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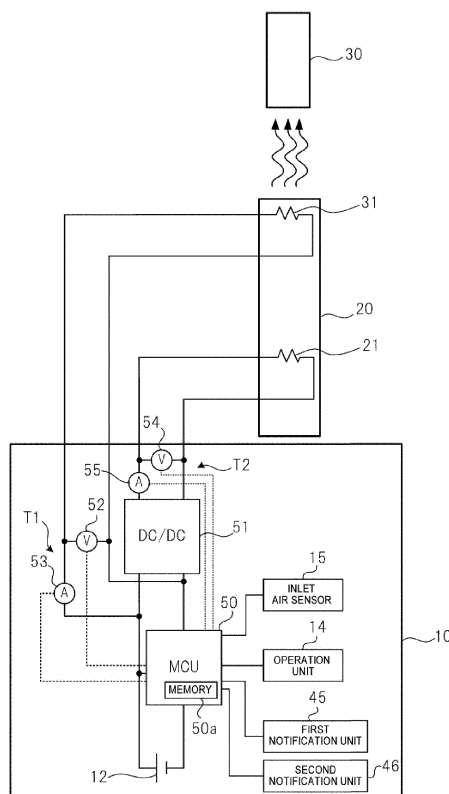
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(54) CONTROL UNIT OF AEROSOL GENERATION DEVICE

(57) A control unit of an aerosol generation device includes a processing device configured to acquire a remaining amount of at least one of an aerosol source and a flavor source configured to add flavor to aerosol generated from the aerosol source. When the remaining amount is equal to or greater than a threshold value, the processing device permits first discharge that is discharge from a power supply to an atomizer configured to atomize the aerosol source and second discharge that is discharge from the power supply to an adjustor capable of adjusting an amount of flavor that is added to the aerosol by the flavor source, and when the remaining amount is smaller than the threshold value, the processing device suppresses any one of the first discharge and the second discharge.

FIG.5



Description

TECHNICAL FIELD

5 [0001] The present invention relates to a control unit of an aerosol generation device.

BACKGROUND ART

10 [0002] Patent Literatures 1, 3 and 4 disclose a device configured to cause aerosol generated by heating a liquid to pass through a flavor source, thereby adding flavor to aerosol and allowing a user to inhale aerosol having the flavor added thereto.

15 [0003] Patent Literature 2 discloses an inhalation device including an element configured to contribute to generation of aerosol or aerosol having flavor added thereto by consuming an accumulated capacity, a sensor configured to detect a predetermined variable, a notification unit configured to issue a notification to an inhaler of the aerosol, and a control unit configured to cause the notification unit to function in a first mode when the detected or estimated capacity is smaller than a threshold value and the variable satisfies a predetermined condition for requesting generation of the aerosol.

[Patent Literature 1] WO2020/039589

[Patent Literature 2] Japanese Patent No. 6,462,965

20 [Patent Literature 3] JP-A-2017-511703

[Patent Literature 4] WO2019/017654

25 [0004] Patent Literatures 1 to 4 do not disclose a notification method to a user when remaining amounts of an aerosol source and a flavor source are small.

SUMMARY OF INVENTION

[0005] An object of the present invention is to provide an aerosol generation device capable of informing a user that it is necessary to replace at least one of the aerosol source and the flavor source.

30 [0006] According to an aspect of the present invention, there is provided a control unit of an aerosol generation device including a processing device configured to acquire a remaining amount of at least one of an aerosol source and a flavor source configured to add flavor to aerosol generated from the aerosol source, wherein when the remaining amount is equal to or greater than a threshold value, the processing device permits first discharge that is discharge from a power supply to an atomizer configured to atomize the aerosol source and second discharge that is discharge from the power supply to an adjustor capable of adjusting an amount of flavor that is added to the aerosol by the flavor source, and when the remaining amount is smaller than the threshold value, the processing device suppresses any one of the first discharge and the second discharge.

35 [0007] According to another aspect of the present invention, there is provided a control unit of an aerosol generation device including a notification unit; and a processing device configured to control discharge from a power supply to a first heater configured to heat one of an aerosol source and a flavor source configured to add flavor to aerosol generated from the aerosol source and discharge from the power supply to a second heater configured to heat the other of the aerosol source and the flavor source and provided separately from the first heater, wherein before causing the notification unit to function, the processing device permits the discharge from the power supply to the first heater and the discharge from the power supply to the second heater, and when causing the notification unit to function, the processing device suppresses any one of the discharge from the power supply to the first heater and the discharge from the power supply to the second heater.

40 [0008] According to the present invention, it is possible to provide the aerosol generation device capable of informing a user that it is necessary to replace at least one of the aerosol source and the flavor source.

BRIEF DESCRIPTION OF DRAWINGS

[0009]

55 FIG. 1 is a perspective view schematically showing a configuration of an aerosol generation device.

FIG. 2 is another perspective view of the aerosol generation device shown in FIG. 1.

FIG. 3 is a sectional view of the aerosol generation device shown in FIG. 1.

FIG. 4 is a perspective view of a power supply unit of the aerosol generation device shown in FIG. 1.

FIG. 5 is a schematic view showing a hardware configuration of the aerosol generation device shown in FIG. 1.

5 FIG. 6 is a schematic view showing a modified embodiment of the hardware configuration of the aerosol generation device shown in FIG. 1.

FIG. 7 is a flowchart for showing operations of the aerosol generation device shown in FIG. 1.

10 FIG. 8 is a flowchart for showing operations of the aerosol generation device shown in FIG. 1.

FIG. 9 is a schematic view showing an example of an electric power threshold value $P_{\max}$ and an amount of increase ΔP .

15 FIG. 10 is a schematic view showing atomizing electric power that is supplied to a first load 21 in step S17 of FIG. 8.

FIG. 11 is a schematic view showing atomizing electric power that is supplied to the first load 21 in step S19 of FIG. 8.

20 FIG. 12 is a schematic view showing an example of a table showing a relationship between a remaining amount of a flavor component and a remaining amount in a reservoir.

FIG. 13 is a timing chart for illustrating operations of the aerosol generation device shown in FIG. 1.

25 FIG. 14 is a flowchart for showing operations of the aerosol generation device 1 of a first modified embodiment.

FIG. 15 is a flowchart for showing operations of the aerosol generation device 1 of the first modified embodiment.

FIG. 16 is a flowchart for showing operations of the aerosol generation device 1 of a second modified embodiment.

30 FIG. 17 is a flowchart for showing operations of the aerosol generation device 1 of the second modified embodiment.

FIG. 18 is a timing chart for illustrating operations of the aerosol generation device of the second modified embodiment.

35 FIG. 19 is a timing chart for illustrating another example of operations of the aerosol generation device of the second modified embodiment.

FIG. 20 is a timing chart for illustrating still another example of operations of the aerosol generation device of the second modified embodiment.

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DESCRIPTION OF EMBODIMENTS

[0010] Hereinafter, an aerosol generation device 1 that is one embodiment of the aerosol generation device of the present invention will be described with reference to FIGS. 1 to 6.

45

(Aerosol Generation Device)

[0011] The aerosol generation device 1 is a device configured to generate aerosol having a flavor component added thereto without burning, and to cause the aerosol to be inhaled, and has a rod shape extending in a predetermined direction (hereinafter, referred to as the longitudinal direction X), as shown in FIGS. 1 and 2. The aerosol generation device 1 includes a power supply unit 10, a first cartridge 20, and a second cartridge 30 provided in corresponding order in the longitudinal direction X. The first cartridge 20 can be attached and detached (in other words, replaced) with respect to the power supply unit 10. The second cartridge 30 can be attached and detached (in other words, replaced) with respect to the first cartridge 20. As shown in FIG. 3, the first cartridge 20 is provided with a first load 21 and a second load 31. An overall shape of the aerosol generation device 1 is not limited to such a shape that the power supply unit 10, the first cartridge 20 and the second cartridge 30 are aligned in line, as shown in FIG. 1. For example, the aerosol generation device 1 may have any shape such as a substantial box shape as long as the first cartridge 20 and the second cartridge 30 can be replaced with respect to the power supply unit 10. Note that, the second cartridge 30 may

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also be attached and detached (in other words, replaced) with respect to the power supply unit 10.

(Power Supply Unit)

[0012] As shown in FIGS. 3 to 5, the power supply unit 10 is configured to accommodate, in a cylindrical power supply unit case 11, a power supply 12, a charging IC 55A, an MCU (Micro Controller Unit) 50, a DC/DC converter 51, an inlet air sensor 15, a temperature detection device T1 including a voltage sensor 52 and a current sensor 53, a temperature detection device T2 including a voltage sensor 54 and a current sensor 55, a first notification unit 45 and a second notification unit 46.

[0013] The power supply 12 is a chargeable secondary battery, an electric double layer capacitor or the like, and is preferably a lithium ion secondary battery. An electrolyte of the power supply 12 may be one or a combination of a gel-like electrolyte, an electrolytic solution, a solid electrolyte and an ionic liquid.

[0014] As shown in FIG. 5, the MCU 50 is connected to the diverse sensor devices such as the inlet air sensor 15, the voltage sensor 52, the current sensor 53, the voltage sensor 54 and the current sensor 55, the DC/DC converter 51, the operation unit 14, the first notification unit 45, and the second notification unit 46, and is configured to perform a variety of controls of the aerosol generation device 1.

[0015] Specifically, the MCU 50 is mainly constituted by a processor, and further includes a memory 50a constituted by a storage medium such as a RAM (Random Access Memory) necessary for operations of the processor and a ROM (Read Only Memory) in which a variety of information is stored. As used herein, the processor is specifically an electric circuit including circuit devices such as semiconductor devices.

[0016] As shown in FIG. 4, a top portion 11a on one end side (first cartridge 20-side) of the power supply unit case 11 in the longitudinal direction X is provided with discharge terminals 41. The discharge terminals 41 are provided to protrude from an upper surface of the top portion 11a toward the first cartridge 20, and are each configured to be electrically connectable to each of the first load 21 and the second load 31 of the first cartridge 20.

[0017] The upper surface of the top portion 11a is also provided with an air supply part 42 configured to supply air to the first load 21 of the first cartridge 20, in the vicinity of the discharge terminals 41.

[0018] A bottom portion 11b on the other end-side (an opposite side to the first cartridge 20) of the power supply unit case 11 in the longitudinal direction X is provided with a charging terminal 43 that can be electrically connected to an external power supply(not shown). The charging terminal 43 is provided on a side surface of the bottom portion 11b, and is, for example, connected to a USB (Universal Serial Bus) terminal, a micro USB terminal or the like.

[0019] Note that, the charging terminal 43 may also be a power receiving unit that can receive electric power transmitted from the external power supply in a wireless manner. In this case, the charging terminal 43 (power receiving unit) may be constituted by a power receiving coil. The method of wireless power transfer may be an electromagnetic induction method, a magnetic resonance method or a combination of the electromagnetic induction method and the magnetic resonance method. The charging terminal 43 may also be a power receiving unit that can receive electric power transmitted from the external power supply in a contactless manner. As another example, the charging terminal 43 can be connected to a USB terminal or a micro USB terminal and may also have the power receiving unit.

[0020] The power supply unit case 11 is provided with an operation unit 14 that can be operated by a user and is provided on a side surface of the top portion 11a so as to face toward an opposite side to the charging terminal 43. More specifically, the operation unit 14 and the charging terminal 43 are point-symmetrical with respect to an intersection of a straight line connecting the operation unit 14 and the charging terminal 43 and a center line of the power supply unit 10 in the longitudinal direction X. The operation unit 14 is constituted by a button-type switch, a touch panel or the like. When a predetermined activation operation is performed by the operation unit 14 in a state where the power supply unit 10 is off, the operation unit 14 outputs an activation command of the power supply unit 10 to the MCU 50. When the MCU 50 acquires the activation command, the MCU starts the power supply unit 10.

[0021] As shown in FIG. 3, the inlet air sensor 15 configured to detect a puff (inhalation) operation is provided in the vicinity of the operation unit 14. The power supply unit case 11 is provided with an air intake port(not shown) to take external air into an inside. The air intake port may be provided near the operation unit 14 or the charging terminal 43.

[0022] The inlet air sensor 15 is configured to output a value in change of pressure (internal pressure) in the power supply unit 10 generated as a result of user's inhalation through an inhalation port 32 (which will be described later). The inlet air sensor 15 is, for example, a pressure sensor configured to output an output value (for example, a voltage value or a current value) corresponding to the internal pressure that changes according to a flow rate (i.e., a user's puff operation) of air inhaled from the air intake port toward the inhalation port 32. The inlet air sensor 15 may be configured to output an analog value or a digital value converted from the analog value.

[0023] The inlet air sensor 15 may also have a built-in temperature sensor configured to detect a temperature (external air temperature) of an environment in which the power supply unit 10 is put, so as to compensate for the detected pressure. The inlet air sensor 15 may also be constituted by a capacitor microphone or the like, other than the pressure sensor.

[0024] When the puff operation is performed and the output value of the inlet air sensor 15 is thus equal to or greater than an output threshold value, the MCU 50 determines that a request for aerosol generation (an atomization command of the aerosol source 22, which will be described later) is made, and thereafter, when the output value of the inlet air sensor 15 falls below the output threshold value, the MCU 50 determines that the request for aerosol generation is over.

Note that, in the aerosol generation device 1, in order to suppress overheating of the first load 21, for example, when a time period for which the request for aerosol generation is made reaches an upper limit time t_{upper} (for example, 2.4 seconds), it is determined that the request for aerosol generation is over, irrespective of the output value of the inlet air sensor 15.

[0025] Note that, the request for aerosol generation may also be detected based on the operation on the operation unit 14, instead of the inlet air sensor 15. For example, when the user performs a predetermined operation on the operation unit 14 so as to start inhalation of aerosol, the operation unit 14 may output a signal indicative of the request for aerosol generation to the MCU 50.

[0026] The charging IC 55A is disposed near the charging terminal 43, and is configured to control charging of electric power input from the charging terminal 43 to the power supply 12. Note that, the charging IC 55A may also be disposed near the MCU 50.

(First Cartridge)

[0027] As shown in FIG. 3, the first cartridge 20 has, in a cylindrical cartridge case 27, a reservoir 23 that constitutes a storage part in which the aerosol source 22 is stored, a first load 21 that constitutes an atomizer configured to generate aerosol by atomizing the aerosol source 22, a wick 24 configured to suck the aerosol source 22 from the reservoir 23 to a position of the first load 21, an aerosol flow path 25 that constitutes a cooling passage for making particle sizes of aerosol generated by atomizing the aerosol source 22 to sizes suitable for inhalation, an end cap 26 configured to accommodate a part of the second cartridge 30, and a second load 31 provided to the end cap 26 and configured to heat the second cartridge 30.

[0028] The reservoir 23 is partitioned to surround the aerosol flow path 25, and is configured to store the aerosol source 22. In the reservoir 23, a porous body such as resin web, cotton or the like may be accommodated, and the aerosol source 22 may be impregnated in the porous body. In the reservoir 23, the porous body such as resin web, cotton or the like may not be accommodated, and only the aerosol source 22 may be stored. The aerosol source 22 includes a liquid such as glycerin, propylene glycol, water or the like.

[0029] The wick 24 is a liquid retaining member for sucking the aerosol source 22 from the reservoir 23 to a position of the first load 21 by using a capillary phenomenon. The wick 24 constitutes a retaining part configured to retain the aerosol source 22 supplied from the reservoir 23 in a position in which the first load 21 can atomize the aerosol source. The wick 24 is constituted, for example, by glass fiber, porous ceramic or the like.

[0030] The aerosol source 22 included in the first cartridge 20 is retained by each in the reservoir 23 and the wick 24. However, in the below, a remaining amount $W_{reservoir}$ in the reservoir, which is a remaining amount of the aerosol source 22 stored in the reservoir 23, is treated as a remaining amount of the aerosol source 22 included in the first cartridge 20. It is assumed that the remaining amount $W_{reservoir}$ in the reservoir is 100% when the first cartridge 20 is in a brand-new state and gradually decreases as aerosol is generated (aerosol source 22 is atomized). The remaining amount $W_{reservoir}$ in the reservoir is calculated by the MCU 50 and is stored in the memory 50a of the MCU 50. In the below, the remaining amount $W_{reservoir}$ in the reservoir is simply described as the remaining amount in the reservoir, in some cases.

[0031] The first load 21 is configured to heat the aerosol source 22 without burning by electric power supplied from the power supply 12 via the discharge terminals 41, thereby atomizing the aerosol source 22. In principle, the more the electric power supplied from the first load 21 to the power supply 12 is, the larger the amount of the aerosol source to be atomized is. The first load 21 is constituted by a heating wire (coil) wound at a predetermined pitch.

[0032] Note that, the first load 21 may be an element that can generate aerosol by heating and atomizing the aerosol source 22. The first load 21 is, for example, a heat generating element. Examples of the heat generating element may include a heat generating resistor, a ceramic heater, an induction heating type heater, and the like.

[0033] As the first load 21, a load whose temperature and electric resistance value have a correlation is used. As the first load 21, for example, a load having a PTC (Positive Temperature Coefficient) characteristic in which the electric resistance value increases as the temperature rises is used.

[0034] The aerosol flow path 25 is provided on a center line L of the power supply unit 10, on a downstream side of the first load 21. The end cap 26 has a cartridge accommodating part 26a configured to accommodate a part of the second cartridge 30 and a communication path 26b configured to communicate the aerosol flow path 25 and the cartridge accommodating part 26a each other.

[0035] The second load 31 is embedded in the cartridge accommodating part 26a. The second load 31 is configured to heat the second cartridge 30 (more specifically, the flavor source 33 included in the second cartridge 30) accommodated in the cartridge accommodating part 26a by electric power supplied from the power supply 12 via the discharge terminals

41. The second load 31 is constituted by a heating wire (coil) wound at a predetermined pitch, for example.

[0036] Note that, the second load 31 may be an element that can heat the second cartridge 30. The second load 31 is, for example, a heat generating element. Examples of the heat generating element may include a heat generating resistor, a ceramic heater, an induction heating type heater, and the like.

[0037] As the second load 31, a load whose temperature and electric resistance value have a correlation is used. As the second load 31, for example, a load having a PTC characteristic is used.

(Second Cartridge)

[0038] The second cartridge 30 is configured to store the flavor source 33. The second cartridge 30 is heated by the second load 31, so that the flavor source 33 is heated. The second cartridge 30 is detachably accommodated in the cartridge accommodating part 26a provided to the end cap 26 of the first cartridge 20. An end portion of the second cartridge 30 on an opposite side to the first cartridge 20-side is configured as the inhalation port 32 for a user. Note that, the inhalation port 32 is not limited to the configuration where it is integrated with the second cartridge 30, and may be detachably attached to the second cartridge 30. In this way, the inhalation port 32 is configured separately from the power supply unit 10 and the first cartridge 20, so that the inhalation port 32 can be hygienically kept.

[0039] The second cartridge 30 is configured to cause aerosol, which are generated as the aerosol source 22 is atomized by the first load 21, to pass through the flavor source 33, thereby adding a flavor component to the aerosol. As a raw material piece that forms the flavor source 33, chopped tobacco or a molded product obtained by molding a tobacco raw material into granules can be used. The flavor source 33 may also be formed by plants (for example, mint, Chinese herbs, herbs and the like) other than tobacco. A fragrance such as menthol may be added to the flavor source 33.

[0040] In the aerosol generation device 1, it is possible to generate aerosol having a flavor component added thereto by the aerosol source 22 and the flavor source 33. Specifically, the aerosol source 22 and the flavor source 33 constitute an aerosol generating source that generates aerosol,

[0041] The aerosol generating source of the aerosol generation device 1 is a part that is replaced and used by a user. This part is provided to the user, as a set of one first cartridge 20 and one or more (for example, five) second cartridges 30, for example. Note that, the first cartridge 20 and the second cartridge 30 may be integrated to constitute one cartridge.

[0042] In the aerosol generation device 1 configured as described above, as shown with an arrow B in FIG. 3, the air introduced from an intake port(not shown) provided to the power supply unit case 11 passes from the air supply part 42 to the vicinity of the first load 21 of the first cartridge 20. The first load 21 is configured to atomize the aerosol source 22 introduced from the reservoir 23 by the wick 24. Aerosol generated as a result of the atomization flows in the aerosol flow path 25 together with the air introduced from the intake port, and are supplied to the second cartridge 30 via the communication path 26b. The aerosol supplied to the second cartridge 30 is added with the flavor component as the aerosol pass through the flavor source 33, and are then supplied to the inhalation port 32.

[0043] The aerosol generation device 1 is also provided with the first notification unit 45 and the second notification unit 46 for notifying a variety of information to the user (refer to FIG. 5). The first notification unit 45 is to give a notification that acts on a user's tactile sense, and is constituted by a vibration element such as a vibrator. The second notification unit 46 is to give a notification that acts on a user's visual sense, and is constituted by a light emitting element such as an LED (Light Emitting Diode). As the notification unit for notifying a variety of information, a sound output element may be further provided so as to give a notification that acts on a user's auditory sense. The first notification unit 45 and the second notification unit 46 may be provided to any of the power supply unit 10, the first cartridge 20 and the second cartridge 30 but is preferably provided to the power supply unit 10. For example, the periphery of the operation unit 14 is transparent, and is configured to emit light by a light emitting element such as an LED.

(Details of Power Supply Unit)

[0044] As shown in FIG. 5, the DC/DC converter 51 is connected between the first load 21 and the power supply 12 in a state where the first cartridge 20 is mounted to the power supply unit 10. The MCU 50 is connected between the DC/DC converter 51 and the power supply 12. The second load 31 is connected between the MCU 50 and the DC/DC converter 51 in the state where the first cartridge 20 is mounted to the power supply unit 10. In this way, in the power supply unit 10, in the state where the first cartridge 20 is mounted, a series circuit of the DC/DC converter 51 and the first load 21 and the second load 31 are connected in parallel to the power supply 12.

[0045] The DC/DC converter 51 is a booster circuit capable of boosting an input voltage, and is configured to be able to supply a voltage obtained by boosting an input voltage or the input voltage to the first load 21. According to the DC/DC converter 51, since it is possible to adjust electric power that is supplied to the first load 21, it is possible to control an amount of the aerosol source 22 that is atomized by the first load 21. As the DC/DC converter 51, for example, a switching regulator configured to convert an input voltage into a desired output voltage by controlling on/off time of a switching element while monitoring an output voltage may be used. In a case where the switching regulator is used as the DC/DC

converter 51, it is possible to output an input voltage, as it is, without boosting the input voltage by controlling the switching element.

[0046] The processor of the MCU 50 is configured to be able to acquire temperatures of the flavor source 33 and the second load 31 so as to control the discharge to the second load 31. Further, the processor of the MCU 50 is preferably configured to be able to acquire a temperature of the first load 21. The temperature of the first load 21 can be used to suppress overheating of the first load 21 or the aerosol source 22 and to highly control an amount of the aerosol source 22 that is atomized by the first load 21.

[0047] The voltage sensor 52 is configured to measure and output a voltage value that is applied to the second load 31. The current sensor 53 is configured to measure and output a current value that flows through the second load 31. The output of the voltage sensor 52 and the output of the current sensor 53 are each input to the MCU 50. The processor of the MCU 50 is configured to acquire a resistance value of the second load 31, based on the output of the voltage sensor 52 and the output of the current sensor 53, and to acquire a temperature of the second load 31 corresponding to the resistance value. The temperature of the second load 31 is not strictly matched with the temperature of the flavor source 33 that is heated by the second load 31 but can be regarded as being substantially the same as the temperature of the flavor source 33.

[0048] Note that, in a configuration where constant current is caused to flow through the second load 31 when acquiring the resistance value of the second load 31, the current sensor 53 is not required in the temperature detection device T1. Likewise, in a configuration where a constant voltage is applied to the second load 31 when acquiring the resistance value of the second load 31, the voltage sensor 52 is not required in the temperature detection device T1.

[0049] Further, as shown in FIG. 6, instead of the temperature detection device T1, the first cartridge 20 may be provided with a temperature detection device T3 for detecting a temperature of the second cartridge 30 or the second load 31. The temperature detection device T3 is constituted, for example, by a thermistor disposed near the second cartridge 30 or the second load 31. In the configuration of FIG. 6, the processor of the MCU 50 is configured to acquire the temperature of the second load 31 or the temperature of the second cartridge 30, in other words, the temperature of the flavor source 33, based on an output of the temperature detection device T3.

[0050] As shown in FIG. 6, the temperature of the flavor source 33 is acquired using the temperature detection device T3, so that it is possible to acquire the temperature of the flavor source 33 more precisely, as compared to the configuration where the temperature of the flavor source 33 is acquired using the temperature detection device T1 of FIG. 5. Note that, the temperature detection device T3 may also be mounted to the second cartridge 30. According to the configuration of FIG. 6 where the temperature detection device T3 is mounted to the first cartridge 20, it is possible to reduce the manufacturing cost of the second cartridge 30 that is most frequently replaced in the aerosol generation device 1.

[0051] Note that, as shown in FIG. 5, when acquiring the temperature of the flavor source 33 by using the temperature detection device T1, the temperature detection device T1 may be provided to the power supply unit 10 that is least frequently replaced in the aerosol generation device 1. Therefore, it is possible to reduce the manufacturing costs of the first cartridge 20 and the second cartridge 30.

[0052] The voltage sensor 54 is configured to measure and output a voltage value that is applied to the first load 21. The current sensor 55 is configured to measure and output a current value that flows through the first load 21. The output of the voltage sensor 54 and the output of the current sensor 55 are each input to the MCU 50. The processor of the MCU 50 is configured to acquire a resistance value of the first load 21, based on the output of the voltage sensor 54 and the output of the current sensor 55, and to acquire a temperature of the first load 21 corresponding to the resistance value. Note that, in a configuration where constant current is caused to flow through the first load 21 when acquiring the resistance value of the first load 21, the current sensor 55 is not required in the temperature detection device T2. Likewise, in a configuration where a constant voltage is applied to the first load 21 when acquiring the resistance value of the first load 21, the voltage sensor 54 is not required in the temperature detection device T2.

(MCU)

[0053] Subsequently, functions of the MCU 50 are described. The MCU 50 has a temperature detection unit, an electric power control unit and a notification control unit, as functional blocks that are implemented as the processor executes programs stored in the ROM.

[0054] The temperature detection unit is configured to acquire a temperature of the flavor source 33, based on an output of the temperature detection device T1 (or the temperature detection device T3). The temperature detection unit is also configured to acquire a temperature of the first load 21, based on an output of the temperature detection device T2.

[0055] The notification control unit is configured to control the first notification unit 45 and the second notification unit 46 to notify a variety of information. For example, the notification control unit is configured to control at least one of the first notification unit 45 and the second notification unit 46 to issue a notification for urging replacement of the second cartridge 30, according to detection of a replacement timing of the second cartridge 30. The notification control unit may also be configured to issue a notification for urging replacement of the first cartridge 20, a notification for urging replace-

ment of the power supply 12, a notification for urging charging of the power supply 12, and the like, without being limited to the notification for urging replacement of the second cartridge 30. A replacement Flag for determining whether it is necessary to replace the second cartridge 30 (flavor source 33) is stored in the memory 50a of the MCU 50. The replacement Flag takes either FALSE or TRUE. FALSE means that replacement is not required. TRUE means that replacement is required. The replacement Flag is set to FALSE when an amount of a flavor component included in the flavor source 33 (a remaining amount of the flavor component, which will be described later) is equal to or greater than the threshold value TH1 and is set to TRUE when the amount is smaller than the threshold value TH1.

[0056] The electric power control unit is configured to control discharge (discharge necessary for heating of a load) from the power supply 12 to at least the first load 21 of the first load 21 and the second load 31, according to a signal indicative of a request for aerosol generation output from the inlet air sensor 15. Specifically, the electric power control unit is configured to perform at least first discharge of first discharge from the power supply 12 to the first load 21 for atomizing the aerosol source 22 and second discharge from the power supply 12 to the second load 31 for heating the flavor source 33.

[0057] In this way, in the aerosol generation device 1, the flavor source 33 can be heated by the discharge to the second load 31. It is experimentally known that it is effective to increase an amount of aerosol generated from the aerosol source 22 and to raise a temperature of the flavor source 33 so as to increase an amount of the flavor component to be added to aerosol.

[0058] Therefore, the electric power control unit is configured to control the discharge for heating from the power supply 12 to the first load 21 and the second load 31 so that a unit amount of flavor (an amount W_{flavor} of the flavor component, which will be described later), which is an amount of the flavor component to be added to aerosol generated in response to each request for aerosol generation, is to converge to a target amount, based on information about the temperature of the flavor source 33. The target amount is a value that is determined as appropriate. However, for example, a target range of the unit amount of flavor may be determined as appropriate, and an intermediate value of the target range may be determined as the target amount. In this way, the unit amount of flavor (amount W_{flavor} of the flavor component) can be converged to the target amount, so that the unit amount of flavor can also be converged to the target range having a width to some extent. Note that, as units of the unit amount of flavor and the amount W_{flavor} of the flavor component, and the target amount, a weight may be used.

[0059] Further, the electric power control unit is configured to control the discharge for heating from the power supply 12 to the second load 31 so that the temperature of the flavor source 33 is to converge to a target temperature (a target temperature $T_{\text{cap_target}}$, which will be described later), based on an output of the temperature detection device T1 (or the temperature detection device T3) configured to output information about the temperature of the flavor source 33.

(Diverse Parameters That Are Used For Generation of Aerosol)

[0060] Subsequently, a variety of parameters and the like that are used for discharge control for generation of aerosol are described before describing specific operations of the MCU 50.

[0061] A weight[mg] of aerosol that are generated in the first cartridge 20 by one inhalation operation by a user is denoted as the aerosol weight W_{aerosol} . The electric power that should be supplied to the first load 21 so as to generate the aerosol is denoted as the atomizing electric power P_{liquid} . Assuming that the aerosol source 22 is sufficiently present, the aerosol weight W_{aerosol} is proportional to the atomizing electric power P_{liquid} , and a supply time t_{sense} of the atomizing electric power P_{liquid} to the first load 21 (in other words, an energization time to the first load 21 or a time for which puff is performed). For this reason, the aerosol weight W_{aerosol} can be modeled by a following equation (1). In the equation (1), α is a coefficient that is experimentally obtained. Note that, the upper limit value of the supply time t_{sense} is the above-described upper limit time t_{upper} . The equation (1) may be replaced with an equation (1A). In the equation (1A), an intercept b having a positive value is introduced into the equation (1). The intercept is a term that can be arbitrarily introduced, considering a fact that a part of the atomizing electric power P_{liquid} is used for temperature rising of the aerosol source 22 that occurs before atomization of the aerosol source 22. The intercept b can also be experimentally obtained.

[formula 1]

$$W_{\text{aerosol}} \equiv \alpha \times P_{\text{liquid}} \times t_{\text{sense}} \cdots (1)$$

$$W_{\text{aerosol}} \equiv \alpha \times P_{\text{liquid}} \times t_{\text{sense}} - b \cdots (1A)$$

[0062] A weight[mg] of the flavor component included in the flavor source 33 in a state where inhalation is performed n_{puff} times (n_{puff} : natural number greater than 0) is denoted as the remaining amount $W_{\text{capsule}(n_{\text{puff}})}$ of the flavor com-

ponent. Note that, the remaining amount ($W_{capsule}(n_{puff}=0)$) of the flavor component included in the flavor source 33 of the second cartridge 30 in a brand-new state is denoted as $W_{initial}$. The information about the temperature of the flavor source 33 is denoted as the capsule temperature parameter $T_{capsule}$. A weight[mg] of the flavor component that is added to aerosol passing through the flavor source 33 by one inhalation operation by a user is denoted as the amount W_{flavor} of the flavor component. The information about the temperature of the flavor source 33 indicates, for example, a temperature of the flavor source 33 or the second load 31 that is acquired based on the output of the temperature detection device T1 (or the temperature detection device T3). In the below, the remaining amount $W_{capsule}(n_{puff})$ of the flavor component may be simply denoted as the remaining amount of the flavor component, in some cases.

[0063] It is experimentally known that the amount W_{flavor} of the flavor component depends on the remaining amount $W_{capsule}(n_{puff})$ of the flavor component, the capsule temperature parameter $T_{capsule}$ and the aerosol weight $W_{aerosol}$. Therefore, the amount W_{flavor} of the flavor component can be modeled by a following equation (2).
[formula 2]

$$W_{flavor} = \beta \times \{W_{capsule}(n_{puff}) \times T_{capsule}\} \times \gamma \times W_{aerosol} \quad \dots (2)$$

[0064] The remaining amount $W_{capsule}(n_{puff})$ of the flavor component is reduced by the amount W_{flavor} of the flavor component each time inhalation is performed. For this reason, the remaining amount $W_{capsule}(n_{puff})$ of the flavor component when n_{puff} is set to 1 or greater, specifically, the remaining amount of the flavor component after inhalation is performed one or more times can be modeled by a following equation (3).
[formula 3]

$$W_{capsule}(n_{puff}) = W_{initial} - \delta \cdot \sum_{i=1}^{n_{puff}} W_{flavor}(i) \quad \dots (3)$$

[0065] In the equation (2), β is a coefficient indicating a ratio of how much of the flavor component included in the flavor source 33 is added to aerosol in one inhalation, and is experimentally obtained. γ in the equation (2) and δ in the equation (3) are coefficients that are each experimentally obtained. During a time period for which one inhalation is performed, the capsule temperature parameter $T_{capsule}$ and the remaining amount $W_{capsule}(n_{puff})$ of the flavor component may each vary. However, in this model, γ and δ are introduced so as to treat the corresponding parameters as constant values.

(Operations of Aerosol Generation Device)

[0066] FIGS. 7 and 8 are flowcharts for describing operations of the aerosol generation device 1 shown in FIG. 1. When the aerosol generation device 1 is activated (power supply ON) by an operation on the operation unit 14 or the like (step S0: YES), the MCU 50 determines whether aerosol have been generated (whether inhalation by the user has been performed even once) after the power supply ON or replacement of the second cartridge 30 (step S1).

[0067] For example, the MCU 50 has a built-in puff-number counter configured to count up n_{puff} from an initial value (for example, 0) each time inhalation (request for aerosol generation) is performed. A count value of the puff-number counter is stored in the memory 50a. The MCU 50 refers to the count value to determine whether it is a state after inhalation has been performed even once.

[0068] When it is first inhalation after the power supply ON or when it is a timing before first inhalation after the second cartridge 30 is replaced (step S1: NO), the heating of the flavor source 33 is not performed yet or is not performed for a while, so that the temperature of the flavor source 33 is highly likely to depend on external environments. Therefore, in this case, the MCU 50 acquires, as the capsule temperature parameter $T_{capsule}$, the temperature of the flavor source 33 acquired based on the output of the temperature detection device T1 (or the temperature detection device T3), sets the acquired temperature of the flavor source 33 as the target temperature T_{cap_target} of the flavor source 33, and stores the same in the memory 50a (step S2).

[0069] Note that, in the state where the determination in step S1 is NO, there is a high possibility that the temperature of the flavor source 33 is close to the outside air temperature or the temperature of the power supply unit 10. For this reason, in step S2, as a modified embodiment, the outside air temperature or the temperature of the power supply unit 10 may be acquired as the capsule temperature parameter $T_{capsule}$, and may be set as the target temperature T_{cap_target} .

[0070] The outside air temperature is preferably acquired from a temperature sensor embedded in the inlet air sensor 15, for example. The temperature of the power supply unit 10 is preferably acquired from a temperature sensor embedded in the MCU 50 so as to manage an inside temperature of the MCU 50, for example. In this case, both the temperature sensor embedded in the inlet air sensor 15 and the temperature sensor embedded in the MCU 50 function as elements configured to output the information about the temperature of the flavor source 33.

[0071] As described above, in the aerosol generation device 1, the discharge from the power supply 12 to the second load 31 is controlled so that the temperature of the flavor source 33 is to converge to the target temperature T_{cap_target} . Therefore, after inhalation is performed even once after the power supply ON or the replacement of the second cartridge 30, there is a high possibility that the temperature of the flavor source 33 is close to the target temperature T_{cap_target} . Therefore, in this case (step S1: YES), the MCU 50 acquires the target temperature T_{cap_target} used for previous generation of aerosol and stored in the memory 50a, as the capsule temperature parameter $T_{capsule}$, and sets the same as the target temperature T_{cap_target} , as it is (step S3). In this case, the memory 50a functions as a device configured to output the information about the temperature of the flavor source 33.

[0072] Note that, in step S3, the MCU 50 may acquire, as the capsule temperature parameter $T_{capsule}$, the temperature of the flavor source 33 acquired based on the output of the temperature detection device T1 (or the temperature detection device T3), and set the acquired temperature of the flavor source 33 as the target temperature T_{cap_target} of the flavor source 33. In this way, the capsule temperature parameter $T_{capsule}$ can be acquired more accurately.

[0073] After step S2 or step S3, the MCU 50 determines the aerosol weight $W_{aerosol}$ necessary to achieve the target amount W_{flavor} of the flavor component by an equation (4), based on the set target temperature T_{cap_target} , and the remaining amount $W_{capsule}(n_{puff})$ of the flavor component of the flavor source 33 at the present moment (step S4). The equation (4) is a modification of the equation (2), in which $T_{capsule}$ is changed to T_{cap_target} . [formula 4]

$$W_{aerosol} = \frac{W_{flavor}}{\beta \times W_{capsule}(n_{puff}) \times T_{cap_target} \times \gamma} \dots (4)$$

[0074] Then, the MCU 50 determines the atomizing electric power P_{liquid} necessary to realize the aerosol weight $W_{aerosol}$ determined in step S4 by the equation (1) where t_{sense} is set as the upper limit time t_{upper} (step S5).

[0075] Note that, a table where a combination of the target temperature T_{cap_target} and the remaining amount $W_{capsule}(n_{puff})$ of the flavor component and the atomizing electric power P_{liquid} are associated with each other may be stored in the memory 50a of the MCU 50, and the MCU 50 may determine the atomizing electric power P_{liquid} by using the table. Thereby, the atomizing electric power P_{liquid} can be determined at high speed and low power consumption.

[0076] In the aerosol generation device 1, as described later, when the temperature of the flavor source 33 does not reach the target temperature at the time of detection of the request for aerosol generation, the deficiency in the amount W_{flavor} of the flavor component is supplemented by an increase in the aerosol weight $W_{aerosol}$ (an increase in the atomizing electric power). In order to secure the increase in the atomizing electric power, it is necessary to make the atomizing electric power determined in step S5 lower than an upper limit value P_{upper} of electric power that can be supplied to the first load 21 determined by the hardware configuration.

[0077] Specifically, after step S5, the MCU 50 sets an electric power threshold value P_{max} lower than the upper limit value P_{upper} (step S6a). When the atomizing electric power P_{liquid} determined in step S5 exceeds the electric power threshold value P_{max} (step S6: NO), the MCU 50 increases the target temperature T_{cap_target} of the flavor source 33 (step S7), and returns the processing to step S4. As can be seen from the equation (4), the aerosol weight $W_{aerosol}$ necessary to achieve the target amount W_{flavor} of the flavor component can be reduced by increasing the target temperature T_{cap_target} . As a result, the atomizing electric power P_{liquid} that is determined in step S5 can be reduced. The MCU 50 can set the determination in step S6, which was originally determined NO, to YES and shift the processing to step S8 by repeating steps S4 to S7.

[0078] The electric power threshold value P_{max} may be a single fixed value, but is preferably a variable value. Specifically, any one of multiple values is set for the electric power threshold value P_{max} . As described above, the atomizing electric power that is determined in step S5 is determined on the premise that the aerosol source 22 (remaining amount $W_{reservoir}$ in the reservoir) is sufficiently large. However, in a case where the remaining amount $W_{reservoir}$ in the reservoir is large and in a case where the remaining amount $W_{reservoir}$ in the reservoir is small, even if the atomizing electric power is the same, when the remaining amount $W_{reservoir}$ in the reservoir is small, an amount of the aerosol source 22 that is supplied to the wick 24 is smaller and it takes more time for the wick 24 to retain a sufficient amount of the aerosol source 22, so that the desired aerosol weight may not be realized. Specifically, when the remaining amount $W_{reservoir}$ in the reservoir is small, the necessary aerosol weight may not be realized. Therefore, it is preferably to reduce the necessary aerosol weight by increasing the target temperature of the flavor source 33 as much as that.

[0079] From such standpoint, in step S6a, the MCU 50 acquires the remaining amount $W_{reservoir}$ in the reservoir, and sets the electric power threshold value P_{max} , based on the remaining amount $W_{reservoir}$ in the reservoir. Specifically, the MCU 50 sets the electric power threshold value P_{max} to a large value so that the larger the remaining amount $W_{reservoir}$ in the reservoir is, the greater the aerosol weight is. In other words, when the remaining amount $W_{reservoir}$ in the reservoir is a first remaining amount, the MCU 50 sets the electric power threshold value P_{max} to a smaller value than when the

remaining amount $W_{\text{reservoir}}$ in the reservoir is a second remaining amount different from the first remaining amount (for example, a remaining amount larger than the first remaining amount). In this way, the atomizing electric power that is supplied to the first load 21 can be adjusted based on the remaining amount $W_{\text{reservoir}}$ in the reservoir. Therefore, it is possible to realize the target amount of the flavor component, irrespective of the remaining amount $W_{\text{reservoir}}$ in the reservoir.

[0080] The upper limit value P_{upper} is described. During the discharge from the power supply 12 to the first load 21, the current flowing through the first load 21 and the voltage of the power supply 12 are each denoted as I and V_{LIB} , an upper limit value of a boost rate of the DC/DC converter 51 is denoted as η_{upper} , an upper limit value of an output voltage of the DC/DC converter 51 is denoted as $P_{\text{DC/DC_upper}}$, and an electric resistance value of the first load 21 in a state where the temperature of the first load 21 reaches a boiling point temperature of the aerosol source 22 is denoted as $R_{\text{HTR}} (T_{\text{HTR}} = T_{\text{B.P.}})$. Hence, the upper limit value P_{upper} can be expressed by a following equation (5). [formula 5]

$$P_{\text{upper}} = I \cdot V_{\text{LIB}} = \min \left(\frac{(\eta_{\text{upper}} \cdot V_{\text{LIB}})^2}{R_{\text{HTR}} (T_{\text{HTR}} = T_{\text{B.P.}})} P_{\text{DC/DC_upper}} \right) - \Delta \quad \dots (5)$$

[0081] In the equation (5), when Δ is set to 0, an ideal value of the upper limit value P_{upper} is obtained. However, in a real circuit, it is necessary to take into consideration a resistance component of a wire connected to the first load 21, a resistance component other than the resistance component connected to the first load 21, and the like. For this reason, Δ that is an adjustment value is introduced in the equation (5) so as to provide a certain margin.

[0082] Note that, in the aerosol generation device 1, the DC/DC converter 51 is not necessarily required, and may be omitted. When the DC/DC converter 51 is omitted, the upper limit value P_{upper} can be expressed by a following equation (6). [formula 6]

$$P_{\text{upper}} = I \cdot V_{\text{LIB}} = \frac{V_{\text{LIB}}^2}{R_{\text{HTR}} (T_{\text{HTR}} = T_{\text{B.P.}})} - \Delta \quad \dots (6)$$

[0083] When the atomizing electric power P_{liquid} determined in step S5 is equal to or less than the electric power threshold value P_{max} (step S6: YES), the MCU 50 acquires the temperature $T_{\text{cap_sense}}$ of the flavor source 33 at the present moment, based on the output of the temperature detection device T1 (or the temperature detection device T3) (step S8).

[0084] Subsequently, the MCU 50 refers to the replacement Flag in the memory 50a. When the replacement Flag is FALSE (step S9a: YES), the MCU 50 controls discharge to the second load 31 for heating of the second load 31, based on the temperature $T_{\text{cap_sense}}$ and the target temperature $T_{\text{cap_target}}$ (step S9). Specifically, the MCU 50 supplies electric power to the second load 31 by PID (Proportional-Integral-Differential) control or ON/OFF control so that the temperature $T_{\text{cap_sense}}$ is to converge to the target temperature $T_{\text{cap_target}}$.

[0085] In the PID control, a difference between the temperature $T_{\text{cap_sense}}$ and the target temperature $T_{\text{cap_target}}$ is fed back and electric power control is performed based on a result of the feedback so that the temperature $T_{\text{cap_sense}}$ is to converge to the target temperature $T_{\text{cap_target}}$. According to the PID control, the temperature $T_{\text{cap_sense}}$ can be converged to the target temperature $T_{\text{cap_target}}$ with high accuracy. Note that, the MCU 50 may also use P (Proportional) control or PI (Proportional-Integral) control, instead of the PID control.

[0086] In the ON/OFF control, in a state where the temperature $T_{\text{cap_sense}}$ is lower than the target temperature $T_{\text{cap_target}}$, electric power is supplied to the second load 31, and in a state where the temperature $T_{\text{cap_sense}}$ is equal to or higher than the target temperature $T_{\text{cap_target}}$, the supply of electric power to the second load 31 is stopped until the temperature $T_{\text{cap_sense}}$ falls below the target temperature $T_{\text{cap_target}}$. According to the ON/OFF control, the temperature of the flavor source 33 can be raised more rapidly than the PID control. For this reason, it is possible to increase a possibility that the temperature $T_{\text{cap_sense}}$ will reach the target temperature $T_{\text{cap_target}}$ before the request for aerosol generation is detected. Note that, the target temperature $T_{\text{cap_target}}$ may have a hysteresis.

[0087] When the replacement Flag is TRUE (step S9a: NO), the MCU 50 shifts the processing to step S10, without executing the processing of step S9. Specifically, when the replacement Flag is TRUE, the MCU 50 further suppresses the discharge to the second load 31 for heating of the second load 31, as compared to when the replacement Flag is FALSE. Specifically, when the replacement Flag is FALSE, the discharge to the second load 31 is permitted, and when the replacement Flag is TRUE, the discharge to the second load 31 is not permitted. Note that, since the remaining amount $W_{\text{capsule}} (n_{\text{puff}})$ of the flavor component is sufficiently large at a timing immediately after replacement of the second cartridge 30, for example, the processing of step S9 is basically executed.

[0088] The description "suppress discharge to the second load 31 for heating of the second load 31" means that electric power equal to or greater than the minimum value of electric power, which is supplied to the second load 31 for generation of aerosol, is not supplied to the second load 31, and ideally, means that no electric power is supplied to the second load 31. The description "discharge to the second load 31 for heating of the second load 31 is permitted" means that the electric power equal to or greater than the minimum value is supplied to the second load 31.

[0089] In step S10 after step S9, the MCU 50 determines whether there is a request for aerosol generation. When a request for aerosol generation is not detected (step S10: NO), the MCU 50 determines a length of a time (hereinafter, referred to as the non-operation time) during which the request for aerosol generation is not performed, in step S11. When the non-operation time has reached a predetermined time (step S11: YES), the MCU 50 shifts to a sleep mode in which the power consumption is reduced (step S12). Note that, in a case where discharge to the second load 31 has started in step S9, the discharge is stopped in step S12. When the non-operation time is less than the predetermined time (step S11: NO), the MCU 50 shifts the processing to step S8.

[0090] When a request for aerosol generation is detected (step S10: YES), the MCU 50 acquires a temperature T_{cap_sense} of the flavor source 33 at that time, based on the output of the temperature detection device T1 (or the temperature detection device T3) (step S14). Then, the MCU 50 determines whether the temperature T_{cap_sense} acquired in step S14 is equal to or higher than the target temperature T_{cap_target} (step S15).

[0091] When the temperature T_{cap_sense} is lower than the target temperature T_{cap_target} (step S15: NO), the MCU 50 increases the atomizing electric power P_{liquid} determined in step S5 so as to supplement a decrease in the amount W_{flavor} of the flavor component due to the insufficient temperature of the flavor source 33. Specifically, the MCU 50 first determines an amount of increase ΔP of the atomizing electric power, based on the remaining amount $W_{reservoir}$ in the reservoir (step S19a), and supplies, to the first load 21, atomizing electric power P_{liquid} obtained by adding the amount of increase ΔP to the atomizing electric power P_{liquid} determined in step S5, thereby starting heating of the first load 21 (step S19). The amount of increase ΔP is a variable value corresponding to the remaining amount $W_{reservoir}$ in the reservoir but may also be a single fixed value. FIG. 9 is a schematic view showing an example of a combination of the electric power threshold value P_{max} and the amount of increase ΔP .

[0092] In the example of FIG. 9, the amount of increase ΔP is a constant value P1 when the remaining amount $W_{reservoir}$ in the reservoir is equal to or greater than a threshold value TH3, and is a value smaller than the value P1 when the remaining amount $W_{reservoir}$ in the reservoir is equal to or greater than a threshold value TH2 and smaller than the threshold value TH3. Specifically, in a range where the remaining amount $W_{reservoir}$ in the reservoir is equal to or greater than the threshold value TH2 and smaller than the threshold value TH3, the smaller the remaining amount $W_{reservoir}$ in the reservoir is, the smaller the amount of increase ΔP is. In the example of FIG. 9, the electric power threshold value P_{max} is a constant value P2 when the remaining amount $W_{reservoir}$ in the reservoir is equal to or greater than the threshold value TH3, and is a value smaller than the value P2 when the remaining amount $W_{reservoir}$ in the reservoir is equal to or greater than the threshold value TH2 and smaller than the threshold value TH3. Specifically, in a range where the remaining amount $W_{reservoir}$ in the reservoir is equal to or greater than the threshold value TH2 and smaller than the threshold value TH3, the smaller the remaining amount $W_{reservoir}$ in the reservoir is, the smaller the electric power threshold value P_{max} is. A sum of the electric power threshold value P_{max} and the amount of increase ΔP corresponding to each remaining amount $W_{reservoir}$ in the reservoir is equal to or smaller than the upper limit value P_{upper} . In addition, a summed value of the value P1 and the value P2 is the same as the upper limit value P_{upper} . The threshold value TH2 shown in FIG. 9 is a value smaller than the threshold value TH3 and is used to determine whether it is necessary to replace the first cartridge 20. Note that, the summed value of the value P1 and the value P2 may also be smaller than the upper limit value P_{upper} . In addition, the threshold value TH2 may be set so that it is determined whether it is necessary to replace the first cartridge 20, before the remaining amount $W_{reservoir}$ in the reservoir becomes zero.

[0093] In step S15, when the temperature T_{cap_sense} is equal to or higher than the target temperature T_{cap_target} (step S15: YES), the MCU 50 supplies the atomizing electric power P_{liquid} determined in step S5 to the first load 21 to start heating of the first load 21 (step S17). Note that, in step S15, the MCU 50 may determine whether the replacement Flag is FALSE, before it is determined whether the temperature T_{cap_sense} is equal to or higher than the target temperature T_{cap_target} . When the replacement Flag is FALSE, the MCU 50 may determine whether the temperature T_{cap_sense} is equal to or higher than the target temperature T_{cap_target} , and may execute the processing of step S17 or step S19a, depending on a result of the determination. When The replacement Flag is TRUE, the MCU 50 may execute the processing of step S19a, without determining whether the temperature T_{cap_sense} is equal to or higher than the target temperature T_{cap_target} . In a state where the remaining amount $W_{capsule(n_puff)}$ of the flavor component is small, even when the temperature of the flavor source 33 is close to the target temperature, the amount W_{flavor} of the flavor component that is added to aerosol may be smaller than the target amount. For this reason, it is possible to converge the amount W_{flavor} of the flavor component to the target amount by increasing the aerosol weight by the processing of step S19.

[0094] After starting heating of the first load 21 in step S19 or step S17, when the request for aerosol generation is not over (step S18: NO) and the duration of the request for aerosol generation is less than the upper limit time t_{upper} (step S18a: YES), the MCU 50 continues the heating of the first load 21, and the heating of the second load 31 if the

processing of step S9 is being executed. When the duration of the request for aerosol generation reaches the upper limit time t_{upper} (step S18a: NO) or when the request for aerosol generation is over (step S18: YES), the MCU 50 stops the supply of electric power to the second load 31 (step S21).

[0095] The MCU 50 may control the heating of the first load 21 in step S17 or step S19, based on the output of the temperature detection device T2. For example, when the MCU 50 executes the PID control or the ON/OFF control, in which the boiling point of the aerosol source 22 is set as the target temperature, based on the output of the temperature detection device T2, it is possible to suppress overheating of the first load 21 and the aerosol source 22, and to accurately control the amount of the aerosol source 22 that is atomized by the first load 21.

[0096] FIG. 10 is a schematic view showing the atomizing electric power that is supplied to the first load 21 in step S17 of FIG. 8. FIG. 11 is a schematic view showing the atomizing electric power that is supplied to the first load 21 in step S19 of FIG. 8. As shown in FIG. 11, when the temperature T_{cap_sense} does not reach the target temperature T_{cap_target} at the time of detection of the request for aerosol generation, the atomizing electric power P_{liquid} is increased, which is then supplied to the first load 21.

[0097] In this way, even though the temperature of the flavor source 33 does not reach the target temperature at the time when the request for aerosol generation is performed, the processing of step S19 is performed, so that the amount of aerosol to be generated can be increased. As a result, the decrease in the amount of the flavor component to be added to aerosol, which is caused due to the temperature of the flavor source 33 being lower than the target temperature, can be supplemented by the increase in the amount of aerosol. Therefore, the amount of the flavor component to be added to aerosol can be converged to the target amount. In addition, the amount of increase ΔP of the atomizing electric power to be increased in step S19 is a value based on the remaining amount $W_{reservoir}$ in the reservoir. Even when the atomizing electric power is increased in step S19, the smaller the remaining amount $W_{reservoir}$ in the reservoir is, the amount of increase ΔP is set to be smaller, so that an appropriate amount of aerosol corresponding to the remaining amount $W_{reservoir}$ in the reservoir can be generated. As a result, it is possible to suppress aerosol having unintended flavor and taste from being generated, which is caused when electric power more than necessity is supplied to the remaining amount $W_{reservoir}$ in the reservoir.

[0098] On the other hand, when the temperature of the flavor source 33 has reached the target temperature at the time when the request for aerosol generation is made, a desired amount of aerosol necessary to achieve the target amount of the flavor component is generated by the atomizing electric power determined in step S5. For this reason, the amount of the flavor component to be added to aerosol can be converged to the target amount.

[0099] After step S21, the MCU 50 acquires a supply time t_{sense} of the atomizing electric power supplied to the first load 21 in step S17 or step S19 to the first load 21 (step S22). Note that, it should be noted that when the MCU 50 detects the request for aerosol generation beyond the upper limit time t_{upper} , the supply time t_{sense} is the same as the upper limit time t_{upper} . Further, the MCU 50 increases the puff-number counter by "1" (step S23).

[0100] The MCU 50 calculates the remaining amount $W_{capsule}(n_{puff})$ of the flavor component of the flavor source 33 at the end of current inhalation, based on the supply time t_{sense} acquired in step S22, the atomizing electric power supplied to the first load 21 according to the received request for aerosol generation, the target temperature T_{cap_target} at the time of detection of the request for aerosol generation, and the remaining amount $W_{capsule}(n_{puff})$ of the flavor component immediately before this point of time (step S24).

[0101] When the control shown in FIG. 10 is performed, the amount W_{flavor} of the flavor component that is added to aerosol generated from start to end of the request for aerosol generation can be obtained by a following equation (7). (tend-tstart) in the equation (7) indicates the supply time t_{sense} . The remaining amount $W_{capsule}(n_{puff})$ of the flavor component in the equation (7) is a value at a point of time immediately before the request for aerosol generation is performed.

[formula 7]

$$W_{flavor}$$

$$= \beta \times \{W_{capsule}(n_{puff}) \times T_{cap_target}\} \times \gamma \times \alpha \times P_{liquid} \times (t_{end} - t_{start}) \quad \dots (7)$$

[0102] When the control shown in FIG. 11 is performed, the amount W_{flavor} of the flavor component that is added to aerosol generated from start to end of the request for aerosol generation can be obtained by a following equation (7A). (tend-tstart) in the equation (7A) indicates the supply time t_{sense} . The remaining amount $W_{capsule}(n_{puff})$ of the flavor component in the equation (7A) is a value at a point of time immediately before the request for aerosol generation is performed.

[formula 8]

$$W_{\text{flavor}}$$

$$= \beta \times \{W_{\text{capsule}}(n_{\text{puff}}) \times T_{\text{cap_target}}\} \times \gamma \times \alpha \times P_{\text{liquid}}' \times (t_{\text{end}} - t_{\text{start}}) \quad \dots (7A)$$

[0103] W_{flavor} for each request for aerosol generation obtained in this way is stored in the memory 50a, and values of the past amounts W_{flavor} of the flavor component including the amount W_{flavor} of the flavor component at the time of current aerosol generation and the amount W_{flavor} of the flavor component at the time of aerosol generation before the previous time are substituted into the equation (3) (specifically, a value obtained by multiplying the coefficient δ by an integral value of the values of the past amounts W_{flavor} of the flavor component is subtracted from W_{initial}), so that the remaining amount $W_{\text{capsule}}(n_{\text{puff}})$ of the flavor component after generation of aerosol can be derived with high accuracy and updated.

[0104] After step S24, the MCU 50 updates the remaining amount $W_{\text{reservoir}}$ in the reservoir stored in the memory 50a (step S24a). The remaining amount $W_{\text{reservoir}}$ in the reservoir can be derived based on a cumulative value of the supply time t_{sense} of the atomizing electric power to the first load 21 after the first cartridge 20 is replaced with a brand-new cartridge. A relationship between the cumulative value and the remaining amount $W_{\text{reservoir}}$ in the reservoir may be experimentally obtained. Alternatively, the remaining amount $W_{\text{reservoir}}$ in the reservoir may be derived based on a cumulative value of products of the supply time t_{sense} of the atomizing electric power to the first load 21 after the first cartridge 20 is replaced with a brand-new cartridge and the electric power (the atomizing electric power P_{liquid} , the atomizing electric power P_{liquid}') electrically discharged to the first load 21. A relationship between the cumulative value and the remaining amount $W_{\text{reservoir}}$ in the reservoir may also be experimentally obtained.

[0105] Further, in step S24a, the MCU 50 may derive the remaining amount $W_{\text{reservoir}}$ in the reservoir, based on the remaining amount $W_{\text{capsule}}(n_{\text{puff}})$ of the flavor component of the second cartridge 30 updated in step S24. In the present embodiment, the five second cartridges 30 can be used for one first cartridge 20. For example, data indicating a relationship between the change in the remaining amount $W_{\text{reservoir}}$ in the reservoir at the time when one second cartridge 30 is used and the change in the remaining amount $W_{\text{capsule}}(n_{\text{puff}})$ of the flavor component of the second cartridge 30 is experimentally obtained. In addition, the remaining amount $W_{\text{reservoir}}$ in the reservoir of the brand-new first cartridge 20 is equally divided for the five second cartridges 30, and a table shown in FIG. 12 in which the data is associated with each of the equally divided remaining amounts is prepared and stored in the memory 50a. In step S24a, the MCU 50 reads out, from the table, the remaining amount $W_{\text{reservoir}}$ in the reservoir corresponding to the current number of the used second cartridges 30 and remaining amount $W_{\text{capsule}}(n_{\text{puff}})$ of the flavor component, based on the cumulative number of the used second cartridges 30 after the first cartridge 20 is replaced with a brand-new cartridge, the remaining amount $W_{\text{capsule}}(n_{\text{puff}})$ of the flavor component acquired in step S24, and the table shown in FIG. 12, and stores the read remaining amount $W_{\text{reservoir}}$ in the reservoir in the memory 50a, as the latest information.

[0106] Subsequently, the MCU 50 determines whether the updated remaining amount $W_{\text{capsule}}(n_{\text{puff}})$ of the flavor component is smaller than the threshold value TH1 (step S25). When the updated remaining amount $W_{\text{capsule}}(n_{\text{puff}})$ of the flavor component is equal to or greater than the threshold value TH1 (step S25: NO), the MCU 50 shifts the processing to step S29. When the updated remaining amount $W_{\text{capsule}}(n_{\text{puff}})$ of the flavor component is smaller than the threshold value TH1 (step S25: YES), the MCU 50 refers to the replacement Flag (step S25a). When the replacement Flag is FALSE (step S25a: NO), the MCU 50 sets the replacement Flag to TRUE (step S25b), and shifts the processing to step S29. Note that, in step S25, YES (affirmative) may not be determined only when the remaining amount $W_{\text{capsule}}(n_{\text{puff}})$ of the flavor component is zero. In other words, the threshold value TH1 may be set so that a result of the determination in step S25 is YES (affirmative) before the remaining amount $W_{\text{capsule}}(n_{\text{puff}})$ of the flavor component becomes zero.

[0107] When the replacement Flag is TRUE (step S25a: YES), the MCU 50 causes at least one of the first notification unit 45 and the second notification unit 46 to issue a notification for urging replacement of at least one of the first cartridge 20 and the second cartridge 30 (step S26). Then, the MCU 50 resets the puff-number counter to an initial value (=0), deletes the value of the past W_{flavor} , and further initializes the target temperature $T_{\text{cap_target}}$ (step S27). Further, the MCU 50 sets the replacement Flag to FALSE (step S28), and executes processing of step S29.

[0108] The initialization of the target temperature $T_{\text{cap_target}}$ means excluding, from the setting values, the target temperature $T_{\text{cap_target}}$ at that time stored in the memory 50a. Note that, as another example, when step S3 is always executed with step S1 and step S2 being omitted, the initialization of the target temperature $T_{\text{cap_target}}$ means setting the target temperature $T_{\text{cap_target}}$ at that time stored in the memory 50a to a room temperature.

[0109] In step S29, when the power supply is not turned off (step S29: NO), the MCU 50 returns the processing to step S1, and when the power supply is turned off (step S29: YES), the MCU 50 ends the processing.

[0110] FIG. 13 is a timing chart for illustrating operations of the aerosol generation device shown in FIG. 1. FIG. 13 shows operations that are performed in a case where the power supply of the aerosol generation device 1 is turned on at time t1, first inhalation starts at time t2 thereafter, the remaining amount $W_{\text{capsule}}(n_{\text{puff}})$ of the flavor component at time t4 after the inhalation is over becomes smaller than the threshold value TH1, and then second inhalation starts at time t5.

[0111] After the power supply is turned on at time t_1 , the processing of step S1 to step S9a shown in FIG. 7 is executed. At a point of time before the first inhalation is performed, the remaining amount $W_{\text{capsule}}(n_{\text{puff}})$ of the flavor component is equal to or greater than the threshold value TH1. For this reason, the result of the determination in step S9a is YES, so that discharge to the second load 31 is started after time t_1 at which the power supply is turned on, as shown in FIG. 13.

[0112] Then, when the request for aerosol generation (atomization command of the aerosol source by the first load 21) is acquired at time t_2 by the MCU 50, discharge to the first load 21 is started. Thereafter, when the request for aerosol generation is over at time t_3 , the discharge to each of the first load 21 and the second load 31 is stopped.

[0113] After time t_3 , the remaining amount $W_{\text{capsule}}(n_{\text{puff}})$ of the flavor component is calculated based on the target temperature at time t_2 , the remaining amount of the flavor component at that time, a time (supply time t_{sense}) between time t_2 and time t_3 , and the atomizing electric power that is started to be supplied to the first load 21 at time t_2 . At time t_4 , when it is checked that the calculated remaining amount $W_{\text{capsule}}(n_{\text{puff}})$ of the flavor component becomes smaller than the threshold value TH1, the replacement Flag is set to TRUE, as shown in step S25b of FIG. 8. Thereafter, the processing of step S1 to step S9a shown in FIG. 7 is again executed. At this time, a result of the determination in step S9a is NO. For this reason, the discharge to the second load 31 after time t_4 is suppressed. Then, when second inhalation is performed at time t_5 , the discharge to the first load 21 is started.

[0114] When the second inhalation is over at time t_6 , the discharge to the first load 21 is stopped. Thereafter, the determination in step S25a of FIG. 8 becomes YES, so that the first notification unit 45 is first activated to issue a notification for urging replacement of the second cartridge 30, as shown in FIG. 13. Then, the second notification unit 46 is activated to issue a notification for urging replacement of the second cartridge 30. The activation start timings of the first notification unit 45 and the second notification unit 46 may be the same or may be reverse to those shown in FIG. 13. The activation start timing of at least one of the first notification unit 45 and the second notification unit 46 may be the same as the timing at which the request for aerosol generation is over.

(Effects of Embodiment)

[0115] As described above, according to the aerosol generation device 1, the discharge from the power supply 12 to the first load 21 and the second load 31 is controlled so that the amount of the flavor component included in aerosol each time the user inhales the aerosol is to converge to the target amount. For this reason, the amount of the flavor component that is provided for the user can be stabilized every inhalation, so that the commercial value of the aerosol generation device 1 can be increased. In addition, as compared to a configuration where the discharge is performed only for the first load 21, the amount of the flavor component that is provided for the user can be stabilized every inhalation, so that the commercial value of the aerosol generation device 1 can be further increased.

[0116] Further, according to the aerosol generation device 1, when the atomizing electric power determined in step S5 of FIG. 7 exceeds the electric power threshold value P_{max} , and hence, generation of aerosol necessary to achieve the target amount of the flavor component cannot be performed, the control on the discharge from the power supply 12 to the second load 31 is performed. In this way, since the discharge to the second load 31 is performed as necessary, the amount of the flavor component that is provided for the user can be stabilized every inhalation, and the amount of electric power for achieving the same can be reduced.

[0117] Further, according to the aerosol generation device 1, the remaining amount of the flavor component is updated in step S24, based on the discharge time (t_{sense}) to the first load 21 corresponding to the request for aerosol generation, $T_{\text{cap_target}}$ at the time of receiving the request for aerosol generation, and the electric power (the atomizing electric power P_{liquid} , the atomizing electric power P_{liquid}) electrically discharged to the first load according to the request for aerosol generation or an amount of the electric power (electric power $\times t_{\text{sense}}$), and the electric power that is electrically discharged to the first load 21 is determined based on the remaining amount of the flavor component, in step S4 and step S5. For this reason, after appropriately considering the electric power or amount of electric power electrically discharged to the first load 21 that highly influences the amount of the flavor component that can be added to aerosol and also appropriately considering the temperature of the flavor source 33 at the time of the discharge to the first load 21 that highly influences the amount of the flavor component that can be added to aerosol, the discharge to the first load 21 can be controlled.

[0118] Further, according to the aerosol generation device 1, the flavor source 33 is heated before the request for aerosol generation is detected. For this reason, the flavor source 33 can be warmed before the generation of aerosol, so that it is possible to shorten a necessary time after the request for aerosol generation is received until aerosol to which a desired amount of the flavor component is added are generated.

[0119] Further, according to the aerosol generation device 1, since the electric power threshold value P_{max} is changed based on the remaining amount $W_{\text{reservoir}}$ in the reservoir, the atomizing electric power is controlled based on the remaining amount $W_{\text{reservoir}}$ in the reservoir. For this reason, it is possible to supply the appropriate electric power based on the remaining amount of the aerosol source 22 to the first load 21. Therefore, it is possible to provide the user with aerosol having appropriate flavor and taste, which can improve the commercial value.

[0120] Further, according to the aerosol generation device 1, when the temperature of the flavor source 33 is lower

than the target temperature, the electric power that is supplied to the first load 21 is controlled according to the remaining amount $W_{\text{reservoir}}$ in the reservoir. For this reason, it is possible to provide the user with aerosol having appropriate flavor and taste, which can improve the commercial value.

[0121] Further, according to the aerosol generation device 1, since the electric power threshold value P_{max} is determined based on the remaining amount $W_{\text{reservoir}}$ in the reservoir, the electric power that is electrically discharged from the power supply 12 to the second load 31 is controlled based on the remaining amount $W_{\text{reservoir}}$ in the reservoir. For this reason, it is possible to supply the appropriate electric power based on the remaining amount of the aerosol source 22 to the second load 31. Therefore, it is possible to provide the user with aerosol having appropriate flavor and taste, which can improve the commercial value.

[0122] Further, according to the aerosol generation device 1, in step S24, the remaining amount of the flavor component is updated based on the discharge time (t_{sense}) to the first load 21 according to the request for aerosol generation, and the remaining amount $W_{\text{reservoir}}$ in the reservoir can be derived based on the remaining amount of the flavor component. As a result, it is not necessary to provide a dedicated sensor so as to measure the remaining amount $W_{\text{reservoir}}$ in the reservoir. For this reason, it is possible to suppress the increase in cost of the aerosol generation device 1.

[0123] Further, according to the aerosol generation device 1, when the remaining amount of the flavor component is smaller than the threshold value TH1, the discharge to the second load 31 is suppressed, so that the flavor and taste of aerosol are changed, as compared to a case where the remaining amount of the flavor component is large. For this reason, it is possible to inform the user by a sense of taste or a sense of smell that it is necessary to replace at least one of the first cartridge 20 and the second cartridge 30. As a result, as compared to a case where a notification is performed by a sense of vision, a sense of touch or a sense of hearing (as compared to a case where a notification is informed through a user's eye, hand or ear), the user can intuitively know the necessity for replacement. In addition, only the discharge to the second load 31 is suppressed, so that it is possible to inform the user that it is necessary to replace the second cartridge 30 including the flavor source 33 closely relating to flavor.

[0124] Further, according to the aerosol generation device 1, the remaining amount of the flavor component is calculated after the inhalation is over, and when the remaining amount of the flavor component is smaller than the threshold value TH1, the discharge to the second load 31 is suppressed (stopped) at the start of next inhalation. For this reason, the decrease in flavor and taste of aerosol at the time of current inhalation can be made remarkable, as compared to the flavor and taste at the time of previous inhalation. As a result, the user can easily notice that it is necessary to replace at least one of the first cartridge 20 and the second cartridge 30.

[0125] So far, the discharge control that is performed when the remaining amount of the flavor component becomes small has been described. However, a similar discharge can also be performed when the remaining amount in the reservoir becomes small. For example, it is assumed that the remaining amount of the flavor component is equal to or greater than the threshold value TH1 and the remaining amount in the reservoir is smaller than the threshold value TH2 at time t_4 of FIG. 13. In this case, the MCU 50 executes the discharge to the second load 31 after time t_4 (executes the processing of step S9 in FIG. 7), and suppresses (stops) the discharge to the first load 21 for heating of the first load 21, which should be executed according to the start of inhalation at time t_5 (does not execute the processing of step S17 or step S19 in FIG. 8). Then, the MCU 50 activates at least one of the first notification unit 45 and the second notification unit 46 to issue a notification for urging replacement of the first cartridge 20. The description "suppress discharge to the first load 21 for heating of the first load 21" means that electric power equal to or greater than the minimum value of electric power, which is supplied to the first load 21 for generation of aerosol, is not supplied to the first load 21, and ideally, means that no electric power is supplied to the first load 21. The description "discharge to the first load 21 is permitted" means that the electric power equal to or greater than the minimum value is supplied to the first load 21.

[0126] In this way, when the remaining amount in the reservoir is small, the discharge to the first load 21 is suppressed, so that the amount of aerosol to be generated is considerably reduced. For this reason, it is possible to inform the user by a sense of smell that it is necessary to replace the first cartridge 20 including the aerosol source 22 closely relating to aerosol.

[0127] It is also considered that the remaining amount of the flavor component is smaller than the threshold value TH1 and the remaining amount in the reservoir is smaller than the threshold value TH2 at time t_4 of FIG. 13. In this case, preferably, the MCU 50 suppresses (stops) only the discharge to the first load 21 of the discharges for heating, which are to be performed according to a next request for aerosol generation, and permits (executes) the discharge to the second load 31.

[0128] In this way, when both the remaining amount of the flavor component and the remaining amount in the reservoir are small, the amount of aerosol, which the user can more sensitively detect, of the amount of flavor and the amount of aerosol is reduced and the deficiency in the remaining amount of the flavor component and the remaining amount in the reservoir is notified to the user. For this reason, the user can more easily notice that it is necessary to replace both the first cartridge 20 and the second cartridge 30. In addition, even when both the remaining amount of the flavor component and the remaining amount in the reservoir are small, any one discharge is continuously performed, so that it is possible

to prevent a situation where there is almost no taste even when inhalation is made, which can improve the commercial value. Note that, it should be noted that even when only the discharge to the first load 21 is suppressed (stopped) and the discharge to the second load 31 is permitted (executed), the flavor and taste are delivered to the user by inhalation. In this case, however, the flavor and taste are different from the flavor and taste that are delivered when the discharges

both to the first load 21 and the second load 31 are permitted (executed).
[0129] Further, in any case of a case where the remaining amount of the flavor component is smaller than the threshold value TH1 and the remaining amount in the reservoir is equal to or greater than the threshold value TH2, a case where the remaining amount of the flavor component is equal to or greater than the threshold value TH1 and the remaining amount in the reservoir is smaller than the threshold value TH2, and a case where the remaining amount of the flavor component is smaller than the threshold value TH1 and the remaining amount in the reservoir is smaller than the threshold value TH2, after next inhalation starts, the MCU 50 executes control of first suppressing (stopping) the discharge to one of the first load 21 and the second load 31, and permitting (executing) the discharge to the other of the first load 21 and the second load 31. In this way, it is possible to make the user who performs inhalation feel the change in flavor and taste stepwise. Therefore, the user can easily notice that it is necessary to replace both or one of the first cartridge 20 and the second cartridge 30.

(First Modified Embodiment of Aerosol Generation Device)

[0130] In the above, the remaining amount of the flavor component is derived, and the atomizing electric power P_{liquid} and the target temperature $T_{\text{cap_target}}$ necessary to achieve the target amount W_{flavor} of the flavor component are determined based on the remaining amount of the flavor component before the request for aerosol generation is performed. In this modified embodiment, the atomizing electric power P_{liquid} that is determined before the request for aerosol generation is performed is set to a constant value, and the target temperature $T_{\text{cap_target}}$ is variably controlled based on the remaining amount of the flavor source 33 (specifically, the smaller the remaining amount is, the target temperature is raised), thereby achieving the target amount W_{flavor} of the flavor component.

[0131] Also in the aerosol generation device 1 of the first modified embodiment, when the temperature of the flavor source 33 is lower than the target temperature at the time of detection of the request for aerosol generation, the deficiency in the amount W_{flavor} of the flavor component is supplemented by the increase in the aerosol weight W_{aerosol} (increase in the atomizing electric power). In order to secure the amount of increase in the atomizing electric power, the atomizing electric power P_{liquid} that is determined before detecting the request for aerosol generation is set lower than the upper limit value P_{upper} .

[0132] In the first modified embodiment, the MCU 50 does not derive the remaining amount of the flavor component, and variably controls the target temperature $T_{\text{cap_target}}$ by using another parameter equivalent to the remaining amount of the flavor component.

[0133] The remaining amount of the flavor component is reduced each time inhalation is performed. For this reason, the remaining amount of the flavor component is inversely proportional to the number of inhalation times, which is the number of times that inhalation is performed (in other words, the number of cumulative times of the discharge operation to the first load 21 for aerosol generation according to the request for aerosol generation). Further, the remaining amount of the flavor component is more reduced as the time during which the discharge to the first load 21 for aerosol generation is performed according to inhalation is longer. For this reason, the remaining amount of the flavor component is also inversely proportional to a cumulative value of time (hereinbelow, referred to as the cumulative discharge time) during which the discharge to the first load 21 for aerosol generation is performed according to inhalation. Therefore, the remaining amount of the flavor component of the second cartridge 30 can be calculated based on the number of inhalation times or the cumulative discharge time while one second cartridge 30 is used, without deriving the remaining amount of the flavor component by the complex calculation as described above.

[0134] As can be seen from the model of the equation (2), assuming that the aerosol weight W_{aerosol} every inhalation is controlled to be substantially constant (the atomizing electric power P_{liquid} is controlled to be constant), in order to stabilize the amount W_{flavor} of the flavor component, it is necessary to raise the temperature of the flavor source 33 according to the decrease in the remaining amount of the flavor component (specifically, the increase in the number of inhalation times or the cumulative discharge time). In the first modified embodiment, the electric power control unit of the MCU 50 manages the target temperature according to a table stored in advance in the memory 50a, in which the number of inhalation times or the cumulative discharge time (or the remaining amount of the flavor source 33 calculated based on the same) and the target temperature of the flavor source 33 are stored in association with each other.

[0135] FIGS. 14 and 15 are flowcharts for describing operations of the aerosol generation device 1 according to the first modified embodiment. When the power supply of the aerosol generation device 1 is turned on as a result of the operation on the operation unit 14, or the like (step S30: YES), the MCU 50 determines (sets) the target temperature $T_{\text{cap_target}}$ of the flavor source 33, based on the number of inhalation times or the cumulative discharge time (or the remaining amount of the flavor source 33) stored in the memory 50a (step S31).

[0136] Subsequently, the MCU 50 acquires the temperature of the flavor source 33 T_{cap_sense} at the present moment, based on the output of the temperature detection device T1 (or the temperature detection device T3) (step S32).

[0137] Then, the MCU 50 refers to the replacement Flag in the memory 50a, and when the replacement Flag is FALSE (step S32a: YES), the MCU 50 controls the discharge for heating of the flavor source 33 to the second load 31, based on the temperature T_{cap_sense} and the target temperature T_{cap_target} (step S33). Specifically, the MCU 50 supplies the electric power to the second load 31 by the PID control or the ON/OFF control so that the temperature T_{cap_sense} is to converge to the target temperature T_{cap_target} .

[0138] When the replacement Flag is TRUE (step S32a: NO), the MCU 50 shifts the processing to step S34 without executing the processing of step S33. Note that, since the remaining amount of the flavor component is sufficiently large at a timing immediately after replacement of the second cartridge 30, or the like, the processing of step S33 is basically performed.

[0139] After step S33, the MCU 50 determines whether there is a request for aerosol generation (step S34). When a request for aerosol generation is not detected (step S34: NO), the MCU 50 determines a length of the non-operation time during which the request for aerosol generation is not performed, in step S35. When the non-operation time has reached a predetermined time (step S35: YES), the MCU 50 shifts to the sleep mode in which the power consumption is reduced (step S36). Note that, when the discharge to the second load 31 has started in step S33, the discharge is stopped in step S36. When the non-operation time has not reached the predetermined time (step S35: NO), the MCU 50 shifts the processing to step S32.

[0140] When a request for aerosol generation is detected (step S34: YES), the MCU 50 acquires the temperature T_{cap_sense} of the flavor source 33 at that time, based on the output of the temperature detection device T1 (or the temperature detection device T3) (step S37). Then, the MCU 50 determines whether the temperature T_{cap_sense} acquired in step S37 is equal to or higher than the target temperature T_{cap_target} (step S42).

[0141] When the temperature T_{cap_sense} is equal to or higher than the target temperature T_{cap_target} (step S42: YES), the MCU 50 supplies the predetermined atomizing electric power P_{liquid} to the first load 21, thereby starting heating of the first load 21 (heating for atomizing the aerosol source 22) (step S43).

[0142] When the temperature T_{cap_sense} is lower than the target temperature T_{cap_target} (step S42: NO), the MCU 50 increases the predetermined atomizing electric power P_{liquid} so as to supplement the decrease in the amount of the flavor component due to the insufficient temperature of the flavor source 33. Specifically, the MCU 50 first acquires the remaining amount $W_{reservoir}$ in the reservoir, and determines an amount of increase ΔPa of the atomizing electric power P_{liquid} , based on the acquired remaining amount $W_{reservoir}$ in the reservoir (step S45). Then, the MCU 50 supplies, to the first load 21, the atomizing electric power P_{liquid}' obtained by adding the amount of increase ΔPa to the atomizing electric power P_{liquid} , thereby starting heating of the first load 21 (step S46). As the amount of increase ΔPa , for example, a variable value that is the same as the amount of increase ΔP shown in FIG. 9 is used.

[0143] After starting the heating of the first load 21 in step S43 or step S46, when the request for aerosol generation is not over yet (step S44: NO) and the duration of the request for aerosol generation is shorter than the upper limit time t_{upper} (step S44a: YES), the MCU 50 continues the heating of the first load 21, and the heating of the second load 31 if the processing of step S33 is being executed. When the duration of the request for aerosol generation reaches the upper limit time t_{upper} (step S44a: NO) or when the request for aerosol generation is over (step S44: YES), the MCU 50 stops the supply of electric power to the first load 21, and the supply of electric power to the second load 31 if the processing of step S33 is being executed (step S48). Note that, when increasing the atomizing electric power P_{liquid} in step S46, the MCU 50 may shorten the upper limit time t_{upper} . Specifically, the value of the upper limit time t_{upper} may be determined so that a product of the atomizing electric power P_{liquid} before the increase and the upper limit time t_{upper} before the shortening is the same as a product of a sum of the atomizing electric power P_{liquid} and the amount of increase ΔPa and the shortened upper limit time t_{upper} .

[0144] In this way, even when the atomizing electric power is increased in step S46, the smaller the remaining amount $W_{reservoir}$ in the reservoir is, the amount of increase ΔPa is set to be smaller, so that the appropriate electric power corresponding to the remaining amount $W_{reservoir}$ in the reservoir can be supplied to the first load 21. As a result, it is possible to suppress aerosol having unintended flavor and taste from being generated, which is caused when electric power more than necessity is supplied to the remaining amount $W_{reservoir}$ in the reservoir. Note that, when the shortening of the upper limit time t_{upper} is also performed, it is possible to suppress more effectively aerosol having unintended flavor and taste from being generated.

[0145] After step S48, the MCU 50 acquires the supply time t_{sense} to the first load 21 of the atomizing electric power supplied to the first load 21 in step S43 or step S46 (step S49). Then, the MCU 50 updates the cumulative discharge time stored in the memory 50a, based on the supply time t_{sense} (step S50). If the number of inhalation times is used when determining the target temperature in step S31, the MCU 50 updates the number of inhalation times stored in the memory 50a in step S50. In addition, the MCU 50 updates the remaining amount $W_{reservoir}$ in the reservoir (step S51). Note that, when the atomizing electric power P_{liquid} is increased in step S46, the MCU 50 may correct the acquired supply time t_{sense} to be long. Specifically, the MCU 50 may set, as the corrected supply time t_{sense} , a value obtained

by dividing a sum of the atomizing electric power P_{liquid} and the amount of increase ΔPa by the atomizing electric power P_{liquid} and then multiplying the supply time t_{sense} , and then perform the processing thereafter.

[0146] The cumulative discharge time or the number of inhalation times updated in step S50 is a parameter indicating a consumed amount of the flavor source 33 after the second cartridge 30 is replaced with a brand-new cartridge. Therefore, it is possible to acquire the remaining amount of the flavor source 33 by comparing the cumulative discharge time or the number of inhalation times and the upper limit value of the cumulative discharge time or the number of inhalation times per one second cartridge 30. For example, the remaining amount[%] of the flavor source 33 can be acquired by dividing a value, which is obtained by subtracting the cumulative discharge time or the number of inhalation times from the upper limit value, by the upper limit value and multiplying 100.

[0147] Then, the MCU 50 determines whether the remaining amount of the flavor source 33 calculated based on the number of inhalation times or the cumulative discharge time after the update in step S50 is smaller than the threshold value TH1 (step S52). When the remaining amount of the flavor source 33 is equal to or greater than the threshold value TH1 (step S52: NO), the MCU 50 shifts the processing to step S58. When the remaining amount of the flavor source 33 is smaller than the threshold value TH1 (step S52: YES), the MCU 50 refers to the replacement Flag (step S53). When the replacement Flag is FALSE (step S53: NO), the MCU 50 sets the replacement Flag to TRUE (step S54), and shifts the processing to step S58.

[0148] When the replacement Flag is TRUE (step S53: YES), the MCU 50 causes at least one of the first notification unit 45 and the second notification unit 46 to issue a notification for urging replacement of the second cartridge 30 (step S55). The notification method is similar to the above method. Then, the MCU 50 resets the number of inhalation times or the cumulative discharge time to the initial value (=0) (step S56). In addition, the MCU 50 sets the replacement Flag to FALSE (step S57), and executes the processing of step S58.

[0149] In step S58, when the power supply is not turned off (step S58: NO), the MCU 50 returns the processing to step S31, and when the power supply is turned off (step S58: YES), the MCU 50 ends the processing. In this way, according to the first modified embodiment, it is possible to stabilize flavor and taste every inhalation while simplifying the operations.

(Second Modified Embodiment of Aerosol Generation Device)

[0150] In the aerosol generation device 1 shown in FIG. 1, the remaining amount of the flavor component and the remaining amount in the reservoir may be calculated during a time period for which generation of aerosol is performed according to the request for aerosol generation, and when at least one of the remaining amount of the flavor component and the remaining amount in the reservoir is smaller than the threshold value, the control of stopping the discharge to any one of the first load 21 and the second load 31 may be performed during the time period.

[0151] FIGS. 16 and 17 are flowcharts for describing operations of the aerosol generation device 1 of a second modified embodiment. The flowchart shown in FIG. 16 is the same as the flowchart shown in FIG. 7, except that step S9a is omitted and step S9 is performed after step S8. Step S15, step S17, step S19a, and step S19 in the flowchart shown in FIG. 17 are the same as the processing shown in FIG. 8. Therefore, in the below, only the operations after step S17 and step S19 in FIG. 17 are described. Note that, the operations after step S17 and step S19 in FIG. 17 indicate operations in a state where $(n_{\text{puff}}+1)^{\text{th}}$ inhalation is being performed after inhalation is performed n_{puff} times since the second cartridge 30 is replaced.

[0152] After step S17 or step S19, the MCU 50 acquires elapsed time from the start of processing of step S17 or step S19 to the present moment (supply time $t_{\text{sense(now)}}$ of the atomizing electric power to the first load 21) (step S51).

[0153] Then, the MCU 50 calculates the remaining amount $W_{\text{capsule(Now)}}$ of the flavor component of the flavor source 33 at the present moment, based on the supply time $t_{\text{sense(now)}}$ acquired in step S51, the atomizing electric power supplied to the first load 21 in step S17 or step S19, the target temperature $T_{\text{cap_target}}$ at the time of detection of the request for aerosol generation, and the remaining amount $W_{\text{capsule}(n_{\text{puff}})}$ of the flavor component at the end of $n_{\text{puff}}^{\text{th}}$ inhalation (step S52).

[0154] The amount $W_{\text{flavor(Now)}}$ of the flavor component that is added to aerosol generated during a time period from the start of step S17 or step S19 to the present moment can be calculated by substituting the supply time $t_{\text{sense(now)}}$ into $(t_{\text{end}}-t_{\text{start}})$ in the equation (7), substituting the atomizing electric power supplied to the first load 21 in step S17 or step S19 into P_{liquid} in the equation (7), and substituting the target temperature at the present moment into $T_{\text{cap_target}}$ in the equation (7).

[0155] By subtracting a value, which is obtained by multiplying an integrated value of the past amounts W_{flavor} of the flavor component including the amount $W_{\text{flavor(Now)}}$ of the flavor component calculated in this way and the amount W_{flavor} of the flavor component added to aerosol during pervious $(n_{\text{puff}}^{\text{th}})$ inhalation by the coefficient δ in the equation (3), from W_{initial} , the MCU 50 calculates the remaining amount $W_{\text{capsule(Now)}}$ of the flavor component at the present moment. Alternatively, the MCU 50 may also calculate the remaining amount of the flavor component $W_{\text{capsule(Now)}}$ at the present moment by subtracting a value, which is obtained by multiplying the amount W_{flavor} of the flavor compo-

ment(Now) by the coefficient δ , from the remaining amount $W_{\text{capsule}(n_{\text{puff}})}$ of the flavor component.

[0156] After step S52, the MCU 50 calculates the remaining amount $W_{\text{reservoir}}$ in the reservoir at the present moment (step S53). The remaining amount $W_{\text{reservoir}}$ in the reservoir at the present moment can be derived based on a cumulative value of the supply time of the atomizing electric power to the first load 21 after the first cartridge 20 is replaced with a brand-new cartridge to the present moment. A relationship between the cumulative value and the remaining amount $W_{\text{reservoir}}$ in the reservoir may be experimentally obtained. As described above, the MCU 50 may also calculate the remaining amount $W_{\text{reservoir}}$ in the reservoir at the present moment, based on the remaining amount of the flavor component $W_{\text{capsule(Now)}}$ calculated in step S52.

[0157] Subsequently, the MCU 50 determines whether the remaining amount $W_{\text{capsule(Now)}}$ of the flavor component is smaller than the threshold value TH1 (step S54). When the remaining amount $W_{\text{capsule(Now)}}$ of the flavor component is equal to or greater than the threshold value TH1 (step S54: NO), the MCU 50 shifts the processing to step S55. In step S55, when the request for aerosol generation is not over yet (step S55: NO) and the duration of the request for aerosol generation is shorter than the upper limit time t_{upper} (step S55a: YES), the MCU 50 returns the processing to step S51. When the duration of the request for aerosol generation reaches the upper limit time t_{upper} (step S55a: NO) or when the request for aerosol generation is over (step S55: YES), the MCU 50 stops (suppresses) the electric power for heating to the first load 21 and the second load 31 (step S56).

[0158] After step S56, the MCU 50 increases the puff-number counter by "1" (step S57). In addition, the MCU 50 stores the remaining amount $W_{\text{capsule(Now)}}$ of the flavor component at the present moment in the memory 50a, as the latest remaining amount $W_{\text{capsule}(n_{\text{puff}})}$ of the flavor component (step S58). After step S58, the processing of step S63 is executed.

[0159] When the remaining amount $W_{\text{capsule(Now)}}$ of the flavor component is smaller than the threshold value TH1 (step S54: YES), the MCU 50 suppresses (stops) the discharge to the second load 31 (heating of the second load 31 for generation of aerosol) (step S59). Further, the MCU 50 causes at least one of the first notification unit 45 and the second notification unit 46 to issue a notification for urging replacement of the second cartridge 30 (step S60). Then, the MCU 50 suppresses (stops) the discharge to the first load 21 (heating of the first load 21 for generation of aerosol) (step S61). Note that, the MCU 50 may execute step S55 after step S59, and when a result of determination in step S55 is affirmative (step S55: YES), the MCU may shift the processing to step S61, and when a result of determination in step S55 is negative (step S55a: YES), the MCU may shift the processing to step S55a. In addition, when a result of determination in step S55a is affirmative (step S55a: YES), the MCU 50 may return the processing to step S51, and when a result of determination in step S55a is negative (step S55a: NO), the MCU 50 may shift the processing to step S61. In this way, the discharge for heating to the first load 21 is continuously performed until it is satisfied that the duration of the request for aerosol generation reaches the upper limit time t_{upper} (step S55a: NO) or that the request for aerosol generation is over (step S55: YES). In addition, the MCU 50 resets the puff-number counter to the initial value (=0), deletes the value of the past amount $W_{\text{flavor(Now)}}$ of the flavor component, and further initializes the target temperature $T_{\text{cap_target}}$ (step S62). After step S62, when the power supply is not turned off (step S63: NO), the MCU 50 returns the processing to step S1, and when the power supply is turned off (step S63: YES), the MCU 50 ends the processing.

[0160] FIG. 18 is a timing chart for illustrating operations of the aerosol generation device of the second modified embodiment. FIG. 18 shows operations that are performed in a case where the power supply of the aerosol generation device 1 is turned on at time t_1 , inhalation starts at time t_2 thereafter, and the remaining amount $W_{\text{capsule(Now)}}$ of the flavor component becomes smaller than the threshold value TH1 at time t_3 of the time period of the inhalation.

[0161] After the power supply is turned on at time t_1 , the processing of step S1 to step S9 shown in FIG. 16 is performed. Therefore, as shown in FIG. 18, after time t_1 at which the power supply is turned on, the discharge to the second load 31 is started.

[0162] After inhalation is started at time t_2 , the MCU 50 updates the remaining amount $W_{\text{capsule(Now)}}$ of the flavor component and the remaining amount $W_{\text{reservoir}}$ in the reservoir every predetermined time. When it is checked that the remaining amount $W_{\text{capsule(Now)}}$ of the flavor component becomes smaller than the threshold value TH1 at time t_3 while the request for aerosol generation is performed, the discharge to the second load 31 is stopped and the first notification unit 45 is activated to issue a notification for urging replacement of the second cartridge 30. Thereafter, the discharge to the first load 21 is stopped at time t_4 , and then the second notification unit 46 is activated to issue a notification for urging replacement of the second cartridge 30. The timing (time t_4) at which the discharge to the first load 21 is stopped may be before the request for aerosol generation is over or after the request for aerosol generation is over.

[0163] Note that, the first notification unit 45 and the second notification unit 46 may be activated at the same time at time t_3 , the first notification unit 45 and the second notification unit 46 may be activated at the same time at time t_4 , the second notification unit 46 may be activated at time t_3 and the first notification unit 45 may be activated at time t_4 , or the first notification unit 45 may be activated at time t_3 and the second notification unit 46 may be activated at time t_4 .

[0164] According to the aerosol generation device 1 of the second modified embodiment, when the remaining amount of the flavor component of the flavor source 33 acquired during the generation of aerosol is small, the discharge to the second load 31 is suppressed during the generation of aerosol. For this reason, it is possible to inform the user that the

remaining amount of the flavor source 33 is small, at as early timing as possible.

[0165] In the aerosol generation device 1 of the second modified embodiment, the similar discharge control can also be performed when the remaining amount in the reservoir becomes small. For example, as shown in FIG. 19, it is assumed that the remaining amount in the reservoir becomes smaller than the threshold value TH2 at time t3. In this case, the MCU 50 executes the discharge to the second load 31 after time t3, and suppresses (stops) the discharge to the first load 21 after time t3. In this way, when the remaining amount in the reservoir is small, the discharge to the first load 21 is suppressed, so that the amount of aerosol to be generated is considerably reduced. For this reason, it is possible to inform the user by the sense of taste that it is necessary to replace the first cartridge 20 including the aerosol source 22 closely relating to aerosol. Note that, it should be noted that even when only the discharge to the first load 21 is suppressed (stopped) and the discharge to the second load 31 is permitted (executed), the flavor and taste are delivered to the user by inhalation. In this case, however, the flavor and taste are different from the flavor and taste that are delivered when the discharges both to the first load 21 and the second load 31 are permitted (executed).

[0166] A case is also considered in which the remaining amount $W_{\text{capsule}}(\text{Now})$ of the flavor component is smaller than the threshold value TH1 and the remaining amount in the reservoir is smaller than the threshold value TH2 at time t3 of FIG. 19. In this case, preferably, the MCU 50 suppresses (stops) only the discharge to the first load 21 after time t3, and executes the discharge to the second load 31. In this way, when both the remaining amount of the flavor component and the remaining amount in the reservoir are small, the amount of aerosol, which the user can more sensitively detect, of the amount of flavor and the amount of aerosol is reduced and the deficiency in the remaining amount of the flavor component and the remaining amount in the reservoir is notified to the user. For this reason, the user can more easily notice that it is necessary to replace both the first cartridge 20 and the second cartridge 30. In addition, even when both the remaining amount of the flavor component and the remaining amount in the reservoir are small, any one discharge is continuously performed, so that it is possible to prevent a situation where there is almost no taste even when inhalation is made, which can improve the commercial value.

[0167] Further, in any case of a case where the remaining amount $W_{\text{capsule}}(\text{Now})$ of the flavor component is smaller than the threshold value TH1 and the remaining amount in the reservoir is equal to or greater than the threshold value TH2, a case where the remaining amount $W_{\text{capsule}}(\text{Now})$ of the flavor component is equal to or greater than the threshold value TH1 and the remaining amount in the reservoir is smaller than the threshold value TH2, and a case where the remaining amount $W_{\text{capsule}}(\text{Now})$ of the flavor component is smaller than the threshold value TH1 and the remaining amount in the reservoir is smaller than the threshold value TH2, after time t3 of FIGS. 18 and 19, the MCU 50 executes control of stopping the discharge to one of the first load 21 and the second load 31, and continuously performing the discharge to the other of the first load 21 and the second load 31. Thereafter, the MCU 50 executes control of stopping the discharges to both the first load 21 and the second load 31. In this way, it is possible to make the user who performs inhalation feel the change in flavor and taste stepwise. Therefore, the user can easily notice that it is necessary to replace both or one of the first cartridge 20 and the second cartridge 30.

[0168] In the example of FIG. 18, the stop of the discharge to the second load 31 and the activation start of the first notification unit 45 are made at the same timing. However, the present invention is not limited thereto. For example, as shown in FIG. 19, the first notification unit 45 may be activated after the discharge is stopped.

[0169] Further, for example, as shown in FIG. 20, the discharge to the second load 31 may be stopped at a timing slightly after time t3 at which the remaining amount $W_{\text{capsule}}(\text{Now})$ of the flavor component becomes smaller than the threshold value TH1, the first notification unit 45 may be activated at a timing (time t3 in the example of FIG. 20) before the discharge is stopped, and the second notification unit 46 may be activated after the discharge to the second load 31 is stopped.

[0170] In this way, since the first notification unit 45 functions at a timing before the discharge to the first load 21 or the second load 31 is suppressed and the flavor and taste are thus changed, the user can more easily notice that the remaining amount of the flavor source 33 or the aerosol source 22 becomes small. In addition, it is possible to replace the first cartridge 20 or the second cartridge 30 before aerosol having the changed flavor and taste are generated. As a result, the merchantability of the aerosol generation device 1 is improved. Further, since the notification is performed by the different notification units before and after the flavor and taste change, the user can more easily notice that it is necessary to replace the first cartridge 20 or the second cartridge 30.

[0171] Further, in the example of FIG. 20, when the discharge to the second load 31 is stopped, the second notification unit 46 is activated. Thereby, the second notification unit 46 can be activated at a timing before the request for aerosol generation is over. For this reason, the user can easily notice the change in flavor and taste.

[0172] In the aerosol generation device 1 of the second modified embodiment, the method of setting the target temperature based on the cumulative discharge time, which has been described in the first modified embodiment, can be applied. Specifically, the MCU 50 may set the target temperature based on the cumulative discharge time, start the discharge to the second load 31 according to the target temperature, calculate the cumulative discharge time at a predetermined interval during the generation of aerosol, and execute the processing of step S59 and thereafter shown in FIG. 17 when the calculated cumulative discharge time exceeds a threshold value TH4 and continue the discharge

to each of the first load 21 and the second load 31 when the calculated cumulative discharge time is equal to or smaller than the threshold value TH4.

[0173] In the aerosol generation device 1 described above, the first cartridge 20 is detachably mounted to the power supply unit 10. However, the first cartridge 20 may also be integrated with the power supply unit 10.

[0174] In the aerosol generation device 1 described above, the first load 21 and the second load 31 are each configured as a heater that generates heat by electric power electrically discharged from the power supply 12. However, the first load 21 and the second load 31 may also be each configured as a Peltier device that can generate heat and cool by electric power electrically discharged from the power supply 12. When the first load 21 and the second load 31 are each configured in this way, the degrees of control freedom on the temperature of the aerosol source 22 and the temperature of the flavor source 33 are increased, so that it is possible to control the unit amount of flavor more highly.

[0175] In addition, the first load 21 may also be configured by a device that can atomize the aerosol source 22 without heating the aerosol source 22 by ultrasonic waves or the like. Further, the second load 31 may also be configured by a device that can change the amount of the flavor component to be added to aerosol by the flavor source 33 without heating the flavor source 33 by ultrasonic waves or the like.

[0176] In a case where an ultrasonic device is used for the second load 31, for example, the MCU 50 may control the discharge to the first load 21 and the second load 31, based on a wavelength of ultrasonic waves applied to the flavor source 33, for example, not the temperature of the flavor source 33, as the parameter that influences the amount of the flavor component to be added to aerosol passing through the flavor source 33.

[0177] The device that can be used for the first load 21 is not limited to a heater, a Peltier device and an ultrasonic device described above, and a variety of devices or a combination thereof can be used as long as it can atomize the aerosol source 22 by consuming the electric power supplied from the power supply 12. Likewise, the device that can be used for the second load 31 is not limited to a heater, a Peltier device and an ultrasonic device as described above, and a variety of devices or a combination thereof can be used as long as it can change the amount of the flavor component to be added to aerosol by consuming the electric power supplied from the power supply 12.

[0178] The present specification discloses at least following matters. Note that, the constitutional elements corresponding to the embodiments are shown in parentheses. However, the present invention is not limited thereto.

(1) A control unit of an aerosol generation device including a processing device (MCU 50) configured to acquire a remaining amount of at least one of an aerosol source (aerosol source 22) and a flavor source (flavor source 33) configured to add flavor to aerosol generated from the aerosol source, wherein when the remaining amount is equal to or greater than a threshold value, the processing device permits first discharge that is discharge from a power supply (power supply 12) to an atomizer (first load 21) configured to atomize the aerosol source and second discharge that is discharge from the power supply to an adjustor (second load 31) capable of adjusting an amount of flavor that is added to the aerosol by the flavor source, and when the remaining amount is smaller than the threshold value, the processing device suppresses any one of the first discharge and the second discharge.

According to the above (1), when the remaining amount of at least one of the flavor source and the aerosol source is small, the discharge to any one of the atomizer and the adjustor is suppressed, so that flavor and taste of aerosol change, as compared to a case where the remaining amount is large. For this reason, it is possible to inform the user by the sense of taste that the remaining amount of at least one of the flavor source and the aerosol source is small. As a result, as compared to a configuration where a notification is performed by a sense of vision, a sense of touch or a sense of hearing, the user can intuitively know the decrease in the remaining amount.

(2) The control unit of an aerosol generation device according to the above (1), wherein the processing device is configured to acquire the remaining amount of the flavor source (remaining amount of a flavor component), and wherein when the remaining amount of the flavor source is smaller than the threshold value (threshold value TH1), the processing device suppresses the second discharge.

According to the above (2), when the remaining amount of the flavor source is small, the discharge to the adjustor is suppressed, so that the amount of flavor to be added to aerosol is reduced. For this reason, it is possible to inform the user that it is necessary to replace the flavor source closely relating to flavor and taste.

(3) The control unit of an aerosol generation device according to the above (1) or (2), wherein the processing device is configured to acquire the remaining amount of the aerosol source (remaining amount in a reservoir), and wherein when the remaining amount of the aerosol source is smaller than the threshold value (threshold value TH2), the processing device suppresses the first discharge.

According to the above (3), when the remaining amount of the aerosol source is small, the discharge to the atomizer is suppressed, so that the amount of aerosol is reduced. For this reason, it is possible to inform the user that it is necessary to replace the aerosol source closely relating to aerosol.

(4) The control unit of an aerosol generation device according to the above (1), further including a notification unit (the first notification unit 45 and the second notification unit 46),

wherein the threshold value includes a first threshold value (threshold value TH1) and a second threshold value (threshold value TH2),

wherein the processing device is configured to acquire the remaining amount of the flavor source (remaining amount of a flavor component) and the remaining amount of the aerosol source (remaining amount in a reservoir), and wherein when the remaining amount of the flavor source is smaller than the first threshold value and the remaining amount of the aerosol source is smaller than the second threshold value, the processing device suppresses only the first discharge of the first discharge and the second discharge and controls the notification unit to notify deficiency in the flavor source and the aerosol source to a user.

According to the above (4), when the remaining amounts of both the flavor source and the aerosol source are small, the amount of aerosol, which the user can more sensitively detect, of the amount of flavor and the amount of aerosol is reduced and the deficiency in the flavor component and the aerosol source is notified to the user. For this reason, the user can more easily notice that it is necessary to replace both the flavor source and the aerosol source.

(5) The control unit of an aerosol generation device according to one of the above (1) to (4), wherein when the remaining amount is smaller than the threshold value, the processing device suppresses any one of the first discharge and the second discharge, and then suppresses the first discharge and the second discharge.

According to the above (5), after the discharge to one of the atomizer and the adjustor is suppressed, the discharges to both the atomizer and the adjustor are suppressed. Thereby, since the flavor and taste change stepwise, the user can more easily notice that the remaining amount is small.

(6) The control unit of an aerosol generation device according to the above (1), wherein the processing device is configured to acquire the remaining amount of at least one of the flavor source and the aerosol source while aerosol is generated, and

wherein when the remaining amount is smaller than the threshold value, the processing device continues one of the first discharge and the second discharge and suppresses the other of the first discharge and the second discharge.

According to the above (6), when the remaining amount acquired during the generation of aerosol is small, one of the first discharge and the second discharge is suppressed during the generation of aerosol. For this reason, it is possible to inform the user that the remaining amount is small, at as early timing as possible.

(7) The control unit of an aerosol generation device according to the above (1), wherein the processing device is configured to acquire an atomization command of the aerosol source by the atomizer,

wherein the processing device is configured to acquire the remaining amount of at least one of the flavor source and the aerosol source after generating aerosol according to the atomization command, and

wherein when the remaining amount is smaller than the threshold value and a next atomization command is acquired, the processing device executes one of the first discharge and the second discharge, and suppresses the other of the first discharge and the second discharge.

According to the above (7), as compared to a configuration where one of the first discharge and the second discharge is suppressed during the generation of aerosol, the flavor and taste of aerosol that are generated when the remaining amount is smaller than the threshold value more change. For this reason, the user can more easily notice that the remaining amount is small.

(8) The control unit of an aerosol generation device according to one of the above (1) to (6), further including a first notification unit (first notification unit 45),

wherein the processing device is configured to cause the first notification unit to function at a timing (time t3 in FIG. 18, time t3 in FIG. 20) before any one of the first discharge and the second discharge is suppressed.

According to the above (8), the first notification unit functions at or before a timing at which any one of the first discharge and the second discharge is suppressed and hence the flavor and taste change. For this reason, in addition to a sense of taste, the user can more easily notice through another sense that the remaining amount is small.

(9) The control unit of an aerosol generation device according to the above (8), wherein the processing device is configured to cause the first notification unit to function at a timing (time t3 in FIG. 20) before any one of the first discharge and the second discharge is suppressed.

According to the above (9), it is possible to make the user notice that the remaining amount is small, through a sense different from a sense of taste, before the flavor and taste change. For this reason, the user can easily notice the change in flavor and taste. In addition, it is possible to replace the flavor source or the aerosol source before aerosol of changed flavor and taste are generated. As a result, the merchantability of the aerosol generation device is improved.

(10) The control unit of an aerosol generation device according to the above (8) or (9), wherein the first notification unit is configured to issue a notification that acts on a user's sense of touch.

According to the above (10), the notification is performed using the notification unit that acts on a user's sense of touch, so that it is difficult for people around the user to notice the necessity for replacement. For this reason, the sophistication of the aerosol generation device is improved, so that the merchantability is improved.

(11) The control unit of an aerosol generation device according to one of the above (1) to (6) and (8) to (10), further

including a second notification unit (second notification unit 46),

wherein when the remaining amount is smaller than the threshold value, the processing device suppresses one of the first discharge and the second discharge, and then suppresses the first discharge and the second discharge, and wherein the processing device is configured to cause the second notification unit to function at a timing before the first discharge and the second discharge are suppressed (before time t4 in FIGS. 18 to 20).

According to the above (11), the second notification unit functions at or before a timing at which the first discharge and the second discharge are suppressed and hence the flavor and taste change. For this reason, in addition to a sense of taste, the user can more easily notice through another sense that the remaining amount is small.

(12) The control unit of an aerosol generation device according to the above (11), wherein the processing device is configured to cause the second notification unit to function at a timing (a timing before time t4 in FIG. 20) before the first discharge and the second discharge are suppressed.

According to the above (12), it is possible to make the user notice that the remaining amount is small, through a sense different from a sense of taste, before the flavor and taste change. For this reason, the user can easily notice the change in flavor and taste. In addition, it is possible to prevent a situation where aerosol is not generated even though inhalation is performed, so that the merchantability of the aerosol generation device is improved.

(13) The control unit of an aerosol generation device according to the above (11) or (12), wherein the second notification unit is configured to issue a notification that acts on a user's sense of vision.

According to the above (13), the notification is performed using the notification unit that acts on a user's sense of vision, so that the user can more easily notice that the remaining amount is small.

(14) A control unit of an aerosol generation device including a notification unit (the first notification unit 45 and the second notification unit 46); and a processing device (MCU 50) configured to control discharge from a power supply to a first heater (first load 21) configured to heat one of an aerosol source (aerosol source 22) and a flavor source (flavor source 33) configured to add flavor to aerosol generated from the aerosol source and discharge from the power supply to a second heater (second load 31) configured to heat the other of the aerosol source and the flavor source and provided separately from the first heater, wherein before causing the notification unit to function, the processing device permits the discharge from the power supply to the first heater and the discharge from the power supply to the second heater, and when causing the notification unit to function, the processing device suppresses any one of the discharge from the power supply to the first heater and the discharge from the power supply to the second heater.

[0179] According to the above (14), when the notification unit functions, the discharge to any one of the first heater and the second heater is suppressed. By the suppression, the flavor and taste of aerosol change, so that the user can easily notice that the notification unit functions. As a result, for example, the notification unit notifies that the remaining amount of the flavor source or the aerosol source is small, so that it is possible to urge the user to replace the flavor source or the aerosol source.

Claims

1. A control unit of an aerosol generation device comprising:

a processing device configured to acquire a remaining amount of at least one of an aerosol source and a flavor source configured to add flavor to aerosol generated from the aerosol source, wherein when the remaining amount is equal to or greater than a threshold value, the processing device permits first discharge that is discharge from a power supply to an atomizer configured to atomize the aerosol source and second discharge that is discharge from the power supply to an adjustor capable of adjusting an amount of flavor that is added to the aerosol by the flavor source, and when the remaining amount is smaller than the threshold value, the processing device suppresses any one of the first discharge and the second discharge.

2. The control unit of an aerosol generation device according to claim 1, wherein the processing device is configured to acquire the remaining amount of the flavor source, and wherein when the remaining amount of the flavor source is smaller than the threshold value, the processing device suppresses the second discharge.

3. The control unit of an aerosol generation device according to claim 1 or 2, wherein the processing device is configured to acquire the remaining amount of the aerosol source, and wherein when the remaining amount of the aerosol source is smaller than the threshold value, the processing device suppresses the first discharge.

4. The control unit of an aerosol generation device according to claim 1, further comprising a notification unit,
wherein the threshold value includes a first threshold value and a second threshold value,
wherein the processing device is configured to acquire the remaining amount of the flavor source and the remaining
amount of the aerosol source, and
5 wherein when the remaining amount of the flavor source is smaller than the first threshold value and the remaining
amount of the aerosol source is smaller than the second threshold value, the processing device suppresses only
the first discharge of the first discharge and the second discharge and controls the notification unit to notify deficiency
in the flavor source and the aerosol source to a user.
- 10 5. The control unit of an aerosol generation device according to one of claims 1 to 4, wherein when the remaining
amount is smaller than the threshold value, the processing device suppresses any one of the first discharge and
the second discharge, and then suppresses the first discharge and the second discharge.
- 15 6. The control unit of an aerosol generation device according to claim 1, wherein the processing device is configured
to acquire the remaining amount of at least one of the flavor source and the aerosol source while aerosol is generated,
and
wherein when the remaining amount is smaller than the threshold value, the processing device continues one of
the first discharge and the second discharge and suppresses the other of the first discharge and the second discharge.
- 20 7. The control unit of an aerosol generation device according to claim 1, wherein the processing device is configured
to acquire an atomization command of the aerosol source by the atomizer,
wherein the processing device is configured to acquire the remaining amount of at least one of the flavor source
and the aerosol source after generating aerosol according to the atomization command, and
25 wherein when the remaining amount is smaller than the threshold value and a next atomization command is acquired,
the processing device executes one of the first discharge and the second discharge, and suppresses the other of
the first discharge and the second discharge.
8. The control unit of an aerosol generation device according to one of claims 1 to 6, further comprising a first notification
unit,
30 wherein the processing device is configured to cause the first notification unit to function at a timing before any one
of the first discharge and the second discharge is suppressed.
9. The control unit of an aerosol generation device according to claim 8, wherein the processing device is configured
to cause the first notification unit to function at a timing before any one of the first discharge and the second discharge
35 is suppressed.
10. The control unit of an aerosol generation device according to claim 8 or 9, wherein the first notification unit is
configured to issue a notification that acts on a user's sense of touch.
- 40 11. The control unit of an aerosol generation device according to one of Claims 1 to 6 and 8 to 10, further comprising
a second notification unit,
wherein when the remaining amount is smaller than the threshold value, the processing device suppresses one of
the first discharge and the second discharge, and then suppresses the first discharge and the second discharge, and
45 wherein the processing device is configured to cause the second notification unit to function at a timing before the
first discharge and the second discharge are suppressed.
12. The control unit of an aerosol generation device according to claim 11, wherein the processing device is configured
to cause the second notification unit to function at a timing before the first discharge and the second discharge are
50 suppressed.
13. The control unit of an aerosol generation device according to claim 11 or 12, wherein the second notification unit is
configured to issue a notification that acts on a user's sense of vision.
- 55 14. A control unit of an aerosol generation device comprising:
a notification unit; and
a processing device configured to control discharge from a power supply to a first heater configured to heat
one of an aerosol source and a flavor source configured to add flavor to aerosol generated from the aerosol

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source and discharge from the power supply to a second heater configured to heat the other of the aerosol source and the flavor source and provided separately from the first heater, wherein before causing the notification unit to function, the processing device permits the discharge from the power supply to the first heater and the discharge from the power supply to the second heater, and when causing the notification unit to function, the processing device suppresses any one of the discharge from the power supply to the first heater and the discharge from the power supply to the second heater.

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FIG.1

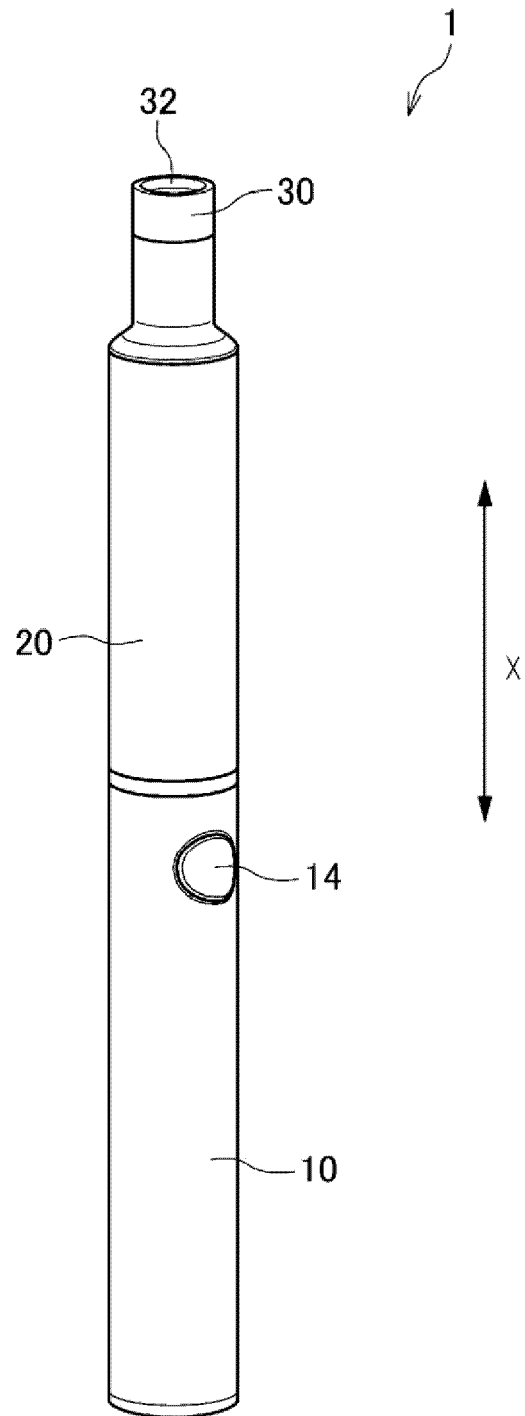


FIG.2

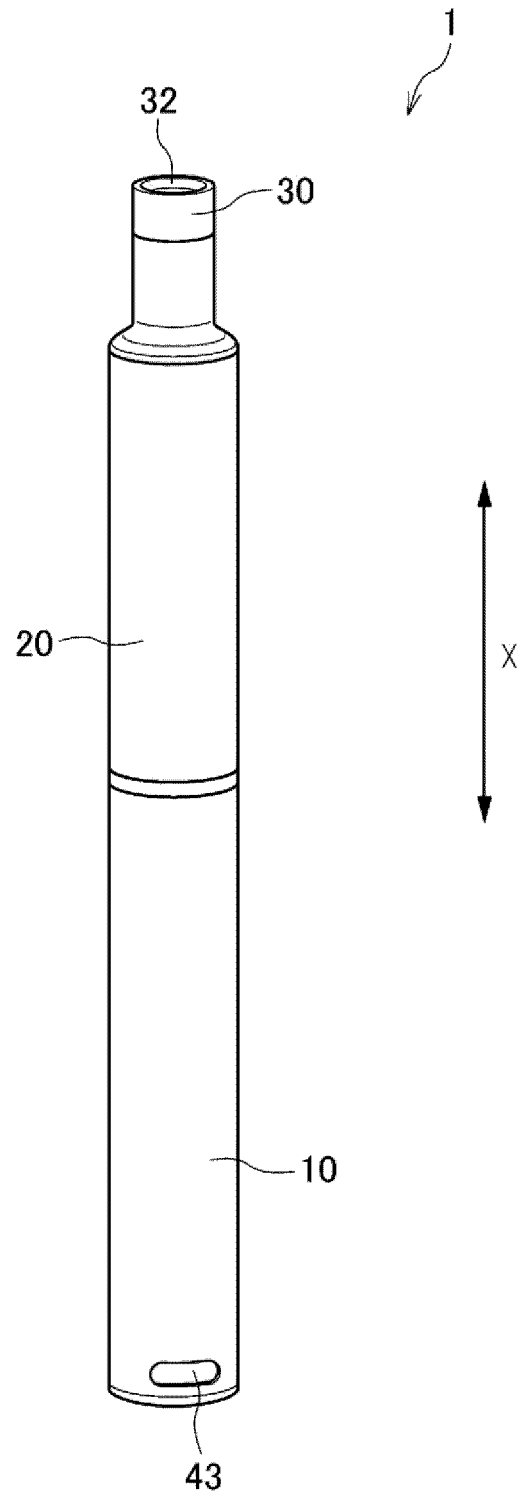


FIG.3

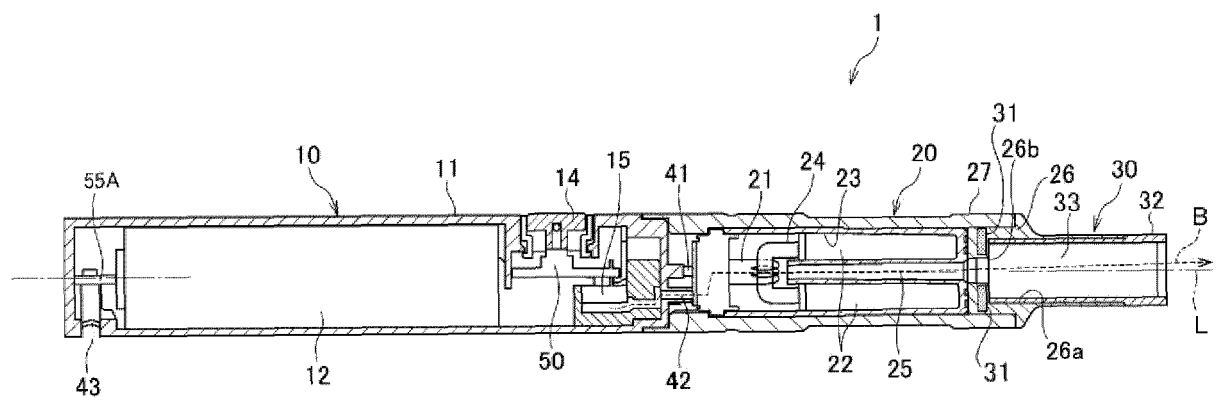


FIG.4

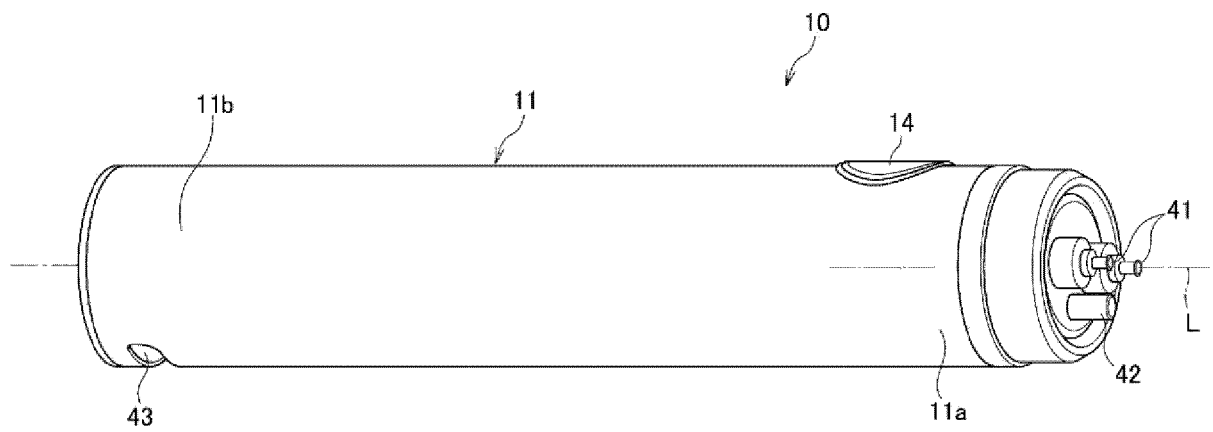


FIG. 5

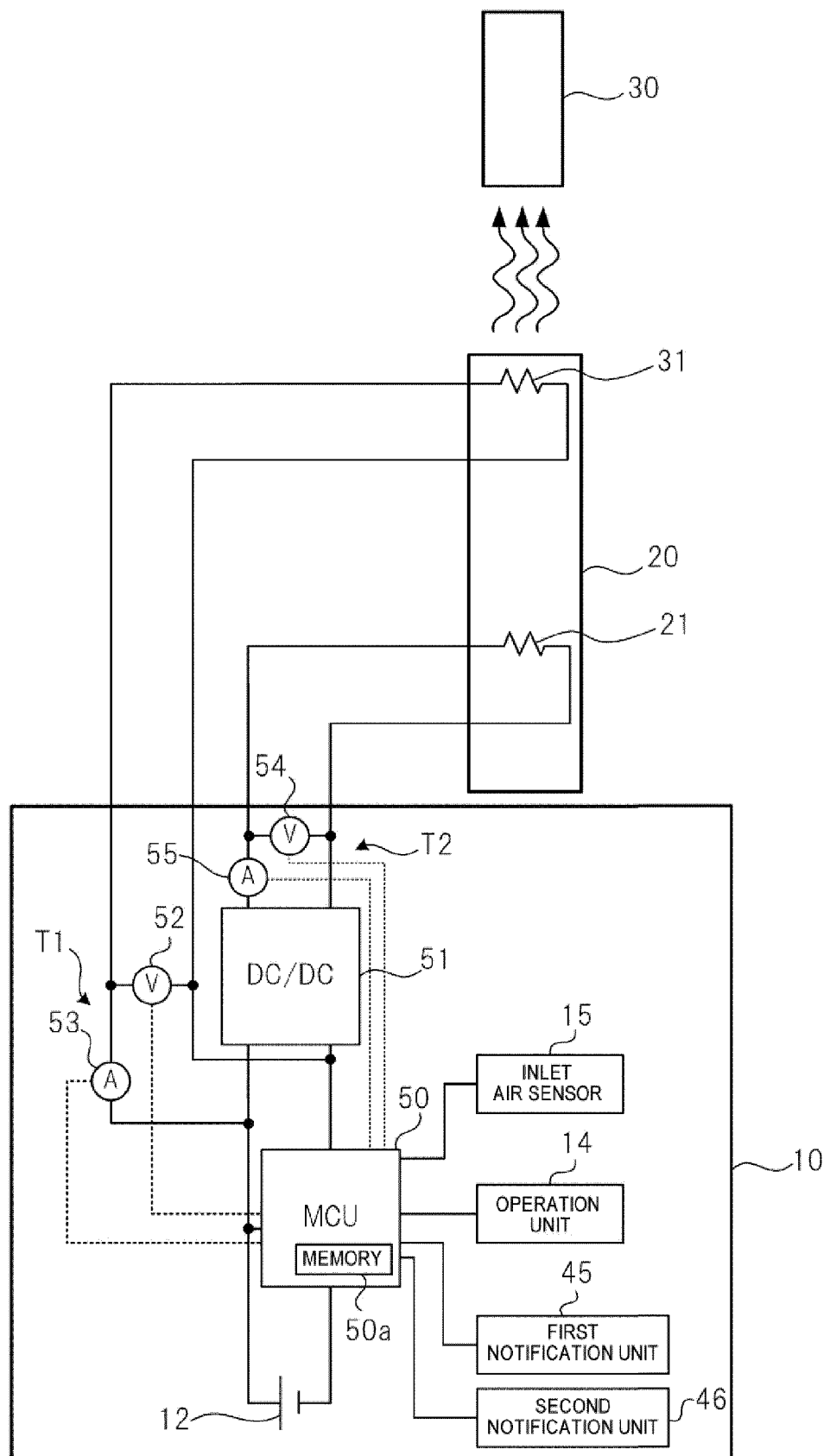


FIG.6

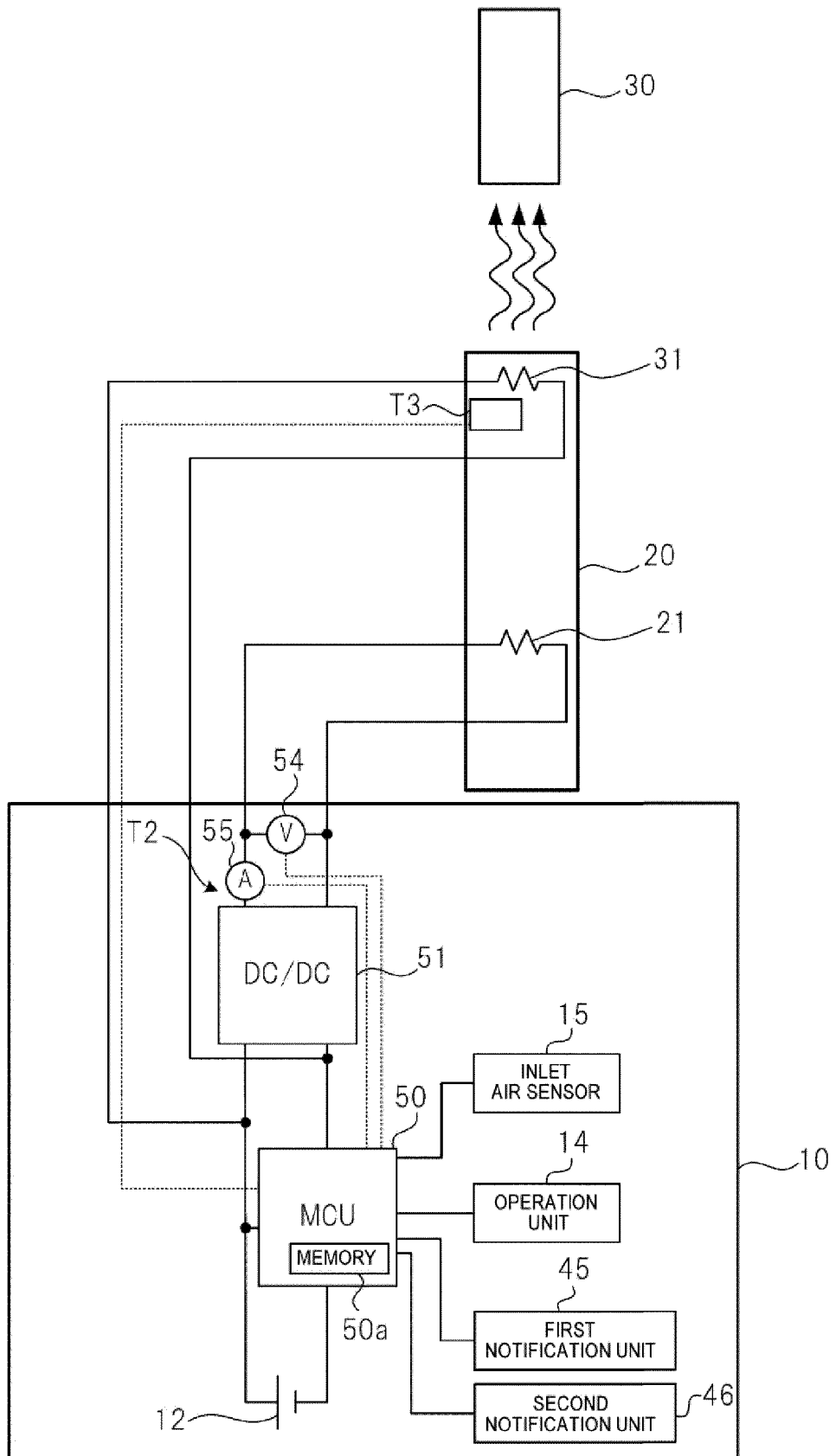


FIG.7

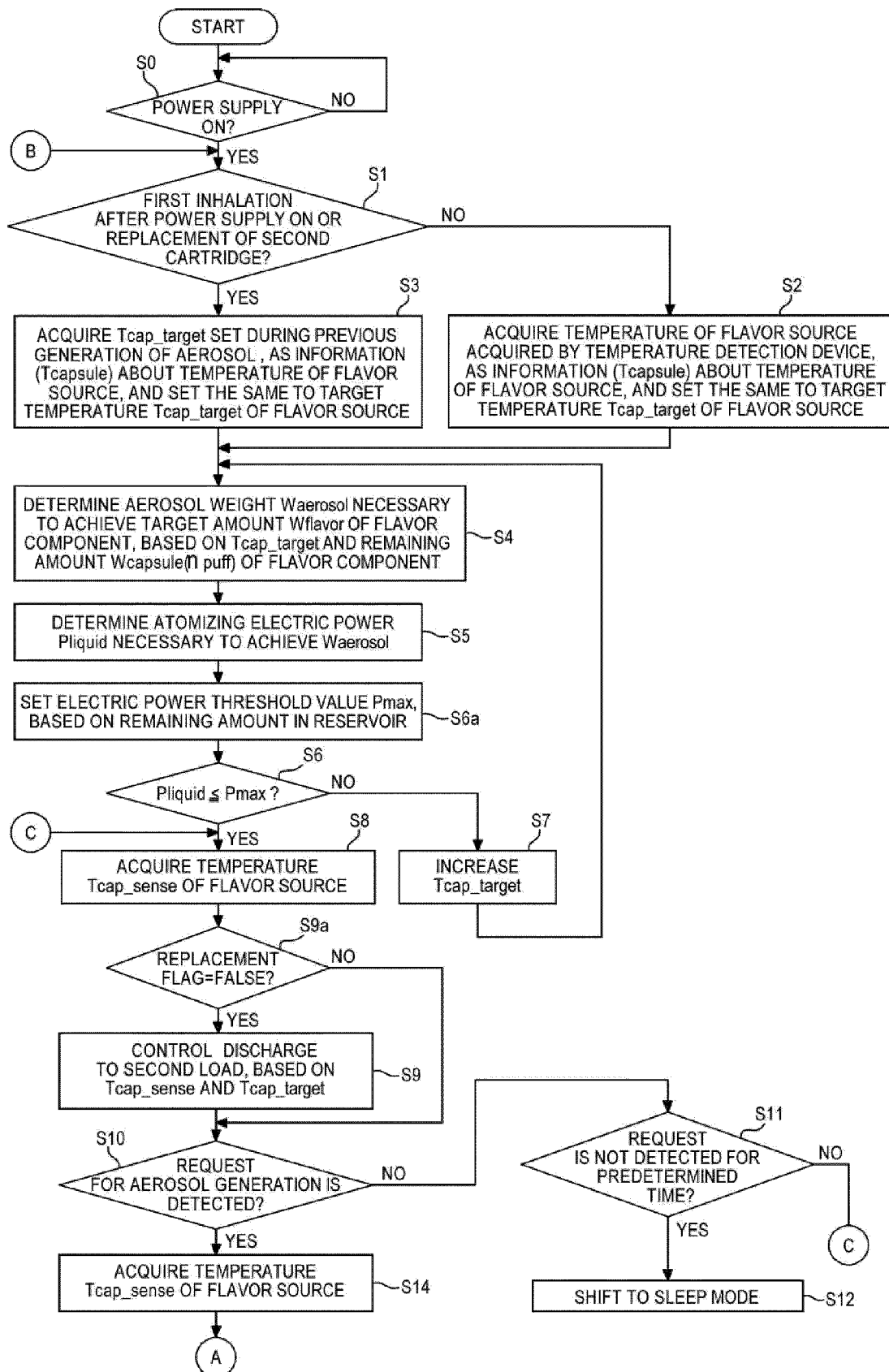


FIG.8

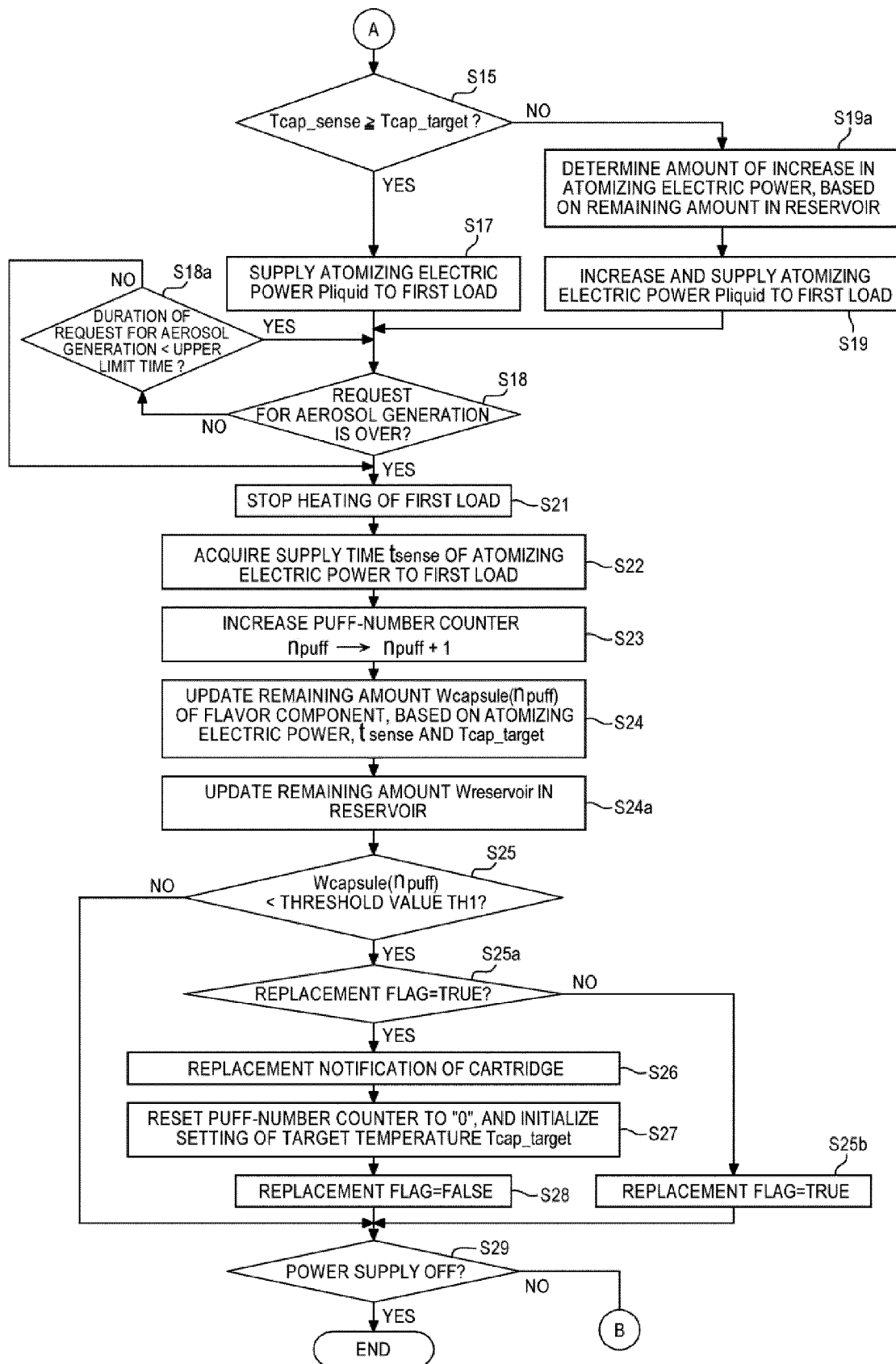


FIG.9

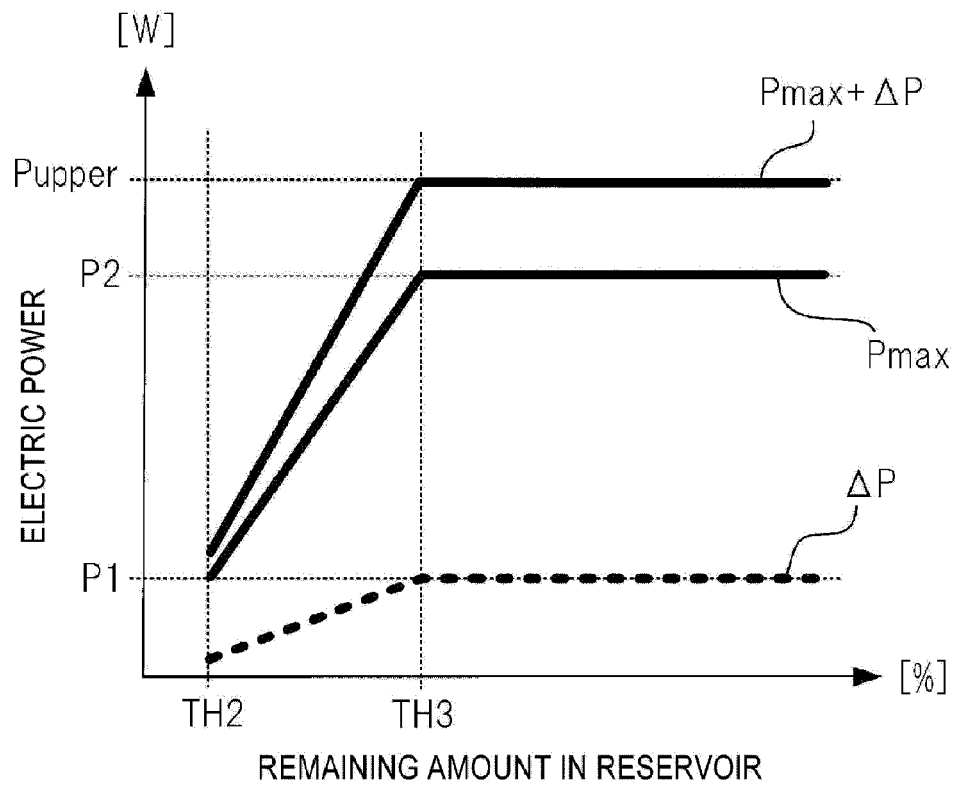


FIG.10

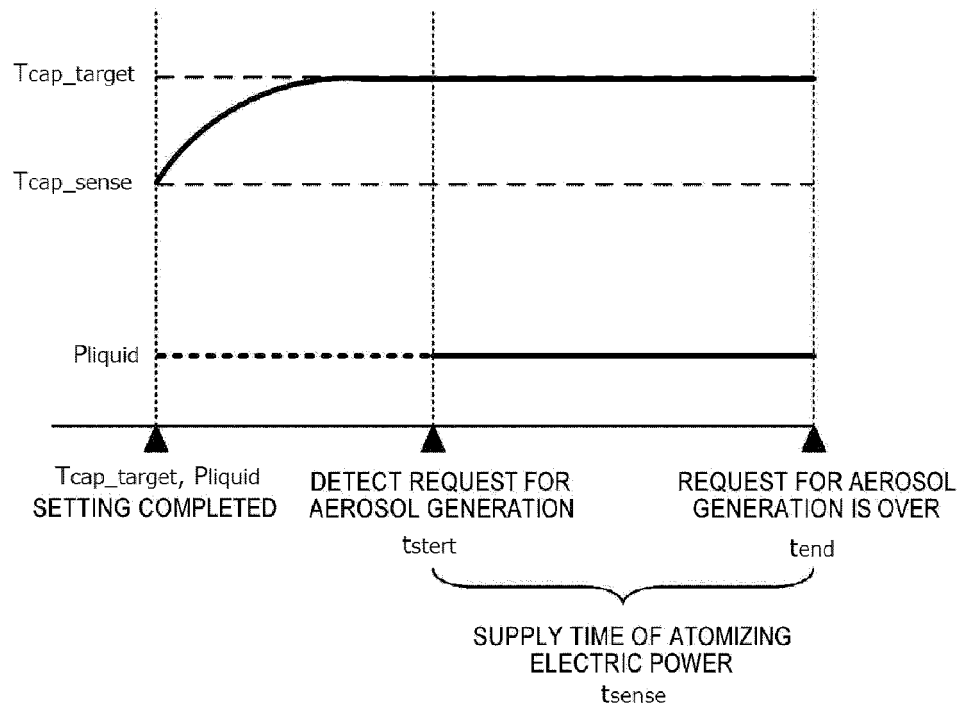


FIG. 11

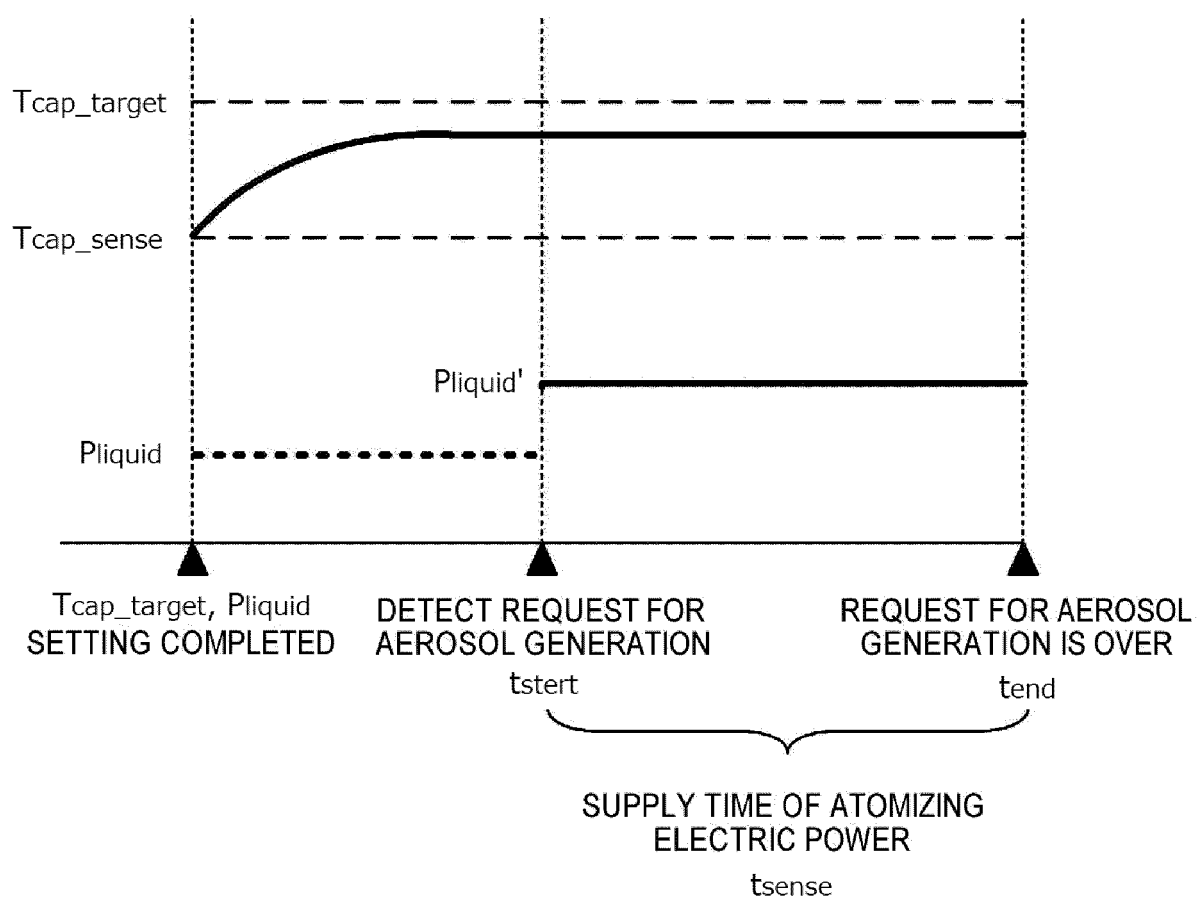


FIG. 12

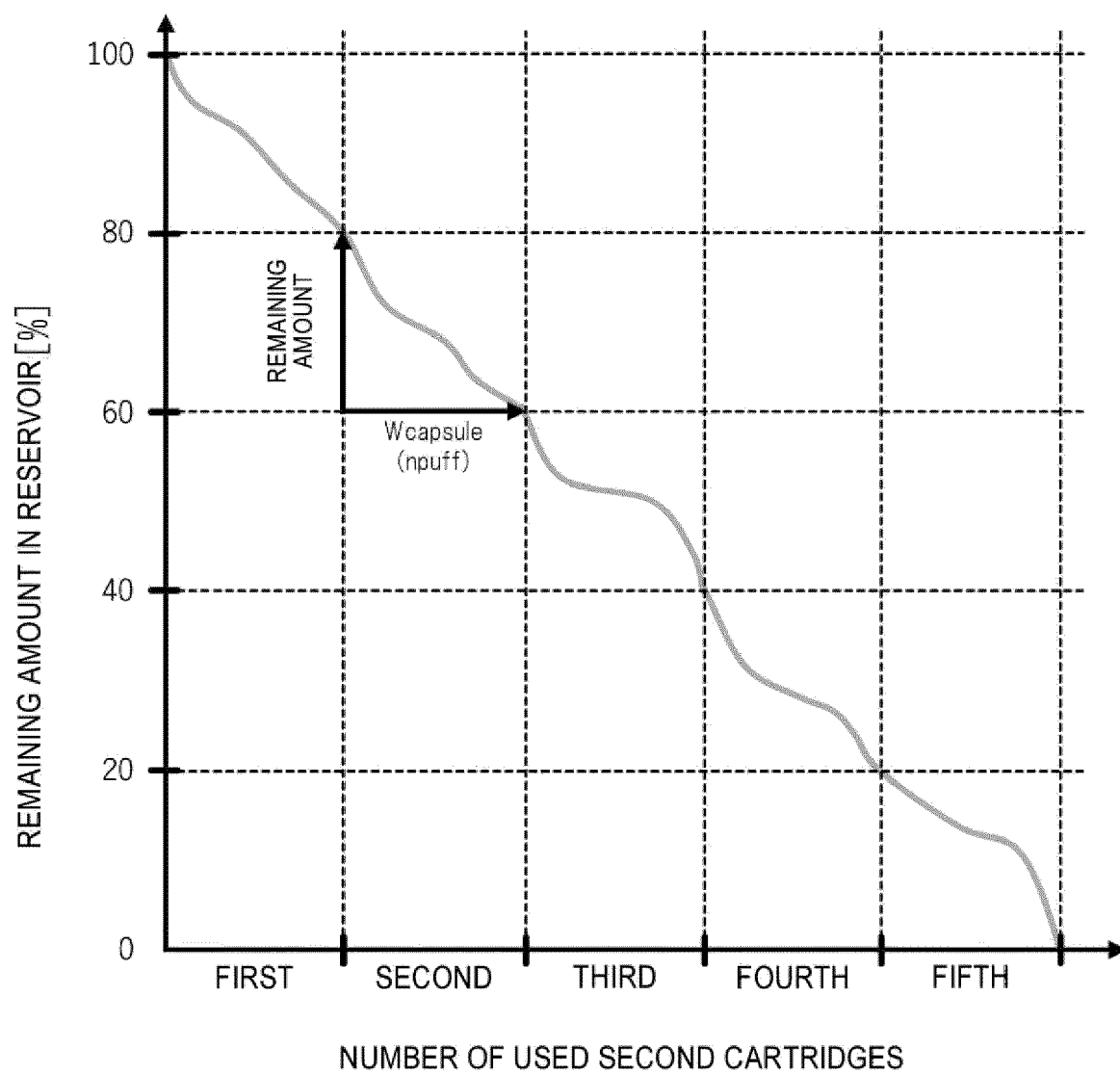


FIG. 13

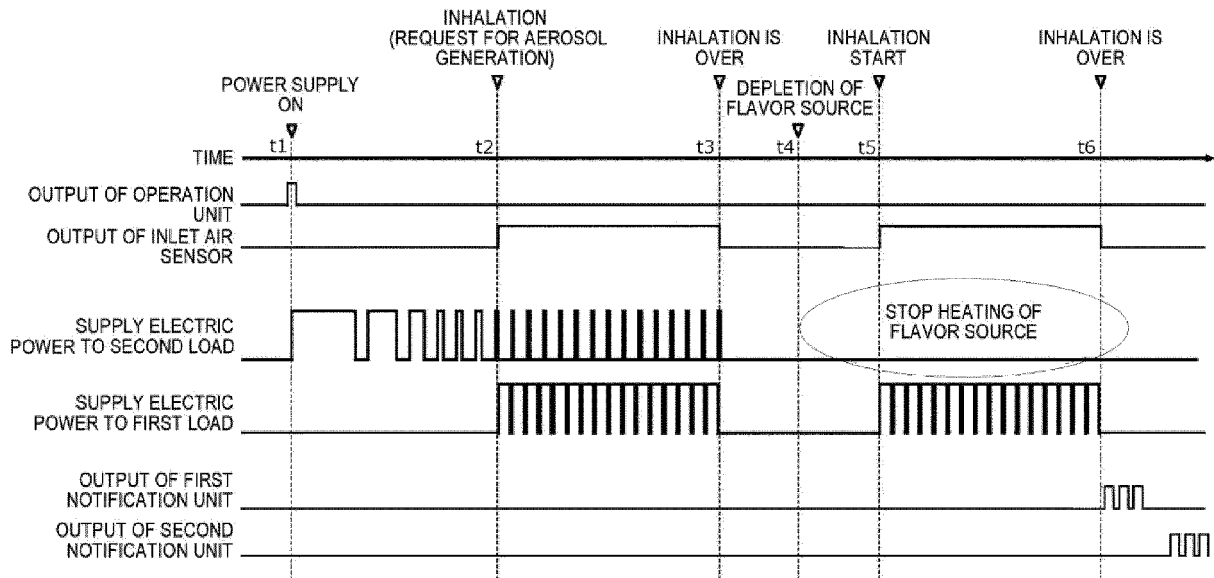


FIG. 14

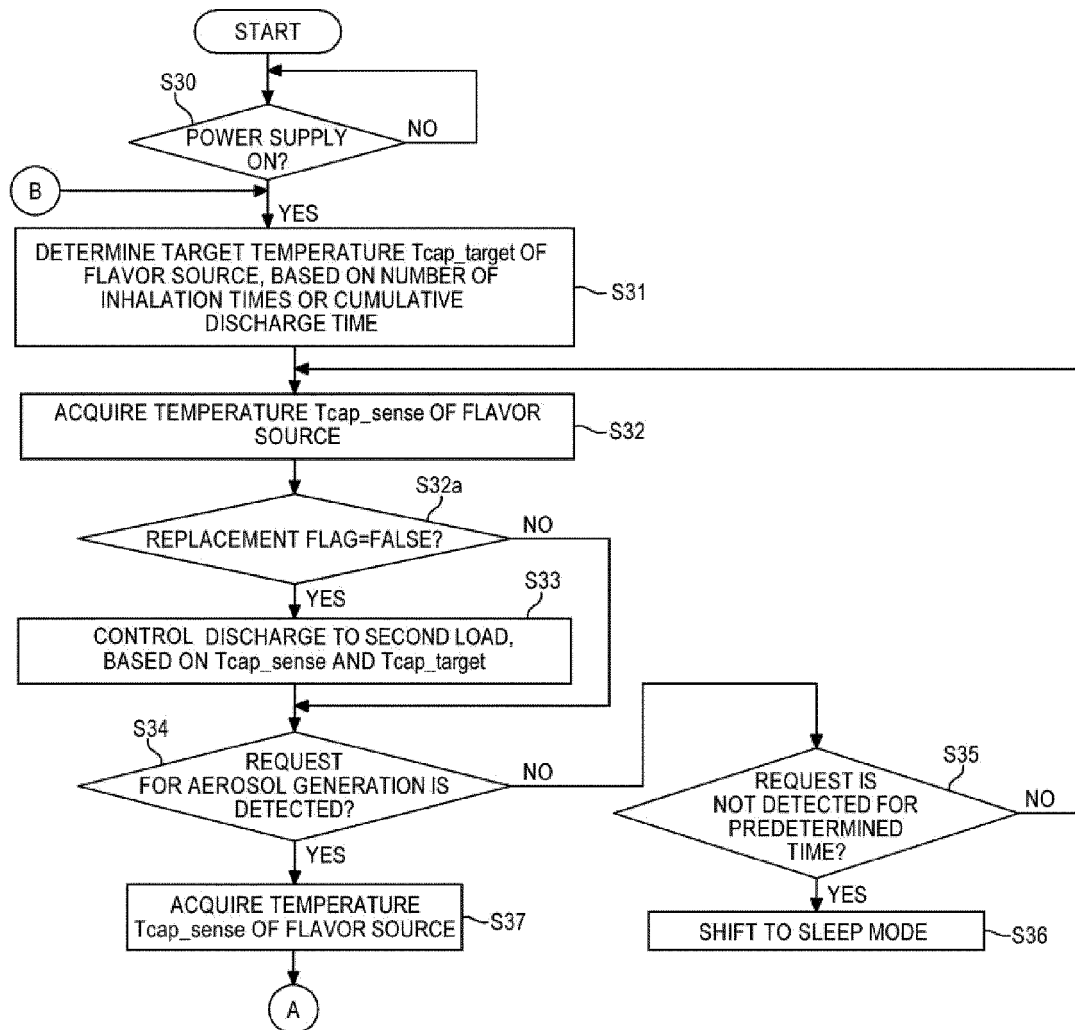


FIG.15

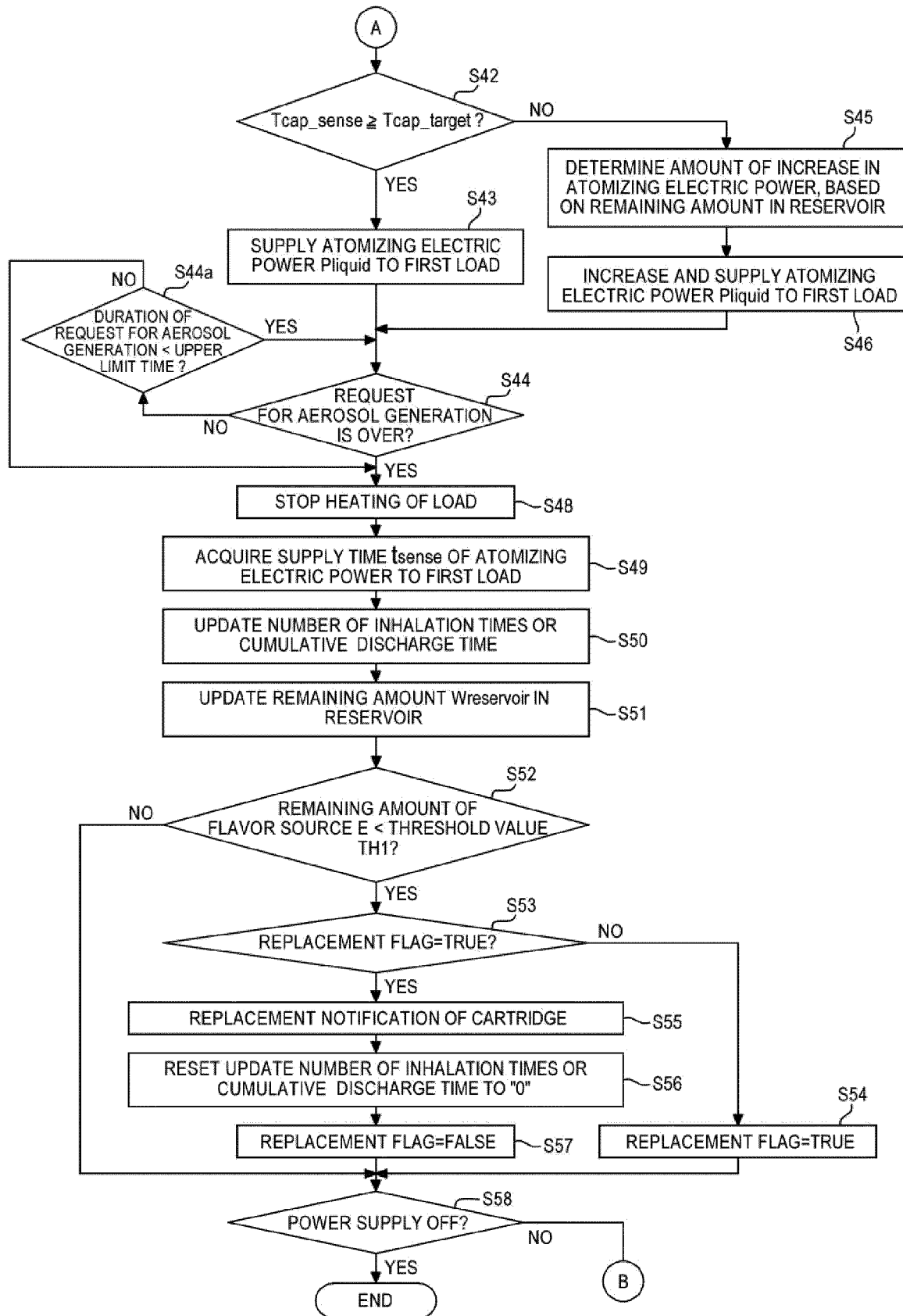


FIG. 16

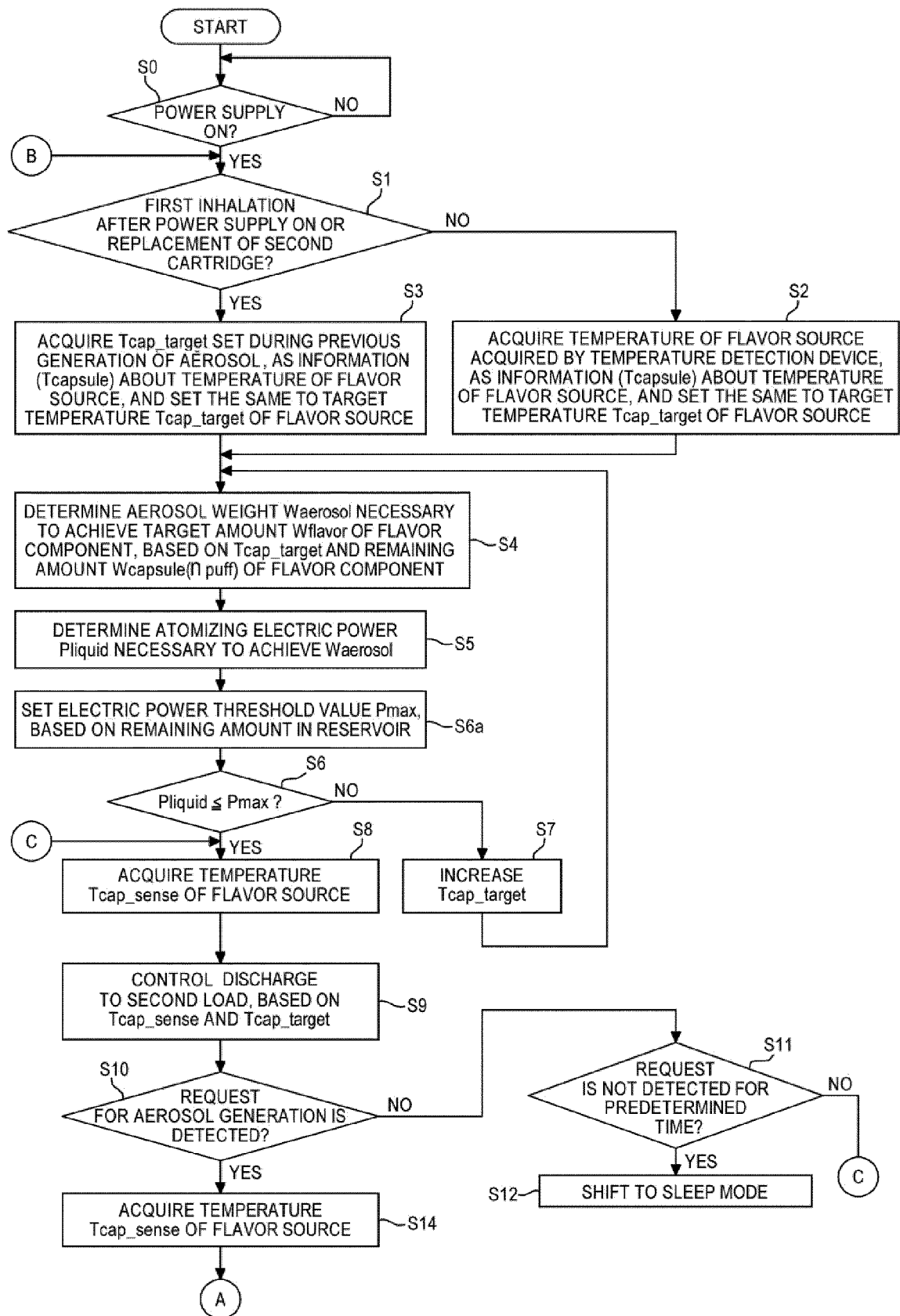


FIG.17

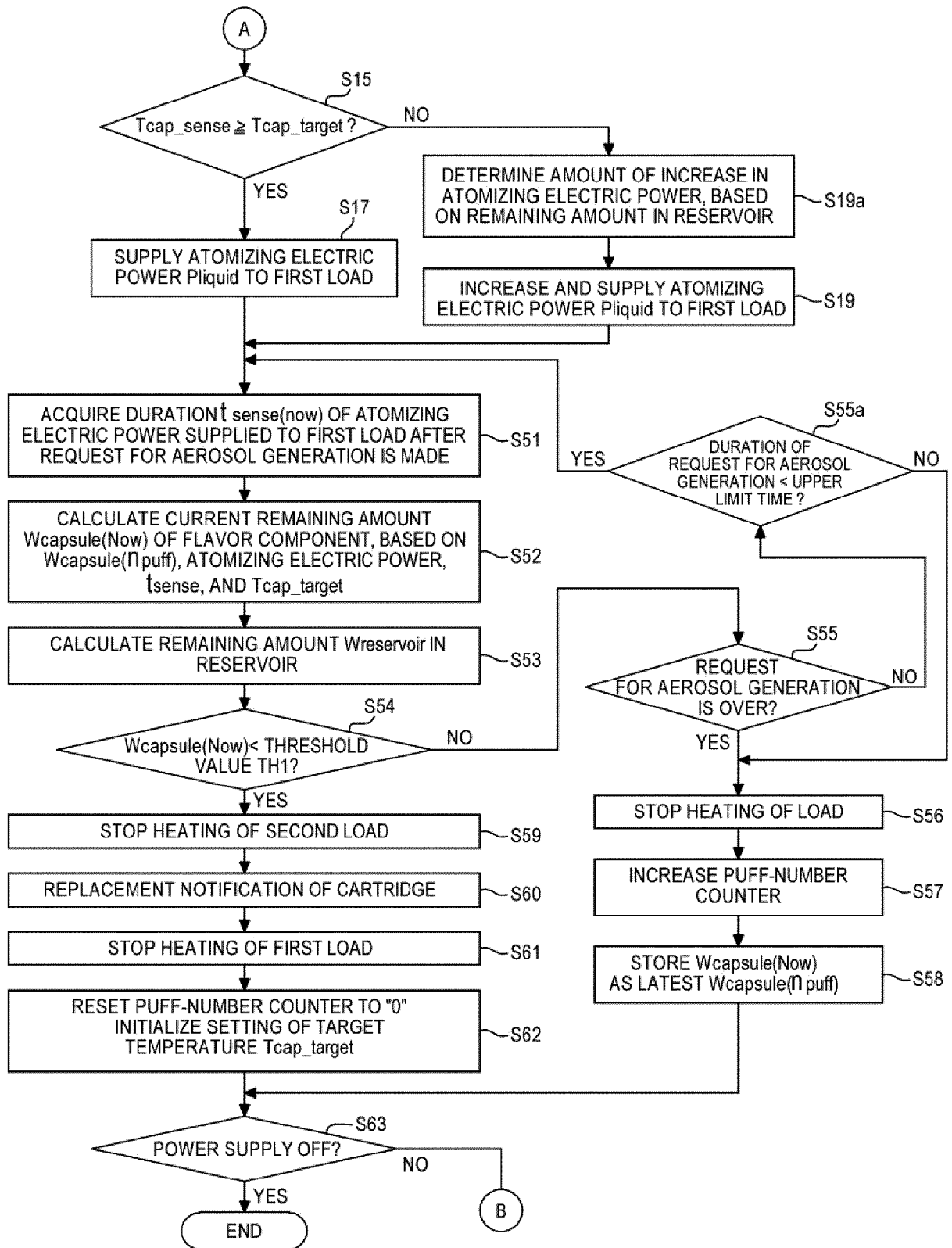


FIG.18

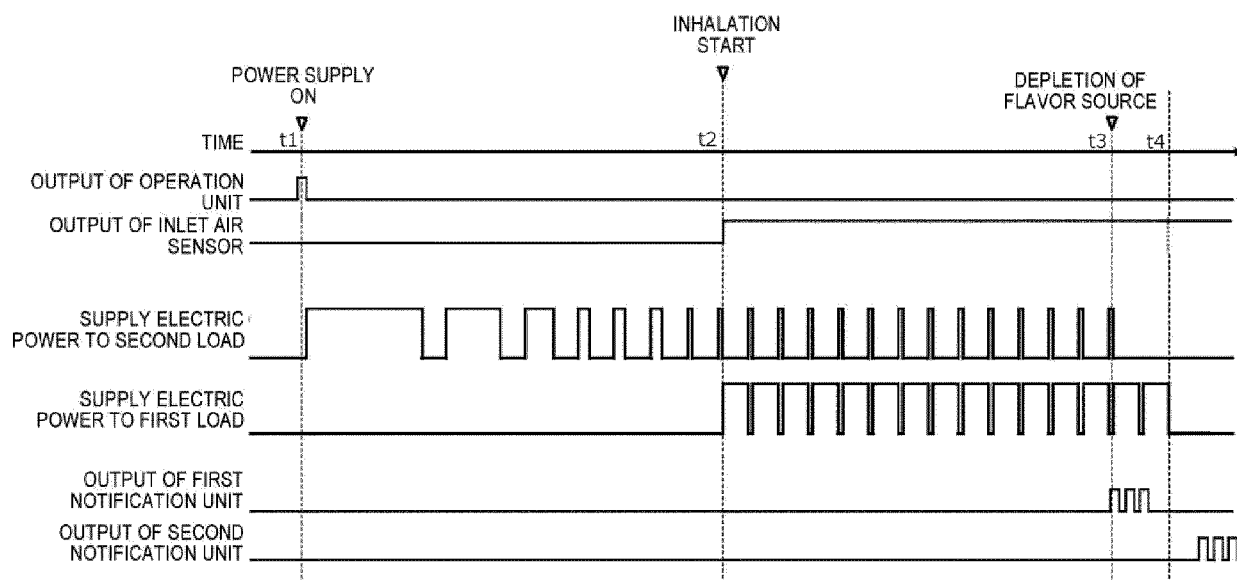


FIG.19

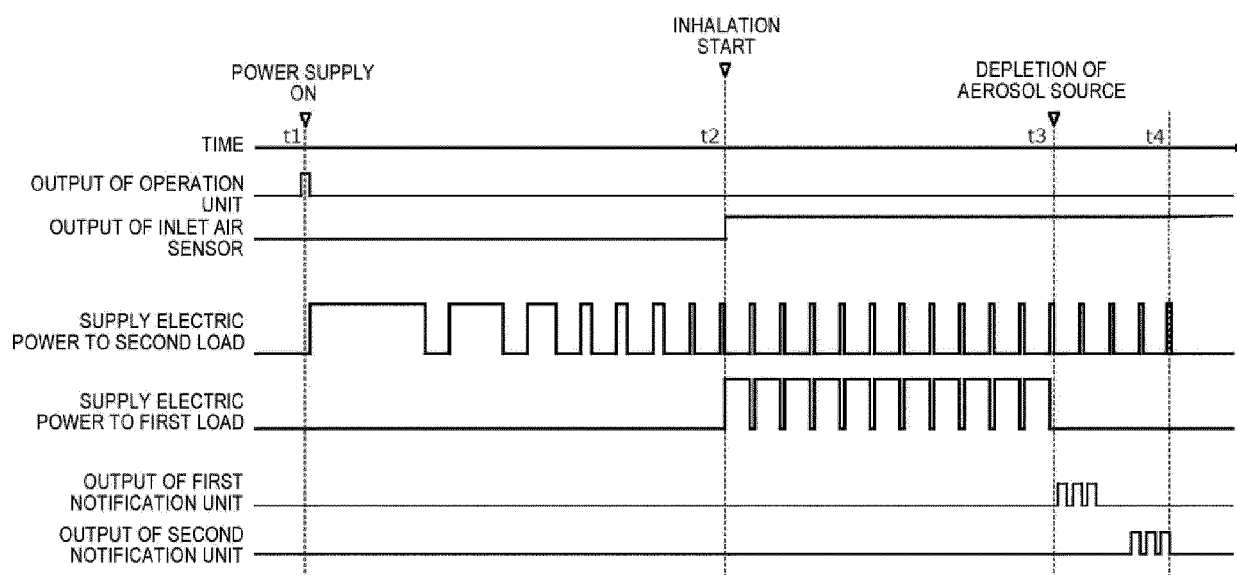
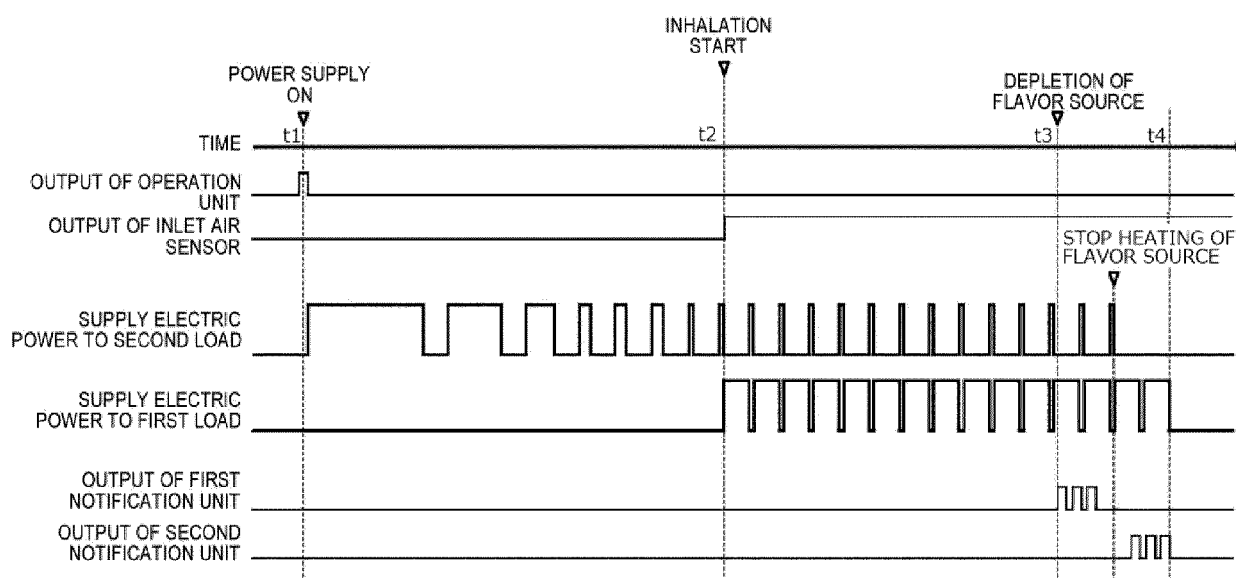


FIG.20



REFERENCES CITED IN THE DESCRIPTION

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