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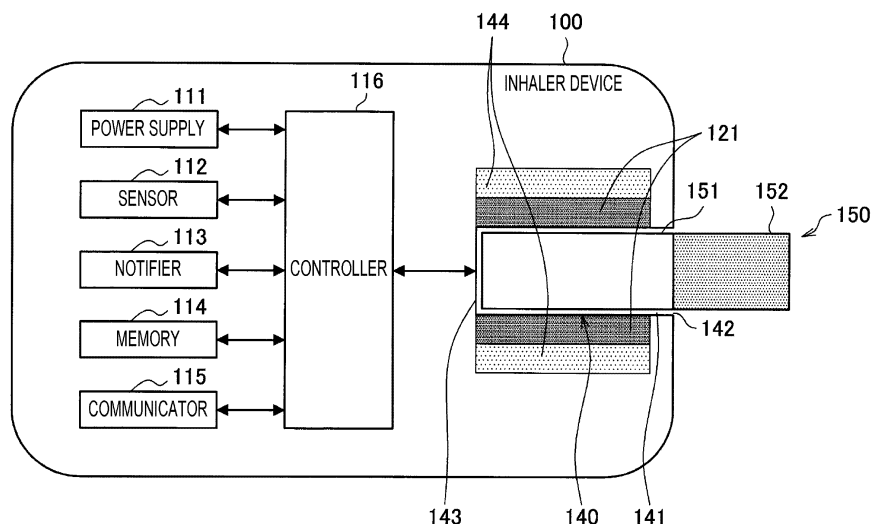
(54) **CONTROL DEVICE, CONTROL METHOD, AND PROGRAM**

(57) [Problem] To provide a mechanism with which it is possible to improve usability of an inhaler.

[Solution] A control device for controlling an inhaler having a detection unit for detecting a user operation and a heating unit which generates, by heating a base material, a substance that is inhaled by a user, the control device comprising a control unit for controlling the heating unit on the basis of the user operation detected by the

detection unit, wherein: the control unit causes the heating unit to operate in a first heating state if the detection unit detects a first user operation and causes the heating unit to operate in a second heating state that is different from the first heating state if the detection unit detects a second user operation different from the first user operation while the heating unit is operating in the first heating state.

FIG. 1



Description

Technical Field

[0001] The present invention relates to a control device, a control method, and a program.

Background Art

[0002] Inhaler devices, such as electronic cigarettes and nebulizers, generating material to be inhaled by users are in widespread use. For example, an inhaler device uses an aerosol source for generating an aerosol and a substrate including a flavor source for imparting a flavor component to the generated aerosol to generate the aerosol to which the flavor component is imparted. When a user inhales the aerosol, generated by the inhaler device, to which the flavor component is imparted, the user can enjoy the flavor.

[0003] Various techniques related to inhaler devices have been developed in recent years. For example, Patent Literature 1 listed below discloses an inhaler device that first activates a heater in response to detection of a user operation and activates a delivery device with a delay of a few seconds.

Citation List

Patent Literature

[0004] Patent Literature 1: JP2019-513354A

Summary of Invention

Technical Problem

[0005] With the technique described in Patent Literature 1 listed above, a plurality of processes are performed step by step in response to a single user operation. However, for example, it is difficult to interrupt a process while the plurality of processes are being performed, and there is room for improvement in usability.

[0006] Accordingly, the present invention has been made in view of the above-described issue, and an object of the present invention is to provide a system for attaining further improvement in usability of an inhaler device.

Solution to Problem

[0007] In order to solve the above-described issue, according to an aspect of the present invention, there is provided a control device for controlling an inhaler device including a detector that detects a user operation and a heater that heats a substrate to thereby generate material to be inhaled by a user, the control device including a controller that controls the heater on the basis of the user operation detected by the detector, in which the controller causes the heater to operate in a first heating state in

response to the detector detecting a first user operation, and causes the heater to operate in a second heating state different from the first heating state in response to the detector detecting a second user operation different from the first user operation while causing the heater to operate in the first heating state.

[0008] The first heating state may be a state where an upper limit of a temperature of the heater is lower than an upper limit of the temperature of the heater in the second heating state.

[0009] An amount of the material that is to be inhaled by the user and that is generated in response to the heater heating the substrate at the upper limit of the temperature of the heater in the first heating state may be smaller than an amount of the material that is to be inhaled by the user and that is generated in response to the heater heating the substrate at the upper limit of the temperature of the heater in the second heating state.

[0010] A rate of rise in a temperature of the heater in the first heating state and a rate of rise in the temperature of the heater in the second heating state may be equal to each other.

[0011] The first heating state may be a state where a rate of rise in a temperature of the heater is lower than a rate of rise in the temperature of the heater in the second heating state.

[0012] Performing the first user operation may be performing a predetermined user operation continuously for a first duration, and performing the second user operation may be performing the predetermined user operation continuously for a second duration longer than the first duration.

[0013] The first heating state may be a state where heating is performed when the predetermined user operation is continuously performed.

[0014] When the predetermined user operation is not detected any more after a duration in which the predetermined user operation is continuously performed reaches the first duration and before the duration reaches the second duration, the controller may stop heating by the heater that is operating in the first heating state.

[0015] The second heating state may be a state where heating is performed without the predetermined user operation being continuously performed.

[0016] The controller may stop heating by the heater when a duration in which the predetermined user operation is continuously performed reaches a third duration longer than the second duration.

[0017] When the number of times the predetermined user operation is detected reaches a predetermined number of times within a fourth time period, the controller may control the heater so as not to perform heating until a fifth time period elapses.

[0018] The inhaler device may further include a notifier that provides information to the user, and the controller may control the notifier to provide first information before a duration in which the predetermined user operation is continuously performed reaches the first duration.

[0019] The inhaler device may further include a notifier that provides information to the user, and the controller may control the notifier to provide second information in response to detection of the second user operation.

[0020] Performing the first user operation may be performing a predetermined user operation, and performing the second user operation may be performing the predetermined user operation continuously for a second duration.

[0021] In order to solve the above-described issue, according to another aspect of the present invention, there is provided a control method for controlling an inhaler device including a detector that detects a user operation and a heater that heats a substrate to thereby generate material to be inhaled by a user, the control method including controlling the heater on the basis of the user operation detected by the detector, in which the controlling of the heater includes causing the heater to operate in a first heating state in response to the detector detecting a first user operation, and causing the heater to operate in a second heating state different from the first heating state in response to the detector detecting a second user operation different from the first user operation while causing the heater to operate in the first heating state.

[0022] In order to solve the above-described issue, according to another aspect of the present invention, there is provided a program for causing a computer, the computer controlling an inhaler device including a detector that detects a user operation and a heater that heats a substrate to thereby generate material to be inhaled by a user, to function as a controller that controls the heater on the basis of the user operation detected by the detector, in which the controller causes the heater to operate in a first heating state in response to the detector detecting a first user operation, and causes the heater to operate in a second heating state different from the first heating state in response to the detector detecting a second user operation different from the first user operation while causing the heater to operate in the first heating state.

Advantageous Effects of Invention

[0023] As described above, according to the present invention, a system for attaining further improvement in usability of an inhaler device is provided.

Brief Description of Drawings

[0024]

[Fig. 1] Fig. 1 is a schematic diagram of a configuration example of an inhaler device according to a first embodiment.

[Fig. 2] Fig. 2 is a graph of an example of a typical heating profile.

[Fig. 3] Fig. 3 is a graph of example changes in the

temperature of a heater according to the present embodiment.

[Fig. 4] Fig. 4 is a graph of example changes in the temperature of the heater according to the present embodiment.

[Fig. 5] Fig. 5 is a diagram for explaining the effect of shortening the wait time of a user attained by the inhaler device according to the present embodiment.

[Fig. 6] Fig. 6 is a flowchart of an example of the flow of a process performed by the inhaler device according to the present embodiment.

[Fig. 7] Fig. 7 is a block diagram of a configuration example of an inhaler system according to a second embodiment.

[Fig. 8] Fig. 8 is a flowchart of an example of the flow of a process performed by a control device according to the present embodiment.

Description of Embodiments

[0025] Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the attached drawings. Note that in the specification and drawings, structural elements having substantially the same functional configurations are assigned the same reference signs to thereby omit a duplicated description.

1. First embodiment

1.1. Configuration example of inhaler device

[0026] 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.

[0027] Fig. 1 is a schematic diagram of a configuration example of an inhaler device according to a first embodiment. 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.

[0028] 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.

[0029] 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.

[0030] 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.

[0031] 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.

[0032] 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).

[0033] 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.

[0034] 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 can also define a flow path of air to be supplied to the stick substrate 150. For example, the bottom 143 has an air inlet hole that is an inlet of air into the flow path. The opening 142 serves as an air outlet hole that is an outlet of the air from the flow path.

[0035] The stick substrate 150 includes a substrate 151 and an inhalation port 152. The substrate 151 includes an aerosol source. The aerosol source according to the present configuration example is not limited to a liquid. The aerosol source 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.

[0036] 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 receiving 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.

[0037] 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.

[0038] 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.

[0039] 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-type substrate 150 and heats the substrate 151 of the stick-type 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.

[0040] 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 sandwich 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.

[0041] 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.

- Supplementary description

[0042] The controller 116 according to the present embodiment is an example of the control device. The controller 116 may be included in the inhaler device 100 as illustrated in Fig. 1 or may be provided outside the inhaler device 100.

[0043] The sensor 112 according to the present embodiment is an example of a detector that detects a user operation. An operation unit may be configured as, for example, a button, a touch sensor, a toggle switch, or a rotary switch. It is hereinafter assumed that the operation unit is, for example, a button. This button is hereinafter also referred to as a power button. The sensor 112 de-

tests pressing and releasing of the power button. Pressing the power button is an example of a user operation for giving an instruction for starting or stopping heating by the heater 121. Releasing the power button is stopping pressing of the power button.

[0044] The controller 116 controls the heater 121 on the basis of a user operation detected by the sensor 112. Controlling the heater 121 is controlling power supply from the power supply 111 to the heater 121. Specifically, the controller 116 causes the power supply 111 to supply electric power to the heater 121 to thereby cause the heater 121 to perform heating. The controller 116 causes the power supply 111 to stop supplying electric power to the heater 121 to thereby stop heating by the heater 121. The controller 116 controls the amount of power supply from the power supply 111 to the heater 121 to thereby control the rate of rise in the temperature of the heater 121.

1.2. Technical features

(1) Typical heating profile

[0045] Fig. 2 is a graph of an example of a typical heating profile. The horizontal axis of a graph 10 represents the elapsed time since the start of heating by the heater 121. The vertical axis of the graph 10 represents the temperature of the heater 121. The heating profile is information that defines changes in the temperature of the heater 121. The inhaler device 100 changes the temperature of the heater 121 in accordance with the heating profile shown by the graph 10. As shown by the graph 10, the heating profile is segmented into three periods, namely, period T11, period T12, and period T13.

[0046] Period T11 is a period until the stick substrate 150 becomes ready for inhalation. Period T11 is also referred to as a first not-ready-to-inhale period. During the first not-ready-to-inhale period, the inhaler device 100 increases the temperature of the heater 121 to a predetermined temperature. The predetermined temperature is hereinafter also referred to as a target temperature. The target temperature is set to a temperature such that when the stick substrate 150 is heated at the target temperature, a sufficient aerosol is expected to be generated. For example, when the heater 121 heats the stick substrate 150 at the target temperature, a large amount of aerosol sufficient for the user to inhale is generated. The target temperature is a temperature higher than the lower limit of a temperature at which an aerosol is generated. That is, an aerosol may be generated even when the temperature of the heater 121 does not reach the target temperature. When the temperature of the heater 121 is increased to the target temperature, the temperature of the substrate 151 of the stick substrate 150 can be increased to the target temperature, and a sufficient aerosol can be generated.

[0047] Period T12 is a period in which the stick substrate 150 is ready for inhalation. When the user inhales

with the stick substrate 150 in their mouth during period T12, the user can inhale an aerosol. Period T12 is also referred to as a ready-to-inhale period. In the ready-to-inhale period, the inhaler device 100 changes the temperature of the heater 121 in accordance with the heating profile. As shown by the graph 10, the inhaler device 100 may perform control to decrease the temperature of the heater 121 after the temperature once reaches the target temperature. When the temperature of the heater 121 is controlled so as not to be kept at a high temperature, it is possible to prevent an aerosol from being excessively generated in a short time. As a result, the lifetime of the stick substrate 150 can be extended. The lifetime of the stick substrate 150 is a period until the aerosol source included in the stick substrate 150 runs out.

[0048] Period T13 is a period after the stick substrate 150 is used. During period T13, the temperature of the heater 121 gradually decreases, and it becomes gradually difficult to inhale an aerosol. Period T13 is also referred to as a second not-ready-to-inhale period. The start of period T13 is the timing when the stick substrate 150 ends its lifetime. In an example, the start of period T13 may be the timing when the elapsed time since the start of heating by the heater 121 reaches a predetermined period. In another example, the start of period T13 may be the timing when the number of times the user inhales reaches a predetermined number of times.

(2) Introduction of simplified heating

[0049] In response to the sensor 112 detecting a first user operation, the inhaler device 100 causes the heater 121 to operate in a first heating state. In response to the sensor 112 detecting a second user operation while the inhaler device 100 is causing the heater 121 to operate in the first heating state, the inhaler device 100 causes the heater 121 to operate in a second heating state. The second user operation is a user operation different from the first user operation. The second heating state is a heating state different from the first heating state. Causing the heater 121 to operate in the first heating state is hereinafter also referred to as simplified heating. Causing the heater 121 to operate in the second heating state is hereinafter also referred to as full heating. The first heating state is hereinafter also referred to as a simplified heating state. The second heating state is hereinafter also referred to as a full heating state.

[0050] With the above-described configuration, the inhaler device 100 performs simplified heating in response to detection of the first user operation and performs full heating in response to subsequent detection of the second user operation. That is, even after performing simplified heating in response to detection of the first user operation, the inhaler device 100 does not perform full heating unless the second user operation is detected. Therefore, even when the user performs the first user operation and simplified heating is performed, the user can interrupt heating by not performing the second user

operation. Accordingly, usability can be improved.

- First user operation and second user operation

[0051] Performing the first user operation may be performing a predetermined user operation continuously for a first duration. Performing the second user operation may be performing the predetermined user operation continuously for a second duration longer than the first duration. The start of the first duration is the same as the start of the second duration. With such a configuration, when the user continuously performs the same user operation, simplified heating can be performed, and subsequently, full heating can be performed. The first operation and the second operation form a seamless operation, and therefore, an operation to be performed by the user can be made less complicated than in a case where the first operation and the second operation do not form a seamless operation. Simplified heating is not performed until the predetermined user operation continues for the first duration, and therefore, taking into consideration the possibility that, for example, the predetermined user operation is instantaneously performed unintentionally, safety can be improved.

[0052] The predetermined user operation performed as the first user operation and as the second user operation may be, for example, pressing of the power button. In this case, when the user presses and holds down the power button for the first duration, simplified heating can be performed. When the user presses and holds down the power button for the second duration, full heating can be performed. A description will be given below under the assumption that the predetermined user operation is pressing of the power button.

- Details of simplified heating state and full heating state

[0053] The simplified heating state is a state where the upper limit of the temperature of the heater 121 is lower than that in the full heating state. An aerosol is generated in response to the stick substrate 150 being heated. Typically, as the heating temperature increases, the amount of generated aerosol increases, and consumption of the aerosol source increases accordingly. In this regard, with the present configuration, the upper limit of the temperature of the heater 121 in the simplified heating state is lower than that in the full heating state, and consumption of the aerosol source decreases accordingly. Therefore, when simplified heating is performed and heating is interrupted, a larger amount of the aerosol source can be left unconsumed in the stick substrate 150 than in a case where full heating is also performed. Accordingly, it is anticipated that the stick substrate 150 is reusable.

[0054] The amount of aerosol generated when the heater 121 heats the stick substrate 150 at the upper limit of the temperature of the heater 121 in the simplified heating state is smaller than the amount of aerosol generated when the heater 121 heats the stick substrate 150 at the

upper limit of the temperature of the heater 121 in the full heating state. For example, when the heater 121 heats the stick substrate 150 at the upper limit of the temperature of the heater 121 in the simplified heating state, a very small amount of aerosol that is not sufficient for the user to inhale is generated. On the other hand, when the heater 121 heats the stick substrate 150 at the upper limit of the temperature of the heater 121 in the full heating state, a large amount of aerosol sufficient for the user to inhale is generated. The upper limit of the temperature of the heater 121 in the full heating state may be equal to the target temperature in period T11 described with reference to Fig. 2. With the present configuration, an aerosol is less likely to be generated in the simplified heating state than in the full heating state. Therefore, when simplified heating is performed and heating is interrupted, the stick substrate 150 can be left in a state closer to an unused state than in a case where heating is interrupted after full heating is started. Accordingly, the stick substrate 150 is reusable.

[0055] Note that the upper limit of the temperature of the heater 121 may be regarded as the target value of the temperature of the heater 121. That is, in the simplified heating state, the inhaler device 100 may control the heater 121 such that the temperature of the heater 121 reaches the upper limit of the temperature of the heater 121 in the simplified heating state. Similarly, in the full heating state, the inhaler device 100 may control the heater 121 such that the temperature of the heater 121 reaches the upper limit of the temperature of the heater 121 in the full heating state. As a matter of course, the inhaler device 100 may perform control to decrease the temperature of the heater 121 after the temperature once reaches the upper limit as described above with reference to Fig. 2.

[0056] A description of example changes in the temperature of the heater 121 in the simplified heating state and in the full heating state will be given below with reference to Fig. 3 and Fig. 4.

[0057] Fig. 3 is a graph of example changes in the temperature of the heater 121 according to the present embodiment. The horizontal axis of a graph 20A represents the elapsed time since the start of holding down of the power button. The vertical axis of the graph 20A represents the temperature of the heater 121. In this example, the first duration is a duration of one second. The second duration is a duration of three seconds. Therefore, during period T21 from when the elapsed time since the start of holding down of the power button reaches one second to when the elapsed time reaches three seconds, the inhaler device 100 performs simplified heating. During period T22 after the elapse of three seconds since the start of holding down of the power button, the inhaler device 100 performs full heating. In this example, the upper limit of the temperature of the heater 121 in the simplified heating state is 60°C. The upper limit of the temperature of the heater 121 in the full heating state is 240°C. Therefore, during period T21, the inhaler device

100 performs control such that the temperature of the heater 121 does not exceed 60°C. During period T22, the inhaler device 100 performs control such that the temperature of the heater 121 reaches 240°C. Note that in the graph 20A, the temperature of the heater 121 rises at a constant rate of rise over period T21 and period T22.

[0058] Fig. 4 is a graph of example changes in the temperature of the heater 121 according to the present embodiment. The horizontal axis, period T21, period T22, the vertical axis, 60°C, and 240°C in a graph 20B have meanings the same as those in the graph 20A illustrated in Fig. 3. During period T21, the inhaler device 100 performs control such that the temperature of the heater 121 does not exceed 60°C. During period T22, the inhaler device 100 performs control such that the temperature of the heater 121 reaches 240°C. Note that in the graph 20B, during period T21, the temperature of the heater 121 is kept at 60°C after the temperature once reaches 60°C, and the temperature rises again in the subsequent period T22.

[0059] From another point of view, the simplified heating state may be a state where the rate of rise in the temperature of the heater 121 is lower than that in the full heating state. For example, the inhaler device 100 may control a rise in the temperature of the heater 121 by PWM (Pulse Width Modulation). In this case, the inhaler device 100 may make the duty ratio in the simplified heating state lower than the duty ratio in the full heating state. With the present configuration, a rapid rise in the temperature in the simplified heating state can be prevented, and the effect of simplified heating on the stick substrate 150 can be reduced. Therefore, the stick substrate 150 is reusable in a state close to an unused state. The graph 20B illustrated in Fig. 4 shows an example case where the rate of rise in the temperature of the heater 121 in the simplified heating state is lower than the rate of rise in the temperature of the heater 121 in the full heating state.

[0060] As a matter of course, the rate of rise in the temperature of the heater 121 in the simplified heating state and the rate of rise in the temperature of the heater 121 in the full heating state may be equal to each other. For example, the inhaler device 100 may make the duty ratio in the simplified heating state and the duty ratio in the full heating state be equal to each other. With the present configuration, the rate of rise in temperature can be made constant. The graph 20A illustrated in Fig. 3 shows an example case where the rate of rise in the temperature of the heater 121 in the simplified heating state and the rate of rise in the temperature of the heater 121 in the full heating state are equal to each other.

[0061] From still another point of view, the simplified heating state may be a state where heating is performed when the power button is continuously pressed. With the present configuration, continuation of pressing of the power button corresponds to continuation of simplified heating, and therefore, the user can perform an intuitive operation.

[0062] When pressing of the power button is not detected any more after the duration in which the power button is continuously pressed reaches the first duration and before the duration reaches the second duration, the inhaler device 100 stops heating by the heater 121 that is operating in the simplified heating state. That is, the inhaler device 100 performs simplified heating when the duration in which the user is holding down the power button reaches the first duration, and stops simplified heating when the user stops pressing the power button before the duration reaches the second duration. As a matter of course, the inhaler device 100 does not perform full heating. With the present configuration, the user can interrupt simplified heating and cancel a transition to full heating by performing a simple operation of stopping pressing of the power button. Therefore, heating based on an erroneous operation can be prevented, and safety can be improved.

[0063] The full heating state may be a state where heating is performed without the power button being continuously pressed. With the present configuration, the user may stop pressing the power button after the user continuously presses the power button for the second duration, and therefore, an operation to be performed by the user can be made less complicated.

(3) Effect of shortening wait time of user

[0064] In recent years, some inhaler devices have had a function of not supplying electric power to the heater unless the power button is pressed for a predetermined duration or the power button is pressed a predetermined number of times. With this function, electric power is not supplied to the heater in response to simple pressing of the power button, and therefore, for example, it is possible to prevent a situation where the inhaler devices accidentally operate in response to, for example, a child's mischief and an unexpected event occurs, and safety can be improved. Meanwhile, the period from when the user presses the power button to when electric power is supplied to the heater becomes long due to the function. As a result, the wait time from when the user presses the power button to when the ready-to-inhale period starts becomes long, and usability is low accordingly.

[0065] In this regard, the inhaler device 100 according to the present embodiment can reduce a decrease in usability while improving safety by performing simplified heating. This will be described in detail with reference to Fig. 5. Fig. 5 illustrates, as a comparative example, an inhaler device that does not perform simplified heating but performs full heating when the duration in which the power button is continuously pressed reaches the second duration.

[0066] Fig. 5 is a diagram for explaining the effect of shortening the wait time of a user attained by the inhaler device 100 according to the present embodiment. The horizontal axis of a graph 30 represents the elapsed time since pressing of the power button. In this example, the

first duration is a duration of one second. The second duration is a duration of three seconds. It is assumed that both the inhaler device 100 according to the present embodiment and the inhaler device according to the comparative example perform heating in accordance with the heating profile illustrated in Fig. 2. In the heating profile illustrated in Fig. 2, it is assumed that the length of the first not-ready-to-inhale period T11 is 15 seconds.

[0067] A graph 31, which is an upper graph, shows example time-series changes in the heating state of the inhaler device according to the comparative example. As shown by the graph 31, the inhaler device according to the comparative example does not supply electric power to the heater until the elapsed time since the start of holding down of the power button reaches three seconds. After the elapse of three seconds, the inhaler device according to the comparative example supplies electric power to the heater and performs full heating. The time from when heating is started to when the temperature reaches the target temperature is 15 seconds, and therefore, the wait time from when the user starts holding down the power button to when the ready-to-inhale period starts is 18 seconds (3 seconds + 15 seconds).

[0068] A graph 32, which is a lower graph, shows example time-series changes in the heating state of the inhaler device 100 according to the present embodiment. As shown by the graph 32, the inhaler device 100 does not supply electric power to the heater until the elapsed time since the start of holding down of the power button reaches one second. After the elapse of one second, the inhaler device 100 supplies electric power to the heater and performs simplified heating. Subsequently, the inhaler device 100 performs full heating after the elapse of three seconds. The time from when heating is started to when the temperature reaches the target temperature is 15 seconds, and therefore, the wait time from when the user starts holding down the power button to when the ready-to-inhale period starts is 16 seconds (1 second + 15 seconds).

[0069] When the graph 31 and the graph 32 are compared with each other, the wait time in the inhaler device 100 according to the present embodiment is shorter than the wait time in the inhaler device according to the comparative example by two seconds. Two seconds by which the wait time is shortened corresponds to two seconds for which simplified heating is performed in the inhaler device 100. Accordingly, the inhaler device 100 according to the present embodiment performs simplified heating to thereby shorten the wait time from when the user starts holding down the power button to when the ready-to-inhale period starts, and a decrease in usability can be reduced. The inhaler device 100 according to the present embodiment does not perform full heating unless the duration in which the power button is held down reaches the second duration. Therefore, safety of a level the same as that in the comparative example can be maintained.

(4) Configuration for further improvement in safety

[0070] When the duration in which the power button is continuously pressed reaches a third duration longer than the second duration, the inhaler device 100 may stop heating by the heater 121. The start of the third duration is the same as the start of the first duration and that of the second duration. That is, the inhaler device 100 performs simplified heating when the duration in which the user continuously presses the power button reaches the first duration, performs full heating when the duration reaches the second duration, and stops full heating when the duration reaches the third duration. Taking into consideration the possibility that, for example, the power button is pressed by another item in a bag and is unintentionally held down, safety can be improved with the present configuration. For example, accidental heating by the heater 121 can be prevented.

[0071] When the number of times pressing of the power button is detected reaches a predetermined number of times within a fourth time period, the inhaler device 100 may control the heater 121 so as not to perform heating until a fifth time period elapses. For example, when the number of times the power button is pressed for less than three seconds reaches three within 30 seconds (which corresponds to the fourth time period), the inhaler device 100 does not perform heating during the subsequent period of three minutes (which corresponds to the fifth time period) even when the power button is pressed. Taking into consideration the possibility that, for example, the power button is repeatedly pressed by another item in a bag or a child repeatedly presses the power button out of mischief, and the power button is unintentionally pressed, safety can be improved with the present configuration.

(5) Notification to user

[0072] In the inhaler device 100, before the duration in which the power button is continuously pressed reaches the first duration, the notifier 113 provides first information. For example, at the timing when holding down of the power button starts, the notifier 113 provides as the first information, information indicating that the power button is pressed, by, for example, vibration, sound, or light. With the present configuration, the inhaler device 100 can make the user recognize that an instruction for starting power supply to the heater 121 is about to be input, thereby calling the user's attention.

[0073] In the inhaler device 100, in response to detection of the second user operation, the notifier 113 provides second information. It is desirable that the second information be information different from the first information. For example, the notifier 113 provides as the second information, information indicating that full heating is started, by, for example, vibration, sound, or light. With the present configuration, the inhaler device 100 can make the user recognize that full heating is started,

thereby calling the user's attention.

(6) Flow of process

[0074] Fig. 6 is a flowchart of an example of the flow of a process performed by the inhaler device 100 according to the present embodiment.

[0075] As illustrated in Fig. 6, the controller 116 first determines whether pressing of the power button is detected by the sensor 112 (step S102). If it is determined that pressing of the power button is not detected (NO in step S102), the process returns to step S102 again. On the other hand, if it is determined that pressing of the power button is detected (YES in step S102), the controller 116 controls the notifier 113 to provide information indicating that the power button is pressed (step S104).

[0076] Next, the controller 116 starts measuring the duration of pressing of the power button (step S106). The duration of pressing of the power button is a duration in which the power button is continuously pressed.

[0077] Next, the controller 116 determines whether the measured duration of pressing of the power button reaches the first duration (step S108). If it is determined that the duration of pressing of the power button does not reach the first duration (NO in step S108), the process returns to step S108 again. On the other hand, if it is determined that the duration of pressing of the power button reaches the first duration (YES in step S108), the controller 116 controls the heater 121 to perform simplified heating (step S110).

[0078] Next, the controller 116 determines whether the measured duration of pressing of the power button reaches the second duration (step S112). If it is determined that the duration of pressing of the power button does not reach the second duration (NO in step S112), the controller 116 determines whether releasing of the power button is detected (step S118). If it is determined that releasing of the power button is not detected (NO in step S118), the process returns to step S112 again. On the other hand, if it is determined that releasing of the power button is detected (YES in step S118), the controller 116 controls the heater 121 to stop heating (step S120), and the process ends. On the other hand, if it is determined that the duration of pressing of the power button reaches the second duration (YES in step S112), the controller 116 controls the heater 121 to perform full heating (step S114).

[0079] The controller 116 controls the notifier 113 to provide information indicating that full heating is started (step S116).

2. Second embodiment

[0080] Fig. 7 is a block diagram of a configuration example of an inhaler system 900 according to a second embodiment. As illustrated in Fig. 7, the inhaler system 900 includes an inhaler device 910 and a control device 920.

[0081] The inhaler device 910 includes a detector 911 and a heater 912. The detector 911 detects a user operation. The heater 912 heats a substrate to thereby generate material to be inhaled by the user.

[0082] The control device 920 includes a controller 921. The controller 921 controls the heater 912 on the basis of a user operation detected by the detector 911. Specifically, in response to the detector 911 detecting the first user operation, the controller 921 causes the heater 912 to operate in the first heating state. In response to the detector 911 detecting the second user operation different from the first user operation while the controller 921 is causing the heater 912 to operate in the first heating state, the controller 921 causes the heater 912 to operate in the second heating state different from the first heating state.

[0083] Now, a description of the flow of a process in the inhaler system 900 according to the present embodiment will be given. Fig. 8 is a flowchart of an example of the flow of the process performed by the control device 920 according to the present embodiment.

[0084] As illustrated in Fig. 8, the control device 920 performs a process related to heating in the first heating state (step S202). Specifically, the controller 921 causes the heater 912 to operate in the first heating state in response to the detector 911 detecting the first user operation.

[0085] Next, the control device 920 performs a process related to heating in the second heating state (step S204). Specifically, in response to the detector 911 detecting the second user operation different from the first user operation while the controller 921 is causing the heater 912 to operate in the first heating state, the controller 921 causes the heater 912 to operate in the second heating state different from the first heating state.

[0086] According to the present embodiment, the controller 921 causes the heater 912 to operate in the first heating state in response to detection of the first user operation and causes the heater 912 to operate in the second heating state in response to subsequent detection of the second user operation. That is, even when the first user operation is detected, the controller 921 does not cause the heater 912 to operate in the second heating state unless the second user operation is detected. Therefore, even when the user has performed the first user operation, the user can interrupt heating before a transition to the second heating state occurs, by not performing the second user operation. From this point of view, usability can be improved.

[0087] Therefore, the present embodiment can also attain an effect similar to the effect attained by the first embodiment described above.

3. Supplementary description

[0088] Although preferred embodiments of the present invention have been described in detail above with reference to the attached drawings, the present invention

is not limited to the above-described examples. It is obvious that one of ordinary skill in the art of the present invention can conceive of various changes or corrections without departing from the technical spirit stated in the claims, and it is understood that such changes and corrections are also within the technical scope of the present invention as a matter of course.

[0089] For example, in the above-described embodiments, although an example has been described where performing the first user operation is performing the predetermined user operation continuously for the first duration and performing the second user operation is performing the predetermined user operation continuously for the second duration, the present invention is not limited to such an example. For example, performing the first user operation may be performing the predetermined user operation. Performing the second user operation may be performing the predetermined user operation continuously for the second duration. In this case, the inhaler device 100 can start simplified heating without waiting for the duration in which the predetermined user operation is continuously performed reaches the first duration. Therefore, the wait time of the user can be further made shorter than that in the above-described embodiments.

[0090] For example, in the above-described embodiments, although an example has been described where the predetermined user operation that is continuously performed as the first user operation and the second user operation is holding down of the power button, the present invention is not limited to such an example. For example, the predetermined user operation may be pressing and releasing of the power button. In this case, repeatedly pressing the power button for the first duration may be detected as the first user operation. Repeatedly pressing the power button for the second duration may be detected as the second user operation. Alternatively, instead of pressing the power button, an operation of, for example, touching a touch panel or rotating a rotary lever may be detected as the first user operation and the second user operation.

[0091] For example, in the above-described embodiments, although an example has been described where the inhaler device 100 generates an aerosol by heating the stick substrate 150, the present invention is not limited to such an example. For example, the inhaler device 100 may generate an aerosol by other means in addition to or instead of heating of the stick substrate 150. For example, the inhaler device 100 may store an aerosol source that is a liquid, guides the aerosol source to the heater 121, and heats and atomizes the aerosol source to thereby generate an aerosol. As the means for atomization, any means, such as induction heating or vibration atomization, may be employed in addition to heating.

[0092] Note that a series of processes performed by the devices described herein may be implemented as any of software, hardware, or a combination of software and hardware. A program that is the software is stored

in advance in, for example, a recording medium (non-transitory medium) that is included in each device or that is externally provided. Each program is loaded to a RAM upon execution by a computer and executed by a processor such as a CPU. Examples of the recording medium include a magnetic disc, an optical disc, a magneto-optical disc, and flash memory. In addition, the computer program may be distributed via, for example, a network without using a recording medium.

[0093] The processes described herein with reference to the flowcharts and sequence charts need not be performed in the illustrated order. Some process steps may be performed in parallel, an additional process step may be employed, and some process steps may be omitted.

Reference Signs List

[0094]

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
144	heat insulator
150	stick substrate
151	substrate
152	inhalation port
900	inhaler system
910	inhaler device
911	detector
912	heater
920	control device
921	controller

Claims

1. A control device for controlling an inhaler device including a detector that detects a user operation and a heater that heats a substrate to thereby generate material to be inhaled by a user, the control device comprising

a controller that controls the heater on the basis of the user operation detected by the detector, wherein the controller

causes the heater to operate in a first heating state in response to the detector detect-

- ing a first user operation, and causes the heater to operate in a second heating state different from the first heating state in response to the detector detecting a second user operation different from the first user operation while causing the heater to operate in the first heating state.
2. The control device according to claim 1, wherein the first heating state is a state where an upper limit of a temperature of the heater is lower than an upper limit of the temperature of the heater in the second heating state.
 3. The control device according to claim 2, wherein an amount of the material that is to be inhaled by the user and that is generated in response to the heater heating the substrate at the upper limit of the temperature of the heater in the first heating state is smaller than an amount of the material that is to be inhaled by the user and that is generated in response to the heater heating the substrate at the upper limit of the temperature of the heater in the second heating state.
 4. The control device according to any one of claims 1 to 3, wherein a rate of rise in a temperature of the heater in the first heating state and a rate of rise in the temperature of the heater in the second heating state are equal to each other.
 5. The control device according to any one of claims 1 to 3, wherein the first heating state is a state where a rate of rise in a temperature of the heater is lower than a rate of rise in the temperature of the heater in the second heating state.
 6. The control device according to any one of claims 1 to 5, wherein

performing the first user operation is performing a predetermined user operation continuously for a first duration, and

performing the second user operation is performing the predetermined user operation continuously for a second duration longer than the first duration.
 7. The control device according to claim 6, wherein the first heating state is a state where heating is performed when the predetermined user operation is continuously performed.
 8. The control device according to claim 7, wherein when the predetermined user operation is not detected any more after a duration in which the predetermined user operation is continuously performed reaches the first duration and before the duration reaches the second duration, the controller stops heating by the heater that is operating in the first heating state.
 9. The control device according to any one of claims 6 to 8, wherein the second heating state is a state where heating is performed without the predetermined user operation being continuously performed.
 10. The control device according to any one of claims 6 to 9, wherein the controller stops heating by the heater when a duration in which the predetermined user operation is continuously performed reaches a third duration longer than the second duration.
 11. The control device according to any one of claims 6 to 10, wherein when the number of times the predetermined user operation is detected reaches a predetermined number of times within a fourth time period, the controller controls the heater so as not to perform heating until a fifth time period elapses.
 12. The control device according to any one of claims 6 to 11, wherein

the inhaler device further includes a notifier that provides information to the user, and

the controller controls the notifier to provide first information before a duration in which the predetermined user operation is continuously performed reaches the first duration.
 13. The control device according to any one of claims 1 to 12, wherein

the inhaler device further includes a notifier that provides information to the user, and

the controller controls the notifier to provide second information in response to detection of the second user operation.
 14. The control device according to any one of claims 1 to 5, wherein

performing the first user operation is performing a predetermined user operation, and

performing the second user operation is performing the predetermined user operation continuously for a second duration.
 15. A control method for controlling an inhaler device including a detector that detects a user operation and a heater that heats a substrate to thereby generate material to be inhaled by a user, the control method comprising

controlling the heater on the basis of the user operation detected by the detector, wherein

the controlling of the heater includes causing the heater to operate in a first heating state in response to the detector detecting a first user operation, and causing the heater to operate in a second heating state different from the first heating state in response to the detector detecting a second user operation different from the first user operation while causing the heater to operate in the first heating state.

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16. A program for causing a computer, the computer controlling an inhaler device including a detector that detects a user operation and a heater that heats a substrate to thereby generate material to be inhaled by a user, to function as

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a controller that controls the heater on the basis of the user operation detected by the detector, wherein the controller

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causes the heater to operate in a first heating state in response to the detector detecting a first user operation, and causes the heater to operate in a second heating state different from the first heating state in response to the detector detecting a second user operation different from the first user operation while causing the heater to operate in the first heating state.

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FIG. 1

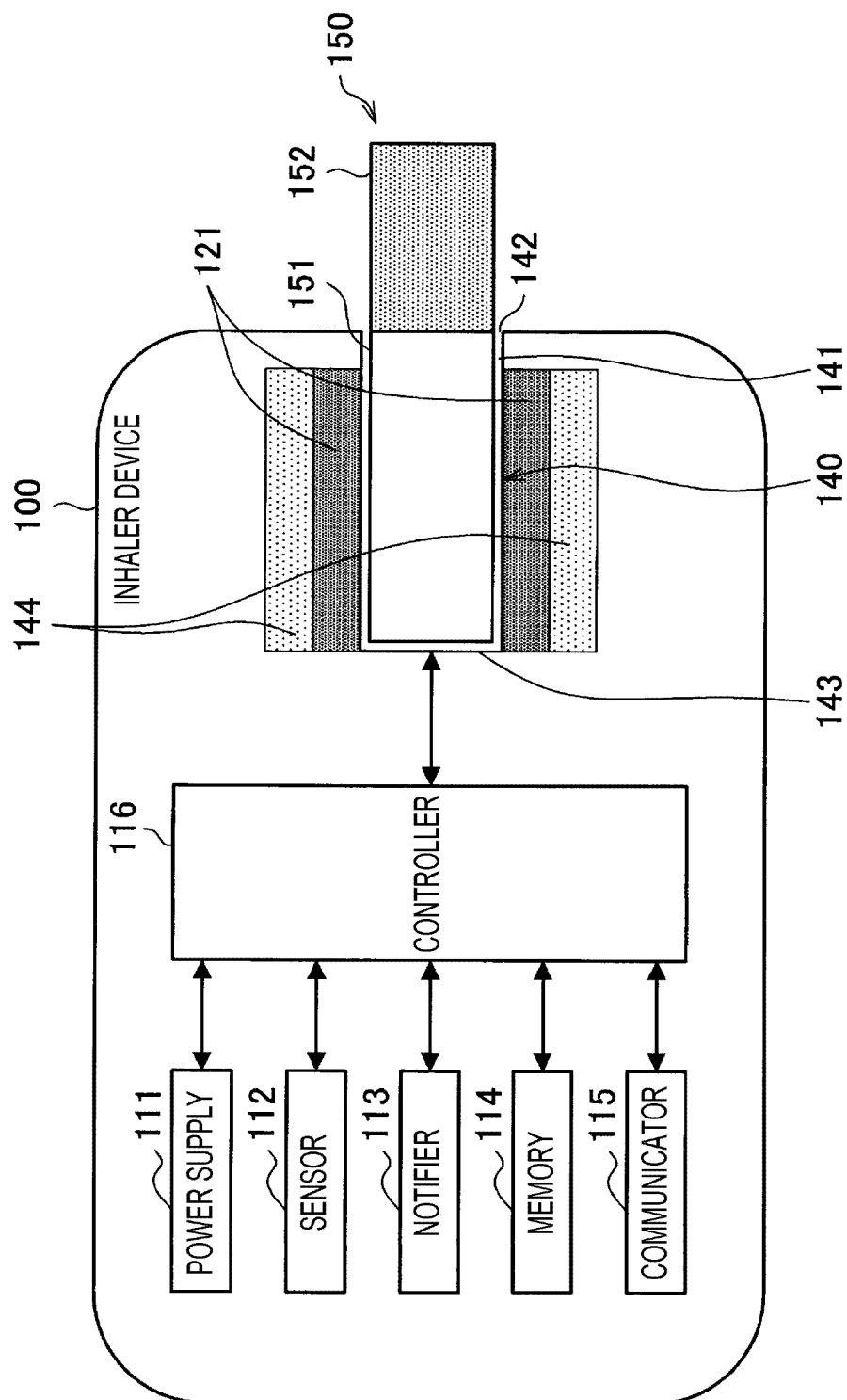


FIG. 2

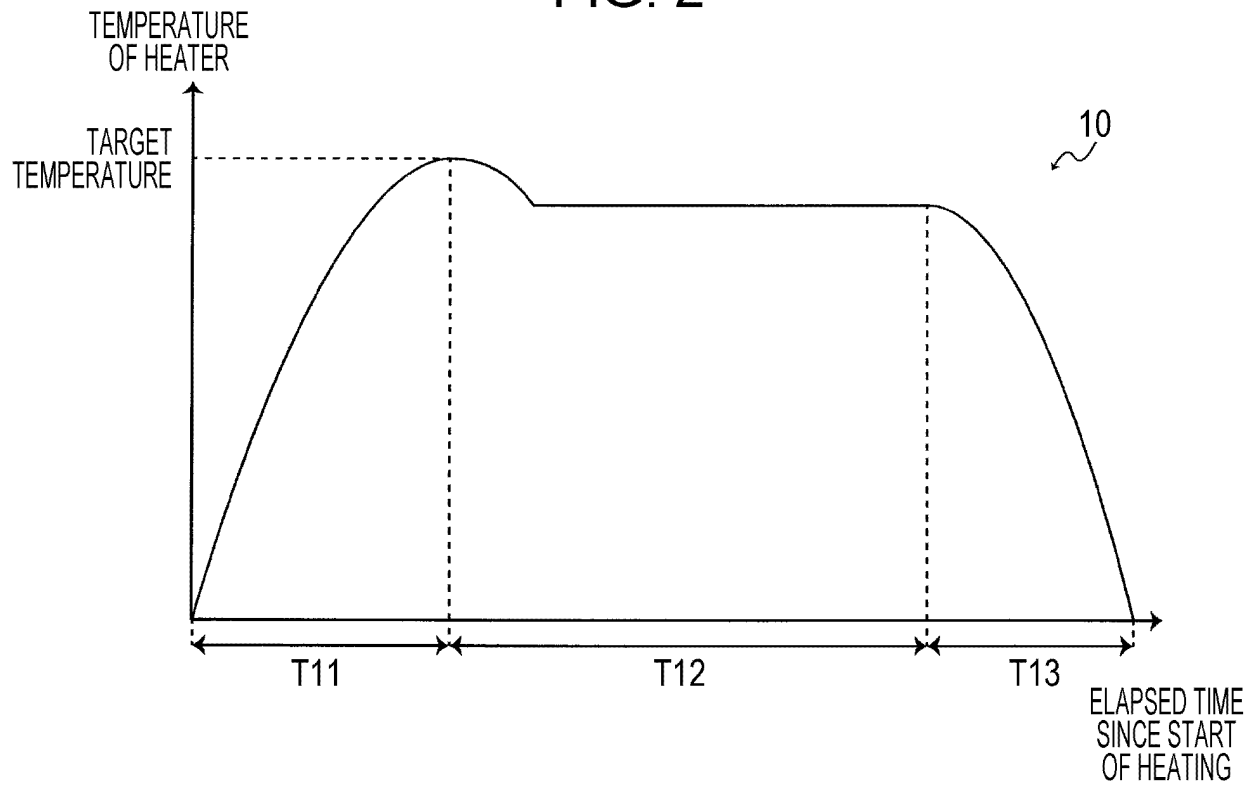


FIG. 3

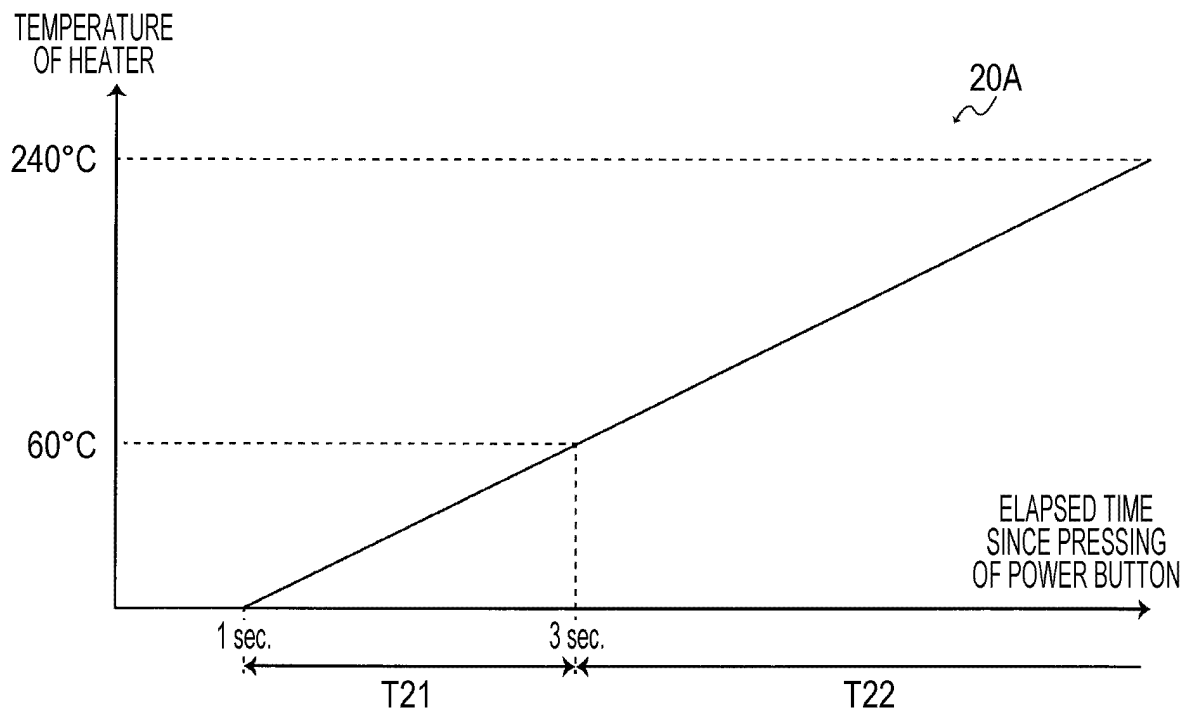


FIG. 4

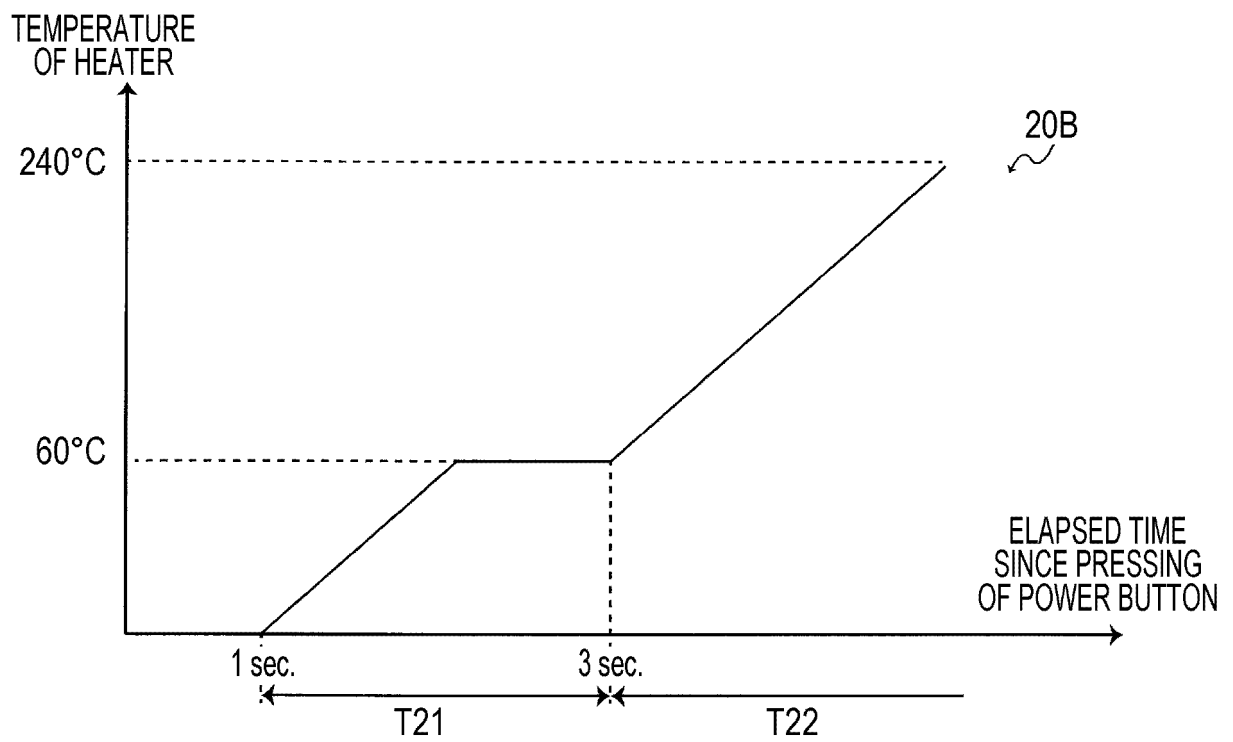


FIG. 5

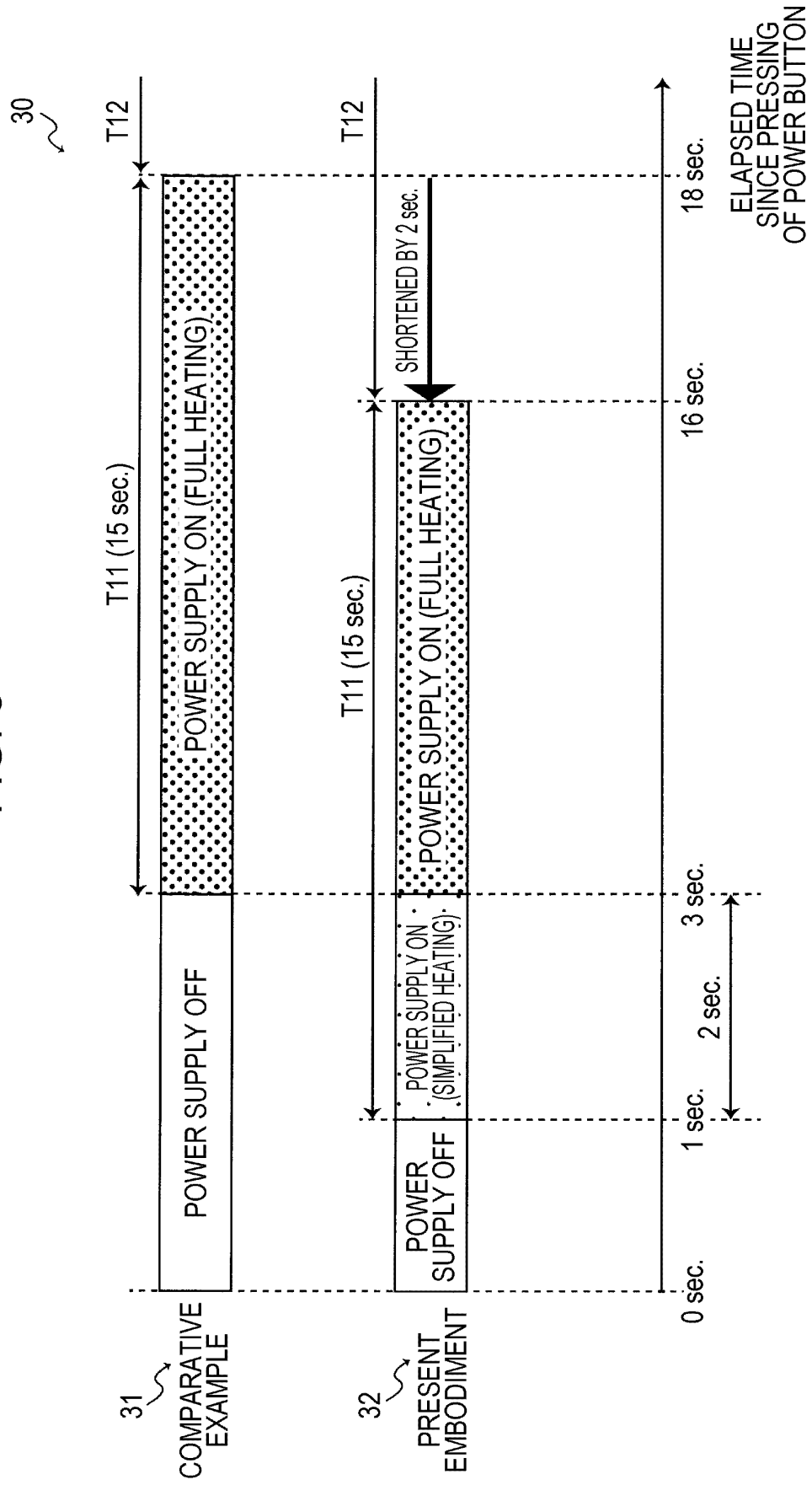


FIG. 6

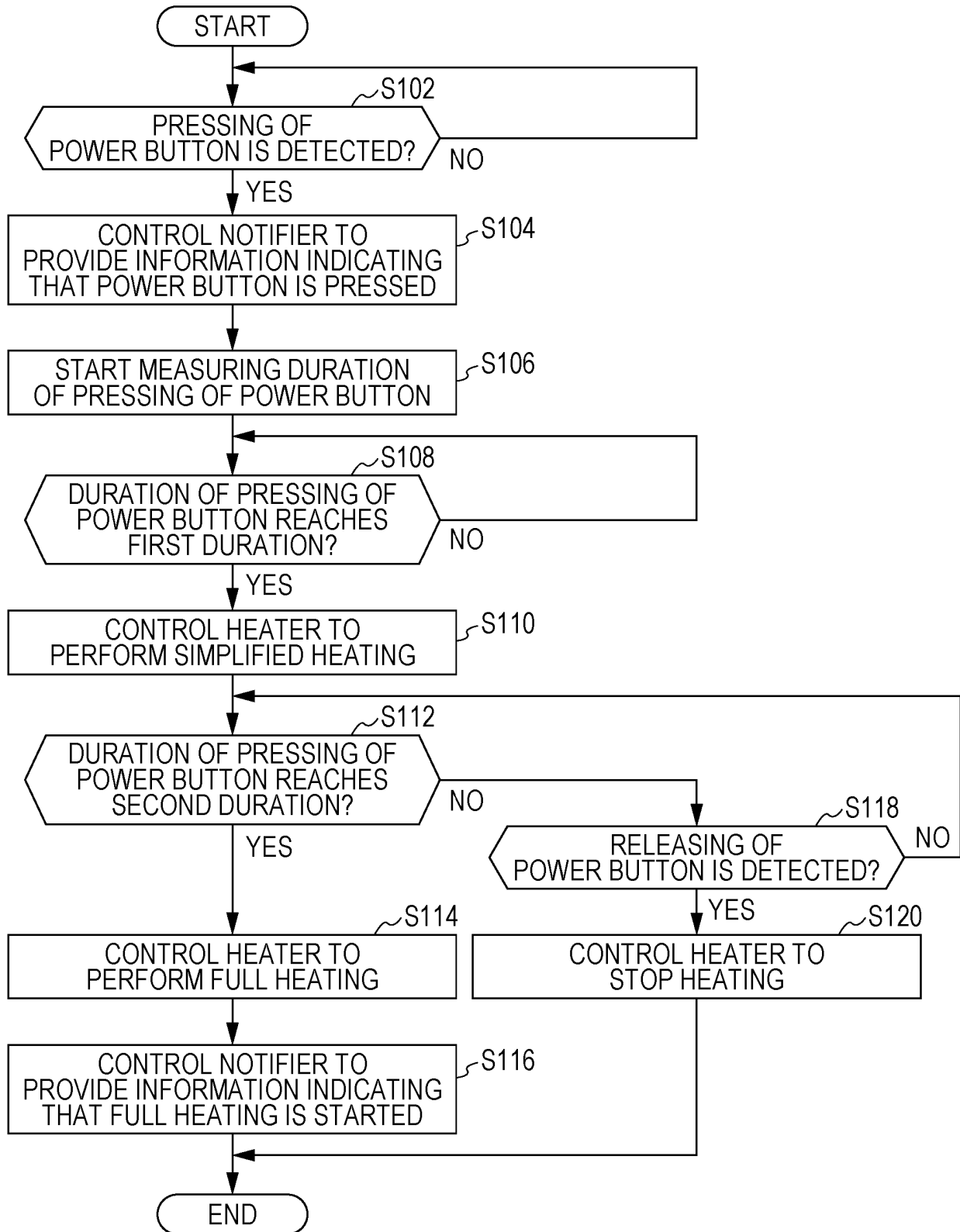


FIG. 7

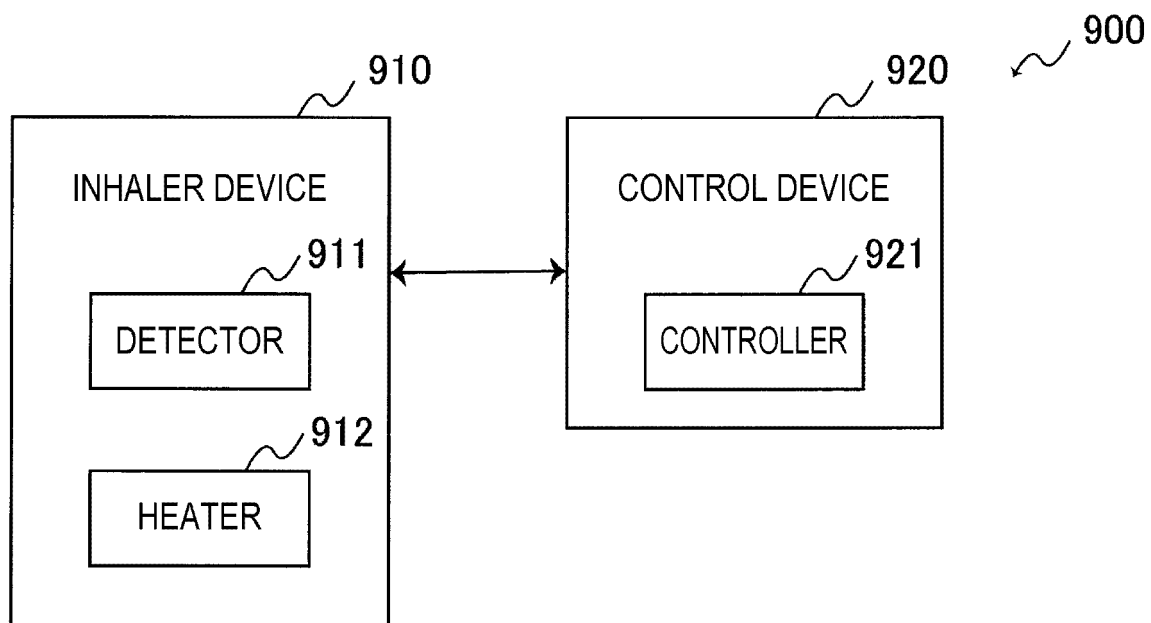
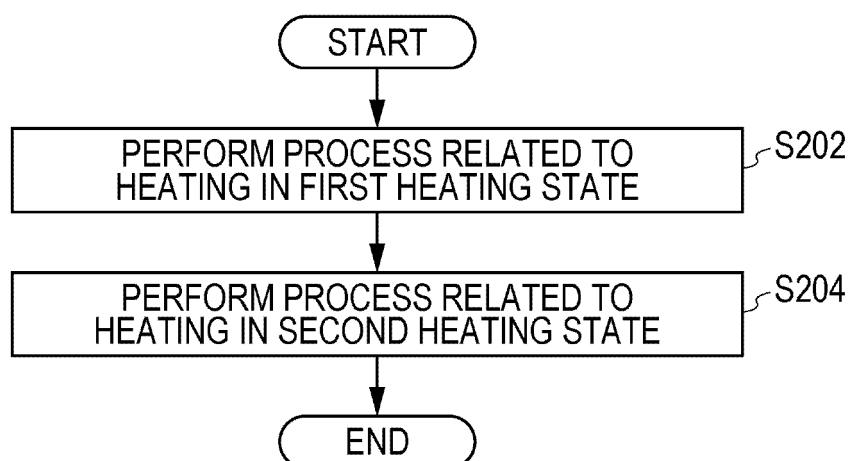


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/011903

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. A24F40/50 (2020.01) i, A24F47/00 (2020.01) i
 FI: A24F40/50, A24F47/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int. Cl. A24F40/50, A24F47/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
 Published unexamined utility model applications of Japan 1971-2020
 Registered utility model specifications of Japan 1996-2020
 Published registered utility model applications of Japan 1994-2020

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A A	US 2018/0177232 A1 (DING, Ya-Ling) 28 June 2018, paragraphs [0030], [0031] JP 2018-520663 A (PHILIP MORRIS PRODUCTS S.A.) 02 August 2018, entire text, all drawings	1-6, 9, 12-16 7-8, 10-11 1-16



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search
13.05.2020

Date of mailing of the international search report
02.06.2020

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Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2020/011903

Patent Documents referred to in the Report	Publication Date	Patent Family	Publication Date
US 2018/0177232 A1	28.06.2018	US 2019/0104770 A1	
JP 2018-520663 A	02.08.2018	US 2018/0160734 A1 WO 2016/198266 A1 EP 3307097 A1 CN 107666837 A KR 10-2018-0015622 A	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2019513354 A [0004]