminates (for example, the timing at which supply of electric power to the heater **121** terminates). In this case, the user is able to take a puff in the puffable period with reference to the notification.

(2) Relationship Between Initial Temperature of Heater **121** and Preheating

[0065] Some users may perform chain smoking. Chain smoking is an action of successively using a plurality of stick substrates **150** at short intervals. When chain smoking is performed, heating of the next stick substrate **150** may be started with the heat used for the preceding stick substrate **150** remaining in the heater **121**. In this case, the stick substrate **150** is excessively heated in the preheating period, and inconvenience such as a poor flavor being delivered to the user in the puffable period may occur.

[0066] On the other hand, a temperature rise may be started from an initial temperature lower than usual, for example, when an ambient temperature is low. In this case, it is impossible to sufficiently heat the stick substrate **150** in the preheating period, and inconvenience such as a poor flavor being delivered to the user in the puffable period may occur.

[0067] Accordingly, the inhaler device **100** according to the present embodiment controls the length of the preheating period in accordance with the initial temperature of the heater **121**. With this configuration, it is possible to prevent the occurrence of the above-described inconvenience associated with the excess or deficiency of preheating resulting from a high or low initial temperature.

(3) Control Based on Initial Temperature of Heater **121**

[0068] The controller **116** controls, based on an initial temperature, which is the temperature of the heater **121** at the start of heating, the length of a temperature rise period which is included in the heating profile and during which the temperature of the heater **121** is raised from the initial temperature to a predetermined temperature. The controller **116** performs such control while acquiring the initial temperature at the start of heating and then periodically acquiring the temperature of the heater **121**. The predetermined temperature is a temperature at which a sufficient amount of aerosol is estimated to be generated when the temperature of the stick substrate **150** reaches the temperature. Hereinafter, the predetermined temperature is also referred to as a first target temperature. With this configuration, the length of the temperature rise period is controlled in accordance with the initial temperature, and thus it is possible to prevent the occurrence of inconvenience resulting from a high or low initial temperature.

[0069] The temperature rise period whose length is controlled based on the initial temperature of the heater **121** is a period from the start of heating to when inhalation of an aerosol by the user becomes possible. That is, the temperature rise period is a preheating period. The first target temperature is a target temperature in the preheating period (for example, the initial temperature rise period). Controlling of the length of the preheating period in accordance with the initial temperature makes it is possible to prevent the occurrence of inconvenience associated with the excess or deficiency of preheating resulting from a high or low initial temperature.

[0070] The control of the length of the preheating period will be described with reference to FIG. **3**. FIG. **3** is a graph showing an example of the transition of the temperature of the heater **121** in the preheating period. The horizontal axis of this graph represents time (seconds). The vertical axis of this graph represents the temperature of the heater **121**. The line **31** in this graph indicates the transition of the temperature of the heater **121**.

[0071] As illustrated in FIG. **3**, the preheating period is composed of a time variable period having a variable length and a time fixed period following the time variable period and having a fixed length. The time variable period is an example of a first period in the present embodiment. The time fixed period is an example of a second period in the present embodiment. In the example illustrated in FIG. **3**, the length of the time variable period is 17 seconds. The length of the time fixed period is 18 seconds.

[0072] As illustrated in FIG. **3**, the controller **116** controls the operation of the heater **121** such that the temperature of the heater **121** is raised from the initial temperature to the first target temperature in the time variable period and that the temperature of the heater **121** is maintained at the first target temperature in the time fixed period. In the example illustrated in FIG. **3**, the first target temperature is 310° C. The stick substrate **150** may contain moisture. When the stick substrate **150** containing moisture is heated at a high temperature, an excessively high temperature aerosol may be generated. To prevent an excessively high temperature aerosol from being inhaled by the user, it is desirable to evaporate the moisture contained in the stick substrate **150** in the preheating period. In this regard, according to the present embodiment, a sufficient period during which the temperature of the heater **121** is maintained at a high temperature such as the first target temperature is provided, and thus it is possible to reliably evaporate the moisture contained in the stick substrate **150** in the preheating period.

[0073] The controller **116** controls the length of the preheating period, based on the initial temperature of the heater **121**, and controls the length of the time variable period, based on the initial temperature of the heater **121**. With this configuration, it is possible to prevent the occurrence of inconvenience associated with the excess or deficiency of preheating resulting from a high or low initial temperature, while maintaining the time fixed period for reliably evaporating the moisture contained in the stick substrate **150**.

[0074] Specifically, the controller **116** shortens the time variable period as the initial temperature of the heater **121** increases, and lengthens the time variable period as the initial temperature of the heater **121** decreases. For example, the memory **114** stores the following Table 2 that defines the details of control of the length of the time variable period in the heating profile. The controller **116** determines the length of the time variable period to be a length corresponding to the initial temperature of the heater **121** with reference to Table 2. With this configuration, when the initial temperature is high, the time variable period can be shortened to prevent an excessive rise in temperature. On the other hand, when the initial temperature is low, the time variable period can be lengthened to prevent a temperature rise from being insufficiently performed.

TABLE 2

Details of control of length of time variable period

Initial temperature of heater 121 [° C.]	Length of time variable period [sec]
0-50	17
51-100	14
101-150	11
151-200	8
201-250	5
251-300	2

[0075] FIG. **4** is a graph showing an example of the transition of the temperature of the heater **121** in a case where the control of the length of the time variable period shown in Table 2 is performed. The horizontal axis of this graph represents time (seconds). The vertical axis of this graph represents the temperature of the heater **121**. The line **32** in this graph indicates the transition of the temperature of the heater **121**. In the example shown in this graph, the initial temperature is 160° C., and thus the length of the time variable period is shortened to 8 seconds. Thus, at the end of the time variable period, the temperature of the heater **121** reaches 310° C., which is the first target temperature, and an excessive rise in temperature is prevented.

[0076] The controller **116** may change, based on the temperature of the heater **121** in the time variable period, the length of the time variable period determined based on the initial temperature of the heater **121**. That is, the controller **116** may change in real time, based on the temperature of the heater **121**, the length of the time variable period that has once been determined based on the initial temperature of the heater **121**. The temperature rising speed of the heater **121** may become higher or lower than expected due to an influence of an environment such as temperature and humidity. In this regard, with this configuration, it is possible to more reliably cause the temperature of the heater **121** to reach the first target temperature in the time variable period. Accordingly, it is possible to deliver an appropriate flavor to the user in the puffable period.

[0077] Specifically, the controller **116** may terminate the time variable period and switch to the time fixed period, in response to the temperature of the heater **121** reaching the first target temperature at the end of the time variable period whose length is determined based on the initial temperature of the heater **121**. When the temperature of the heater **121** rises as expected, the temperature of the heater **121** reaches the first target temperature at the end of the time variable period whose length is determined with reference to Table 2. In such a case, it is possible to deliver an appropriate flavor to the user in the puffable period by terminating the time variable period, switching to the time fixed period, and maintaining the temperature of the heater **121** at the first target temperature.

[0078] The controller **116** may extend the time variable period in response to the temperature of the heater **121** not reaching the first target temperature at the end of the time variable period whose length is determined based on the initial temperature of the heater **121**. The temperature rising speed of the heater **121** may become lower than expected due to an influence of an environment such as temperature and humidity. In this regard, with this configuration, it is possible to more reliably cause the temperature of the heater **121** to reach the first target temperature. This point will be described in detail with reference to FIG. **5**.

[0079] FIG. **5** is a graph showing an example of the transition of the temperature of the heater **121** in a case where the control of the length of the time variable period shown in Table 2 is performed. The horizontal axis of this graph represents time (seconds). The vertical axis of this graph represents the temperature of the heater **121**. The line **33** in this graph indicates the transition of the temperature of the heater **121**. In the example shown in this graph, the initial temperature is 0° C., and thus the length of the time variable period is determined to be 17 seconds. However, the temperature of the heater **121** does not reach 310° C., which is the first target temperature, at the end of the time variable period of 17 seconds determined based on the initial temperature of the heater **121**, and thus the time variable period is extended by 10 seconds. As a result, at the end of the extended time variable period, the temperature of the heater **121** reaches 310° C., which is the first target temperature, and an insufficient rise in temperature is prevented.

[0080] Here, the controller **116** may extend the time variable period whose length is determined based on the initial temperature of the heater **121** by a time corresponding to the initial temperature of the heater **121**. For example, the controller **116** may extend the time variable period by a length corresponding to the length of the initial time variable period determined based on the initial temperature of the heater **121**. This is because the difference between the temperature of the heater **121** at the end of the time variable period and the first target temperature is considered to increase as the length of the time variable period increases. With this configuration, it is possible to extend the time variable period to an appropriate length.

[0081] The controller **116** may stop the operation of the heater **121** in response to the temperature of the heater **121** not reaching the first target temperature at the end of the extended time variable period. That is, the controller **116** may stop supply of electric power from the power supply **111** to the heater **121**. When the temperature of the heater **121** at the end of the extended time variable period is below the first target temperature, there is a possibility that some kind of malfunction has occurred in the inhaler device **100**. In this regard, with this configuration, it is possible to improve safety in using the inhaler device **100**.

[0082] The controller **116** may terminate the time variable period and switch to the time fixed period, in response to the temperature of the heater **121** reaching the first target temperature before the end of the time variable period whose length is determined based on the initial temperature of the

heater **121**. The temperature rising speed of the heater **121** may become higher than expected due to an influence of an environment such as temperature and humidity. In this regard, with this configuration, it is possible to more reliably prevent the temperature of the heater **121** from rising above the first target temperature.

(4) Flow of Process

[0083] FIG. **6** is a flowchart illustrating an example of a flow of a process executed by the inhaler device **100** according to the present embodiment.

[0084] As illustrated in FIG. **6**, first, the controller **116** determines whether a puff request has been detected (step S**102**). The puff request is a user operation requesting generation of an aerosol. An example of the puff request is an operation on the inhaler device **100**, such as an operation on a switch or the like provided in the inhaler device **100**. Another example of the puff request is insertion of the stick substrate **150** into the inhaler device **100**. The insertion of the stick substrate **150** into the inhaler device **100** may be detected by a capacitive proximity sensor that detects the capacitance in a space near the opening **142**, a pressure sensor that detects the pressure in the internal space **141**, or the like.

[0085] If it is determined that a puff request has not been detected (NO in step S**102**), the controller **116** waits until a puff request has been detected.

[0086] On the other hand, if it is determined that a puff request has been detected (YES in step S**102**), the controller **116** acquires the initial temperature of the heater **121** (step S**104**). For example, the controller **116** acquires the initial temperature of the heater **121**, based on an electric resistance value obtained when a weak current is applied to the heater **121**, or from a temperature sensor installed near the heater **121**.

[0087] Subsequently, the controller **116** determines, based on the initial temperature of the heater **121**, the length of the preheating period (step S**106**). For example, the controller **116** determines the length of the time variable period in the preheating period with reference to Table 2.

[0088] Subsequently, the controller **116** controls the operation of the heater **121** to perform heating based on the heating profile in which the length of the preheating period has been adjusted (step S**108**). For example, the controller **116** starts supply of electric power from the power supply **111** to the heater **121**, based on the heating profile in which the length of the preheating period is adjusted in step S**106**.

[0089] Subsequently, the controller **116** determines whether a termination condition is satisfied (step S**110**). An example of the termination condition is that the elapsed time from the start of heating has reached a predetermined time. Here, the predetermined time refers to the duration of the entire heating profile in which the length of the preheating period is adjusted in step S**106**. Another example of the termination condition is that the number of puffs from the start of heating has reached a predetermined number.

[0090] If it is determined that the termination condition is not satisfied (NO in step S**110**), the controller **116** waits until the termination condition is satisfied.

[0091] If it is determined that the termination condition is satisfied (YES in step S**110**), the controller **116** terminates the heating based on the heating profile (step S**112**). Specifically, the controller **116** terminates supply of electric power from the power supply **111** to the heater **121**. Thereafter, the process ends.

<3. Modification>

[0092] In the above-described embodiment, an example in which the inhaler device **100** includes one heater **121** has been described, but the present invention is not limited to such an example. The inhaler device **100** may include a plurality of heaters **121**. In this case, the controller **116** performs control such that the time variable periods in a plurality of temperature settings for the plurality of heaters **121** have respective lengths that are different from each other. The plurality of heaters **121** heat different portions of the stick substrate **150**. In this regard, with this configuration, it is possible to increase the temperature of each portion of the stick substrate **150** at an appropriate temperature rising speed. Accordingly, it is possible to deliver a more appropriate flavor to the user.

[0093] The plurality of heaters **121** are disposed at different positions in the direction in which the stick substrate **150** is inserted. For example, the plurality of heaters **121** may be disposed at different positions from an upstream side to a downstream side of the holder **140**. The downstream side refers to a side close to the opening **142**. On the other hand, the upstream side refers to a side close to the bottom **143**. When a puff is taken, an air flow from the upstream side toward the downstream side is generated.

[0094] The controller **116** sequentially raises the temperatures of the heaters **121** from the heater **121** disposed on the downstream side to the heater **121** disposed on the upstream side. In an example, the controller **116** may start heating or raise the temperature to a maximum temperature sequentially from the heater **121** disposed on the downstream side to the heater **121** disposed on the upstream side. With this configuration, the aerosol source is heated sequentially from the downstream side to the upstream side of the substrate **151**, and an aerosol is generated. If an upstream-side portion of the substrate **151** is heated before a downstream-side portion, the aerosol generated on the upstream side may be cooled and condensed when passing through the downstream-side portion. In this case, the downstream-side portion of the substrate **151** that has not been heated is moistened, and the flavor that the user tastes when the downstream-side portion of the substrate **151** is heated may be deteriorated. In this regard, with this configuration, a generated aerosol does not pass through an unheated portion of the substrate **151**. Accordingly, the unheated portion of the substrate **151** is prevented from getting wet, and it is possible to prevent deterioration of the flavor that the user tastes.

[0095] At this time, the controller **116** makes the time variable period in the heating profile for the heater **121** disposed on the upstream side among the plurality of heaters **121** longer than the time variable period in the heating profile for the heater **121** disposed on the downstream side among the plurality of heaters **121**. For example, the controller **116** makes the duty ratio of an electric power pulse applied to the heater **121** disposed on the upstream side smaller than the duty ratio of an electric power pulse applied to the heater **121** disposed on the downstream side in the time variable period. With this configuration, the temperature rising speed of the portion of the stick substrate **150** that is heated by the heater **121** disposed on the upstream side

can be lowered. Thus, it is possible to prevent the aerosol source from being damaged by a rapid temperature change and to prevent deterioration of the flavor that the user tastes. The above-described points will be described in detail with reference to FIG. **7** and FIG. **8**.

[0096] FIG. **7** is a schematic diagram of a configuration example of the inhaler device **100** according to the present modification. As illustrated in FIG. **7**, the inhaler device **100** according to the present modification is different from the example illustrated in FIG. **1** in that the inhaler device **100** includes two heaters **121** (heaters **121**A and **121**B). The heater **121**A is an example of the heater **121** disposed near the opening **142**, that is, disposed on a downstream side. The heater **121**B is an example of the heater **121** disposed near the bottom **143**, that is, disposed on an upstream side. Hereinafter, a description will be given mainly of the differences from the configuration described above with reference to FIG. **1** among the configurations of the structural elements of the inhaler device **100** according to the present modification.

[0097] The controller **116** shortens the time variable period as the initial temperature of the heater **121** increases, and lengthens the time variable period as the initial temperature of the heater **121** decreases. The controller **116** makes the time variable period in the heating profile for the heater **121**B longer than the time variable period in the heating profile for the heater **121**A.

[0098] For example, the memory **114** stores the following Table 3 and Table 4. Table 3 defines the details of control of the length of the time variable period in the heating profile applied to the heater **121**A. Table 4 defines the details of control of the length of the time variable period in the heating profile applied to the heater **121**B. The controller **116** controls the length of the time variable period in preheating using the heater **121**A to the length corresponding to the initial temperature of the heater **121**A, with reference to Table 3. The controller **116** controls the length of the time variable period in preheating using the heater **121**B to the length corresponding to the initial temperature of the heater **121**B, with reference to Table 4. As shown in Table 3 and Table 4, when the initial temperature of the heater **121**A and the initial temperature of the heater **121**B are the same, the time variable period in preheating using the heater **121**B is longer than the time variable period in preheating using the heater **121**A.

TABLE 3

Details of control of length of time variable period in heating profile applied to heater 121A

Initial temperature of heater 121A [° C.]	Length of time variable period [sec]
0-50	17
51-100	14
101-150	11
151-200	8
201-250	5
251-300	2

TABLE 4

Details of control of length of time variable period in heating profile applied to heater 121B

Initial temperature of heater 121B [° C.]	Length of time variable period [sec]
0-50	67
51-100	64
101-150	61
151-200	58
201-250	55
251-300	52

[0099] FIG. **8** is a graph showing an example of the transition of the temperature of the heater **121** in a case where the control of the length of the time variable period shown in Table 3 and Table 4 is performed. The horizontal axis of this graph represents time (seconds). The vertical axis of this graph represents the temperature of the heater **121**. The line **41**A in this graph indicates the transition of the temperature of the heater **121**A. The line **41**B in this graph indicates the transition of the temperature of the heater **121**B. In the example shown in this graph, the initial temperature of the heater **121**A is 0° C., and thus the length of the time variable period in the heating profile applied to the heater **121**A is set to 17 seconds. On the other hand, the initial temperature of the heater **121**B is 0° C., and thus the length of the time variable period in the heating profile applied to the heater **121**B is set to 67 seconds.

[0100] In the example illustrated in FIG. **8**, heating by the heater **121**B is started at the end of the time variable period in the heating profile applied to the heater **121**A, but these timings may be different. In addition, the lengths of the time fixed periods of the heater **121**A and the heater **121**B are the same, but these lengths may be different.

<4. Supplementary Description>

[0101] While a preferred embodiment of the present invention has been described in detail with reference to the accompanying drawings, the present invention is not limited to the foregoing examples. It will be apparent that those skilled in the art to which the present invention belongs are able to conceive of various modifications or variations within the scope of the technical ideas described in the claims, and it is understood that such modifications or variations also belong to the technical scope of the present invention.

[0102] For example, in the above-described embodiment, a description has been given of an example in which the length of the time variable period determined based on the initial temperature of the heater **121** is changed based on the temperature of the heater **121** in the time variable period, but the present invention is not limited to such an example. The controller **116** may control (that is, determine) the length of the preheating period, based on the temperature of the heater **121** in the preheating period in addition to or instead of the initial temperature. More specifically, the controller **116** may control the length of the time variable period, based on the temperature of the heater **121** in the time variable period in addition to or instead of the initial temperature. For example, the controller **116** periodically acquires the temperature of the heater **121** in the time variable period. The controller **116** may terminate the time variable period and switch to the time fixed period, at the timing at which the temperature of

the heater **121** reaches the first target temperature. This configuration makes it is possible to cause the temperature of the heater **121** to reliably reach the first target temperature in the time variable period. Accordingly, it is possible to deliver an appropriate flavor to the user in the puffable period.

[0103] For example, in the above-described embodiment, a description has been given of an example in which the length of the preheating period is controlled based on the initial temperature of the heater **121**, but the present invention is not limited to such an example. For example, the controller **116** may control (that is, determine) the length of the preheating period, based on the elapsed time from the termination of preceding heating based on the heating profile, in addition to or instead of the initial temperature. Specifically, the controller **116** may increase the preheating period as the elapsed time from the termination of preceding heating based on the heating profile increases. This is because it is considered that the initial temperature decreases as the interval of using the stick substrate **150** increases. On the other hand, the controller **116** may decrease the preheating period as the elapsed time from the termination of preceding heating based on the heating profile decreases. This is because it is considered that the initial temperature increases as the interval of using the stick substrate **150** decreases. With this configuration, it is possible to prevent the occurrence of inconvenience associated with the excess or deficiency of preheating resulting from a high or low initial temperature.

[0104] A series of processes performed by the individual devices described in this specification may be implemented by using any of software, hardware, and a combination of software and hardware. Programs constituting the software are stored in advance in, for example, a recording medium (specifically, a non-transitory computer-readable storage medium) provided inside or outside each device. Each program is read into a RAM and is executed by a processor such as a CPU when being executed by a computer that controls each device described in this specification, for example. The recording medium is, for example, a magnetic disk, an optical disc, a magneto-optical disc, a flash memory, or the like. In addition, the foregoing computer programs may be distributed via a network, for example, without using a recording medium.

[0105] In addition, the process described using a flowchart and a sequence diagram in this specification need not necessarily be executed in the illustrated order. Some processing steps may be executed in parallel. In addition, an additional processing step may be employed, and some processing steps may be omitted.

[0106] The following configurations also belong to the technical scope of the present invention.

(1)

[0107] An inhaler device including:

[0108] a heater configured to heat a substrate including an aerosol source to generate an aerosol; and

[0109] a controller configured to control, based on a temperature setting defining a time-series transition of a target temperature, the target temperature being a target value of a temperature of the heater, an operation of the heater, wherein

[0110] the temperature setting includes a temperature rise period during which the temperature of the heater is raised from an initial temperature to a predetermined temperature, the initial temperature being the temperature of the heater at start of heating, and

[0111] the controller is configured to control, based on the initial temperature, a length of the temperature rise period.

(2)

[0112] The inhaler device according to (1) above, wherein

[0113] the temperature rise period is composed of a first period having a length that is variable and a second period following the first period and having a length that is fixed, and

[0114] the controller is configured to control, based on the initial temperature, the length of the first period.

(3)

[0115] The inhaler device according to (2) above, wherein

[0116] the controller is configured to shorten the first period as the initial temperature increases and lengthen the first period as the initial temperature decreases.

(4)

[0117] The inhaler device according to (2) or (3) above, wherein

[0118] the controller is configured to change, based on the temperature of the heater in the first period, the length of the first period determined based on the initial temperature.

(5)

[0119] The inhaler device according to (4) above, wherein

[0120] the controller is configured to terminate the first period and switch to the second period, in response to the temperature of the heater reaching the predetermined temperature at an end of the first period whose length is determined based on the initial temperature.

(6)

[0121] The inhaler device according to (4) or (5) above, wherein

[0122] the controller is configured to extend the first period in response to the temperature of the heater not reaching the predetermined temperature at an end of the first period whose length is determined based on the initial temperature.

(7)

[0123] The inhaler device according to (6) above, wherein

[0124] the controller is configured to extend, by a time corresponding to the initial temperature, the first period whose length is determined based on the initial temperature.

(8)

[0125] The inhaler device according to (6) or (7) above, wherein

[0126] the controller is configured to stop the operation of the heater in response to the temperature of the heater not reaching the predetermined temperature at an end of the extended first period.

(9)

[0127] The inhaler device according to any one of (4) to (8) above, wherein

[0128] the controller is configured to terminate the first period and switch to the second period, in response to the temperature of the heater reaching the predetermined temperature before an end of the first period whose length is determined based on the initial temperature.

(10)

[0129] The inhaler device according to any one of (2) to (9) above, wherein

[0130] the inhaler device includes a plurality of the heaters, and

[0131] the controller is configured to perform control such that first periods in a plurality of the temperature settings for the plurality of heaters have respective lengths that are different from each other.

(11)

[0132] The inhaler device according to (10) above, wherein

[0133] the controller is configured to make the first period in the temperature setting for the heater disposed on an upstream side among the plurality of heaters longer than the first period in the temperature setting for the heater disposed on a downstream side among the plurality of heaters.

(12)

[0134] The inhaler device according to any one of (2) to (11) above, wherein

[0135] the controller is configured to control the operation of the heater such that the temperature of the heater is raised from the initial temperature to the predetermined temperature in the first period and that the temperature of the heater is maintained at the predetermined temperature in the second period.

(13)

[0136] The inhaler device according to any one of (1) to (12) above, wherein

[0137] the temperature rise period is a period from the start of heating to when inhalation of the aerosol by a user becomes possible.

(14)

[0138] The inhaler device according to any one of (1) to (13) above, wherein

[0139] the controller is configured to control, based on the temperature of the heater in the temperature rise period, the length of the temperature rise period.

(15)

[0140] The inhaler device according to any one of (1) to (14) above, wherein

[0141] the controller is configured to control, based on an elapsed time from termination of preceding heating that is based on the temperature setting, the length of the temperature rise period.

(16)

[0142] A substrate that includes an aerosol source and that is to be heated by an inhaler device to generate an aerosol, the inhaler device including:

[0143] a heater configured to heat the substrate including the aerosol source to generate the aerosol; and

[0144] a controller configured to control, based on a temperature setting defining a time-series transition of a target temperature, the target temperature being a target value of a temperature of the heater, an operation of the heater, wherein

[0145] the temperature setting includes a temperature rise period during which the temperature of the heater is raised from an initial temperature to a predetermined temperature, the initial temperature being the temperature of the heater at start of heating, and

[0146] the controller is configured to control, based on the initial temperature, a length of the temperature rise period.

(17)

[0147] A control method for controlling an inhaler device including a heater configured to heat a substrate including an aerosol source to generate an aerosol, the control method including:

[0148] controlling, based on a temperature setting defining a time-series transition of a target temperature, the target temperature being a target value of a temperature of the heater, an operation of the heater, wherein

[0149] the temperature setting includes a temperature rise period during which the temperature of the heater is raised from an initial temperature to a predetermined temperature, the initial temperature being the temperature of the heater at start of heating, and

[0150] the controlling of the operation of the heater includes controlling, based on the initial temperature, a length of the temperature rise period.

Reference Signs List

100	inhaler device
111	power supply
112	sensor
113	notifier
114	memory
115	communicator
116	controller
121	heater
140	holder
141	internal space
142	opening
143	bottom
150	stick substrate
151	substrate
152	inhalation port

1. An inhaler device comprising:

a heater configured to heat a substrate including an aerosol source to generate an aerosol; and

a controller configured to control, based on a temperature setting defining a time-series transition of a target temperature, the target temperature being a target value of a temperature of the heater, an operation of the heater, wherein

the temperature setting includes a temperature rise period during which the temperature of the heater is raised from an initial temperature to a predetermined temperature, the initial temperature being the temperature of the heater at start of heating, and

the controller is configured to control, based on the initial temperature, a length of the temperature rise period.

2. The inhaler device according to claim **1**, wherein

the temperature rise period is composed of a first period having a length that is variable and a second period following the first period and having a length that is fixed, and

the controller is configured to control, based on the initial temperature, the length of the first period.

3. The inhaler device according to claim **2**, wherein

the controller is configured to shorten the first period as the initial temperature increases and lengthen the first period as the initial temperature decreases.

4. The inhaler device according to claim 2, wherein
the controller is configured to change, based on the temperature of the heater in the first period, the length of the first period determined based on the initial temperature.

5. The inhaler device according to claim 4, wherein
the controller is configured to terminate the first period and switch to the second period, in response to the temperature of the heater reaching the predetermined temperature at an end of the first period whose length is determined based on the initial temperature.

6. The inhaler device according to claim 4, wherein
the controller is configured to extend the first period in response to the temperature of the heater not reaching the predetermined temperature at an end of the first period whose length is determined based on the initial temperature.

7. The inhaler device according to claim 6, wherein
the controller is configured to extend, by a time corresponding to the initial temperature, the first period whose length is determined based on the initial temperature.

8. The inhaler device according to claim 6, wherein
the controller is configured to stop the operation of the heater in response to the temperature of the heater not reaching the predetermined temperature at an end of the extended first period.

9. The inhaler device according to claim 4, wherein
the controller is configured to terminate the first period and switch to the second period, in response to the temperature of the heater reaching the predetermined temperature before an end of the first period whose length is determined based on the initial temperature.

10. The inhaler device according to claim 2, wherein
the inhaler device comprises a plurality of the heaters, and
the controller is configured to perform control such that first periods in a plurality of the temperature settings for the plurality of heaters have respective lengths that are different from each other.

11. The inhaler device according to claim 10, wherein
the controller is configured to make the first period in the temperature setting for the heater disposed on an upstream side among the plurality of heaters longer than the first period in the temperature setting for the heater disposed on a downstream side among the plurality of heaters.

12. The inhaler device according to claim 2, wherein
the controller is configured to control the operation of the heater such that the temperature of the heater is raised from the initial temperature to the predetermined temperature in the first period and that the temperature of the heater is maintained at the predetermined temperature in the second period.

13. The inhaler device according to claim 1, wherein
the temperature rise period is a period from the start of heating to when inhalation of the aerosol by a user becomes possible.

14. The inhaler device according to claim 1, wherein
the controller is configured to control, based on the temperature of the heater in the temperature rise period, the length of the temperature rise period.

15. The inhaler device according to claim 1, wherein
the controller is configured to control, based on an elapsed time from termination of preceding heating that is based on the temperature setting, the length of the temperature rise period.

16. A substrate that includes an aerosol source and that is to be heated by an inhaler device to generate an aerosol, the inhaler device comprising:
a heater configured to heat the substrate including the aerosol source to generate the aerosol; and
a controller configured to control, based on a temperature setting defining a time-series transition of a target temperature, the target temperature being a target value of a temperature of the heater, an operation of the heater, wherein
the temperature setting includes a temperature rise period during which the temperature of the heater is raised from an initial temperature to a predetermined temperature, the initial temperature being the temperature of the heater at start of heating, and
the controller is configured to control, based on the initial temperature, a length of the temperature rise period.

17. A control method for controlling an inhaler device including a heater configured to heat a substrate including an aerosol source to generate an aerosol, the control method comprising:
controlling, based on a temperature setting defining a time-series transition of a target temperature, the target temperature being a target value of a temperature of the heater, an operation of the heater, wherein
the temperature setting includes a temperature rise period during which the temperature of the heater is raised from an initial temperature to a predetermined temperature, the initial temperature being the temperature of the heater at start of heating, and
the controlling of the operation of the heater includes controlling, based on the initial temperature, a length of the temperature rise period.

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