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(71) Applicant: **Japan Tobacco Inc.**
Tokyo 105-6927 (JP)

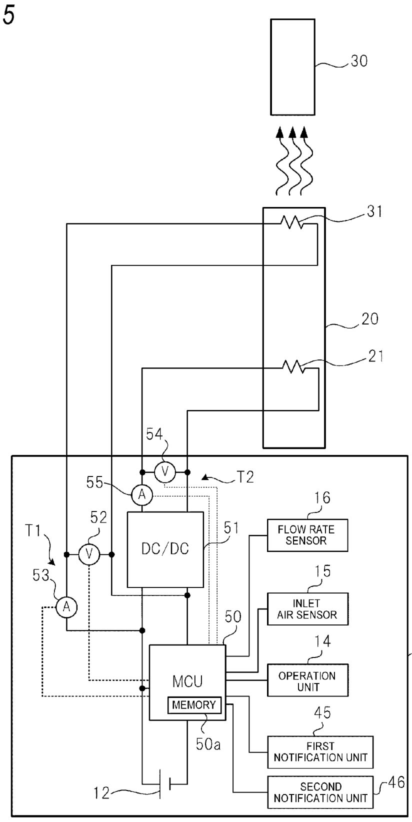
(72) Inventors:
- **Nakano, Takuma**
  Tokyo, 130-8603 (JP)
- **Kaihatsu, Yutaka**
  Tokyo, 130-8603 (JP)
- **Marubashi, Keiji**
  Tokyo, 130-8603 (JP)
- **Fujinaga, Ikuo**
  Tokyo, 130-8603 (JP)
- **Fujita, Hajime**
  Tokyo, 130-8603 (JP)

(74) Representative: **Hoffmann Eitle**
Patent- und Rechtsanwälte PartmbB
Arabellastraße 30
81925 München (DE)

(54) CONTROL UNIT OF AEROSOL GENERATION DEVICE

(57) A control unit of an aerosol generation device includes: a sensor configured to output inhalation by a user; and a processing device configured to control discharge from a power supply to an atomizer configured to atomize an aerosol source. The processing device is configured: to acquire an inhalation time that is a length of each inhalation and an discharge time that is a length of discharge to the atomizer corresponding to each inhalation, based on an output of the sensor; and to acquire at least one of a remaining amount of a flavor source configured to add flavor to aerosol generated from the aerosol source and a consumed amount of the flavor source, based on the inhalation time and the discharge time.

FIG.5



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Description

TECHNICAL FIELD

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

BACKGROUND ART

[0002] Patent Literature 1 discloses a non-burning type flavor inhaler including an atomizing unit configured to atomize an aerosol source without burning, a battery configured to accumulate electric power that is supplied to the atomizing unit, and a controller configured to output a predetermined instruction to the battery as an instruction to the battery, the predetermined instruction instructing the battery to make an amount of aerosol atomized by the atomizing unit fall within a desired range, wherein the controller stops supply of electric power from the battery to the atomizing unit when a predetermined time period elapses from start of the supply of electric power to the atomizing unit.

[0003] Patent Literature 2 discloses an inhalation device including an element configured to contribute to generation of aerosol by consuming an accumulated capacity, a sensor configured to detect a predetermined variable, and a notification unit configured to issue a notification to an inhaling person of the aerosol, wherein the notification unit is caused to function when the capacity is smaller than a threshold value and the variable satisfies a predetermined condition for requesting generation of the aerosol.

[0004] [Patent Literature 1] WO2016/076147
[Patent Literature 2] Japanese Patent No. 6,462,965

[0005] In the aerosol generation device configured to generate aerosol and allow a user to inhale the same, it is preferable to accurately determine a consumed state of the flavor source or the aerosol source so as to stably provide the user with aerosol having flavor added thereto.

SUMMARY OF INVENTION

[0006] An object of the present invention is to correctly acquire a remaining amount or a consumed amount of a flavor source or an aerosol source of an aerosol generation device.

[0007] According to an aspect of the present invention, there is provided a control unit of an aerosol generation device including: a sensor configured to output inhalation by a user; and a processing device configured to control discharge from a power supply to an atomizer configured to atomize an aerosol source, wherein the processing device is configured to acquire an inhalation time that is a length of each inhalation and an discharge time that is a length of discharge to the atomizer corresponding to each inhalation, based on an output of the sensor, and to acquire at least one of a remaining amount of a flavor source configured to add flavor to aerosol generated from the aerosol source and a consumed amount of the flavor source, based on the inhalation time and the discharge time.

[0008] According to another aspect of the present invention a control unit of an aerosol generation device including: a sensor configured to output inhalation by a user; and a processing device configured to control discharge from a power supply to an atomizer configured to atomize an aerosol source, wherein the processing device is configured to acquire an inhalation time that is a length of each inhalation and an discharge time that is a length of discharge to the atomizer corresponding to each inhalation, based on an output of the sensor, and to acquire at least one of a remaining amount of the aerosol source and a consumed amount of the aerosol source, based on the inhalation time and the discharge time.

[0009] According to the present invention, it is possible to correctly acquire the remaining amount or the consumed amount of the flavor source or the aerosol source.

BRIEF DESCRIPTION OF DRAWINGS

[0010]

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.
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.
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.

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.

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 schematic view showing an example of correction data when an inhalation time is equal to or shorter than an upper limit time t_{upper}.

FIG. 14 is a schematic view showing an example of correction data when the inhalation time exceeds the upper limit time t_{upper}.

FIG. 15 is a schematic view showing an example of correction data when the inhalation time is equal to or shorter than the upper limit time t_{upper}.

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

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

FIG. 18 is a flowchart for showing operations of the aerosol generation device 1 of the second modified embodiment.

DESCRIPTION OF EMBODIMENTS

[0011] 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.

(Aerosol Generation Device)

[0012] 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 also be attached and detached (in other words, replaced) with respect to the power supply unit 10.

(Power Supply Unit)

[0013] 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.

[0014] 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.

[0015] 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.

[0016] 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.

[0017] 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.

[0018] 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.

[0019] 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.

[0020] 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.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] 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.

[0025] 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 (specifically, a time period for which the inhalation operation by the user continues) reaches an upper limit time t_{upper} (for example, 2.4 seconds), the discharge for heating to the first load 21 is stopped.

[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 replacement 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.

[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_{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]

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

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

[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 $W_{Capsule}(n_{puff})$ of the flavor component. 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 a 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. In addition, the remaining amount $W_{capsule}(n_{puff})$ of the flavor component may also be referred to as the remaining amount of the flavor source 33.

[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]

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

[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]

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

[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]

$$W_{aerosol} = \frac{W_{flavor}}{\beta \times W_{capsule}(n_{puff}) \times T_{cap\_target} \times \gamma} \cdots (4)$$

[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} is a single fixed value, but is preferably a variable value. 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 $W_{reservoir}$ 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 $W_{reservoir}$ in the reservoir. Therefore, it is possible to realize the target amount of the flavor component, irrespective of the remaining amount $W_{reservoir}$ 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_{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_{HTR} ($T_{HTR}=T_{B.P.}$). Hence, the upper limit value P_{upper} can be expressed by a following equation (5).

[formula 5]

$$P_{upper} = \mathrm{I} \cdot V_{LIB} = MIN\left(\frac{(\eta_{upper} \cdot V_{LIB})^2}{R_{HTR}(T_{HTR} = T_{B.P.})} \quad P_{DC/DC\_upper} \right) - \Delta \quad \cdots (5)$$

[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]

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

[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_{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] Then, the MCU 50 controls the discharge to the second load 31 for heating of the second load 31, based on the temperature T_{cap_sense} and the target temperature T_{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_{cap_sense} is to converge to the target temperature T_{cap_target}.

[0085] In the PID control, a difference between the temperature T_{cap_sense} and the target temperature T_{cap_target} is fed back and electric power control is performed based on a result of the feedback so that the temperature T_{cap_sense} is to converge to the target temperature T_{cap_target}. According to the PID control, the temperature T_{cap_sense} can be converged to the target temperature T_{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_{cap_Sense} is lower than the target temperature T_{cap_target}, electric power is supplied to the second load 31, and in a state where the temperature T_{cap_sense} is equal to or higher than the target temperature T_{cap_target}, the supply of electric power to the second load 31 is stopped until the temperature T_{cap_Sense} falls below the target temperature T_{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_{cap_sense} will reach the target temperature T_{cap_target}, before the request for aerosol generation is detected. Note that, the target temperature T_{cap_target} may have a hysteresis.

[0087] After step S9, the MCU 50 determines whether there is a request for aerosol generation (step S10). 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 SI1. When the non-operation time has reached a predetermined time (step S11: YES), the MCU 50 ends the discharge to the second load 31 (step S12), and shifts to a sleep mode in which the power consumption is reduced (step S13). When the non-operation time is less than the predetermined time (step S11: NO), the MCU 50 shifts the processing to step S8.

[0088] When a request for aerosol generation is detected (step S10: YES), the MCU 50 ends the discharge to the second load 31, and 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).

[0089] 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 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).

[0090] 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.

[0091] In the example of FIG. 9, the amount of increase ΔP is a constant value PI when the remaining amount $W_{reservoir}$ in the reservoir is equal to or greater than a threshold value TH1, and is a value smaller than the value PI 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 TH1. 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 TH1, 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 TH1, 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 TH1. Specifically, in the 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 TH1, 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 PI and the value P2 is the same as the upper limit value P_{upper}. Note that, the summed value of the value PI and the value P2 may be smaller than the upper limit value P_{upper}.

[0092] The threshold value TH2 shown in FIG. 9 is a value smaller than the threshold value TH1, and is used to perform a determination to suppress the discharge for heating to the first load 21. The description "suppress the discharge for heating to the first load 21" means prohibiting the discharge to the first load 21 or setting electric power that can be electrically discharged to the first load 21 to be lower than a minimum value of electric power that is supplied to the first load 21 for heating of the first load 21 according to a request for aerosol generation.

[0093] When the remaining amount $W_{reservoir}$ in the reservoir acquired in step S6a is smaller than the threshold value TH2, for example, the MCU 50 performs control of prohibiting the discharge from the power supply 12 to the first load 21, in other words, control of further suppressing the discharge from the power supply 12 to the first load 21 than when the remaining amount $W_{reservoir}$ in the reservoir is equal to or greater than the threshold value TH2, and further performs control of issuing a replacement notification of the first cartridge 20.

[0094] Alternatively, when the remaining amount $W_{reservoir}$ in the reservoir updated in step S24a (which will be described later) is smaller than the threshold value TH2, for example, the MCU 50 may perform control of prohibiting the discharge from the power supply 12 to the first load 21, and further perform control of issuing a replacement notification of the first cartridge 20. When a replacement notification of the first cartridge 20 is issued, the MCU 50 resets the remaining amount $W_{reservoir}$ in the reservoir stored in the memory 50a to 100%.

[0095] 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, thereby generating aerosol (step S17).

[0096] 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 to heat the first load 21. 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 first load 21 (step S21).

[0097] 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.

[0098] 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.

[0099] 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 caused to converge 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.

[0100] 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 caused to converge to the target amount.

[0101] After step S21, the MCU 50 acquires a supply time t_{sense} to the first load 21 of the atomizing electric power supplied to the first load 21 in step S17 or step S19 (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).

[0102] The MCU 50 updates the remaining amount $W_{capsule}(n_{puff})$ of the flavor component of the flavor source 33, 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, and the target temperature $T_{cap\text{-}target}$ at the time of detection of the request for aerosol generation (step S24).

[0103] When the control shown in FIG. 10 is performed, the amount 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]

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

[0104] 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]

$$W_{flavor} = \beta \times \{W_{capsule}(n_{puff}) \times T_{cap\_target}\} \times \gamma \times \alpha \times P_{liquid}' \times (t_{end} - t_{start}) \quad \cdots (7A)$$

[0105] The amount W_{flavor} of the flavor component for each request for aerosol generation obtained in this way is stored in the memory 50a, and values of the past amount 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 amount W_{flavor} of the flavor component is subtracted from $W_{initial}$), so that the remaining amount $W_{capsule}(n_{puff})$ of the flavor component after generation of aerosol can be derived with high accuracy and updated.
[0106] After step S24, the MCU 50 updates the remaining amount $W_{reservoir}$ in the reservoir stored in the memory 50a (step S24a). The remaining amount $W_{reservoir}$ 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 $W_{reservoir}$ in the reservoir may be experimentally obtained.
[0107] In step S24a, the MCU 50 may derive the remaining amount $W_{reservoir}$ in the reservoir, based on the remaining amount $W_{capsule}(n_{puff})$ 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 $W_{reservoir}$ in the reservoir at the time when one second cartridge 30 is used and the change in the remaining amount $W_{capsule}(n_{puff})$ of the flavor component of the second cartridge 30 is experimentally obtained. In addition, the remaining amount $W_{reservoir}$ 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 $W_{reservoir}$ in the reservoir corresponding to the current number of the used second cartridges 30 and remaining amount $W_{capsule}(n_{puff})$ 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 $W_{capsule}(n_{puff})$ of the flavor component acquired in step S24, and the table shown in FIG. 12, and stores the read remaining amount $W_{reservoir}$ in the reservoir in the memory 50a, as the latest information.
[0108] Subsequently, the MCU 50 determines whether the updated remaining amount $W_{capsule}(n_{puff})$ of the flavor component is smaller than the threshold value of the remaining amount (step S25). When the updated remaining amount $W_{capsule}(n_{puff})$ of the flavor component is equal to or greater than the threshold value of the remaining amount (step S25: NO), the MCU 50 shifts the processing to step S28. When the updated remaining amount $W_{capsule}(n_{puff})$ of the flavor component is smaller than the threshold value of the remaining amount (step S25: 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 S26). Then, the MCU 50 resets the puff-number counter to an initial value (=0), deletes the value of the past amount W_{flavor} of the flavor component, and further initializes the target temperature T_{cap_target} (step S27).
[0109] The initialization of the target temperature T_{cap_target} means excluding, from the setting values, the target temperature T_{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_{cap_target} means setting the target temperature T_{cap_target} at that time stored in the memory 50a to a room temperature.
[0110] After step S27, when the power supply is not turned off (step S28: NO), the MCU 50 returns the processing to step S1, and when the power supply is turned off (step S28: YES), the MCU 50 ends the processing.

(Effects of Embodiment)

[0111] 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.

[0112] Further, according to the aerosol generation device 1, when the atomizing electric power determined in step S5 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 of 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.

[0113] 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_{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$\times t_{sense}$), 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. In this way, the discharge to the first load 21 is controlled after appropriately considering the state of the aerosol generation device 1, so that the amount of the flavor component can be stabilized with high accuracy every inhalation and the commercial value of the aerosol generation device 1 can be thus increased.

[0114] 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.

[0115] Further, according to the aerosol generation device 1, after the request for aerosol generation is received, the discharge to the second load 31 is stopped. For this reason, it is not necessary to perform the discharge to the first load 21 and the second load 31 at the same time, so that it is possible to suppress deficiency in electric power that is electrically discharged to the second load 31. In addition to this, the large current is suppressed from being electrically discharged from the power supply 12. Therefore, the deterioration in the power supply 12 can be suppressed.

[0116] Further, according to the aerosol generation device 1, after aerosol is generated, the discharge to the second load 31 is resumed, so that even when aerosol is continuously generated, the flavor source 33 can be kept warmed. For this reason, it is possible to provide the user with the stable amount of the flavor component over a plurality of continuous inhalations.

[0117] Further, according to the aerosol generation device 1, since the electric power threshold value P_{max} is changed based on the remaining amount $W_{reservoir}$ in the reservoir, the atomizing electric power is controlled based on the remaining amount $W_{reservoir}$ 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.

[0118] 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 $W_{reservoir}$ 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.

[0119] Further, according to the aerosol generation device 1, since the electric power threshold value P_{max} is determined based on the remaining amount $W_{reservoir}$ 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 $W_{reservoir}$ 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.

[0120] 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 $W_{reservoir}$ 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 $W_{reservoir}$ in the reservoir. For this reason, it is possible to suppress the increase in cost of the aerosol generation device 1.

(First Modified Embodiment of Aerosol Generation Device)

[0121] In the above, it is premised that almost all of the aerosol weight $W_{aerosol}$ generated in response to one inhalation operation by the user is inhaled by the user. However, strictly speaking, an amount of aerosol (hereinafter, referred to as 'consumed amount of aerosol'), which reach a user-side end portion of the inhalation port 32, of the aerosol weight $W_{aerosol}$ generated in response to one inhalation operation by the user can be changed depending on inhalation conditions. The consumed amount of aerosol is an amount of aerosol, which could be actually inhaled by the user, of a total amount of aerosol generated in response to one inhalation operation by the user.

[0122] The reason is that aerosol, which are generated near the first load 21 and do not reach the user-side end portion of the inhalation port 32, are reaggregated in a more inner space (a space ranging from the user-side end portion of the inhalation port 32 to a space in which the wick 24 and the first load 21 are accommodated) than the inhalation port 32, and remain as a liquid aerosol source, and a remaining amount thereof is varied depending on the inhalation conditions. Note that, since a part of the remaining aerosol source finally returns to the wick 24 or the aerosol source 22, it is reused for generation of aerosol during next inhalation. The remaining of the aerosol source is not a phenomenon that always occurs. That is, depending on the inhalation conditions, almost all of the aerosol weight $W_{aerosol}$ generated in response to one inhalation operation by the user reaches the user-side end portion of the inhalation port 32. In other words, it should be noted that the aerosol weight $W_{aerosol}$ generated in response to one inhalation operation by the user and the consumed amount of aerosol are substantially the same, depending on the inhalation conditions.

[0123] The time for which the inhalation operation by the user is performed (the time for which an output value of the inlet air sensor 15 is equal to or greater than an output threshold value, the duration of the request for aerosol generation) is referred to as inhalation time. As described above, the supply time t_{sense} of the atomizing electric power to the first load 21 has the upper limit value (upper limit time t_{upper}). When the inhalation time is equal to or shorter than the upper limit time t_{upper}, the inhalation time and the supply time t_{sense} coincide with each other, so that the inhalation operation and the supply operation of the atomizing electric power to the first load 21 are over substantially at the same time. Therefore, the aerosol generated immediately before the supply of the atomizing electric power to the first load 21 is over remain without being inhaled by the user.

[0124] On the other hand, when the inhalation time exceeds the upper limit time t_{upper}, the inhalation operation continues even after the supply of the atomizing electric power to the first load 21 is over. For this reason, the aerosol generated immediately before the supply of the atomizing electric power to the first load 21 is over is more inhaled by the user as the inhalation time is longer. In the case where the inhalation time exceeds the upper limit time t_{upper}, when the inhalation time is lengthened to some extent, all the aerosol generated as a result of the supply of the atomizing electric power to the first load 21 are inhaled by the user. Specifically, in the case where the inhalation time exceeds the upper limit time t_{upper}, when the inhalation time is lengthened to some extent, the consumed amount of aerosol and the aerosol weight generated as a result of the supply of the atomizing electric power to the first load 21 are substantially matched.

[0125] Therefore, when the supply time t_{sense} (in other words, a value having a strong correlation with a theoretical value of the aerosol weight generated by this inhalation operation, which is necessary to calculate the amount of the flavor component consumed by the user during this inhalation operation) that is used in calculating the remaining amount of the flavor component in step S24 of FIG. 8 is corrected (in other words, the theoretical value of the aerosol weight is corrected into the consumed amount of aerosol actually consumed by the user), considering the difference in the remaining amount of the aerosol source due to the difference in the inhalation condition, the remaining amount of the flavor component can be acquired more correctly. By using the correct remaining amount of the flavor component, it is possible to improve the acquisition accuracy of the remaining amount in the reservoir.

[0126] Specifically, the MCU 50 corrects the supply time t_{sense} by using different correction data when the inhalation time is equal to or shorter than the upper limit time t_{upper} (in other words, the inhalation time is equal to or shorter than the supply time t_{sense}) and when the inhalation time is longer than the upper limit time t_{upper} (in other words, the inhalation time is longer than the supply time t_{sense}).

[0127] FIG. 13 is a schematic view showing an example of correction data when the inhalation time is equal to or shorter than the upper limit time t_{upper}. In FIG. 13, the horizontal axis indicates the supply time t_{sense} of the atomizing electric power to the first load 21. In FIG. 13, the vertical axis indicates the supply time t_{sense} after correction. When the inhalation time is equal to or shorter than the upper limit time t_{upper}, the supply time t_{sense} and the inhalation time coincide with each other.

[0128] FIG. 14 is a schematic view showing an example of correction data when the inhalation time exceeds the upper limit time t_{upper}. In FIG. 14, the horizontal axis indicates a time difference obtained by subtracting the supply time t_{sense} of the atomizing electric power to the first load 21 from the inhalation time. In FIG. 14, the vertical axis indicates the supply time t_{sense} after correction.

[0129] In the correction data shown in FIG. 13, the supply time t_{sense} after correction monotonically increases as the supply time t_{sense} increases. As described above, when the inhalation time is equal to or shorter than the upper limit time t_{upper}, the aerosol generated immediately before the supply of the atomizing electric power to the first load 21 is over remain without being inhaled by the user. For this reason, as shown in FIG. 13, when the supply time t_{sense} reaches the upper limit time t_{upper}, the supply time t_{sense} is corrected to time t1 shorter than the upper limit time t_{upper}.

[0130] In the aerosol generation device 1, the atomization of the aerosol source 22 is not started at the time of start of the supply of the atomizing electric power to the first load 21, and instead, the atomization of the aerosol source 22 is started after the first load 21 is heated to a certain temperature. Considering this, in the correction data shown in FIG. 13, during a time period for which the supply time t_{sense} is equal to or less than a threshold value THa (a time period after the supply of the atomizing electric power to the first load 21 is started until the atomization of the aerosol source 22 is started), the increase in the supply time t_{sense} after correction is gentle, and when the supply time t_{sense} exceeds the threshold value THa, the increase in the supply time t_{sense} after correction is accelerated. Thereby, for example, when the inhalation operation is over within the time period, aerosol can be regarded as being little consumed, so that the remaining amount of the flavor component and the remaining amount in the reservoir can be calculated more correctly.

[0131] Note that, the correction data shown in FIG. 13 may be changed to correction data shown in FIG. 15. The correction data shown in FIG. 15 is different from the correction data shown in FIG. 13, in that a relationship between the supply time t_{sense} and the supply time t_{sense} after correction is linear. Even when correcting the supply time t_{sense} by using the correction data shown in FIG. 15, the remaining amount of the flavor component and the remaining amount in the reservoir can be calculated, considering the remaining of the aerosol source.

[0132] In the correction data shown in FIG. 14, the supply time t_{sense} after correction monotonically increases as a time difference between the inhalation time and the supply time t_{sense} increases, and thereafter, becomes a constant value. Specifically, in the correction data shown in FIG. 14, during a time period for which the time difference is greater than 0 and less than a threshold value THb, the supply time t_{sense} after correction linearly monotonically increases from time t1 to the upper limit time t_{upper}. When the time difference becomes equal to or greater than the threshold value THb, the supply time t_{sense} after correction is clipped to the upper limit time t_{upper}.

[0133] The correction data shown in FIGS. 13 to 15 can be experimentally obtained and stored in the memory 50a.

[0134] In the below, operations of the aerosol generation device 1 of the first modified embodiment are described. Since the operations are different from only the processing of step S24 and step S24a shown in FIG. 8, the processing is described.

[0135] In step S24 of FIG. 8, when the request for aerosol generation continues, the MCU 50 waits for the end of the request for aerosol generation, acquires the inhalation time, and corrects the supply time t_{sense}, based on the supply time t_{sense} acquired in step S22 and the inhalation time. Specifically, the MCU 50 compares the inhalation time and the supply time t_{sense}, and when the inhalation time is equal to or shorter than the supply time t_{sense} (upper limit time t_{upper}), the MCU 50 corrects the supply time t_{sense} by a second algorithm according to the correction data shown in FIG. 13 or 15. When the inhalation time exceeds the supply time t_{sense} (upper limit time t_{upper}), the MCU 50 corrects the supply time t_{sense} by a first algorithm according to the correction data shown in FIG. 14. Then, the MCU 50 updates the remaining amount $W_{capsule}(n_{puff})$ of the flavor component of the flavor source 33, based on the supply time t_{sense} after correction, the atomizing electric power supplied to the first load 21 according to the received request for aerosol generation, and the target temperature T_{cap_target} at the time of detection of the request for aerosol generation.

[0136] In step S24a, the MCU 50 may calculate the remaining amount in the reservoir based on the remaining amount $W_{capsule}(n_{puff})$ of the flavor component calculated in step S24, or may calculate the remaining amount in the reservoir based on a cumulative value of the supply time t_{sense} after correction after the first cartridge 20 is replaced with a brand-new cartridge.

[0137] Note that, in step S24, the remaining amount $W_{capsule}(n_{puff})$ of the flavor component of the flavor source 33 is calculated. However, a consumed amount of the flavor component included in the flavor source 33 (hereinafter, referred to as ' consumed amount of the flavor source 33') may also be acquired by subtracting the remaining amount $W_{capsule}(n_{puff})$ of the flavor component from $W_{initial}$. Similarly, the consumed amount of the aerosol source 22 can also be acquired by subtracting the remaining amount in the reservoir calculated in step S24a from a total amount of the aerosol source 22 included in a brand-new first cartridge 20.

[0138] In the aerosol generation device 1, only one or both of the remaining amount of the flavor component and the consumed amount of the flavor source 33 may be calculated. In the aerosol generation device 1, only one or both of the remaining amount in the reservoir and the consumed amount of the aerosol source 22 may be calculated.

[0139] As described above, according to the aerosol generation device 1 of the first modified embodiment, at least one of the remaining amount and the consumed amount of the flavor source 33 can be acquired, considering the remaining of the aerosol source. For this reason, at least one of the remaining amount and the consumed amount of the flavor source 33 can be acquired more correctly.

(Second Modified Embodiment of Aerosol Generation Device)

[0140] In the aerosol generation device 1 of the first modified embodiment, the remaining amount of the flavor component is derived, and the atomizing electric power P_{liquid} and the target temperature T_{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 instead, based on the consumed amount of the flavor source 33, the target temperature T_{cap_target} is variably controlled (specifically, the larger the consumed amount of the flavor source 33 is, the higher the target temperature is) to achieve the target amount W_{flavor} of the flavor component.

[0141] Also in the aerosol generation device 1 of the second 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}.

[0142] The consumed amount of the flavor source 33 has a strong correlation with a cumulative value of the consumed amount of aerosol actually inhaled by the user. For this reason, a cumulative value (hereinafter, referred to as 'cumulative discharge time ΣLa') of the supply time t_{sense} after correction every inhalation operation after the second cartridge 30 is replaced with a brand-new cartridge, which has been described in the first modified embodiment, can be used as information indicative of the consumed amount of the flavor source 33. Specifically, the MCU 50 obtains the cumulative discharge time ΣLa to acquire the consumed amount of the flavor source 33.

[0143] 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 consumed amount of the flavor source 33 (the cumulative discharge time ΣLa)). In the second 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 cumulative discharge time ΣLa and the target temperature of the flavor source 33 are stored in association with each other.

[0144] FIGS. 16 to 18 are flowcharts for describing operations of the aerosol generation device 1 according to the second 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_{cap_target} of the flavor source 33, based on the current cumulative discharge time ΣL a stored in the memory 50a (step S31).

[0145] Subsequently, the MCU 50 acquires the temperature T_{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 S32).

[0146] Then, 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}.

[0147] 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 ends the discharge to the second load 31 (step S36), and shifts to a sleep mode in which the power consumption is reduced (step S37). When the non-operation time has not reached the predetermined time (step S35: NO), the MCU 50 shifts the processing to step S32.

[0148] When a request for aerosol generation is detected (step S34: YES), the MCU 50 ends the discharge for heating of the flavor source 33 to the second load 31, and 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 S41). Then, the MCU 50 determines whether the temperature T_{cap_sense} acquired in step S41 is equal to or higher than the target temperature T_{cap_target} (step S42). Note that, the MCU 50 may continue the discharge for heating of the flavor source 33 to the second load 31 even after step S34.

[0149] 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).

[0150] 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 current remaining amount $W_{reservoir}$ in the reservoir stored in the memory 50a, 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. The method of calculating the remaining amount $W_{reservoir}$ in the reservoir will be described later. Note that, the amount of increase ΔPa may be a fixed value, not the variable value. 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 lengthened. Specifically, a value obtained by multiplying the supply time t_{sense} by a value, which is 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}, may be set as the corrected supply time t_{sense}, and the processing thereafter may be performed.

[0151] 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 (i.e., inhalation time) of the request for aerosol generation is shorter than the upper limit time t_{upper} (step S44a: YES), the MCU 50 continues to heat the first load 21. 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 (step S21).

[0152] 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.

[0153] After step S48, when the request for aerosol generation continues, the MCU 50 waits for end of the request for aerosol generation. Then, 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, and the inhalation time of this inhalation, and corrects the supply time t_{sense}, based on these information (step S49). The correction method is as described above.

[0154] Then, the MCU 50 obtains the cumulative discharge time ΣLa by adding the supply time t_{sense} after correction to a cumulative value of the supply time t_{sense} after correction since the second cartridge 30 is replaced with a brand-new cartridge, and updates the cumulative discharge time ΣLa stored in the memory 50a (step S50).

[0155] The cumulative discharge time ΣLa indicates the consumed amount of the flavor source 33 after the second cartridge 30 is replaced with a brand-new cartridge, as a time. Therefore, by comparing the cumulative discharge time ΣLa and a threshold value TH4 indicative of the upper limit value of the cumulative discharge time ΣLa per one second cartridge 30, at least one of the consumed amount and the remaining amount of the flavor source 33 can be acquired.

[0156] For example, it is possible to acquire the remaining[%] of the flavor source 33 by a calculation of $\{(TH4-\Sigma La)/TH4\} \times 100$. Further, it is possible to acquire the consumed amount[%] of the flavor source 33 by a calculation of $(\Sigma La/TH4)\times 100$.

[0157] After step S50, the MCU 50 updates the remaining amount $W_{reservoir}$ in the reservoir (step S51). Specifically, the MCU 50 obtains a cumulative discharge time ΣLb by adding the supply time t_{sense} after correction obtained in step S49 to a cumulative value of the supply time t_{sense} after correction since the first cartridge 20 is replaced with a brand-new cartridge.

[0158] The cumulative discharge time ΣLb indicates the consumed amount of the aerosol source 22 since the first cartridge 20 is replaced with a brand-new cartridge by time. Therefore, by comparing the cumulative discharge time ΣLb and a threshold value TH5 indicative of the upper limit value of the cumulative discharge time ΣLb per one first cartridge 20, at least one of the consumed amount and the remaining amount (i.e., the remaining amount in the reservoir) of the aerosol source 22 can be acquired.

[0159] For example, the remaining amount[%] in the reservoir can be acquired by a calculation of $\{(TH5-\Sigma Lb)/TH5\} \times 100$. The MCU 50 updates the remaining amount in the reservoir by storing the remaining amount in the reservoir acquired in this way in the memory 50a. In addition, the consumed amount[%] of the aerosol source 22 can also be acquired by performing a calculation of $(\Sigma Lb/TH5)\times 100$.

[0160] Then, the MCU 50 determines whether the cumulative discharge time ΣLb updated in step S51 is equal to or greater than the threshold value TH5 (step S52). When the cumulative discharge time ΣLb is smaller than the threshold value TH5 (step S52: NO), the MCU 50 shifts the processing to step S56. When the cumulative discharge time ΣLb is equal to or greater than the threshold value TH5, i.e., the remaining amount of the aerosol source 22 is 0% (step S52: 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 first cartridge 20 and the second cartridge 30 (step S53). Then, the MCU 50 resets each of the cumulative discharge time ΣLa and the cumulative discharge time ΣLb to the initial value (=0), and initializes the target temperature T_{cap_target} (step S54). The initialization of the target temperature T_{cap_target} means excluding, from the setting values, the target temperature T_{cap_target} at that time stored in the memory 50a.

[0161] Instead of the above operations, when the cumulative discharge time ΣLb updated in step S51 is equal to or greater than the threshold value TH5 (step S52: YES), the MCU 50 may determine whether the cumulative discharge time ΣLa updated in step S50 is equal to or greater than the threshold value TH4. Only when the updated cumulative discharge time ΣLa is equal to or greater than the threshold value TH4, the MCU 50 may cause 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, in step S53. Further, only when the updated cumulative discharge time ΣLa is equal to or greater than the threshold value TH4, the MCU 50 may reset the cumulative discharge time ΣLa to the initial value (=0) and initialize the target temperature T_{cap_target}, in step S54.

[0162] In step S56, the MCU 50 determines whether the cumulative discharge time ΣLa updated in step S50 is equal to or greater than the threshold value TH4. When the cumulative discharge time ΣLa is smaller than the threshold value TH4 (step S56: NO), the MCU 50 shifts the processing to step S55. When the cumulative discharge time ΣLa is equal to or greater than the threshold value TH4, i.e., the remaining amount of the flavor source 33 is 0% (step S56: 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 S57). Then, the MCU 50 resets the cumulative discharge time ΣLa to the initial value (=0), and initializes the target temperature T_{cap_target} (step S58).

[0163] After step S54, the result of determination in step S56 is NO or step S58, when the power supply is not turned off (step S55: NO), the MCU 50 returns the processing to step S31, and when the power supply is turned off (step S55: YES), the MCU 50 ends the processing.

[0164] According to the aerosol generation device 1 of the second modified embodiment, it is possible to provide the user with aerosol having stable flavor and taste by the simpler control than the aerosol generation device 1 of the first modified embodiment. In addition, similar to the first modified embodiment, it is possible to acquire at least one of the remaining amount and the consumed amount of the flavor source 33 and at least one of the remaining amount and the consumed amount of the aerosol source 22 more correctly.

[0165] The aerosol generation device 1 described above is configured to be able to heat the flavor source 33. However, this configuration is not necessarily required. Even when the heating of the flavor source 33 is not performed, it is possible to accurately acquire at least one of the remaining amount and the consumed amount of the flavor source 33 and at least one of the remaining amount and the consumed amount of the aerosol source 22, based on the inhalation time and the supply time t_{sense}.

[0166] 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.

[0167] 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.

[0168] 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.

[0169] 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.

[0170] 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.

[0171] 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 sensor (inlet air sensor 15) configured to output inhalation by a user; and
a processing device (MCU 50) configured to control discharge from a power supply (power supply 12) to an atomizer (first load 21) configured to atomize an aerosol source (aerosol source 22),
wherein the processing device is configured:

to acquire an inhalation time that is a length of each inhalation and an discharge time (supply time t_{sense}) that is a length of discharge to the atomizer corresponding to each inhalation, based on an output of the sensor, and

to acquire at least one of a remaining amount of a flavor source (flavor source 33) configured to add flavor to aerosol generated from the aerosol source and a consumed amount of the flavor source, based on the inhalation time and the discharge time.

According to the above (1), at least one of the remaining amount the consumed amount of the flavor source is acquired, considering the inhalation time and the discharge time. For this reason, the acquisition accuracy of at least one of the remaining amount and the consumed amount of the flavor source is improved, as compared to a configuration where only the discharge time is used.

(2) The control unit of an aerosol generation device according to the above (1), wherein the processing device is configured to acquire at least one of the remaining amount of the flavor source and the consumed amount of the flavor source, based on comparison of the inhalation time and the discharge time.

According to the above (2), at least one of the remaining amount and the consumed amount of the flavor source is acquired, based on comparison of the inhalation time and the discharge time. Therefore, the acquisition accuracy of at least one of the remaining amount and the consumed amount of the flavor source is improved, as compared to a configuration where only the discharge time is used.

(3) The control unit of an aerosol generation device according to the above (1) or (2), wherein the processing device is configured:

to acquire at least one of the remaining amount of the flavor source and the consumed amount of the flavor source by using a first algorithm when the inhalation time is longer than the discharge time corresponding to the inhalation time, and

to acquire at least one of the remaining amount of the flavor source and the consumed amount of the flavor source by using a second algorithm different from the first algorithm when the inhalation time is equal to or shorter than the discharge time corresponding to the inhalation time.

According to the above (3), since at least one of the remaining amount and the consumed amount of the flavor source is acquired by separating aerosol into aerosol that are inhaled during generation of the aerosol and aerosol that are inhaled after generation of the aerosol, the acquisition accuracy of at least one of the remaining amount and the consumed amount of the flavor source is improved.

(4) The control unit of an aerosol generation device according to the above (1) or (2), wherein a decrease aspect of the remaining amount of the flavor source corresponding to an increase in the inhalation time when the inhalation time is longer than the discharge time corresponding to the inhalation time is different from a decrease aspect of the remaining amount of the flavor source with respect to an increase in the discharge time when the inhalation time is equal to or shorter than the discharge time corresponding to the inhalation time, and/or

wherein an increase aspect of the consumed amount of the flavor source with respect to an increase in the inhalation time when the inhalation time is longer than the discharge time corresponding to the inhalation time is different from an increase aspect of the consumed amount of the flavor source with respect to an increase in the inhalation time when the inhalation time is equal to or shorter than the discharge time corresponding to the inhalation time.

According to the above (4), since at least one of the remaining amount and the consumed amount of the flavor source is acquired by separating aerosol into aerosol that are inhaled during generation of the aerosol and aerosol that are inhaled after generation of the aerosol, the acquisition accuracy of at least one of the remaining amount and the consumed amount of the flavor source is improved.

(5) The control unit of an aerosol generation device according to the above (1) or (2), wherein the processing device is configured:

to decrease the remaining amount of the flavor source according to an increase in difference between the inhalation time and the discharge time corresponding to the inhalation time when the inhalation time is longer than the discharge time corresponding to the inhalation time, and to decrease the remaining amount of the flavor source according to an increase in the discharge time corresponding to the inhalation time when the inhalation time is equal to or shorter than the discharge time corresponding to the inhalation time, and/or

to increase the consumed amount of the flavor source according to an increase in difference between the inhalation time and the discharge time corresponding to the inhalation time when the inhalation time is longer than the discharge time corresponding to the inhalation time, and to increase the consumed amount of the flavor source according to an increase in the discharge time corresponding to the inhalation time when the inhalation time is equal to or shorter than the discharge time corresponding to the inhalation time.

According to the above (5), since at least one of the remaining amount and the consumed amount of the flavor source is acquired by separating aerosol into aerosol that are inhaled during generation of the aerosol and aerosol that are inhaled after generation of the aerosol, the acquisition accuracy of at least one of the remaining amount and the consumed amount of the flavor source is improved.

(6) The control unit of an aerosol generation device according to the above (1) or (2), wherein when the inhalation time is equal to or shorter than the discharge time corresponding to the inhalation time, the processing device is configured to monotonically decrease the remaining amount of the flavor source with respect to the discharge time, and/or to monotonically increase the consumed amount of the flavor source with respect to the discharge time.

According to the above (6), at least one of the remaining amount and the consumed amount of the flavor source is acquired, regarding the aerosol that are inhaled during generation of the aerosol as monotonically increasing. Therefore, the acquisition accuracy of at least one of the remaining amount and the consumed amount of the flavor source is improved in inhalation during generation of the aerosol.

(7) The control unit of an aerosol generation device according to the above (6), wherein when the inhalation time is equal to or shorter than the discharge time corresponding to the inhalation time and exceeds a threshold value (threshold value THa), the processing device is configured to accelerate at least one of a decrease in the remaining amount of the flavor source and an increase in the consumed amount of the flavor source according to an increase in the discharge time.

According to the above (7), at least one of the remaining amount and the consumed amount of the flavor source is acquired, considering a time until an amount of aerosol generation starts to increase immediately after the inhalation starts (the discharge starts). Therefore, the acquisition accuracy of at least one of the remaining amount and the consumed amount of the flavor source is improved in inhalation during generation of the aerosol.

(8) The control unit of an aerosol generation device according to one of the above (1), (2), (6) and (7), wherein when the inhalation time is longer than the discharge time corresponding to the inhalation time, the processing device is configured to monotonically decrease at least partially the remaining amount of the flavor source with respect to a difference between the inhalation time and the discharge time corresponding to the inhalation time, and/or to monotonically increase at least partially the consumed amount of the flavor source with respect to the difference.

According to the above (8), for inhalation after generation of the aerosol, at least one of the remaining amount and the consumed amount of the flavor source is acquired based on the difference between the inhalation time and the discharge time. Therefore, the acquisition accuracy of at least one of the reamaining amount and the consumed amount of the flavor source is improved in inhalation during generation of the aerosol.

(9) The control unit of an aerosol generation device according to one of the above (1), (2), (6) and (7), wherein the processing device is configured so that:

a decrease aspect of the remaining amount of the flavor source corresponding to a difference between the inhalation time and the discharge time corresponding to the inhalation time when the inhalation time is longer than the discharge time and the difference is less than a second threshold value (threshold value THb) is different from a decrease aspect of the remaining amount of the flavor source corresponding to the difference when the inhalation time is longer than the discharge time and the difference is equal to or greater than the second threshold value, and/or

an increase aspect of the consumed amount of the flavor source corresponding to the difference when the inhalation time is longer than the discharge time corresponding to the inhalation time and the difference is less than the second threshold value is different from an increase aspect of the consumed amount of the flavor source corresponding to the difference when the inhalation time is longer than the discharge time and the difference is equal to or greater than the second threshold value.

According to the above (9), the method of acquiring at least one of the remaining amount and the consumed amount of the flavor source is changed, in inhalation of aerosol remaining in a flow path after generation of the aerosol and in inhalation of aerosol after the remaining aerosol is substantially completely inhaled. Therefore, the acquisition accuracy of at least one of the remaining amount and the consumed amount of the flavor source is improved in inhalation during generation of the aerosol.

(10) The control unit of an aerosol generation device according to the above (9), wherein the processing device is configured:

to monotonically decrease the remaining amount of the flavor source with respect to the difference when the inhalation time is longer than the discharge time corresponding to the inhalation time and the difference is less than the second threshold value, and to set the remaining amount of the flavor source to be constant with respect to the difference when the inhalation time is longer than the discharge time corresponding to the inhalation time and the difference is equal to or greater than the second threshold value, and/or to monotonically increase the consumed amount of the flavor source with respect to the difference when the inhalation time is longer than the discharge time corresponding to the inhalation time and the difference is less than the second threshold value, and to set the consumed amount of the flavor source to be constant with respect to the difference when the inhalation time is longer than the discharge time corresponding to the inhalation time and the difference is equal to or greater than the second threshold value.

According to the above (10), the method of acquiring at least one of the remaining amount and the consumed amount of the flavor source is changed, in inhalation of aerosol remaining in a flow path after generation of the aerosol and in inhalation of aerosol after the remaining aerosol is substantially completely inhaled. Therefore, the acquisition accuracy of at least one of the remaining amount and the consumed amount of the flavor source is improved in inhalation during generation of the aerosol.
(11) The control unit of an aerosol generation device according to the above (1), wherein the processing device is configured to acquire at least one of a remaining amount of the aerosol source and a consumed amount of the aerosol source, based on the inhalation time and the discharge time.
According to the above (11), at least one of the remaining amount and the consumed amount of the aerosol source is acquired, considering the inhalation time and the discharge time. Therefore, as compared to a configuration where only the discharge time is used, the acquisition accuracy of at least one of the remaining amount and the consumed amount of the aerosol source is improved.
(12) A control unit of an aerosol generation device including:

a sensor (inlet air sensor 15) configured to output inhalation by a user; and
a processing device (MCU 50) configured to control discharge from a power supply (power supply 12) to an atomizer (first load 21) configured to atomize an aerosol source (aerosol source 22),
wherein the processing device is configured:

to acquire an inhalation time that is a length of each inhalation and an discharge time (supply time t_{sense}) that is a length of discharge to the atomizer corresponding to each inhalation, based on an output of the sensor, and
to acquire at least one of a remaining amount of the aerosol source and a consumed amount of the aerosol source, based on the inhalation time and the discharge time.

[0172] According to the above (12), at least one of the remaining amount and the consumed amount of the aerosol source is acquired, considering the inhalation time and the discharge time. Therefore, as compared to a configuration where only the discharge time is used, the acquisition accuracy of at least one of the remaining amount and the consumed amount of the aerosol source is improved.

Claims

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

a sensor configured to output inhalation by a user; and
a processing device configured to control discharge from a power supply to an atomizer configured to atomize an aerosol source,
wherein the processing device is configured:

to acquire an inhalation time that is a length of each inhalation and an discharge time that is a length of discharge to the atomizer corresponding to each inhalation, based on an output of the sensor; and
to acquire at least one of a remaining amount of a flavor source configured to add flavor to aerosol generated from the aerosol source and a consumed amount of the flavor source, based on the inhalation time and the discharge time.

2. The control unit of an aerosol generation device according to claim 1, wherein the processing device is configured to acquire at least one of the remaining amount of the flavor source and the consumed amount of the flavor source, based on comparison of the inhalation time and the discharge time.

3. The control unit of an aerosol generation device according to claim 1 or 2, wherein the processing device is configured:

to acquire at least one of the remaining amount of the flavor source and the consumed amount of the flavor source by using a first algorithm when the inhalation time is longer than the discharge time corresponding to the inhalation time; and

to acquire at least one of the remaining amount of the flavor source and the consumed amount of the flavor source by using a second algorithm different from the first algorithm when the inhalation time is equal to or shorter than the discharge time corresponding to the inhalation time.

4. The control unit of an aerosol generation device according to claim 1 or 2, wherein a decrease aspect of the remaining amount of the flavor source corresponding to an increase in the inhalation time when the inhalation time is longer than the discharge time corresponding to the inhalation time is different from a decrease aspect of the remaining amount of the flavor source with respect to an increase in the discharge time when the inhalation time is equal to or shorter than the discharge time corresponding to the inhalation time, and/or
wherein an increase aspect of the consumed amount of the flavor source with respect to an increase in the inhalation time when the inhalation time is longer than the discharge time corresponding to the inhalation time is different from an increase aspect of the consumed amount of the flavor source with respect to an increase in the inhalation time when the inhalation time is equal to or shorter than the discharge time corresponding to the inhalation time.

5. The control unit of an aerosol generation device according to claim 1 or 2, wherein the processing device is configured:

to decrease the remaining amount of the flavor source according to an increase in difference between the inhalation time and the discharge time corresponding to the inhalation time when the inhalation time is longer than the discharge time corresponding to the inhalation time, and to decrease the remaining amount of the flavor source according to an increase in the discharge time corresponding to the inhalation time when the inhalation time is equal to or shorter than the discharge time corresponding to the inhalation time; and/or

to increase the consumed amount of the flavor source according to an increase in difference between the inhalation time and the discharge time corresponding to the inhalation time when the inhalation time is longer than the discharge time corresponding to the inhalation time, and to increase the consumed amount of the flavor source according to an increase in the discharge time corresponding to the inhalation time when the inhalation time is equal to or shorter than the discharge time corresponding to the inhalation time.

6. The control unit of an aerosol generation device according to claim 1 or 2, wherein when the inhalation time is equal to or shorter than the discharge time corresponding to the inhalation time, the processing device is configured to monotonically decrease the remaining amount of the flavor source with respect to the discharge time, and/or to monotonically increase the consumed amount of the flavor source with respect to the discharge time.

7. The control unit of an aerosol generation device according to claim 6, wherein when the inhalation time is equal to or shorter than the discharge time corresponding to the inhalation time and exceeds a threshold value, the processing device is configured to accelerate at least one of a decrease in the remaining amount of the flavor source and an increase in the consumed amount of the flavor source according to an increase in the discharge time.

8. The control unit of an aerosol generation device according to one of claims 1, 2, 6 and 7, wherein when the inhalation time is longer than the discharge time corresponding to the inhalation time, the processing device is configured to monotonically decrease at least partially the remaining amount of the flavor source with respect to a difference between the inhalation time and the discharge time corresponding to the inhalation time, and/or to monotonically increase at least partially the consumed amount of the flavor source with respect to the difference.

9. The control unit of an aerosol generation device according to one of claims 1, 2, 6 and 7, wherein the processing device is configured so that:

a decrease aspect of the remaining amount of the flavor source corresponding to a difference between the inhalation time and the discharge time corresponding to the inhalation time when the inhalation time is longer than the discharge time and the difference is less than a second threshold value is different from a decrease aspect of the remaining amount of the flavor source corresponding to the difference when the inhalation time is longer than the discharge time and the difference is equal to or greater than the second threshold value; and/or

an increase aspect of the consumed amount of the flavor source corresponding to the difference when the inhalation time is longer than the discharge time corresponding to the inhalation time and the difference is less than the second threshold value is different from an increase aspect of the consumed amount of the flavor source corresponding to the difference when the inhalation time is longer than the discharge time and the difference is equal to or greater than the second threshold value.

10. The control unit of an aerosol generation device according to claim 9, wherein the processing device is configured:

to monotonically decrease the remaining amount of the flavor source with respect to the difference when the inhalation time is longer than the discharge time corresponding to the inhalation time and the difference is less than the second threshold value, and to set the remaining amount of the flavor source to be constant with respect to the difference when the inhalation time is longer than the discharge time corresponding to the inhalation time and the difference is equal to or greater than the second threshold value; and/or

to monotonically increase the consumed amount of the flavor source with respect to the difference when the inhalation time is longer than the discharge time corresponding to the inhalation time and the difference is less than the second threshold value, and to set the consumed amount of the flavor source to be constant with respect to the difference when the inhalation time is longer than the discharge time corresponding to the inhalation time and the difference is equal to or greater than the second threshold value.

11. The control unit of an aerosol generation device according to claim 1, wherein the processing device is configured to acquire at least one of a remaining amount of the aerosol source and a consumed amount of the aerosol source, based on the inhalation time and the discharge time.

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

a sensor configured to output inhalation by a user; and
a processing device configured to control discharge from a power supply to an atomizer configured to atomize an aerosol source,
wherein the processing device is configured:

to acquire an inhalation time that is a length of each inhalation and an discharge time that is a length of discharge to the atomizer corresponding to each inhalation, based on an output of the sensor; and
to acquire at least one of a remaining amount of the aerosol source and a consumed amount of the aerosol source, based on the inhalation time and the discharge time.

FIG.1

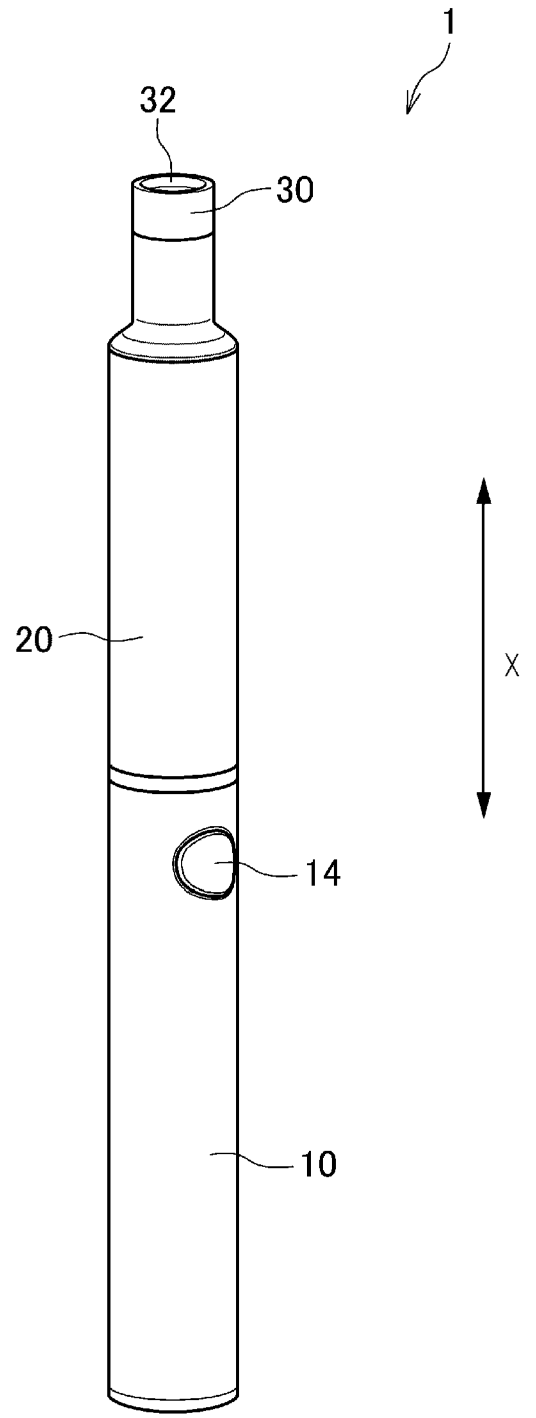


FIG.2

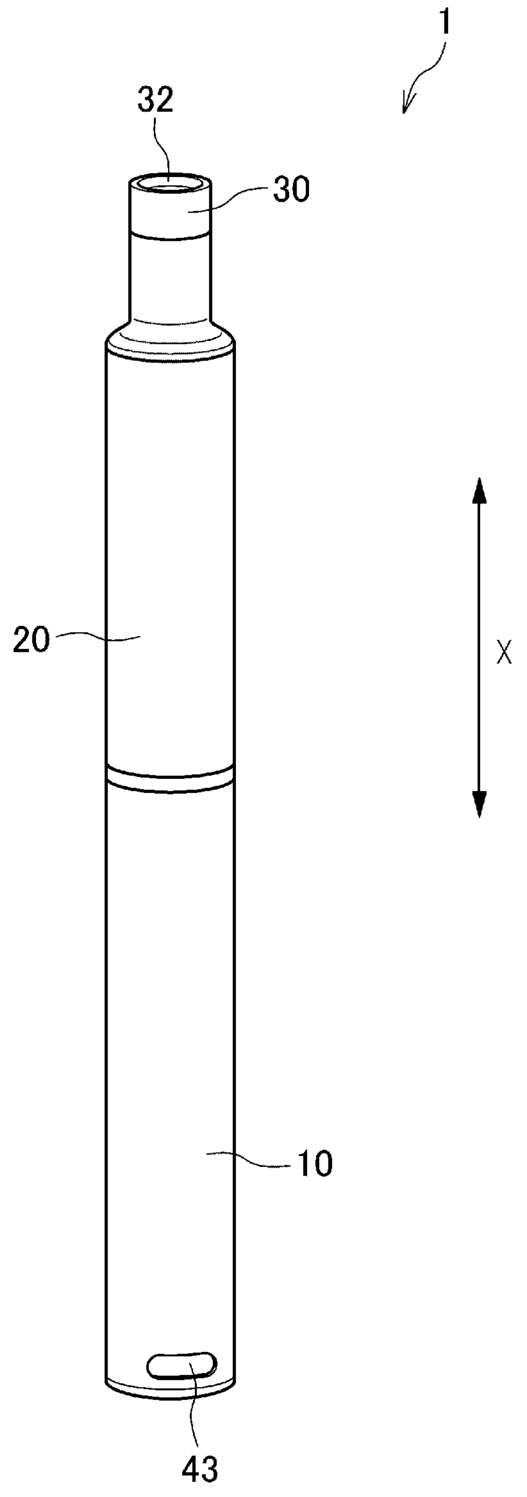


FIG.3

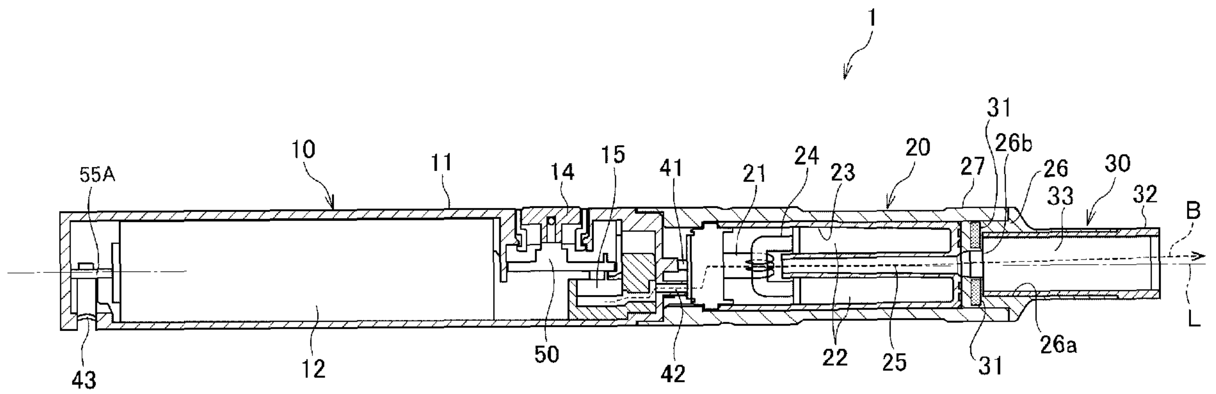

1
10
11
14
15
41
21
24
23
20
27
31
26b
26
30
33
32
B
55A
L
43
12
50
42
22
25
31
26a

FIG.4

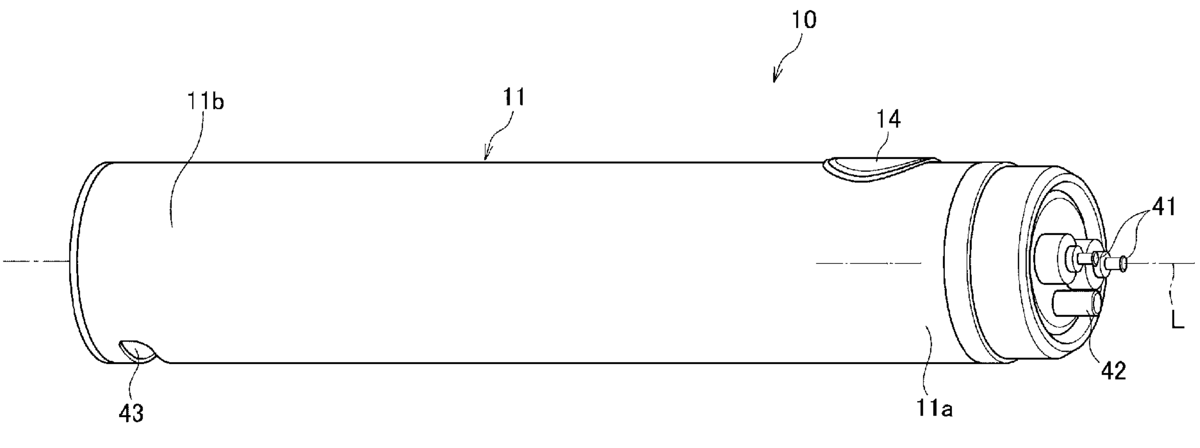


FIG.5

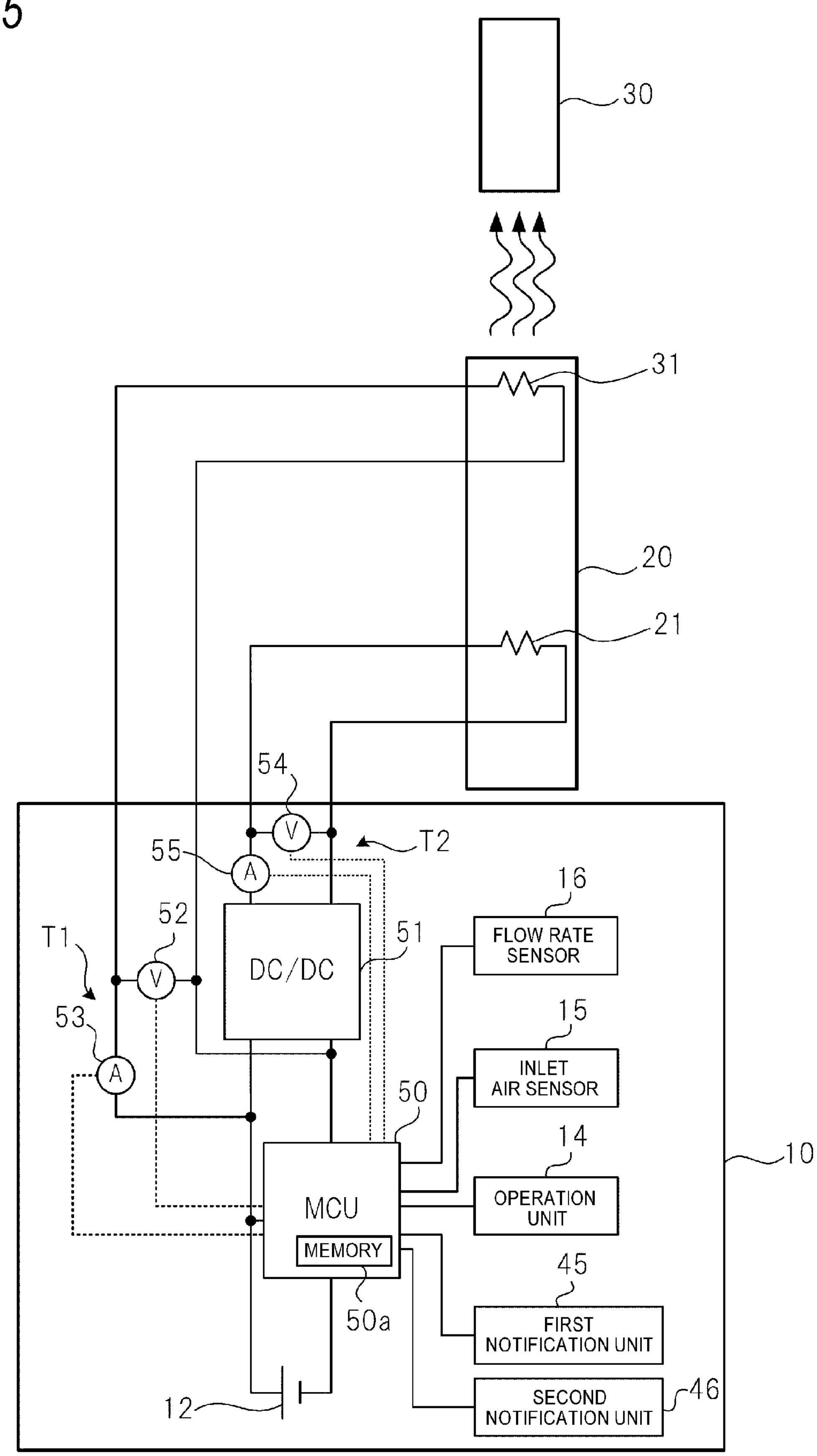

30
31
20
21
54
T2
55
52
51
T1
DC/DC
16
FLOW RATE SENSOR
53
15
INLET AIR SENSOR
50
14
MCU
OPERATION UNIT
10
MEMORY
45
50a
FIRST NOTIFICATION UNIT
12
SECOND NOTIFICATION UNIT
46

FIG.6

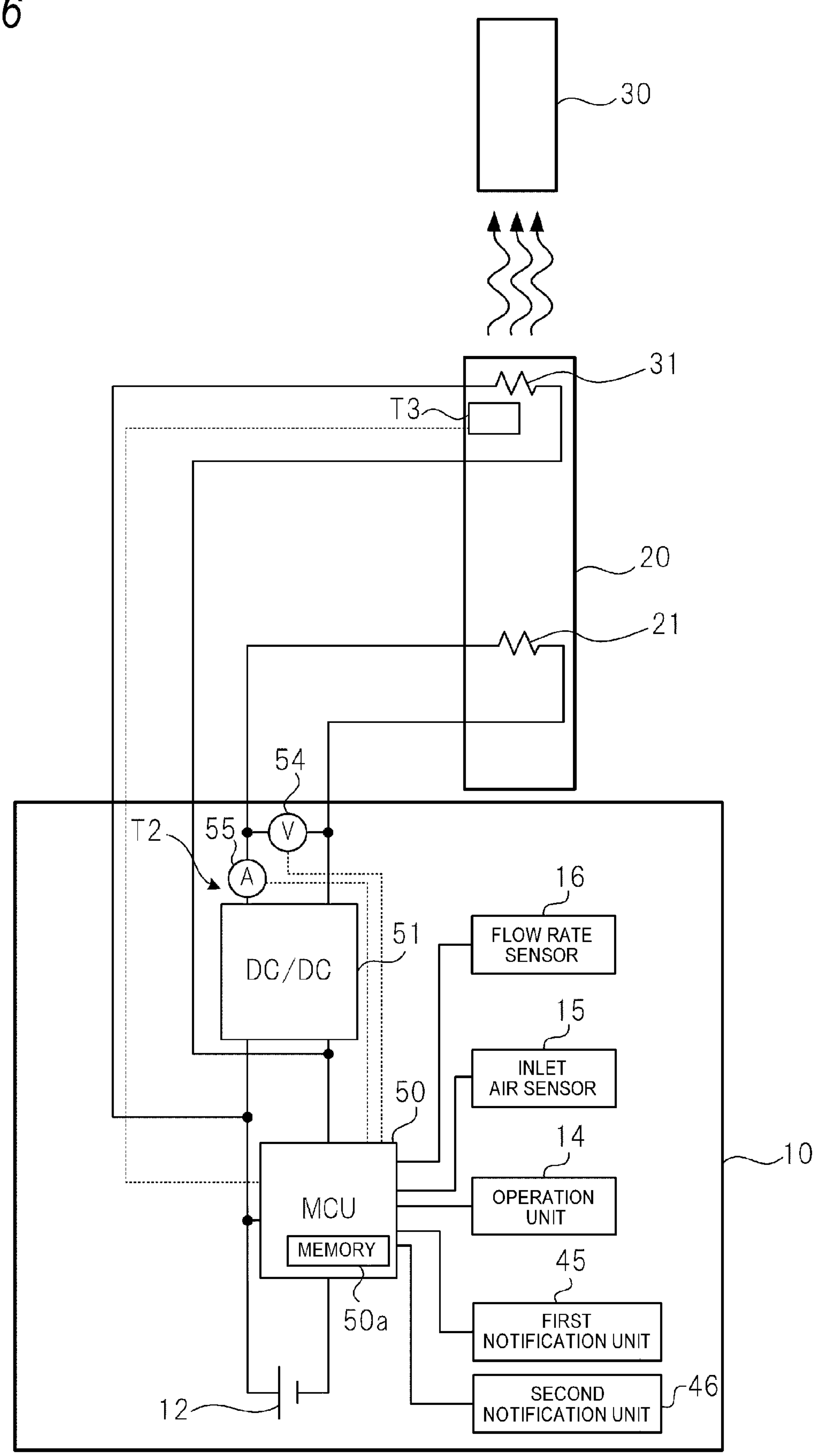
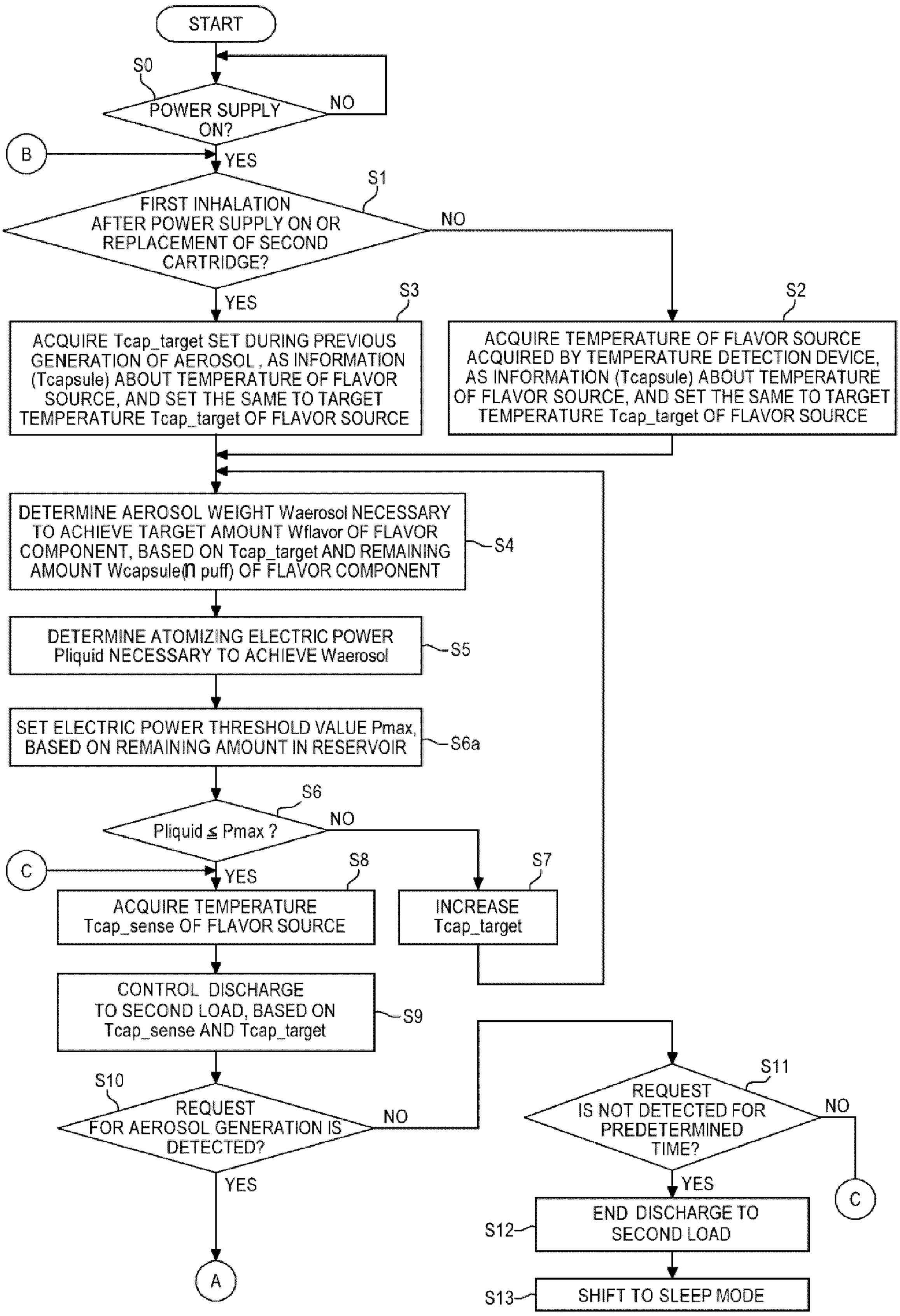

30
31
T3
20
21
54
T2
55
V
A
DC/DC
51
16
FLOW RATE SENSOR
15
INLET AIR SENSOR
50
14
OPERATION UNIT
10
MCU
MEMORY
45
50a
FIRST NOTIFICATION UNIT
SECOND NOTIFICATION UNIT
46
12

FIG.7



START
S0
POWER SUPPLY ON?
NO
YES
B
S1
FIRST INHALATION AFTER POWER SUPPLY ON OR REPLACEMENT OF SECOND CARTRIDGE?
NO
YES
S3
ACQUIRE Tcap_target SET DURING PREVIOUS GENERATION OF AEROSOL , AS INFORMATION (Tcapsule) ABOUT TEMPERATURE OF FLAVOR SOURCE, AND SET THE SAME TO TARGET TEMPERATURE Tcap_target OF FLAVOR SOURCE
S2
ACQUIRE TEMPERATURE OF FLAVOR SOURCE ACQUIRED BY TEMPERATURE DETECTION DEVICE, AS INFORMATION (Tcapsule) ABOUT TEMPERATURE OF FLAVOR SOURCE, AND SET THE SAME TO TARGET TEMPERATURE Tcap_target OF FLAVOR SOURCE
DETERMINE AEROSOL WEIGHT Waerosol NECESSARY TO ACHIEVE TARGET AMOUNT Wflavor OF FLAVOR COMPONENT, BASED ON Tcap_target AND REMAINING AMOUNT Wcapsule(n puff) OF FLAVOR COMPONENT
S4
DETERMINE ATOMIZING ELECTRIC POWER Pliquid NECESSARY TO ACHIEVE Waerosol
S5
SET ELECTRIC POWER THRESHOLD VALUE Pmax, BASED ON REMAINING AMOUNT IN RESERVOIR
S6a
S6
Pliquid ≦ Pmax ?
NO
C
YES
S8
ACQUIRE TEMPERATURE Tcap_sense OF FLAVOR SOURCE
S7
INCREASE Tcap_target
CONTROL DISCHARGE TO SECOND LOAD, BASED ON Tcap_sense AND Tcap_target
S9
S10
REQUEST FOR AEROSOL GENERATION IS DETECTED?
NO
YES
A
S11
REQUEST IS NOT DETECTED FOR PREDETERMINED TIME?
NO
YES
C
S12
END DISCHARGE TO SECOND LOAD
S13
SHIFT TO SLEEP MODE

FIG.8

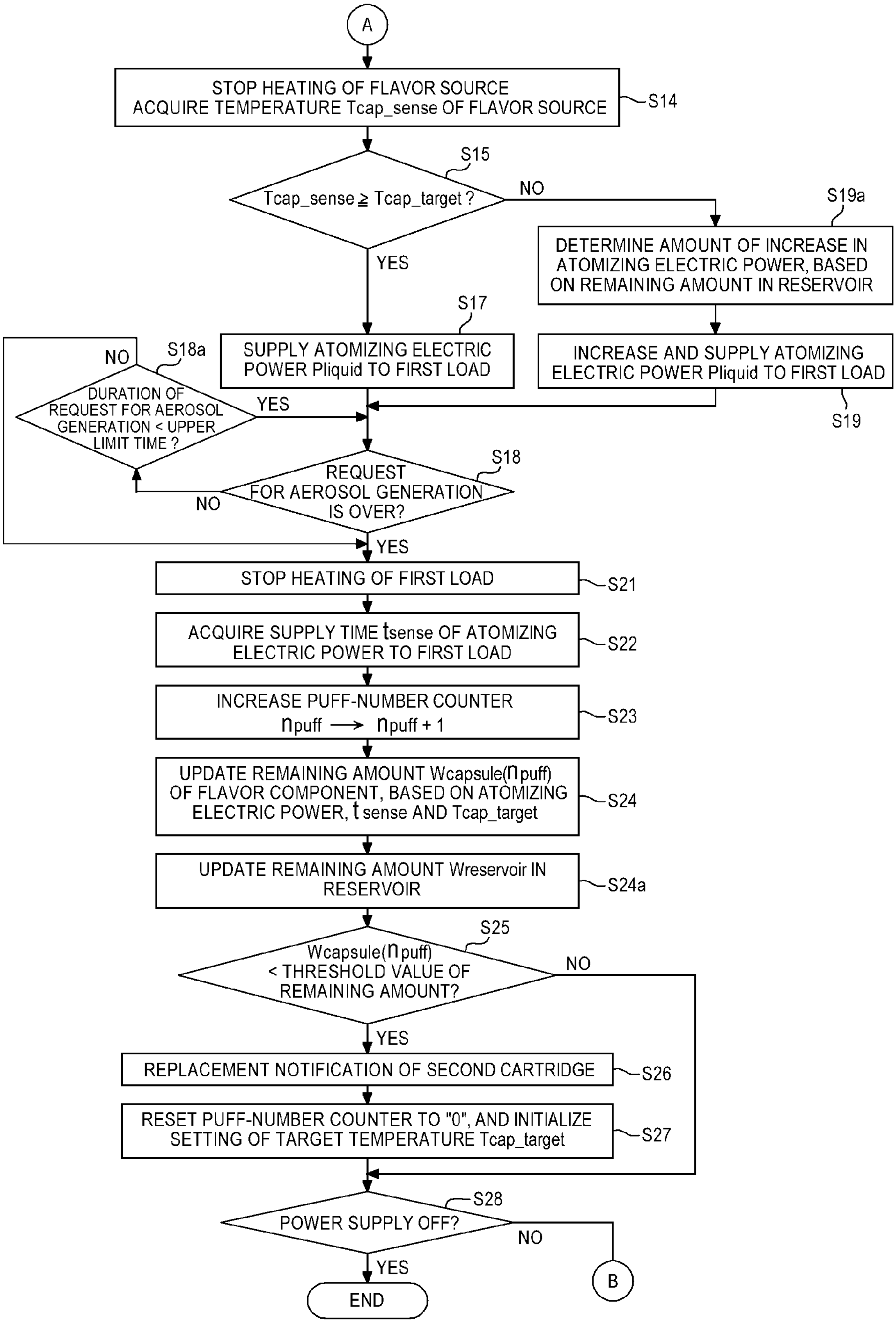

A
STOP HEATING OF FLAVOR SOURCE
ACQUIRE TEMPERATURE Tcap_sense OF FLAVOR SOURCE
S14
S15
Tcap_sense ≧ Tcap_target ?
NO
YES
S19a
DETERMINE AMOUNT OF INCREASE IN ATOMIZING ELECTRIC POWER, BASED ON REMAINING AMOUNT IN RESERVOIR
S17
SUPPLY ATOMIZING ELECTRIC POWER Pliquid TO FIRST LOAD
INCREASE AND SUPPLY ATOMIZING ELECTRIC POWER Pliquid TO FIRST LOAD
S19
S18a
DURATION OF REQUEST FOR AEROSOL GENERATION < UPPER LIMIT TIME ?
NO
YES
S18
REQUEST FOR AEROSOL GENERATION IS OVER?
NO
YES
STOP HEATING OF FIRST LOAD
S21
ACQUIRE SUPPLY TIME tsense OF ATOMIZING ELECTRIC POWER TO FIRST LOAD
S22
INCREASE PUFF-NUMBER COUNTER
npuff ⟶ npuff + 1
S23
UPDATE REMAINING AMOUNT Wcapsule(npuff) OF FLAVOR COMPONENT, BASED ON ATOMIZING ELECTRIC POWER, t sense AND Tcap_target
S24
UPDATE REMAINING AMOUNT Wreservoir IN RESERVOIR
S24a
S25
Wcapsule(npuff) < THRESHOLD VALUE OF REMAINING AMOUNT?
NO
YES
REPLACEMENT NOTIFICATION OF SECOND CARTRIDGE
S26
RESET PUFF-NUMBER COUNTER TO "0", AND INITIALIZE SETTING OF TARGET TEMPERATURE Tcap_target
S27
S28
POWER SUPPLY OFF?
NO
YES
END
B

FIG.9

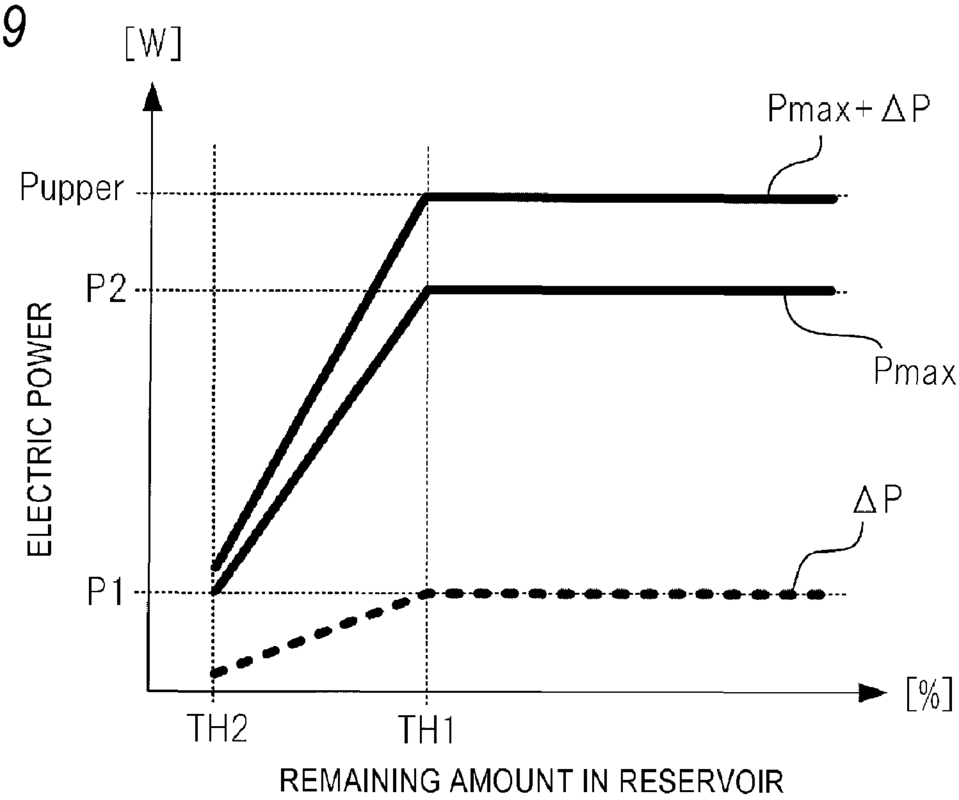

[W]
Pmax+ΔP
Pupper
P2
Pmax
ELECTRIC POWER
ΔP
P1
[%]
TH2
TH1
REMAINING AMOUNT IN RESERVOIR

FIG.10

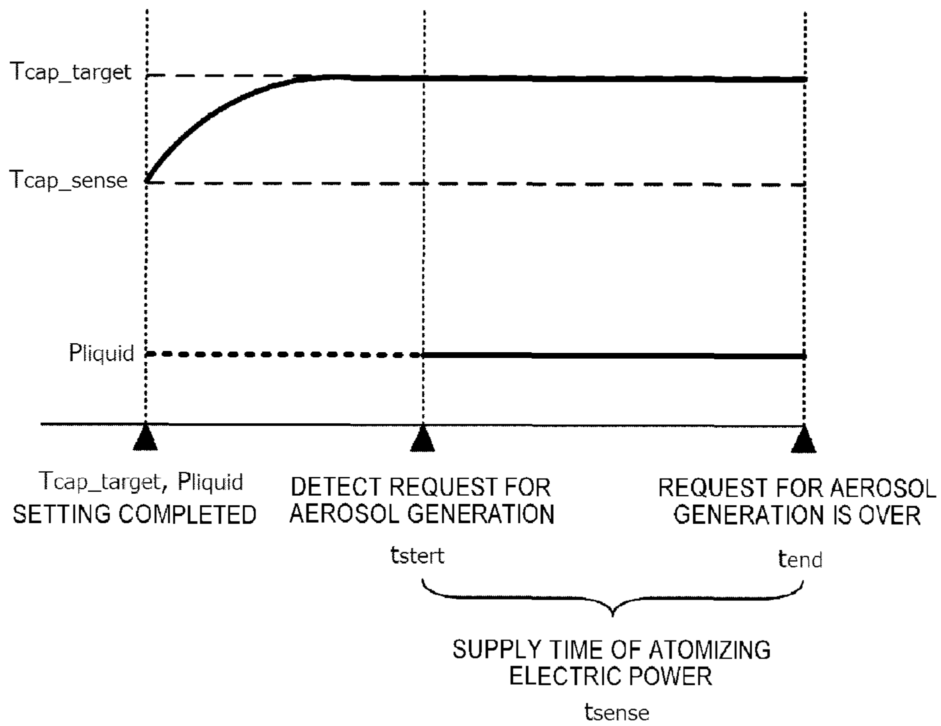

Tcap_target
Tcap_sense
Pliquid
Tcap_target, Pliquid
SETTING COMPLETED
DETECT REQUEST FOR
AEROSOL GENERATION
REQUEST FOR AEROSOL
GENERATION IS OVER
tstert
tend
SUPPLY TIME OF ATOMIZING
ELECTRIC POWER
tsense

FIG.11

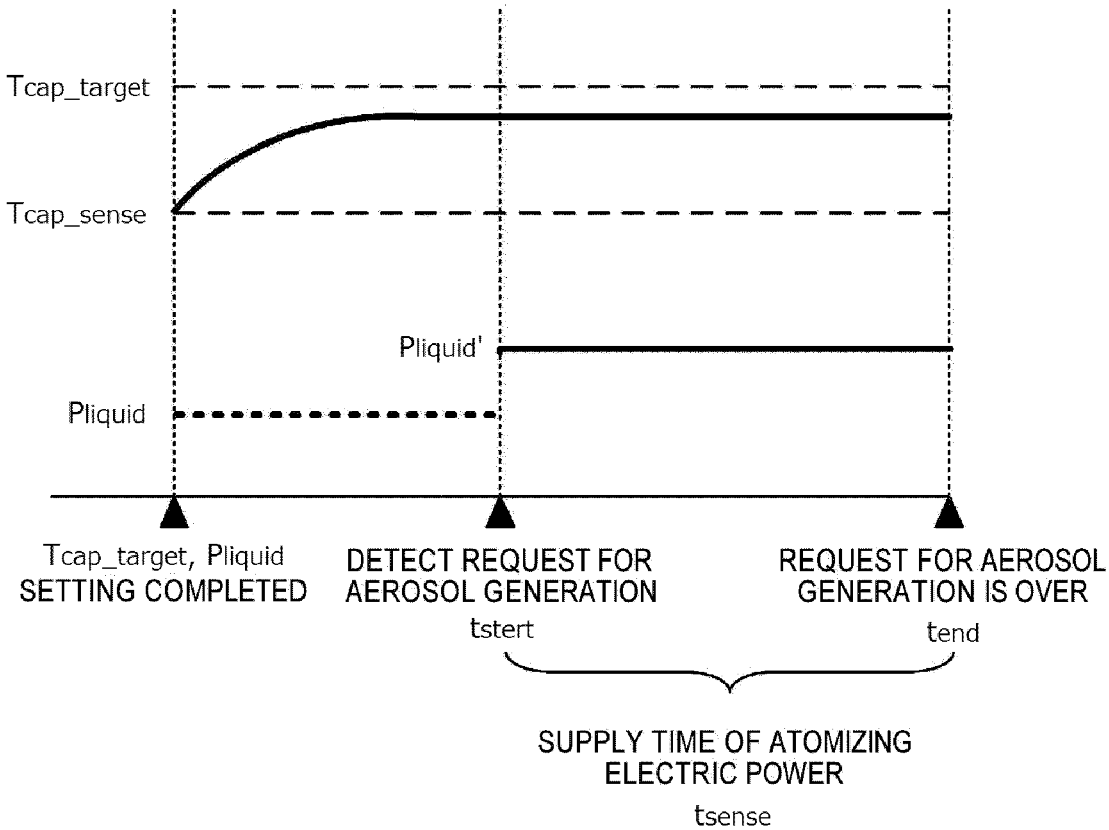

Tcap_target
Tcap_sense
Pliquid'
Pliquid
Tcap_target, Pliquid
SETTING COMPLETED
DETECT REQUEST FOR
AEROSOL GENERATION
tstert
REQUEST FOR AEROSOL
GENERATION IS OVER
tend
SUPPLY TIME OF ATOMIZING
ELECTRIC POWER
tsense

FIG.12

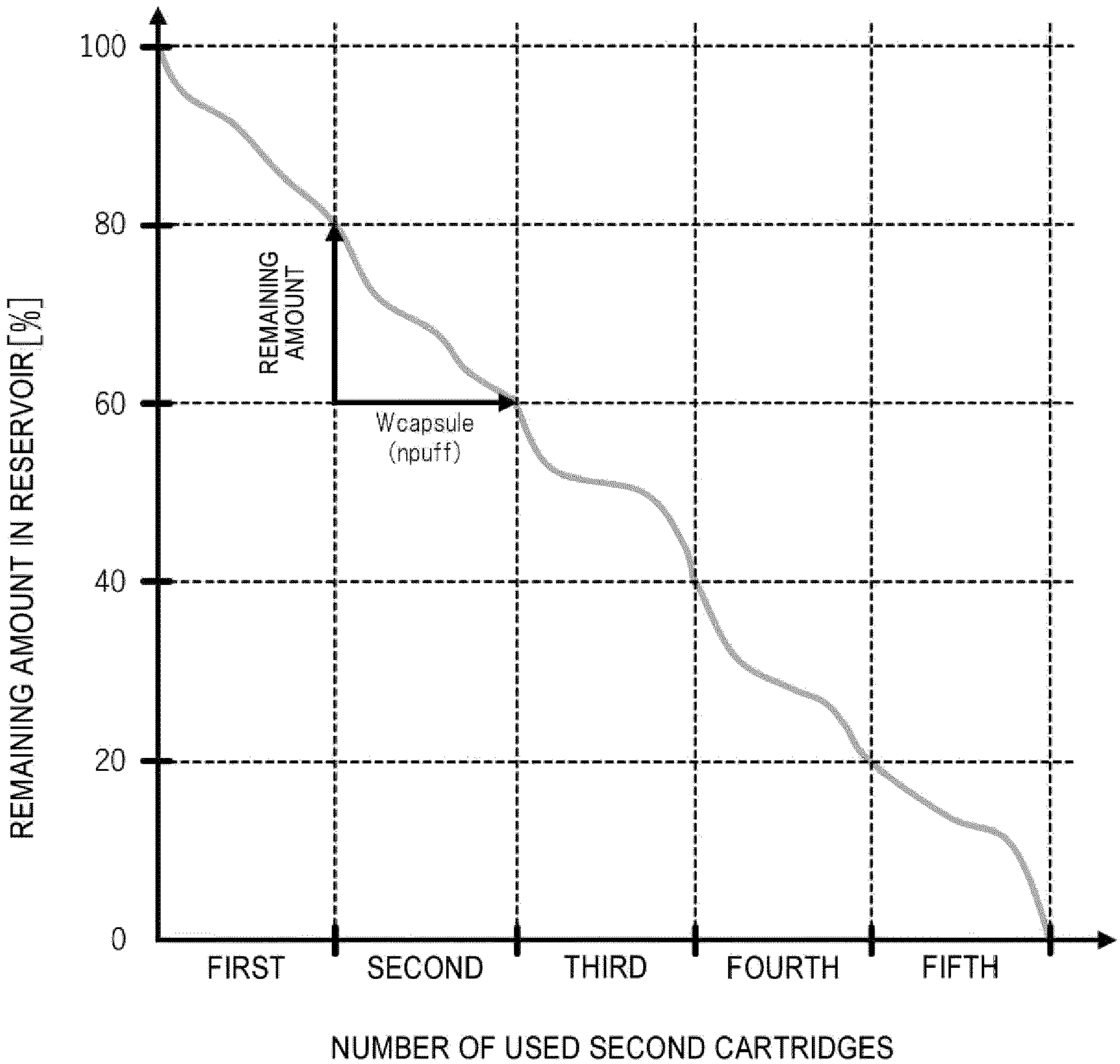

100
80
60
40
20
0
REMAINING AMOUNT IN RESERVOIR [%]
REMAINING AMOUNT
Wcapsule (npuff)
FIRST
SECOND
THIRD
FOURTH
FIFTH
NUMBER OF USED SECOND CARTRIDGES

FIG.13

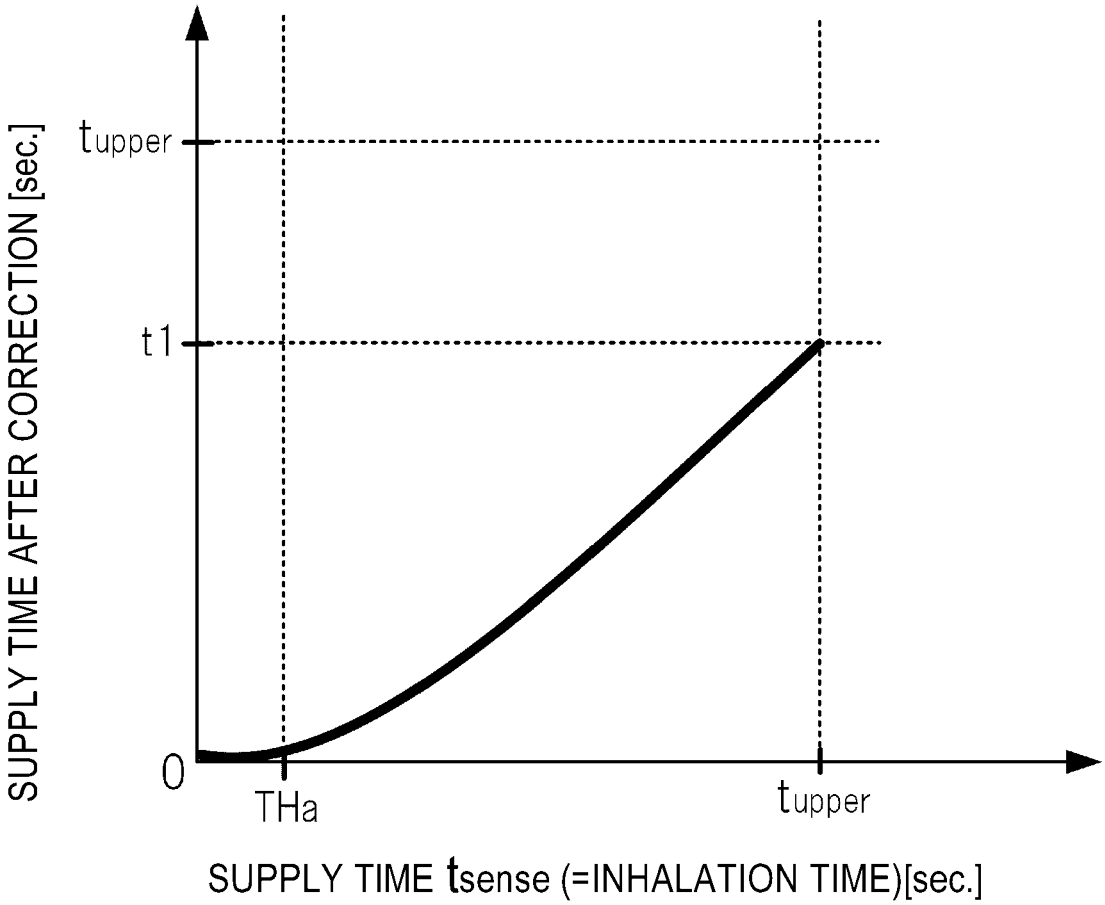

SUPPLY TIME AFTER CORRECTION [sec.]
tupper
t1
0
THa
tupper
SUPPLY TIME tsense (=INHALATION TIME)[sec.]

FIG.14

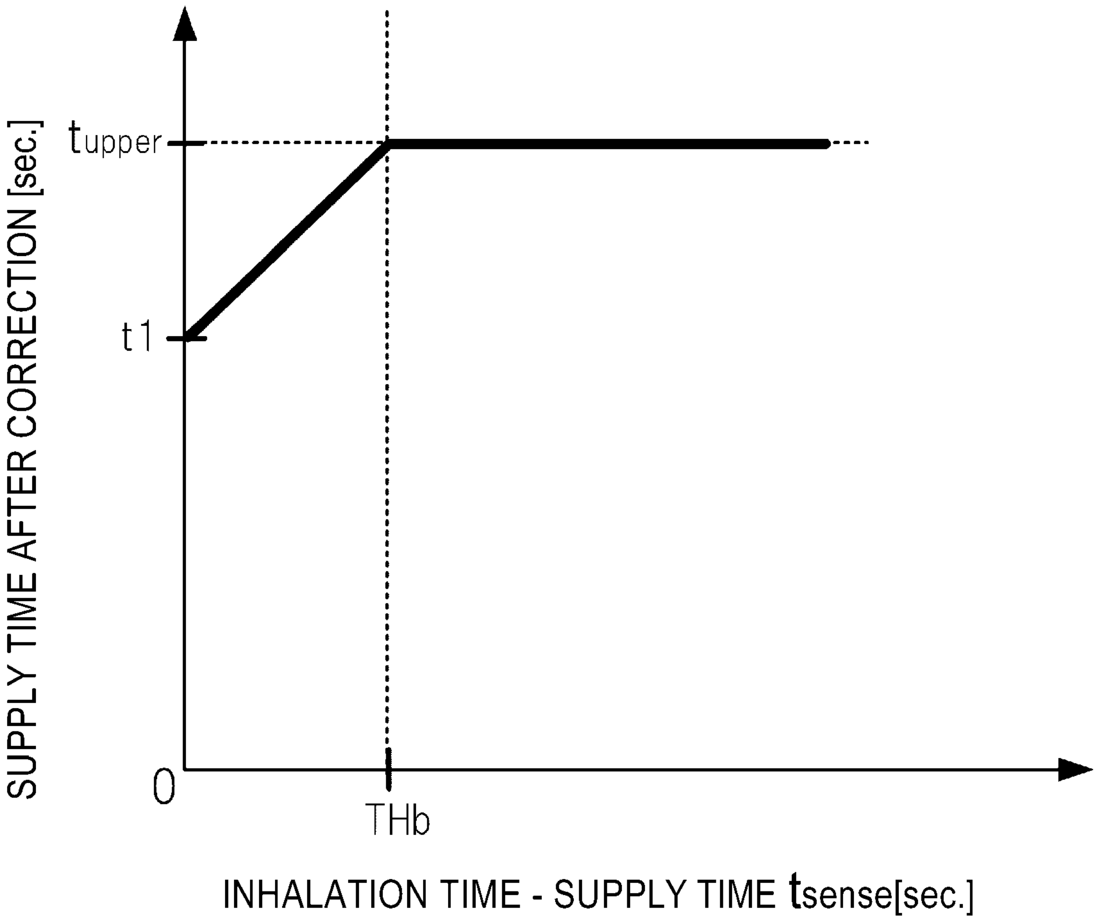

SUPPLY TIME AFTER CORRECTION [sec.]
tupper
t1
0
THb
INHALATION TIME - SUPPLY TIME tsense[sec.]

FIG.15

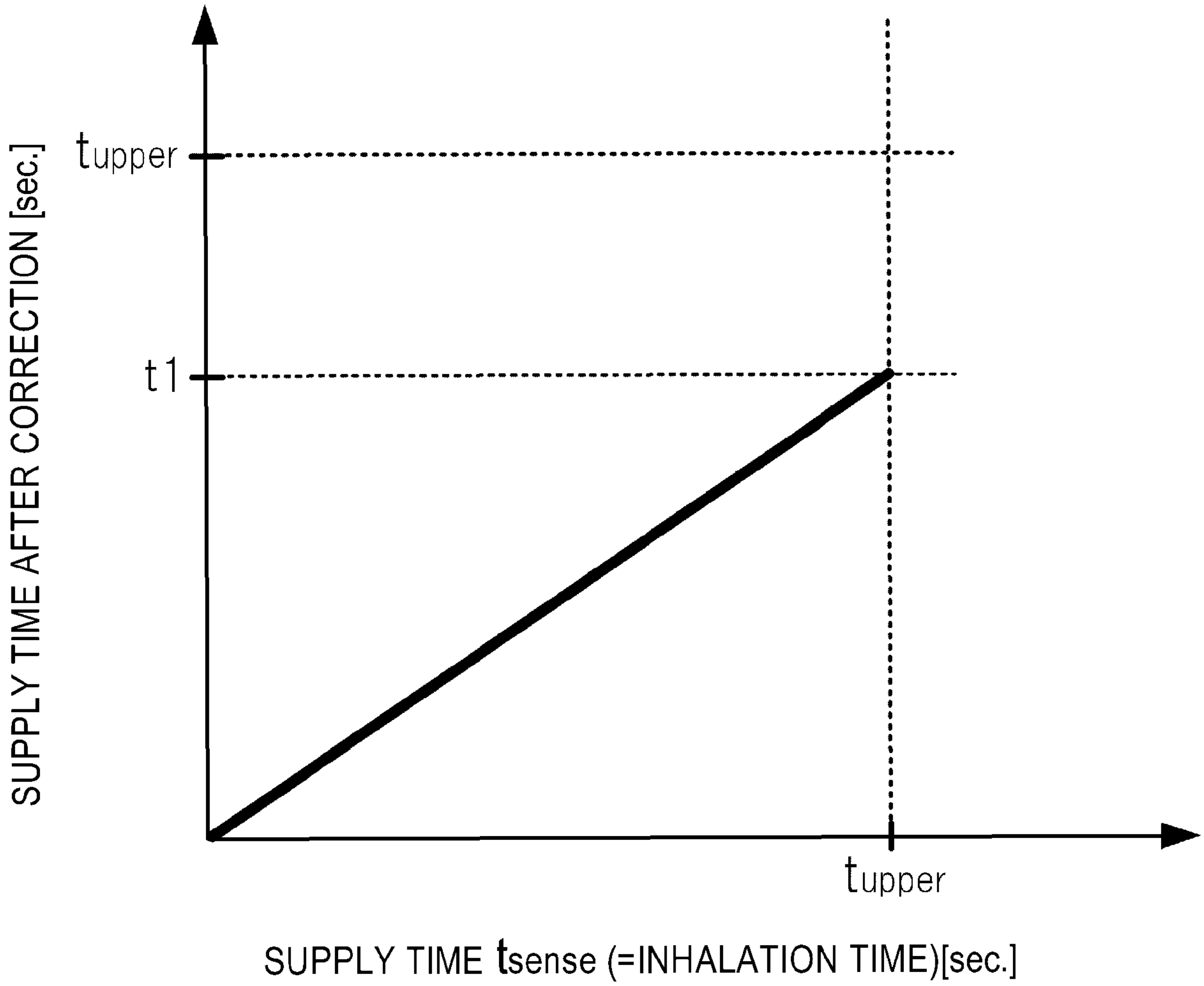

SUPPLY TIME AFTER CORRECTION [sec.]
tupper
t1
tupper
SUPPLY TIME tsense (=INHALATION TIME)[sec.]

FIG.16

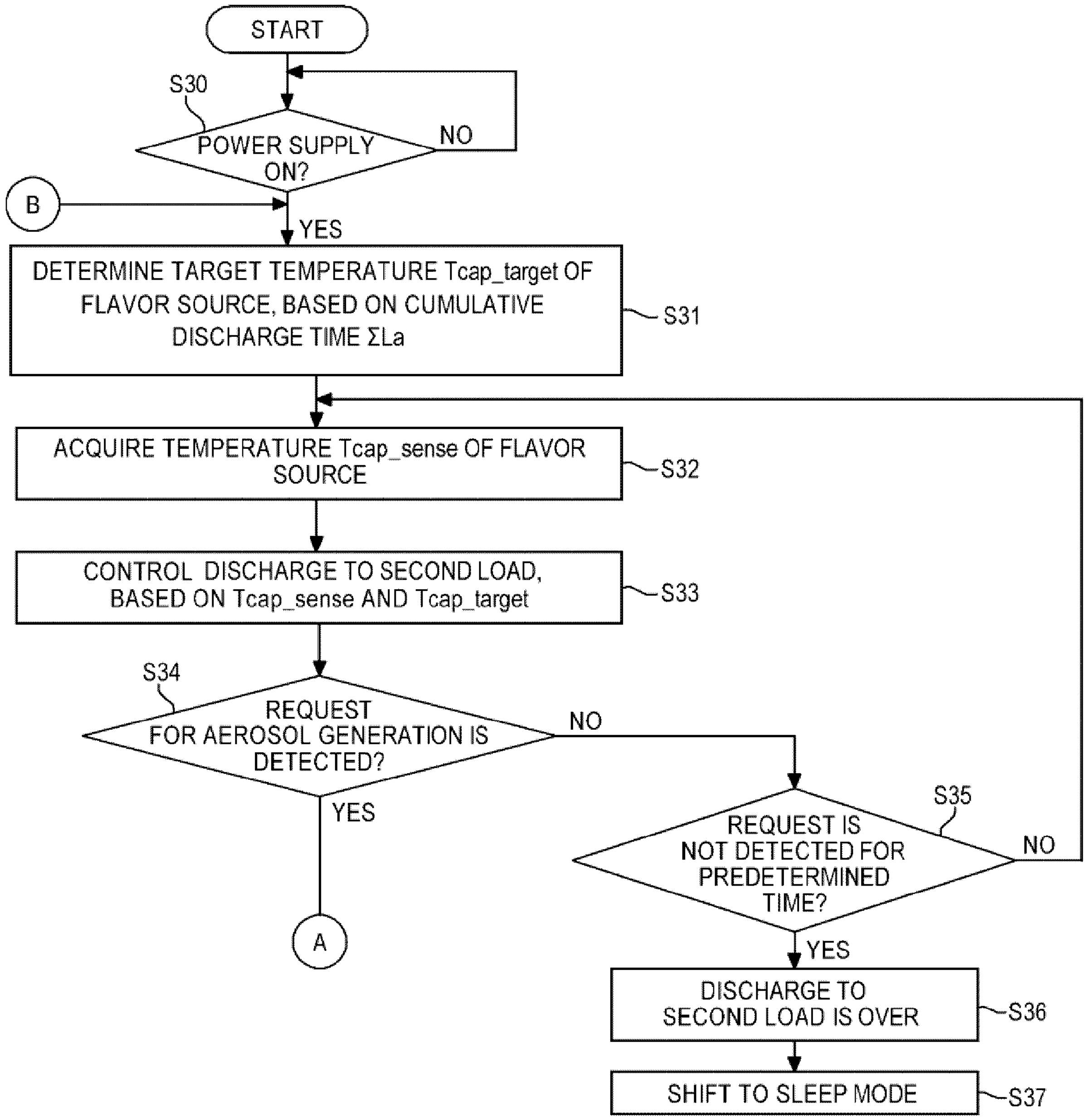

START
S30
POWER SUPPLY ON?
NO
B
YES
DETERMINE TARGET TEMPERATURE Tcap_target OF FLAVOR SOURCE, BASED ON CUMULATIVE DISCHARGE TIME ΣLa
S31
ACQUIRE TEMPERATURE Tcap_sense OF FLAVOR SOURCE
S32
CONTROL DISCHARGE TO SECOND LOAD, BASED ON Tcap_sense AND Tcap_target
S33
S34
REQUEST FOR AEROSOL GENERATION IS DETECTED?
NO
YES
A
S35
REQUEST IS NOT DETECTED FOR PREDETERMINED TIME?
NO
YES
DISCHARGE TO SECOND LOAD IS OVER
S36
SHIFT TO SLEEP MODE
S37

FIG.17

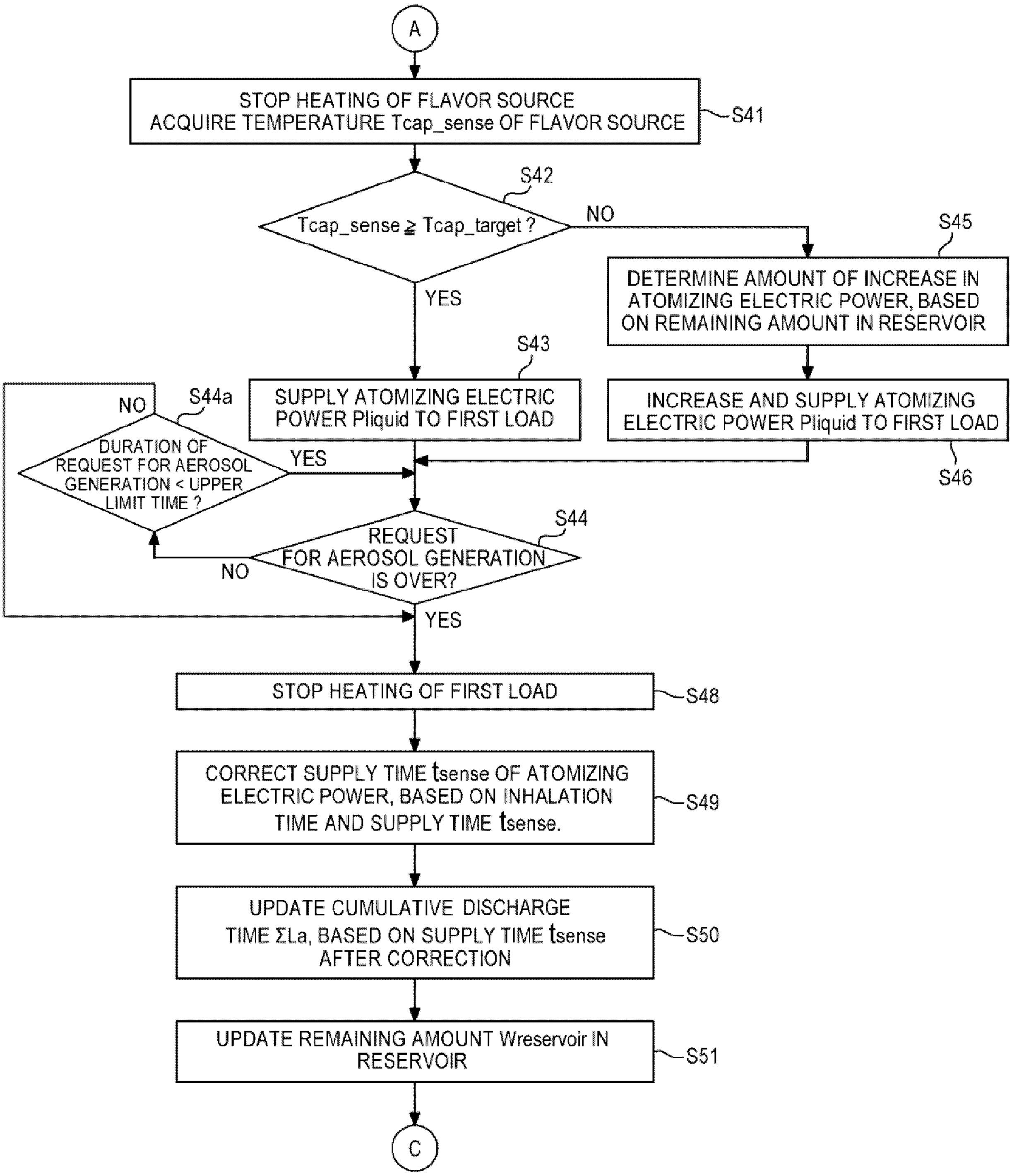
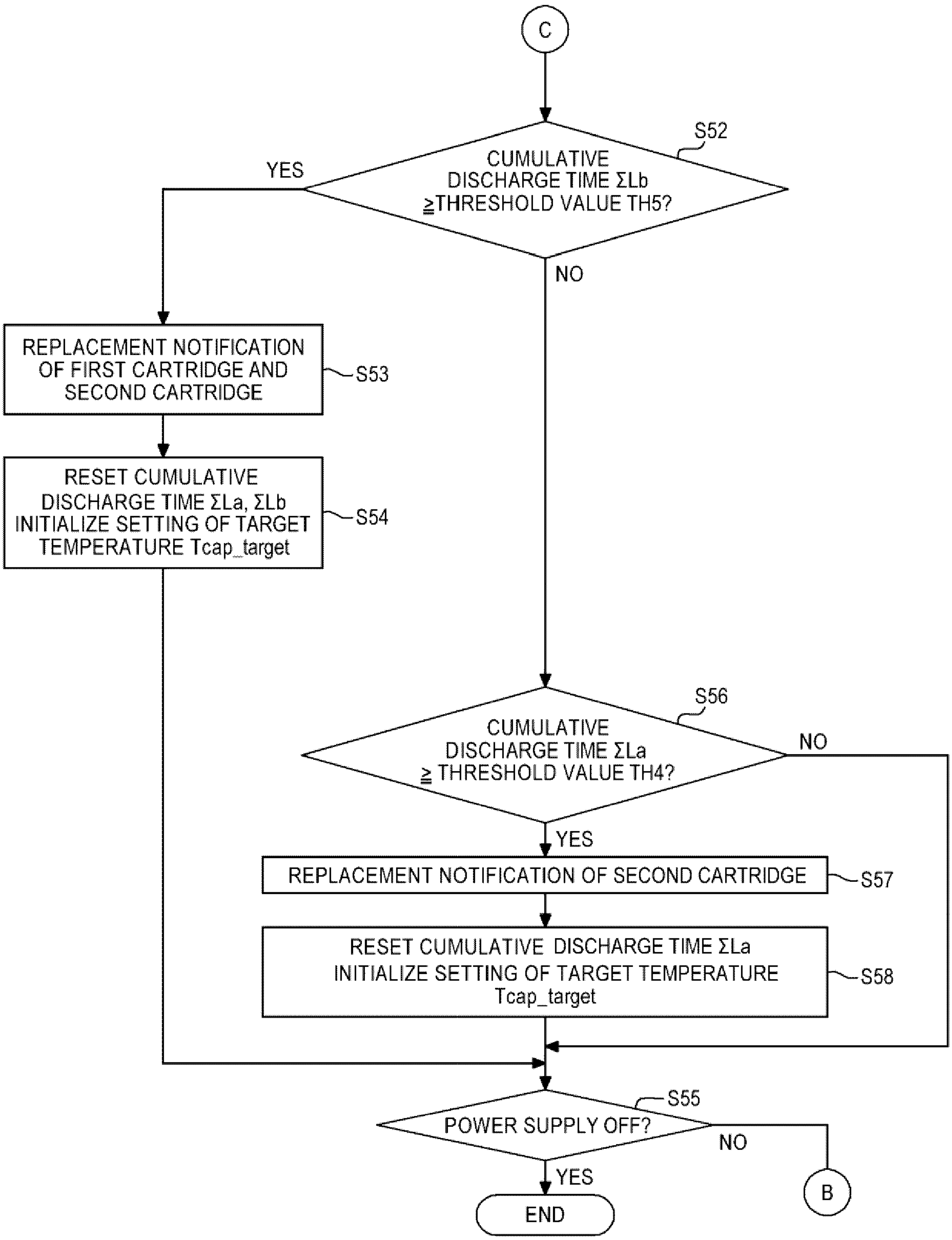

A
STOP HEATING OF FLAVOR SOURCE
ACQUIRE TEMPERATURE Tcap_sense OF FLAVOR SOURCE
S41
S42
Tcap_sense ≧ Tcap_target ?
NO
S45
DETERMINE AMOUNT OF INCREASE IN ATOMIZING ELECTRIC POWER, BASED ON REMAINING AMOUNT IN RESERVOIR
YES
S43
SUPPLY ATOMIZING ELECTRIC POWER Pliquid TO FIRST LOAD
INCREASE AND SUPPLY ATOMIZING ELECTRIC POWER Pliquid TO FIRST LOAD
S46
NO
S44a
DURATION OF REQUEST FOR AEROSOL GENERATION < UPPER LIMIT TIME ?
YES
S44
REQUEST FOR AEROSOL GENERATION IS OVER?
NO
YES
STOP HEATING OF FIRST LOAD
S48
CORRECT SUPPLY TIME tsense OF ATOMIZING ELECTRIC POWER, BASED ON INHALATION TIME AND SUPPLY TIME tsense.
S49
UPDATE CUMULATIVE DISCHARGE TIME ΣLa, BASED ON SUPPLY TIME tsense AFTER CORRECTION
S50
UPDATE REMAINING AMOUNT Wreservoir IN RESERVOIR
S51
C

FIG.18


C
CUMULATIVE DISCHARGE TIME ΣLb ≧THRESHOLD VALUE TH5?
S52
YES
NO
REPLACEMENT NOTIFICATION OF FIRST CARTRIDGE AND SECOND CARTRIDGE
S53
RESET CUMULATIVE DISCHARGE TIME ΣLa, ΣLb INITIALIZE SETTING OF TARGET TEMPERATURE Tcap_target
S54
CUMULATIVE DISCHARGE TIME ΣLa ≧ THRESHOLD VALUE TH4?
S56
NO
YES
REPLACEMENT NOTIFICATION OF SECOND CARTRIDGE
S57
RESET CUMULATIVE DISCHARGE TIME ΣLa INITIALIZE SETTING OF TARGET TEMPERATURE Tcap_target
S58
POWER SUPPLY OFF?
S55
NO
YES
END
B

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EUROPEAN SEARCH REPORT

Application Number
EP 21 18 3961

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The present search report has been drawn up for all claims

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Place of search	Date of completion of the search	Examiner
Munich	15 November 2021	Cabrele, Silvio

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