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(12) United States Patent

Lee

(10) **Patent No.: US 12,389,949 B2**
(45) **Date of Patent: Aug. 19, 2025**

(54) **AEROSOL GENERATING DEVICE INCLUDING AN ELECTRODE**

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(72) Inventor: **Jaemin Lee**, Gyeonggi-do (KR)

(73) Assignee: **KT&G CORPORATION**, Daejeon (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 622 days.

(21) Appl. No.: **17/631,158**

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(86) PCT No.: **PCT/KR2021/008567**
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(2) Date: **Jan. 28, 2022**

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PCT Pub. Date: **Feb. 3, 2022**

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(30) **Foreign Application Priority Data**

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Jun. 25, 2021 (KR) 10-2021-0083117

(51) **Int. Cl.**
A24F 40/53 (2020.01)
A24F 40/20 (2020.01)
(Continued)

(52) **U.S. Cl.**
CPC ***A24F 40/53*** (2020.01); ***A24F 40/20*** (2020.01); ***A24F 40/465*** (2020.01); ***A24F 40/51*** (2020.01);
(Continued)

(58) **Field of Classification Search**
None
See application file for complete search history.

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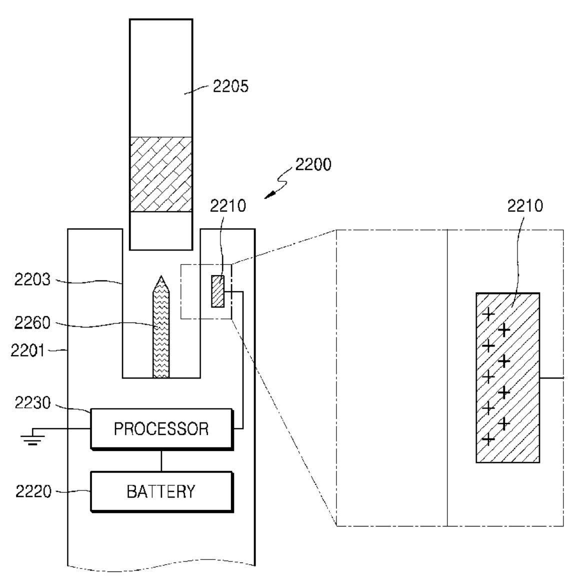
Primary Examiner — Manley L Cummins, IV
(74) *Attorney, Agent, or Firm* — Sughrue Mion, PLLC

(57) **ABSTRACT**

Provided is an aerosol generating device including: a heater, a housing including an accommodation portion into which an aerosol generating article is inserted, an electrode apart from the aerosol generating article inserted into the accommodation portion and located to correspond to at least a part of the aerosol generating article, and a processor electrically connected to the heater and the electrode. In addition, various embodiments identified through the specification are possible.

15 Claims, 46 Drawing Sheets



(51) **Int. Cl.**

A24F 40/465	(2020.01)
A24F 40/51	(2020.01)
A24F 40/57	(2020.01)
A24F 40/85	(2020.01)
H05B 6/10	(2006.01)

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

CPC ***A24F 40/57*** (2020.01); ***A24F 40/85*** (2020.01); ***H05B 6/105*** (2013.01)

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KR	10-2020-0016679	A		2/2020	
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FIG. 1

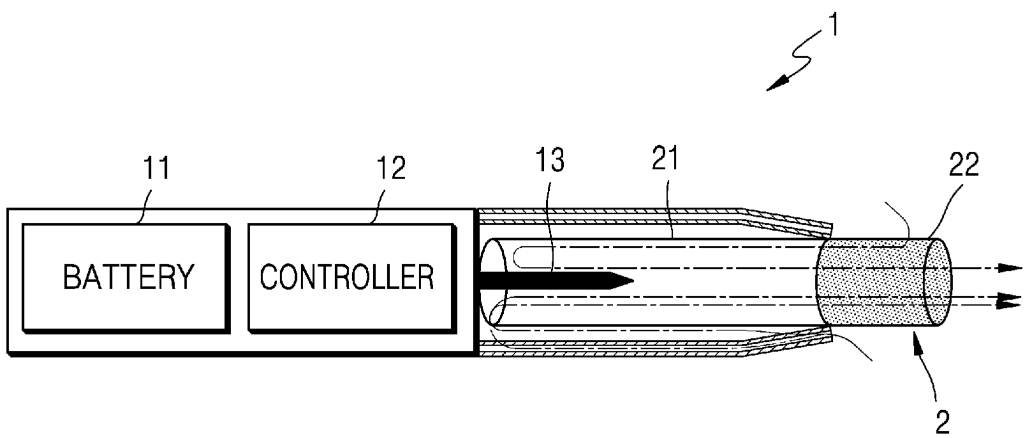


FIG. 2

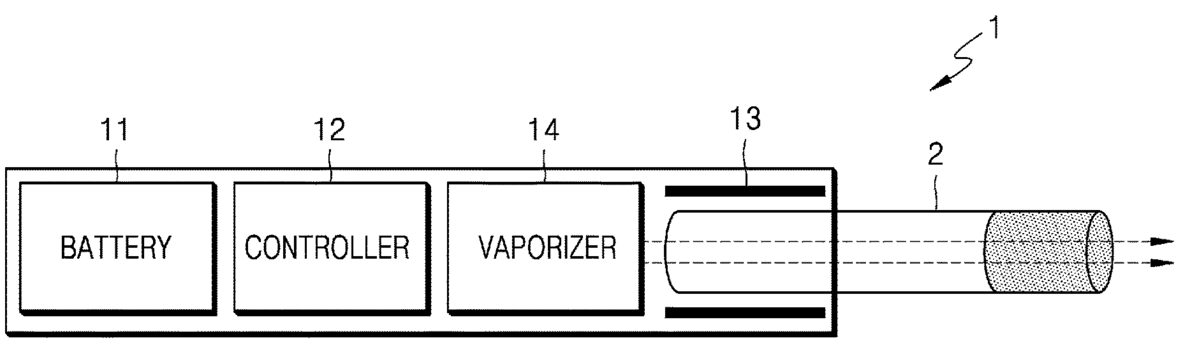


FIG. 3

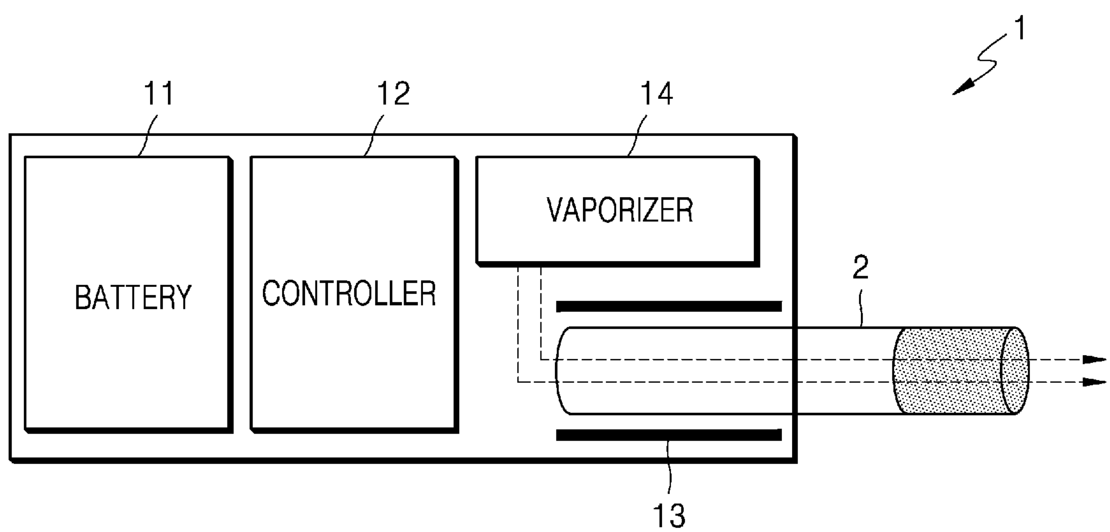


FIG. 4

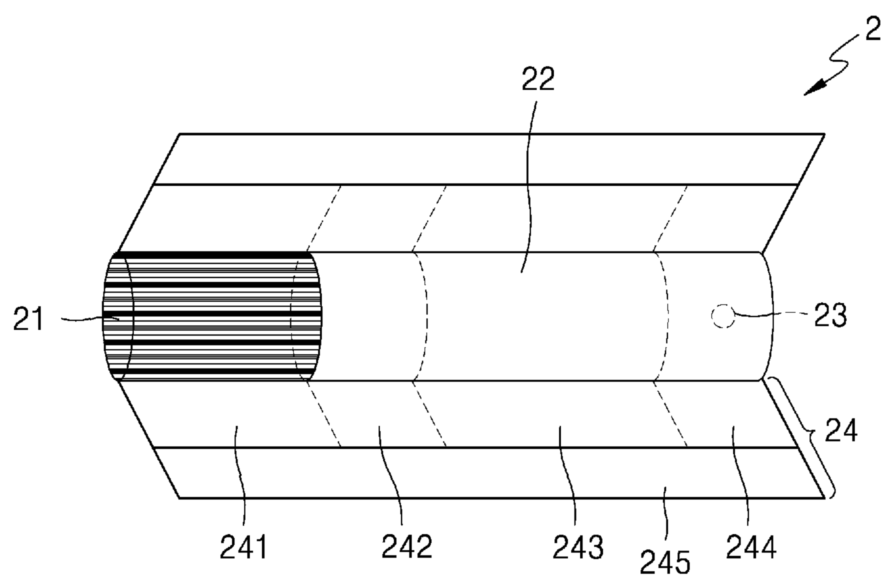


FIG. 5

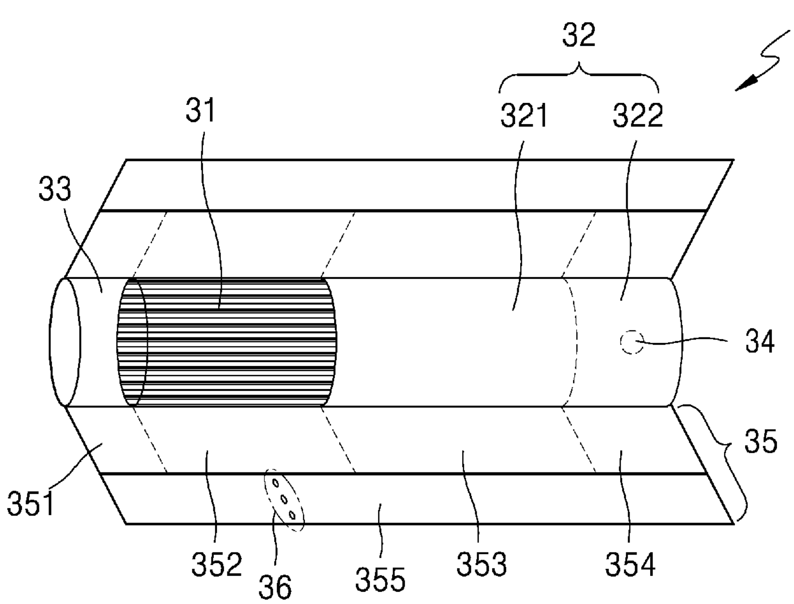


FIG. 6A

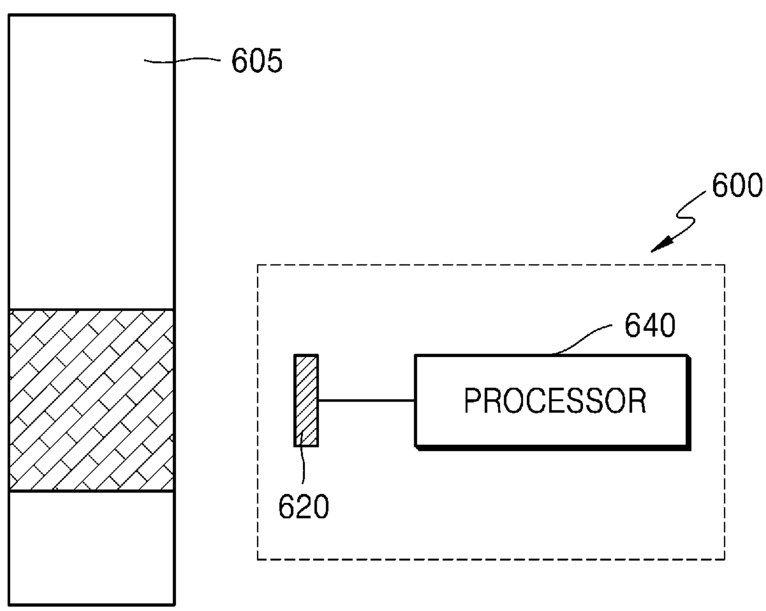


FIG. 6B

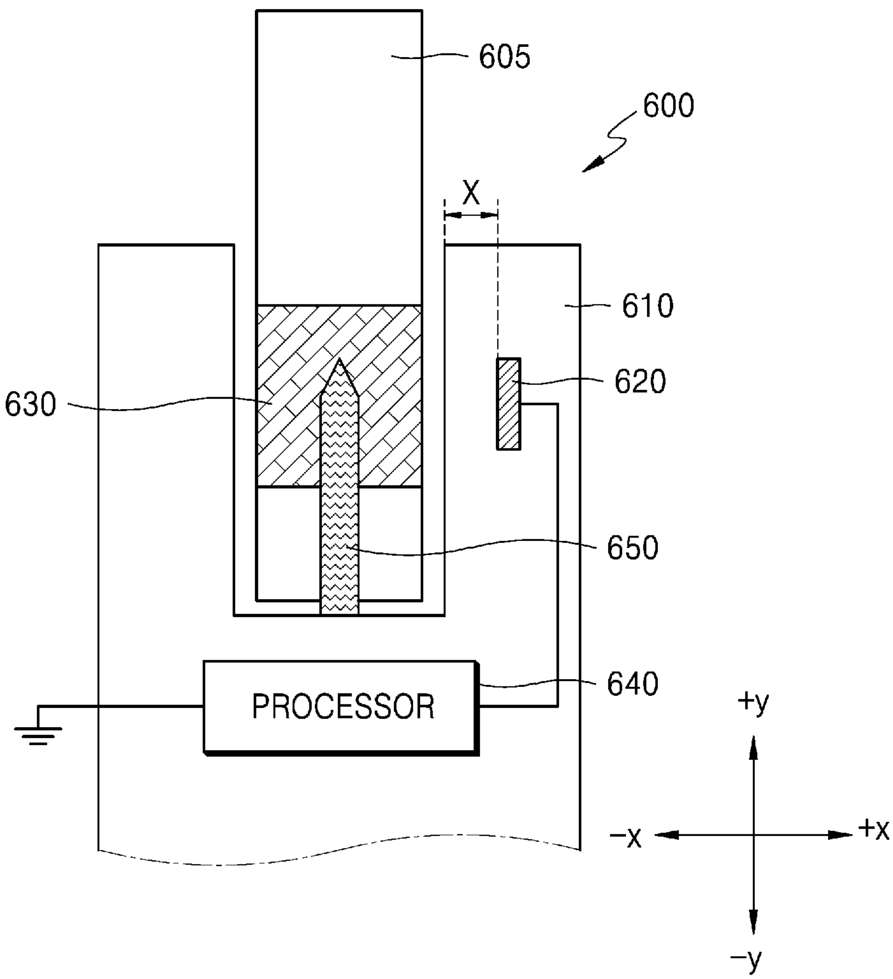


FIG. 7A

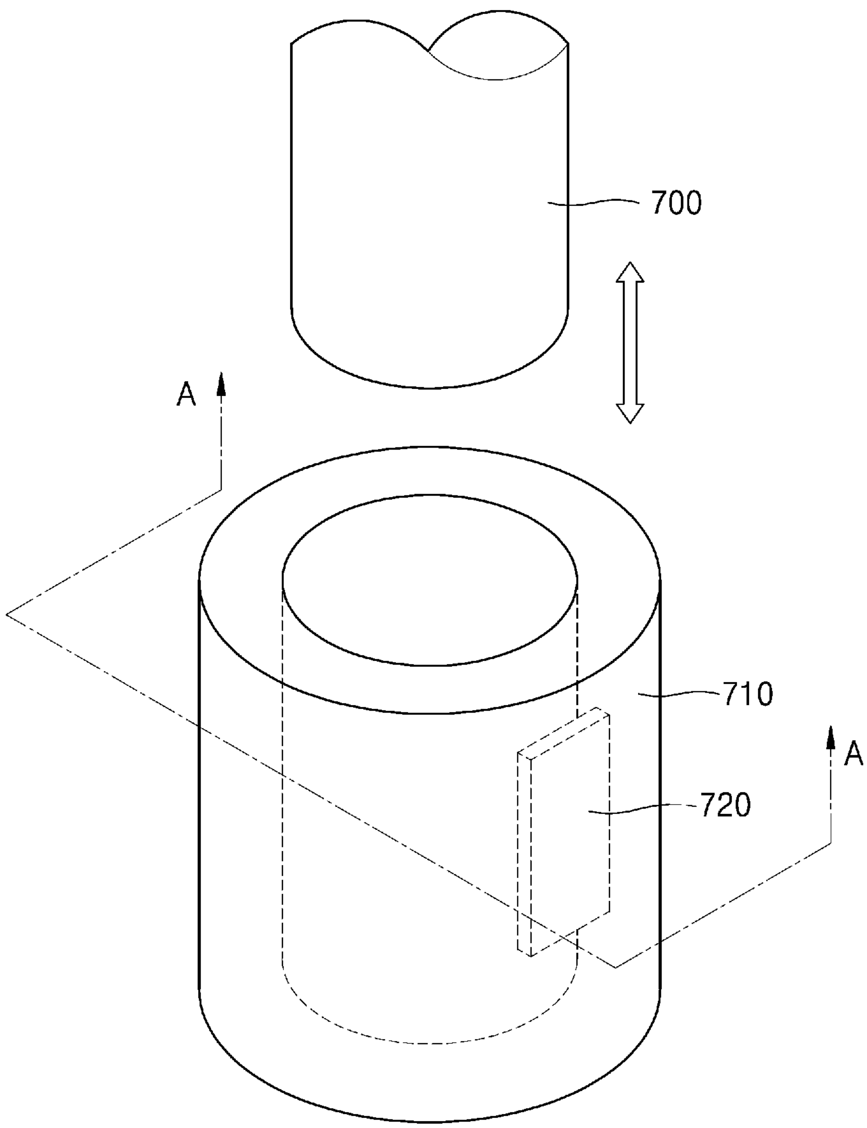


FIG. 7B

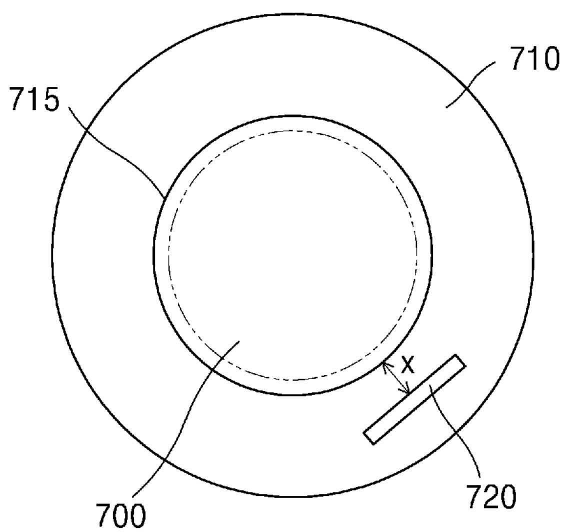


FIG. 8A

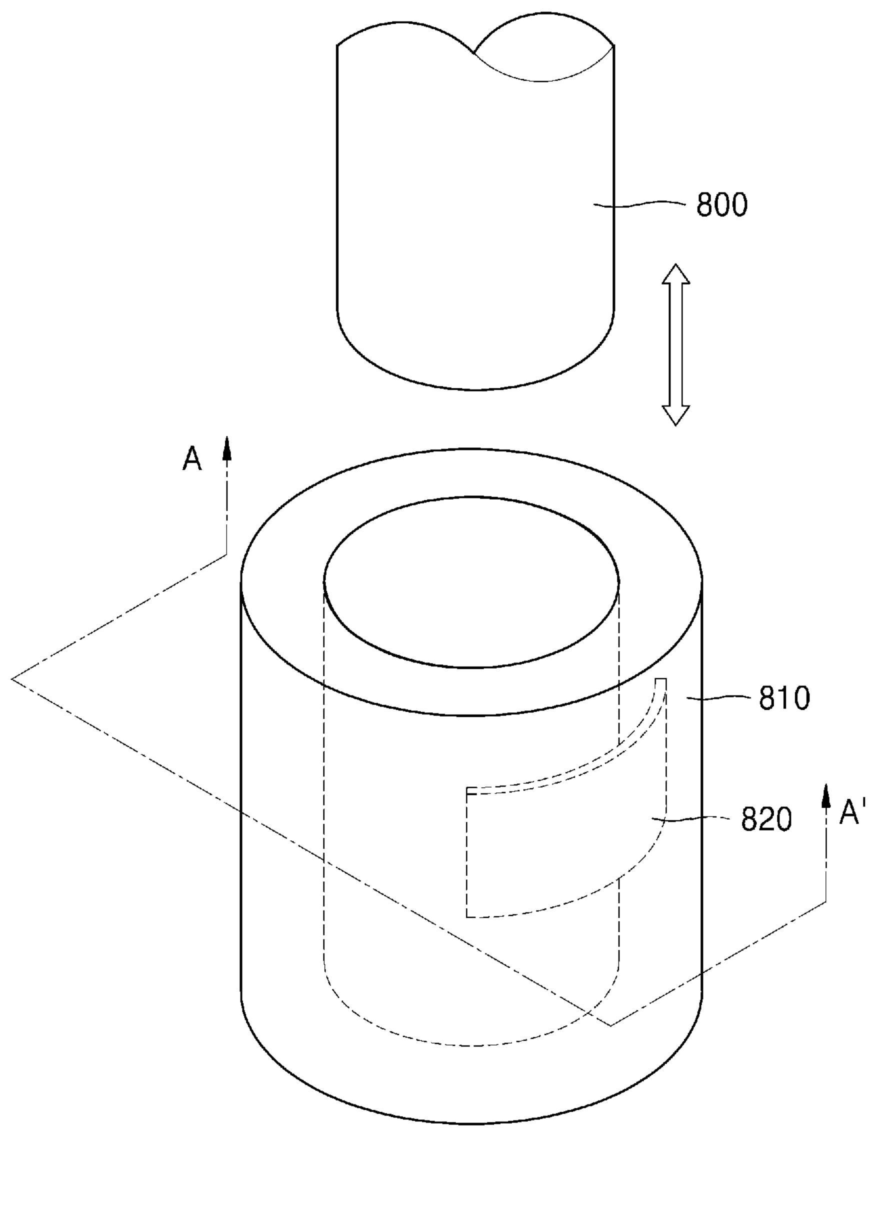


FIG. 8B

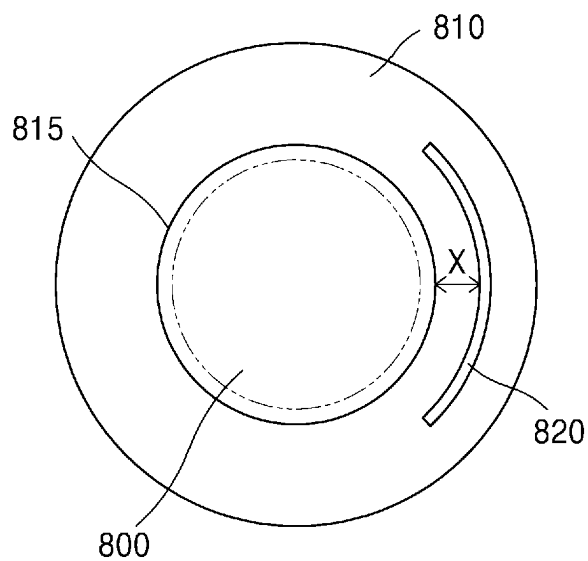


FIG. 9A

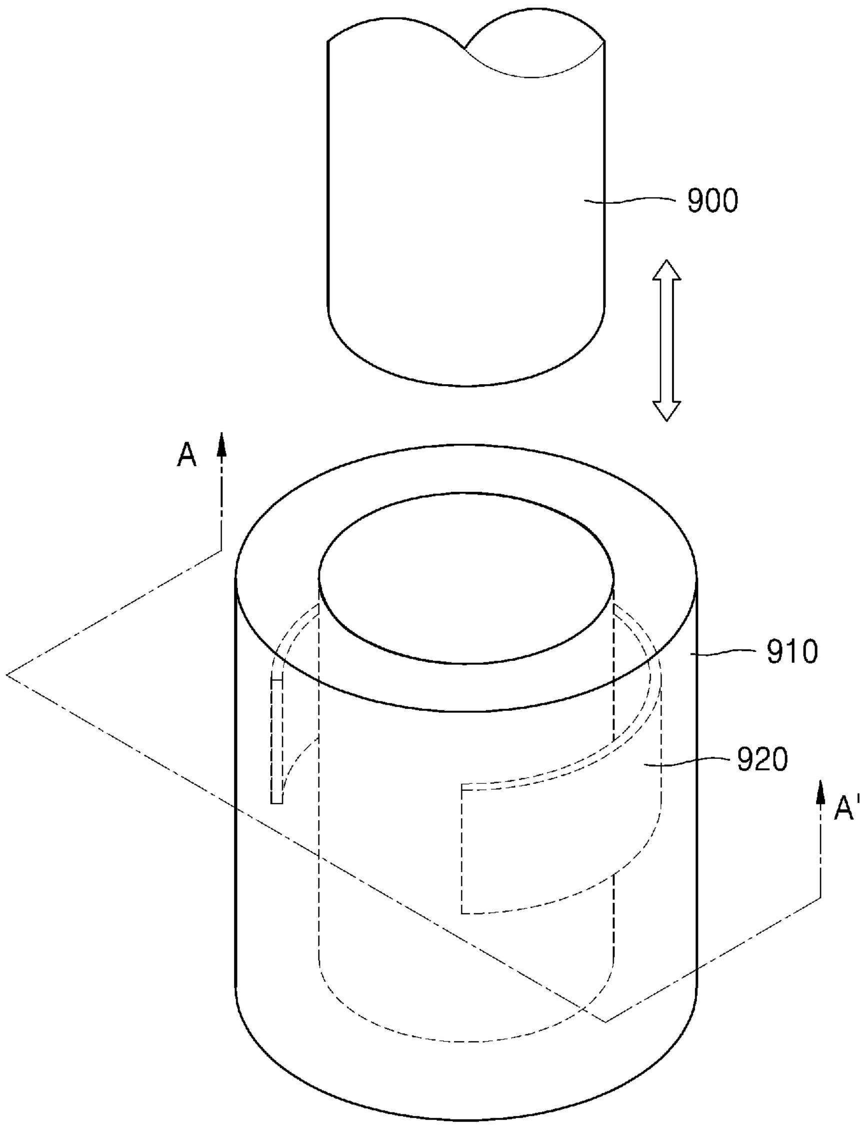


FIG. 9B

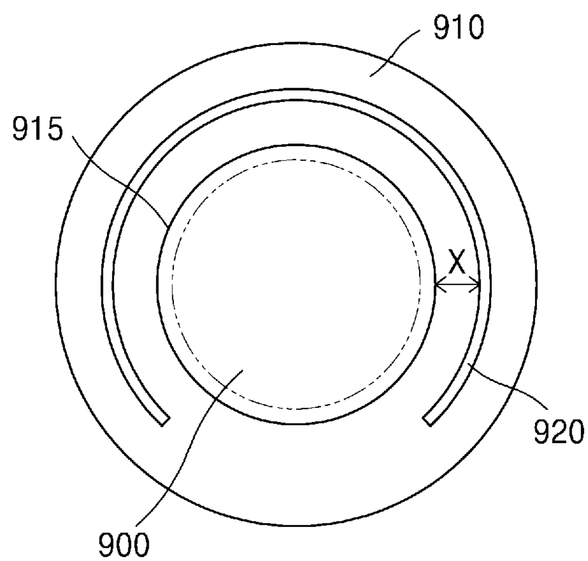


FIG. 10

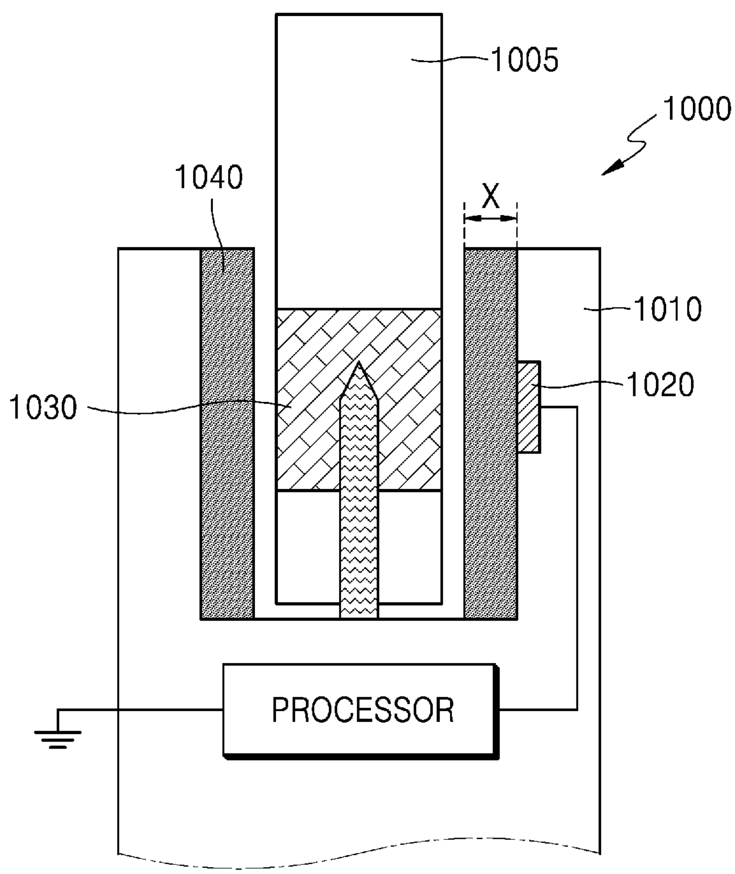


FIG. 11A

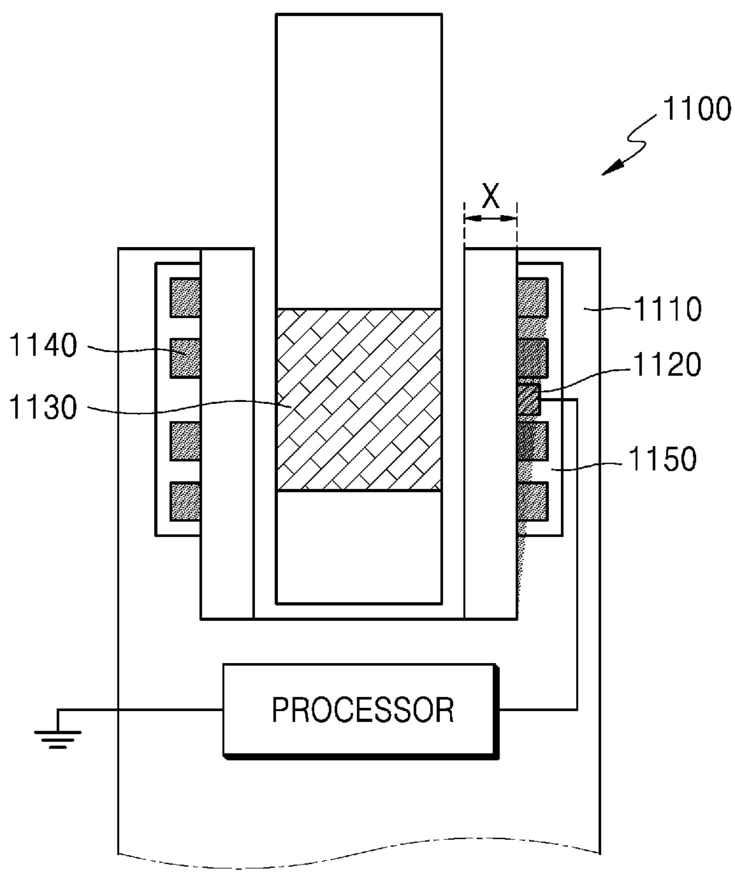


FIG. 11B

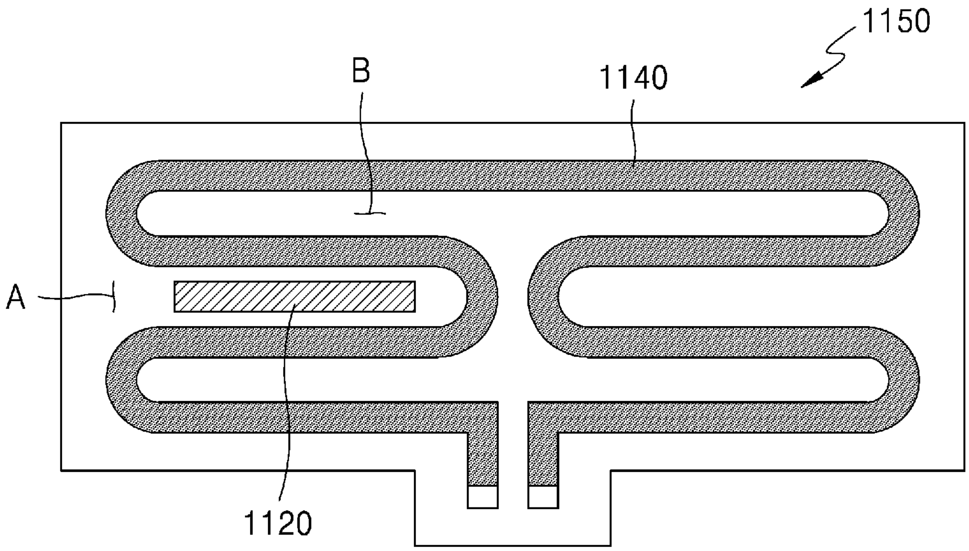


FIG. 12A

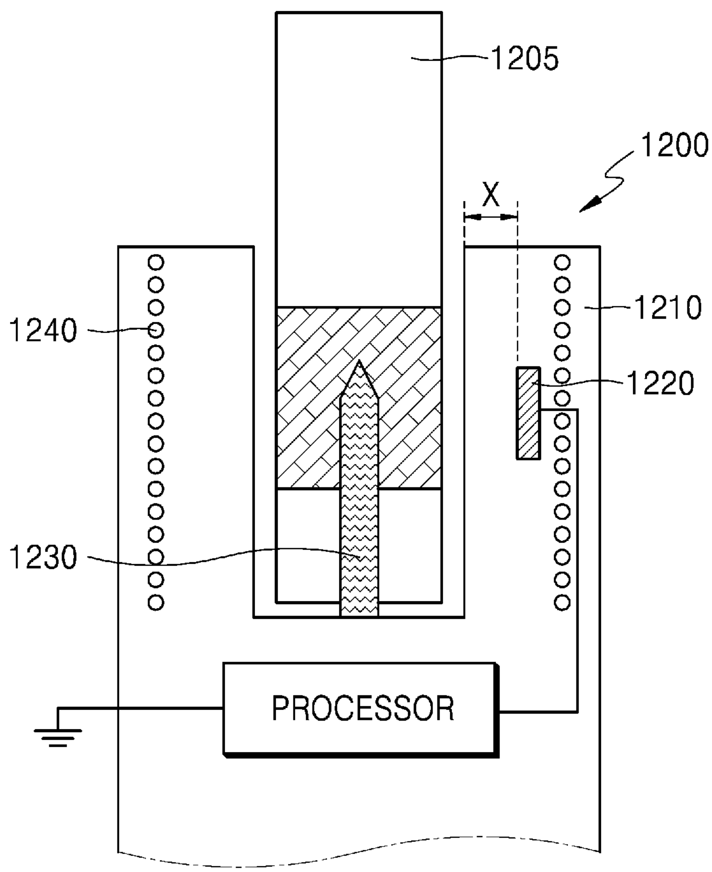


FIG. 12B

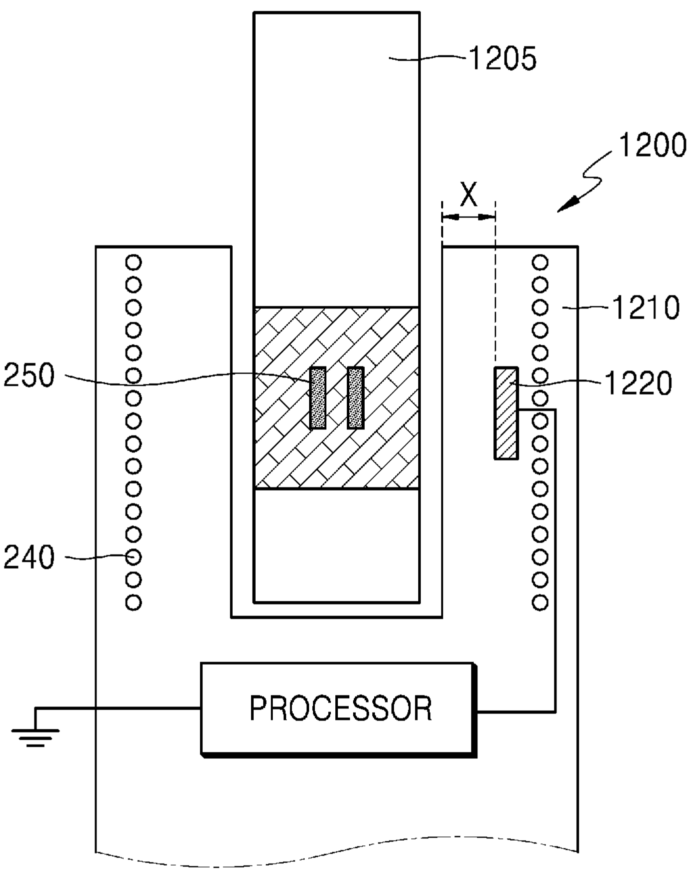


FIG. 13A

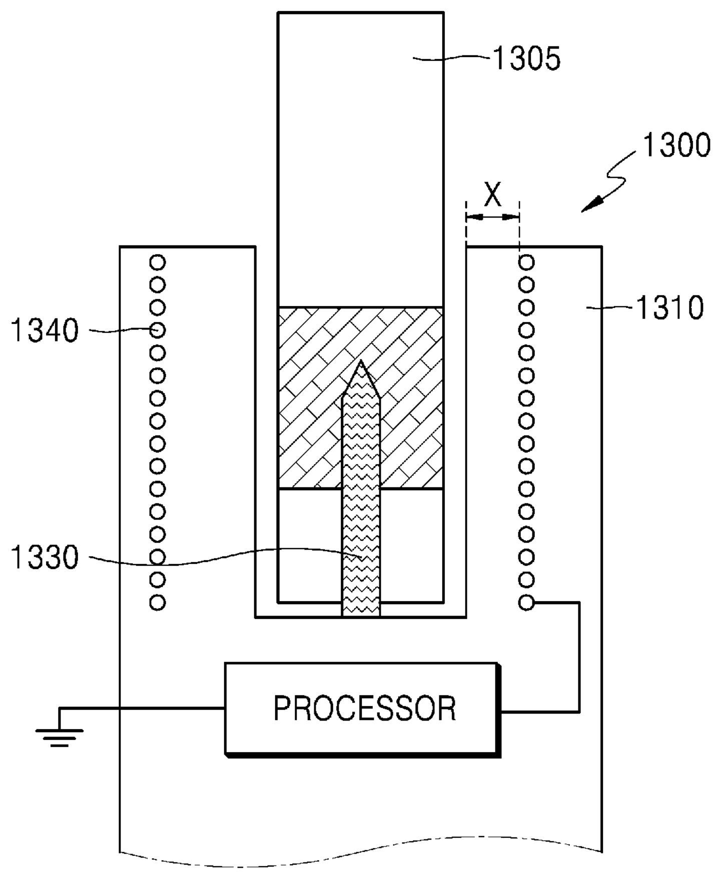


FIG. 13B

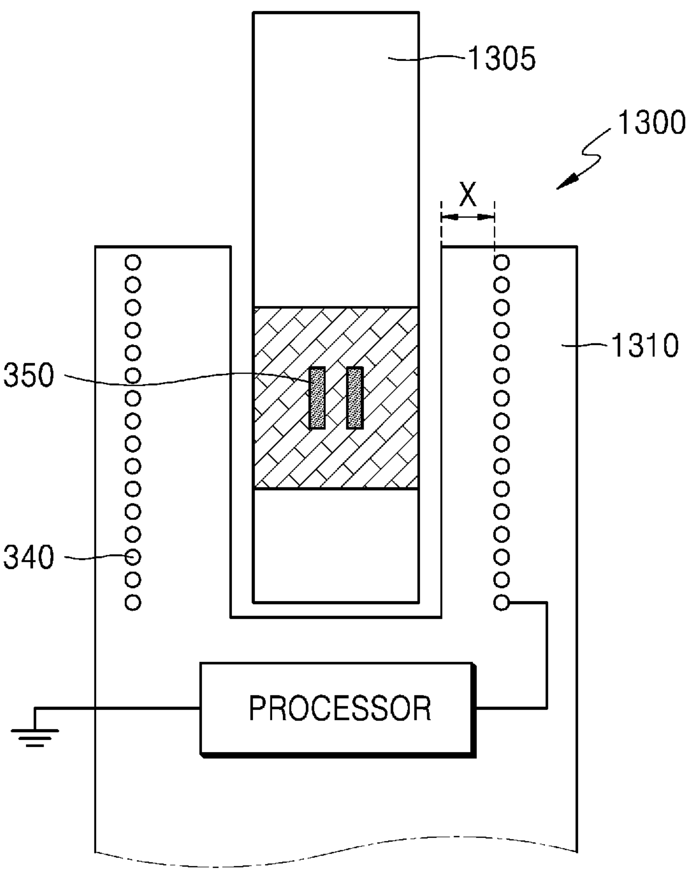
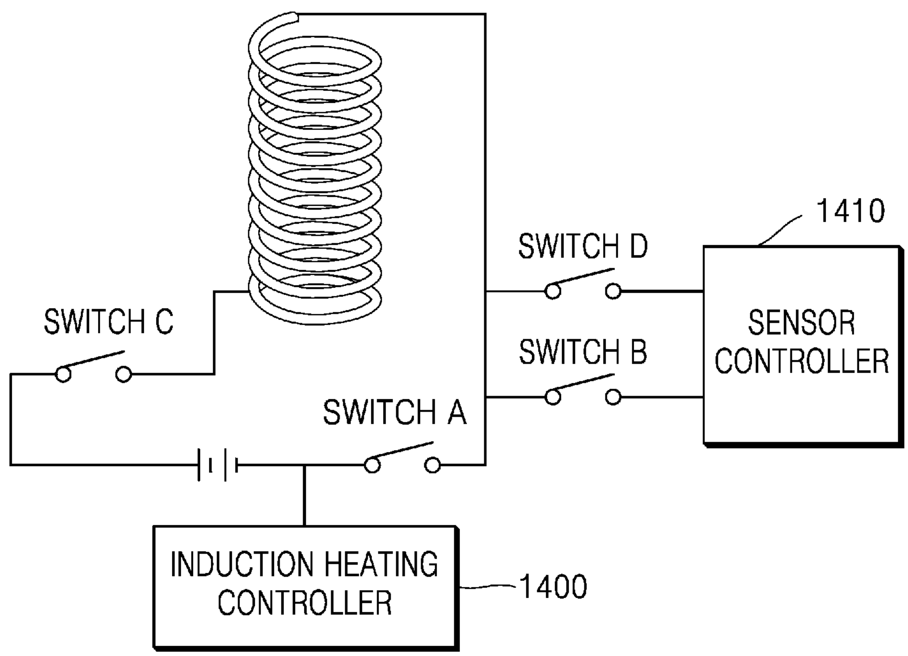


FIG. 14



1410
SWITCH D
SWITCH C
SENSOR CONTROLLER
SWITCH B
SWITCH A
INDUCTION HEATING CONTROLLER
1400

FIG. 15

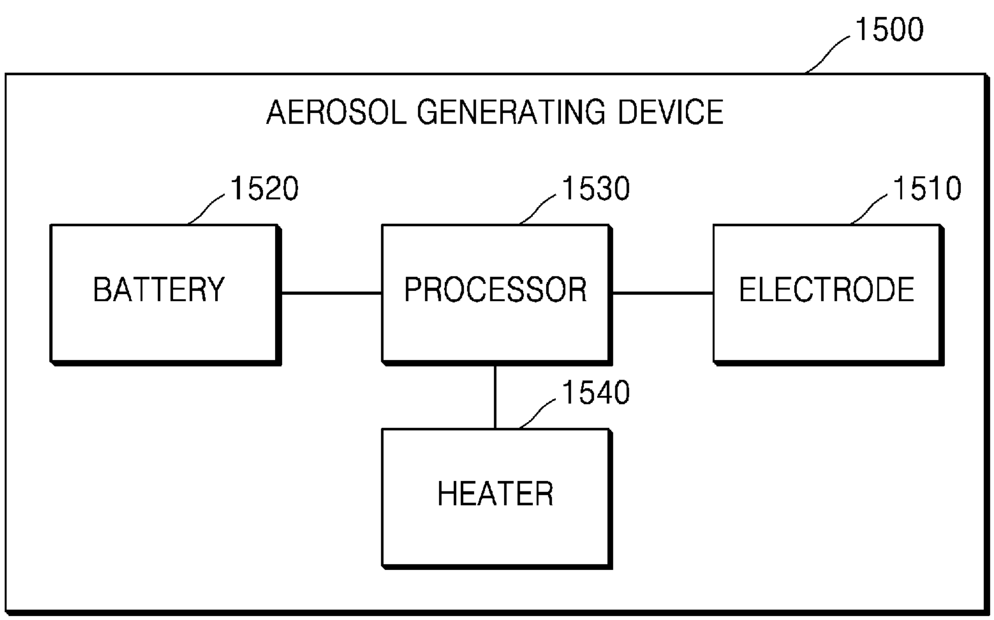

1500
AEROSOL GENERATING DEVICE
1520
1530
1510
BATTERY
PROCESSOR
ELECTRODE
1540
HEATER

FIG. 16A

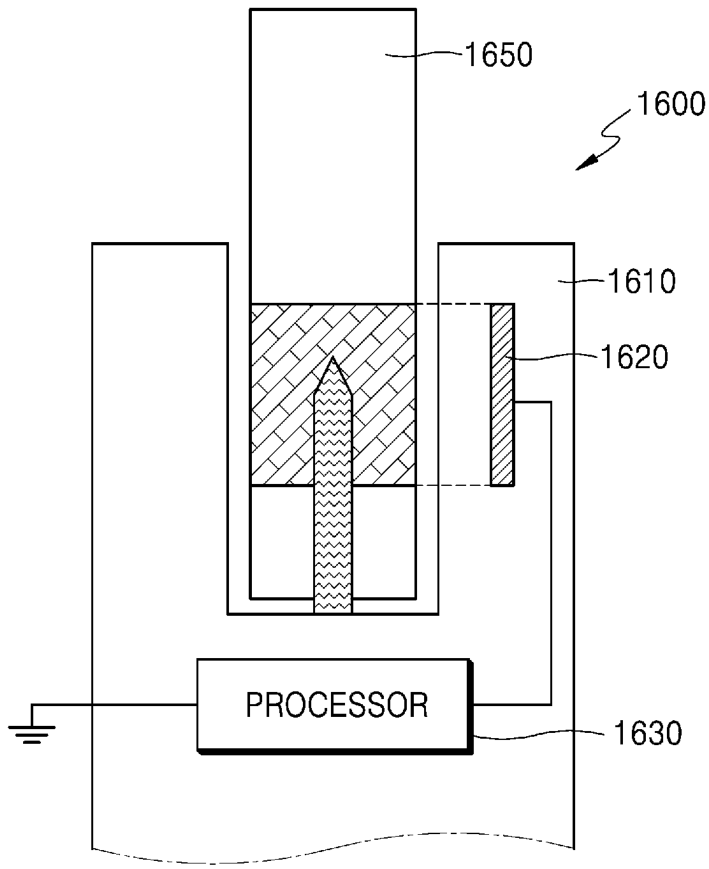


FIG. 16B

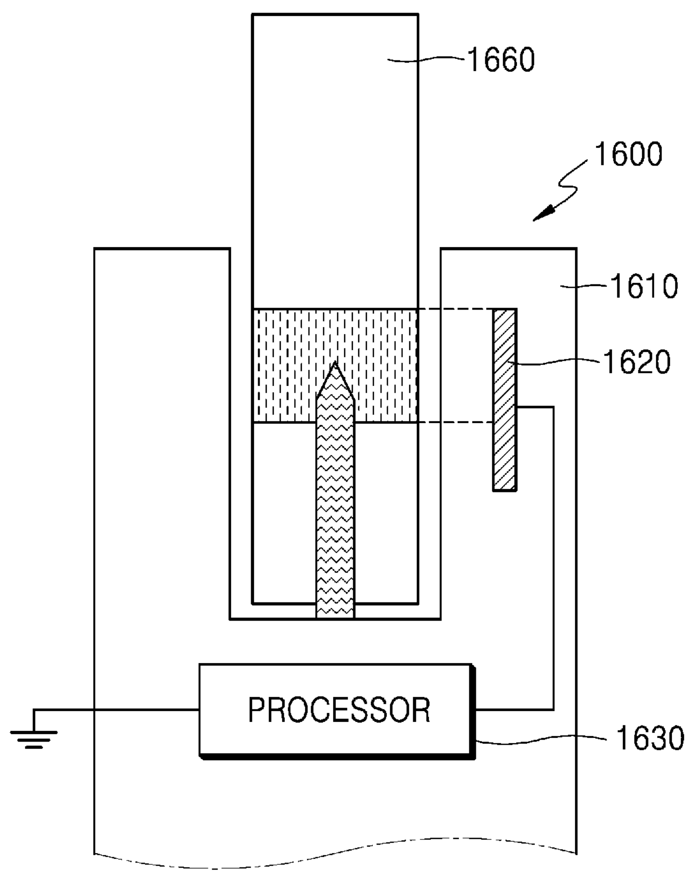


FIG. 17A

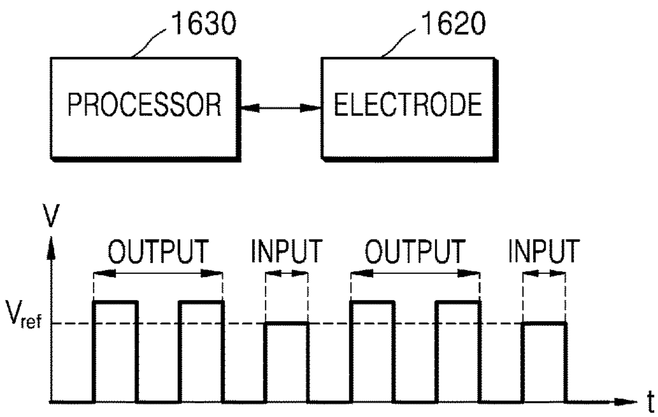


FIG. 17B

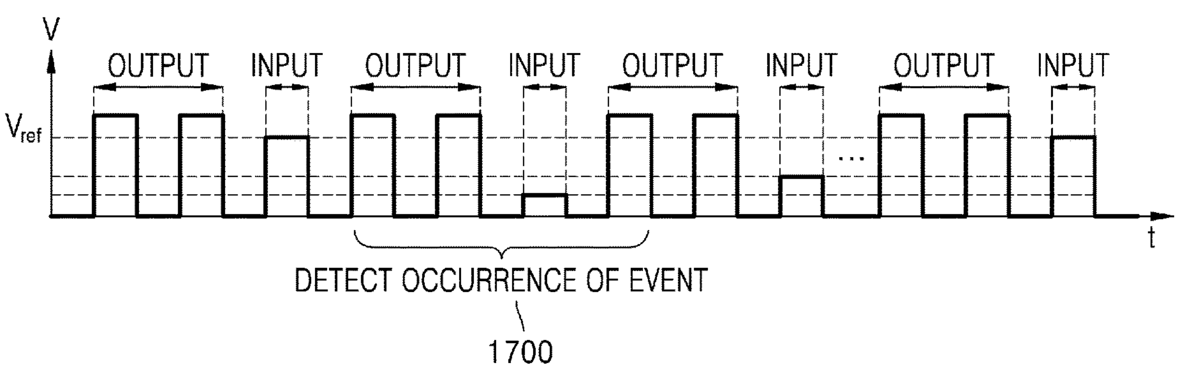


FIG. 18A

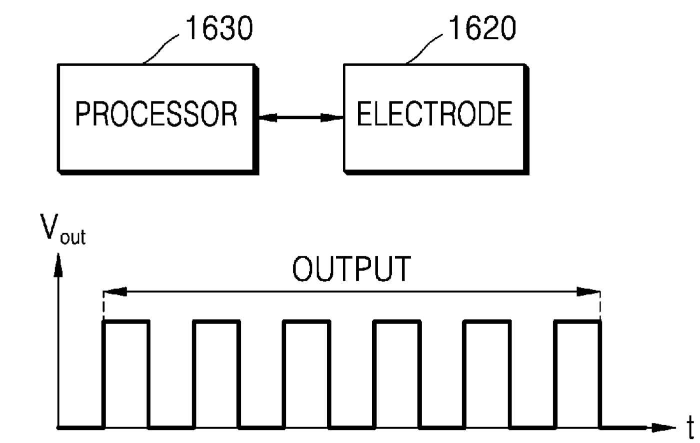


FIG. 18B

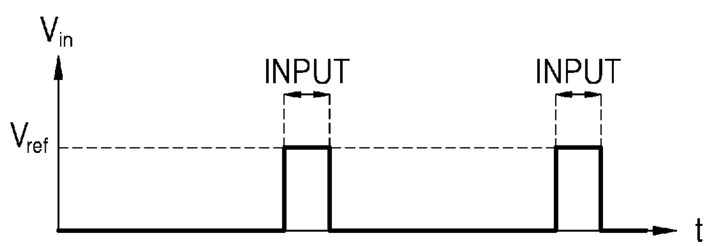


FIG. 19A

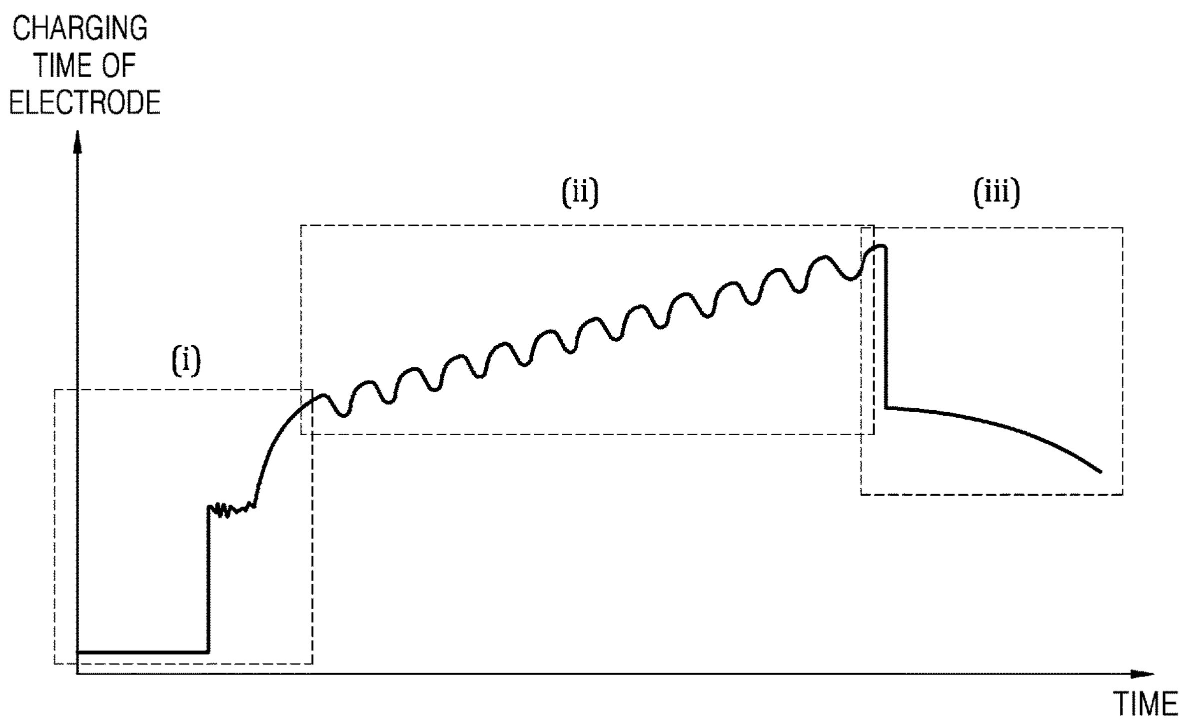


FIG. 19B

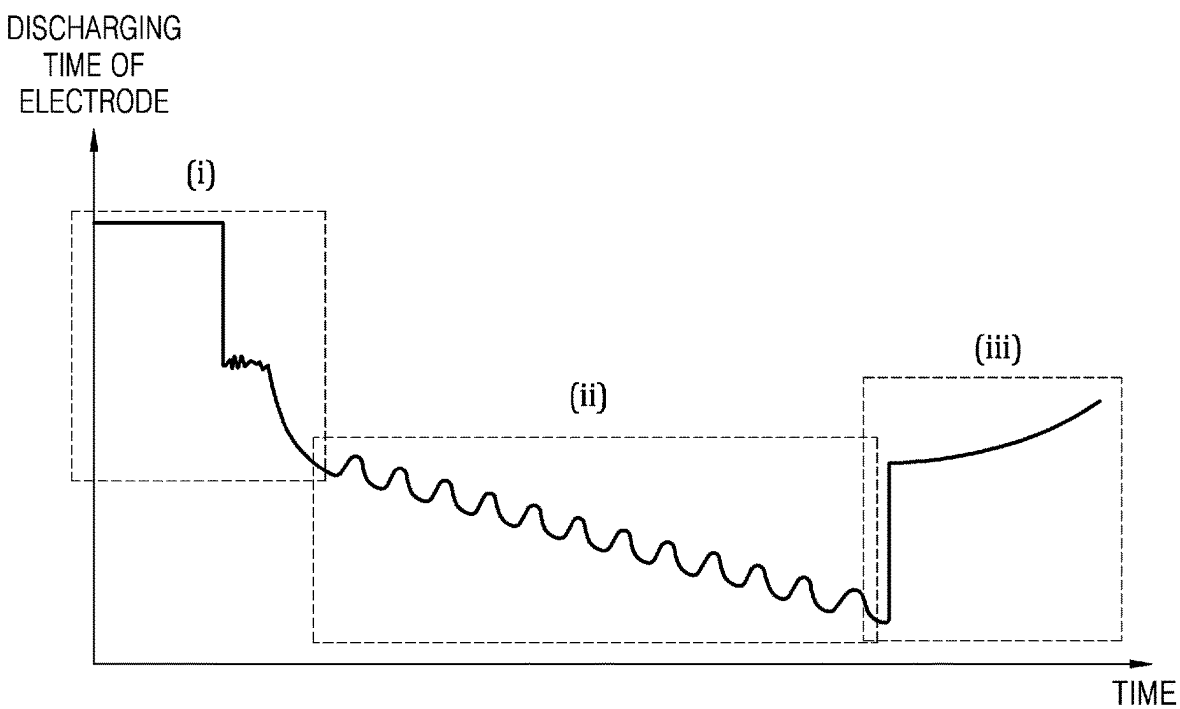


FIG. 20

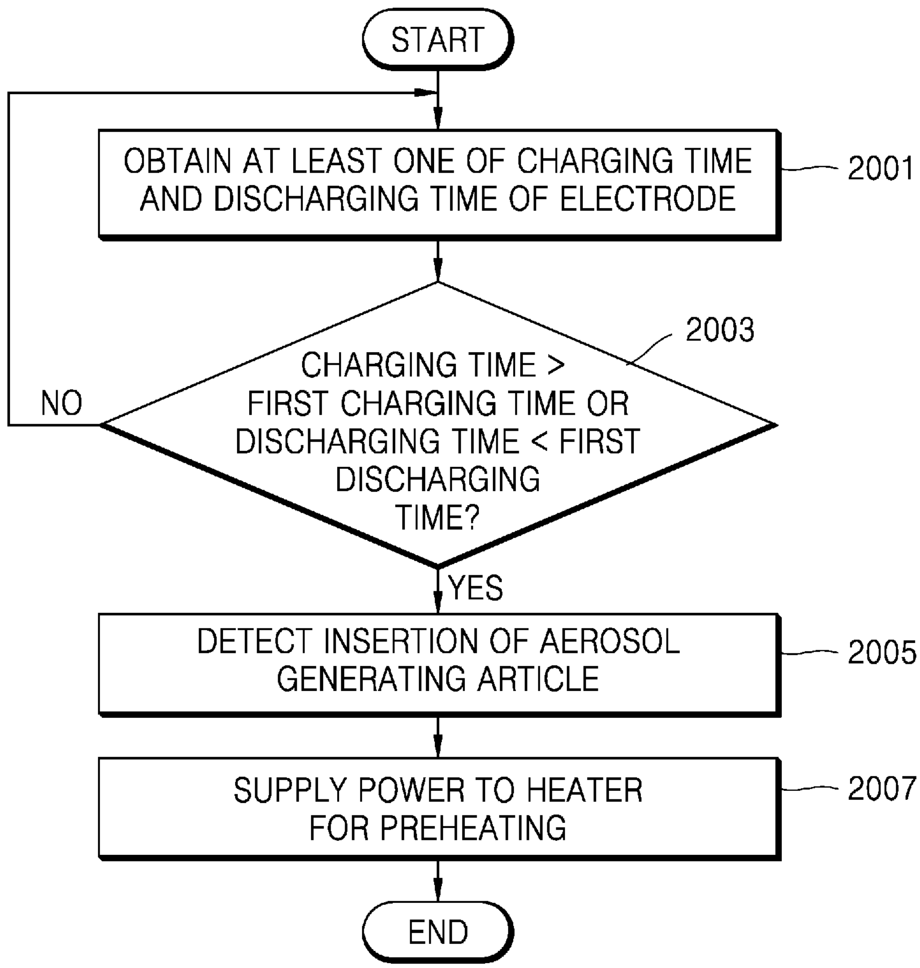

START
OBTAIN AT LEAST ONE OF CHARGING TIME AND DISCHARGING TIME OF ELECTRODE
2001
CHARGING TIME > FIRST CHARGING TIME OR DISCHARGING TIME < FIRST DISCHARGING TIME?
2003
NO
YES
DETECT INSERTION OF AEROSOL GENERATING ARTICLE
2005
SUPPLY POWER TO HEATER FOR PREHEATING
2007
END

FIG. 21

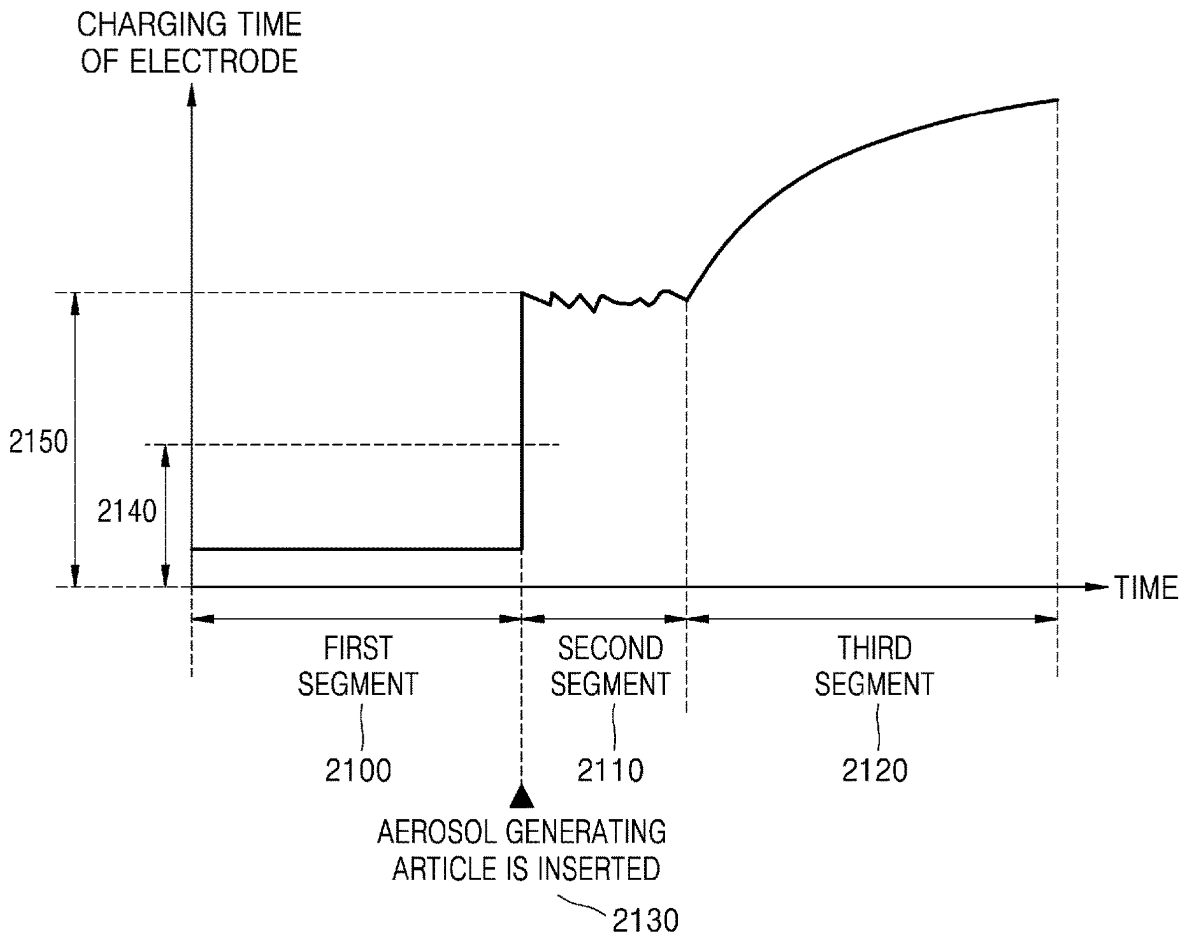

CHARGING TIME
OF ELECTRODE
2150
2140
TIME
FIRST
SEGMENT
2100
SECOND
SEGMENT
2110
THIRD
SEGMENT
2120
AEROSOL GENERATING
ARTICLE IS INSERTED
2130

FIG. 22A

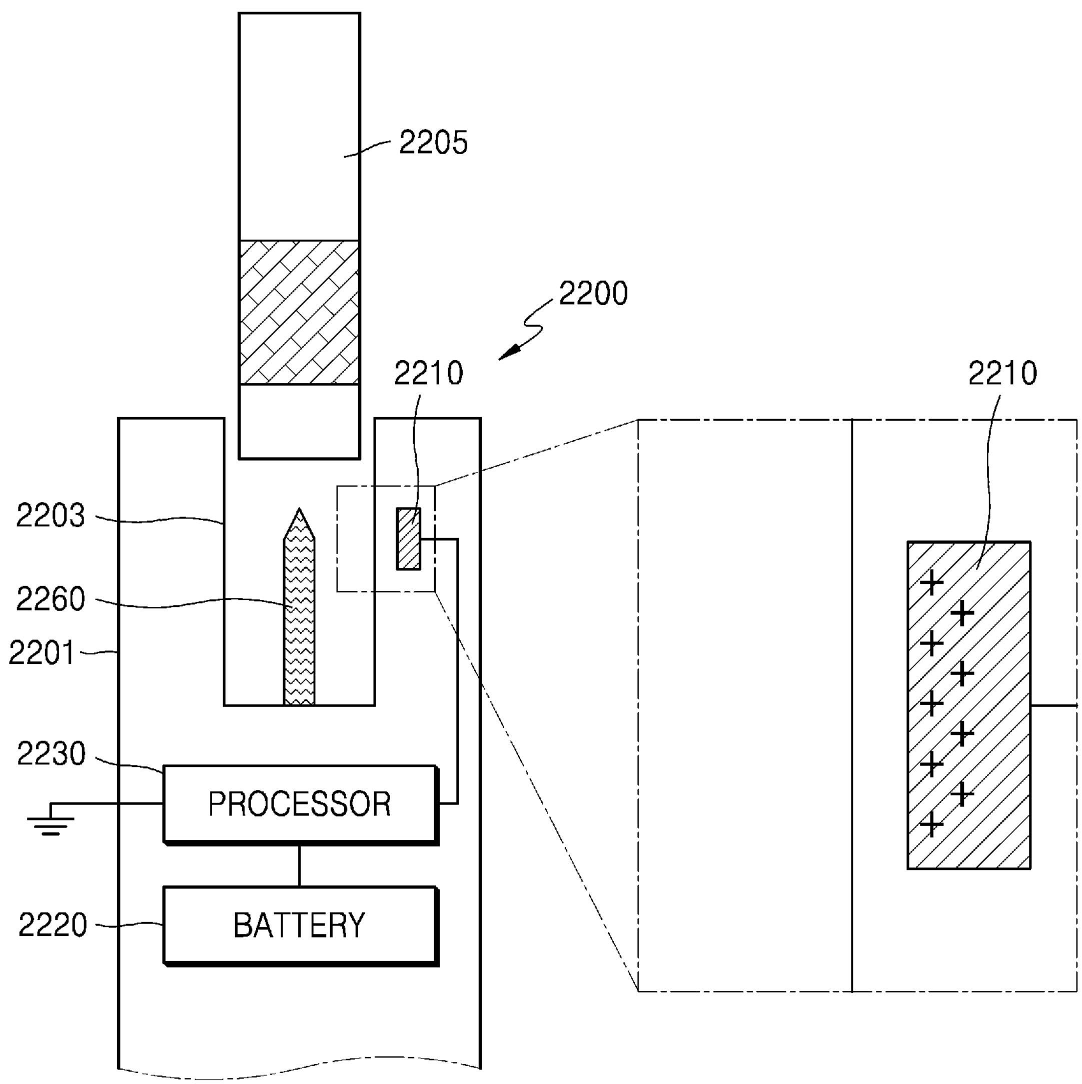

2205
2200
2210
2210
2203
2260
2201
2230
PROCESSOR
2220
BATTERY

FIG. 22B

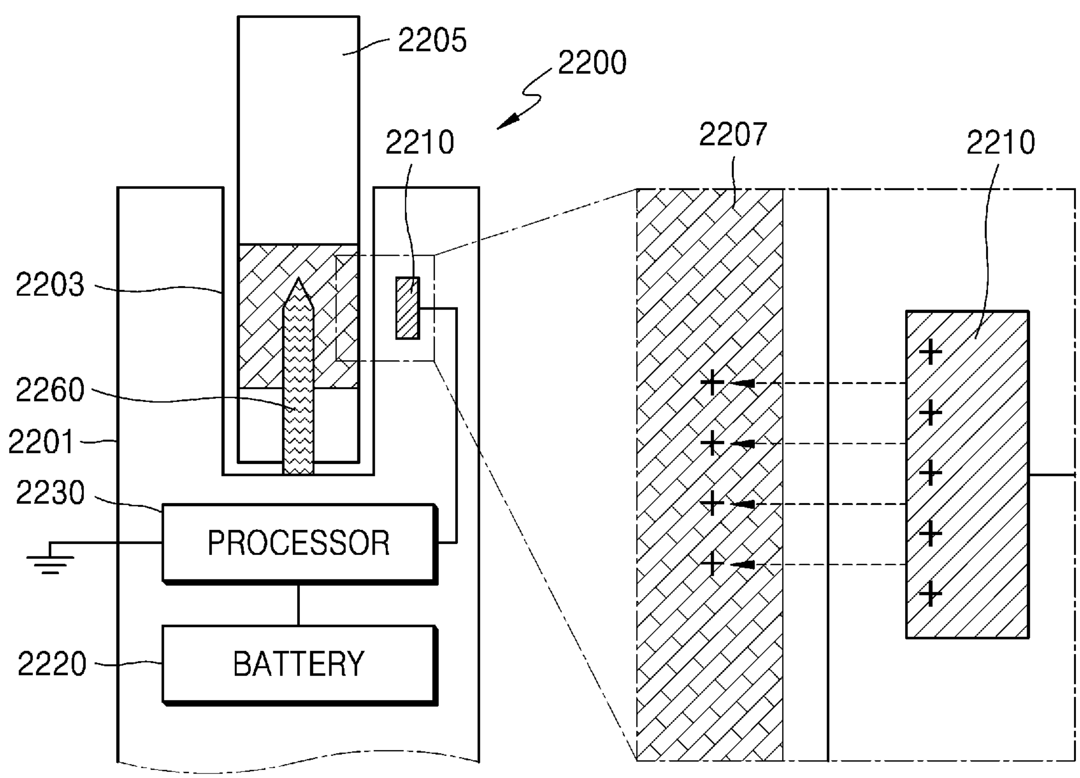

2205
2200
2210
2207
2210
2203
2260
2201
2230
PROCESSOR
2220
BATTERY

FIG. 23

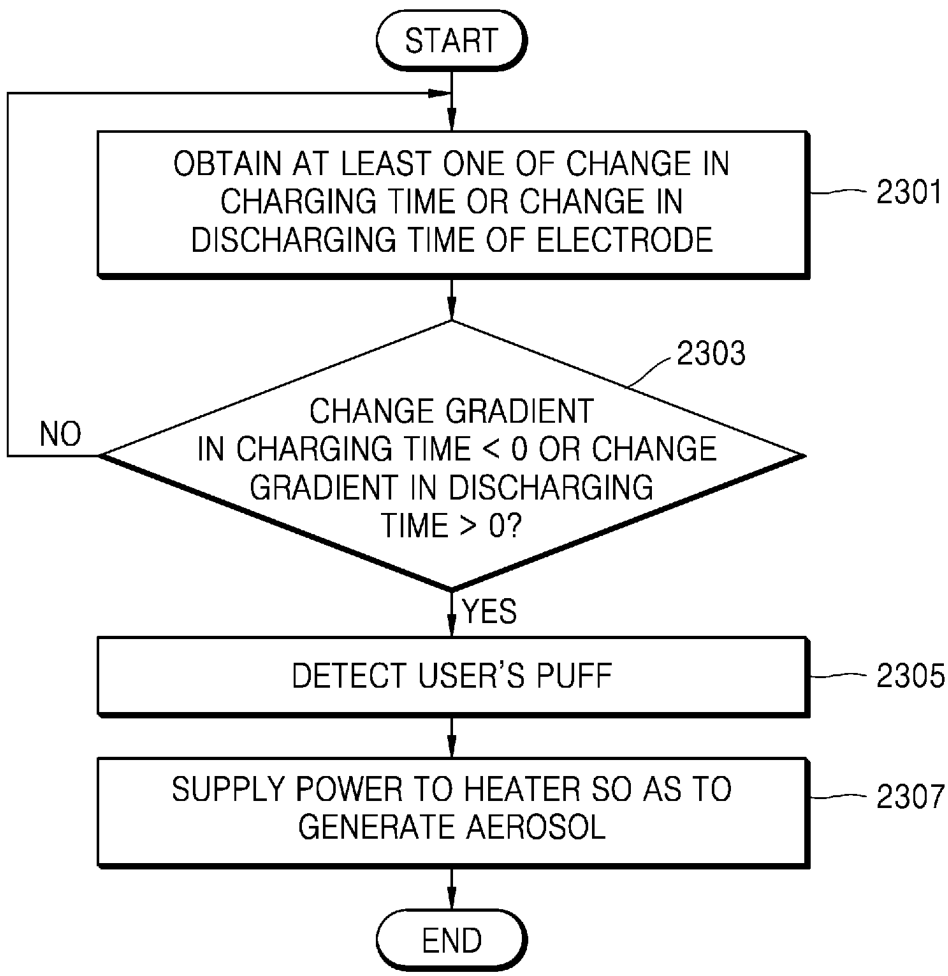

START
OBTAIN AT LEAST ONE OF CHANGE IN CHARGING TIME OR CHANGE IN DISCHARGING TIME OF ELECTRODE
2301
2303
CHANGE GRADIENT IN CHARGING TIME < 0 OR CHANGE GRADIENT IN DISCHARGING TIME > 0?
NO
YES
DETECT USER'S PUFF
2305
SUPPLY POWER TO HEATER SO AS TO GENERATE AEROSOL
2307
END

FIG. 24

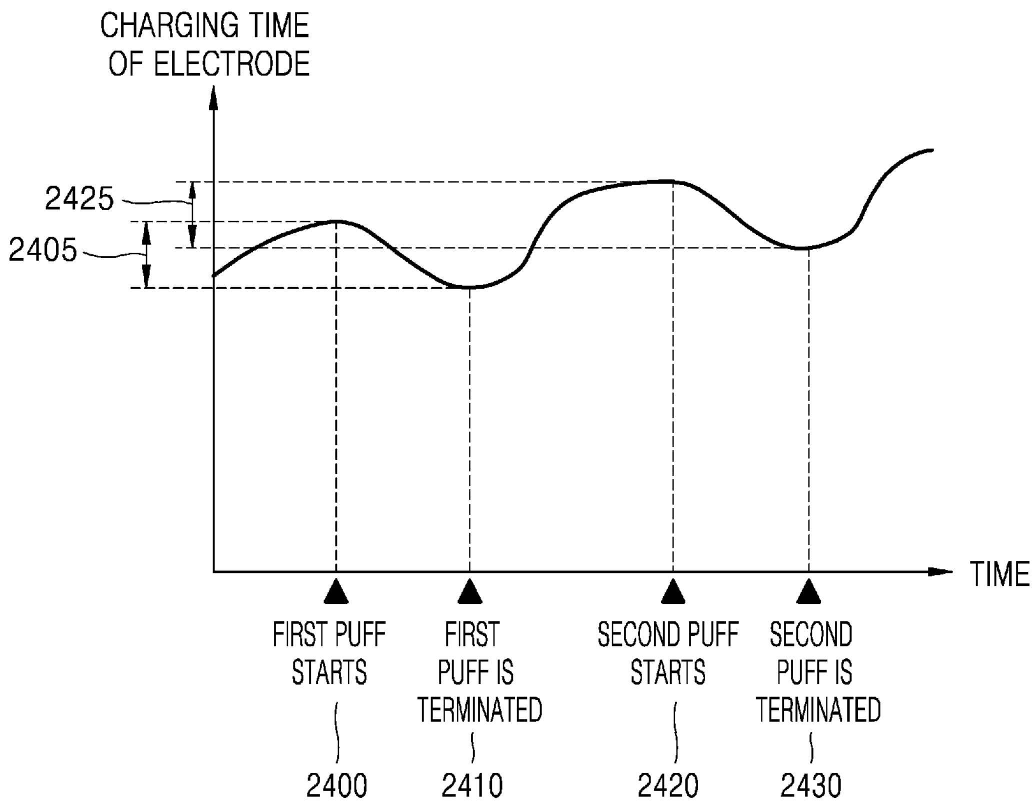

CHARGING TIME
OF ELECTRODE
2425
2405
TIME
FIRST PUFF
STARTS
2400
FIRST
PUFF IS
TERMINATED
2410
SECOND PUFF
STARTS
2420
SECOND
PUFF IS
TERMINATED
2430

FIG. 25A

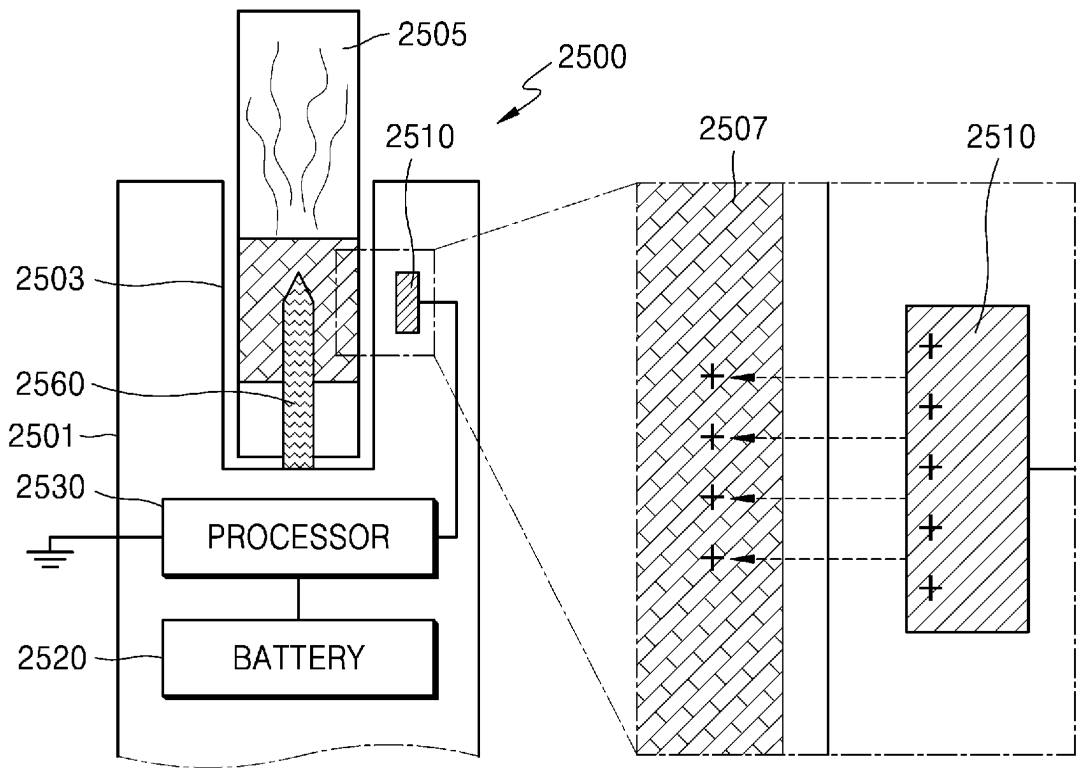

2505
2500
2510
2507
2510
2503
2560
2501
2530
PROCESSOR
2520
BATTERY

FIG. 25B

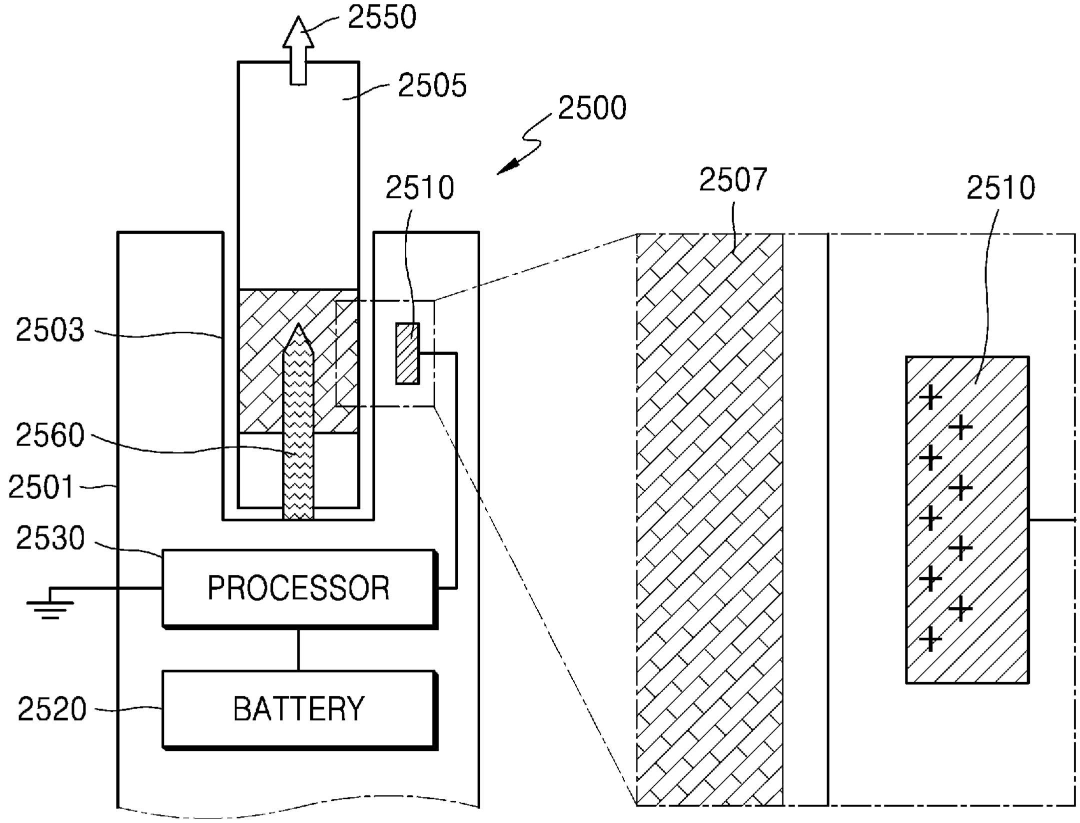

2550
2505
2500
2510
2507
2510
2503
2560
2501
2530
PROCESSOR
2520
BATTERY

FIG. 26

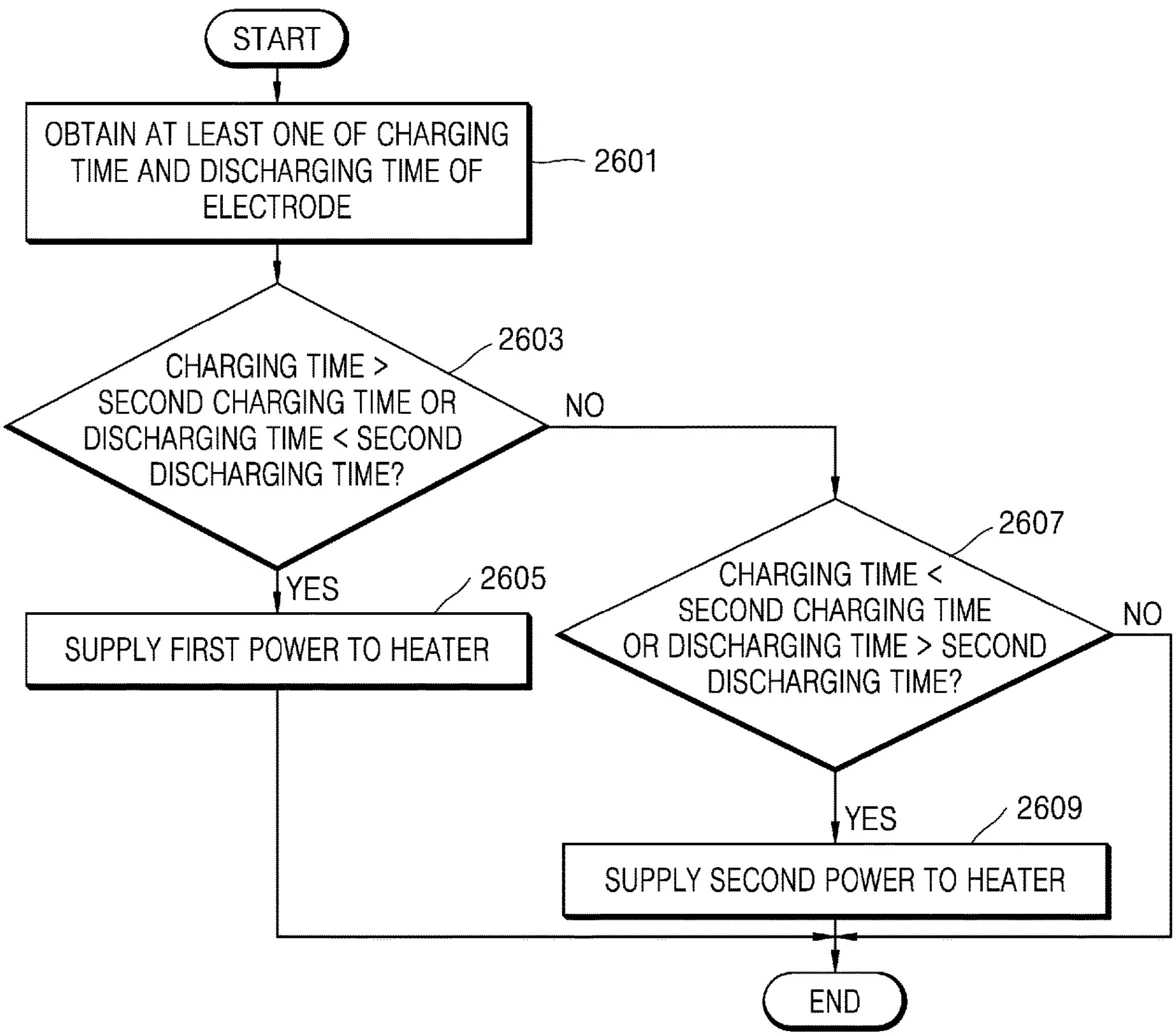

START
OBTAIN AT LEAST ONE OF CHARGING TIME AND DISCHARGING TIME OF ELECTRODE
2601
CHARGING TIME > SECOND CHARGING TIME OR DISCHARGING TIME < SECOND DISCHARGING TIME?
2603
NO
YES
SUPPLY FIRST POWER TO HEATER
2605
CHARGING TIME < SECOND CHARGING TIME OR DISCHARGING TIME > SECOND DISCHARGING TIME?
2607
NO
YES
SUPPLY SECOND POWER TO HEATER
2609
END

FIG. 27

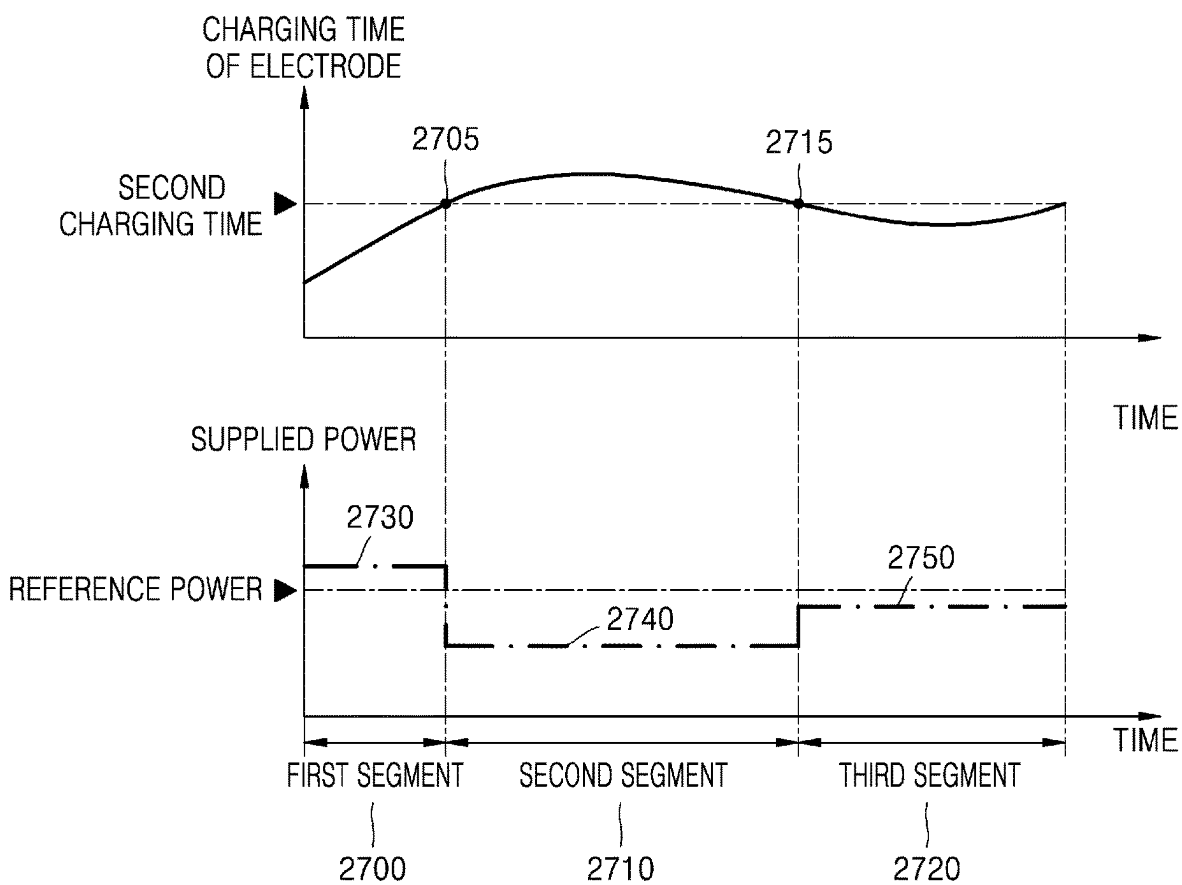

CHARGING TIME
OF ELECTRODE
2705
2715
SECOND
CHARGING TIME
TIME
SUPPLIED POWER
2730
REFERENCE POWER
2750
2740
TIME
FIRST SEGMENT
SECOND SEGMENT
THIRD SEGMENT
2700
2710
2720

FIG. 28

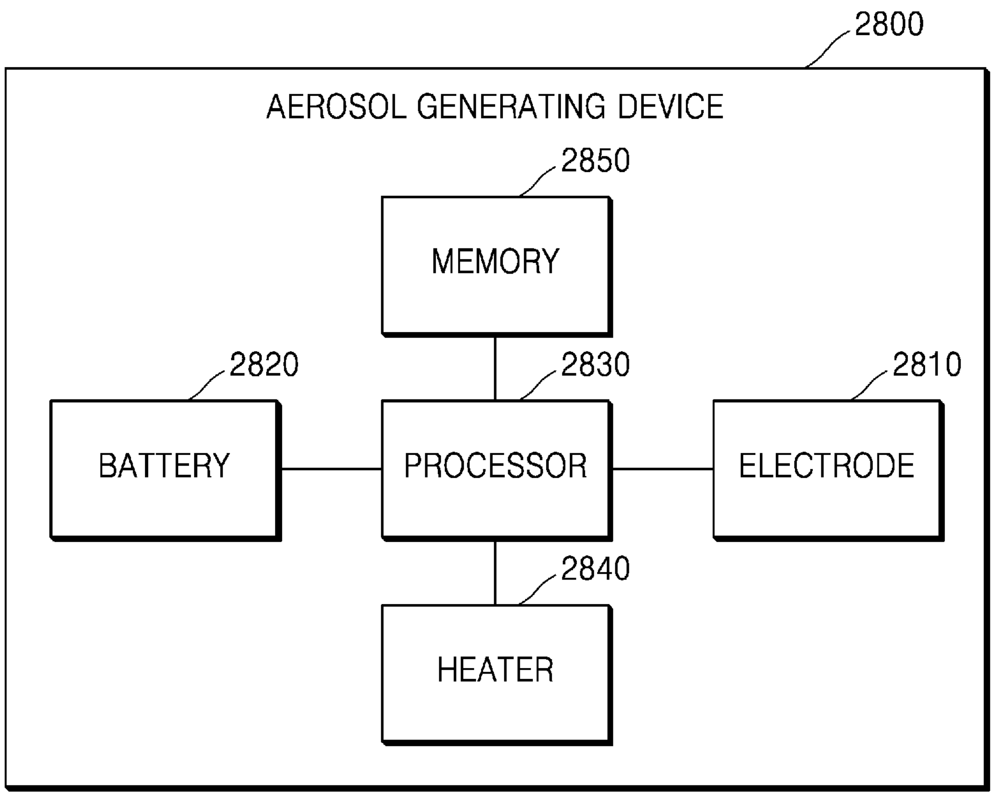

2800
AEROSOL GENERATING DEVICE
2850
MEMORY
2820
BATTERY
2830
PROCESSOR
2810
ELECTRODE
2840
HEATER

FIG. 29

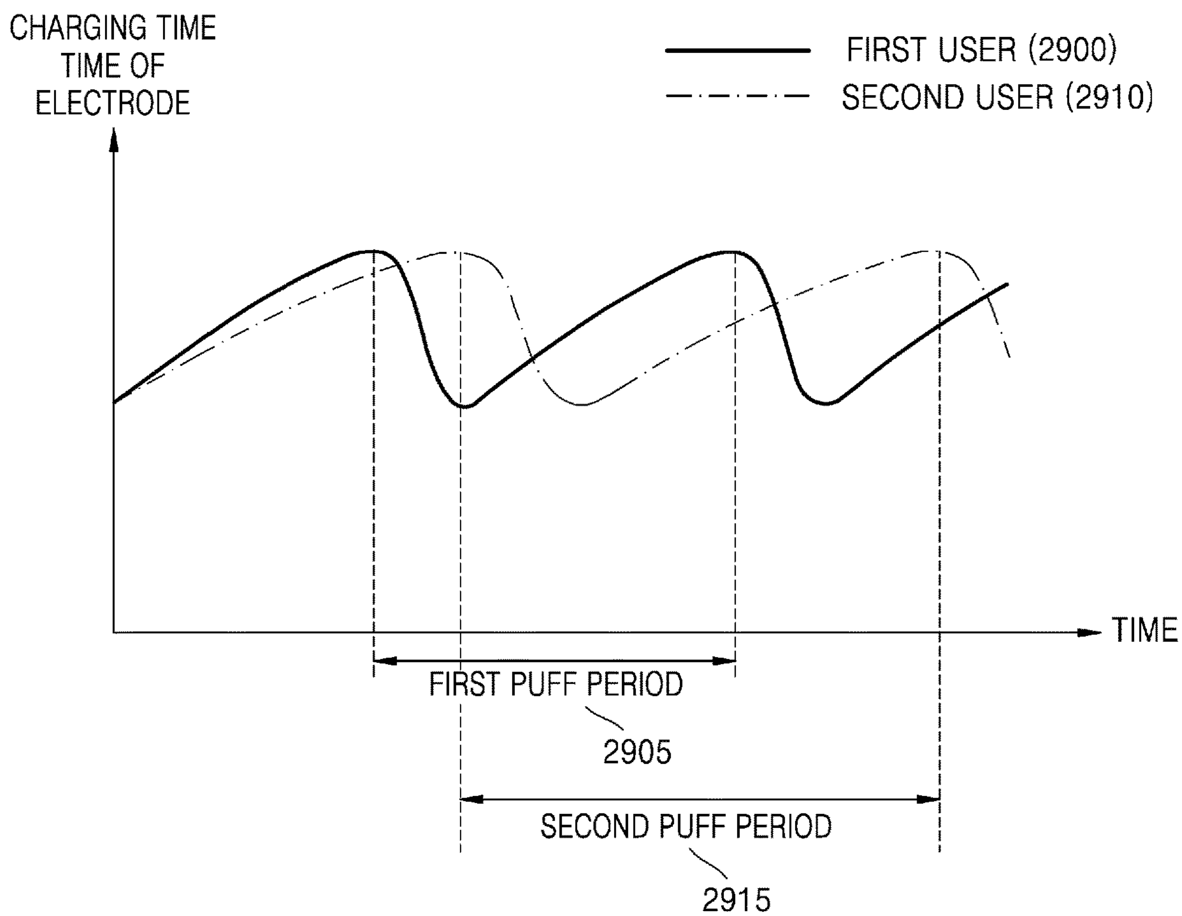
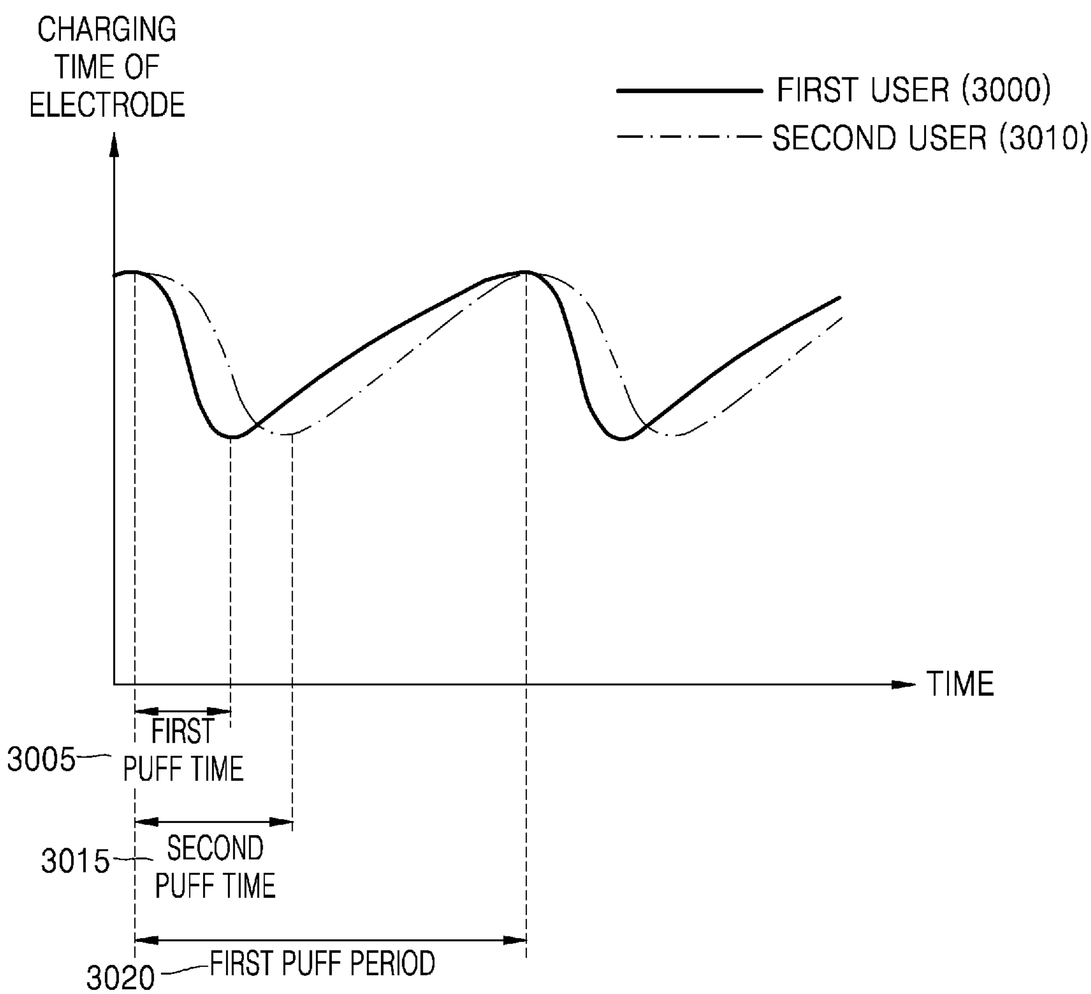
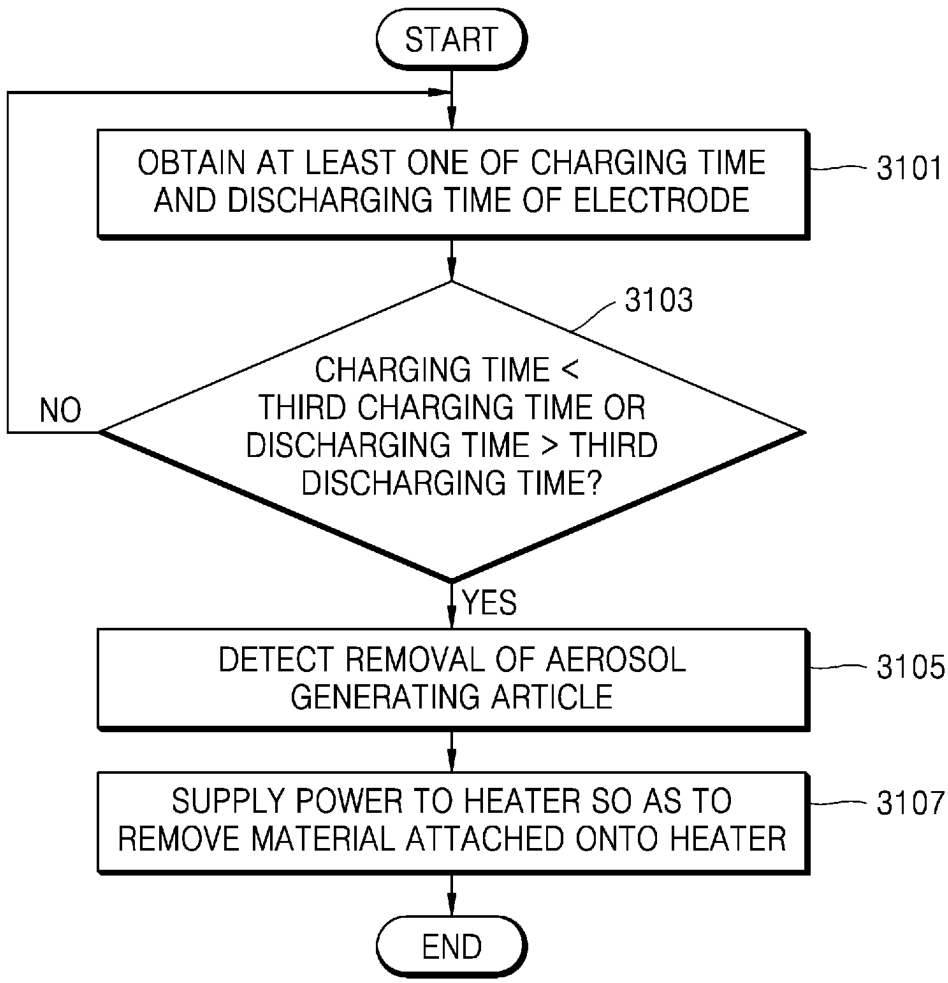

CHARGING TIME
TIME OF
ELECTRODE
FIRST USER (2900)
SECOND USER (2910)
TIME
FIRST PUFF PERIOD
2905
SECOND PUFF PERIOD
2915

FIG. 30



CHARGING TIME OF ELECTRODE
FIRST USER (3000)
SECOND USER (3010)
TIME
FIRST PUFF TIME
3005
SECOND PUFF TIME
3015
FIRST PUFF PERIOD
3020

FIG. 31



START
OBTAIN AT LEAST ONE OF CHARGING TIME AND DISCHARGING TIME OF ELECTRODE
3101
3103
CHARGING TIME < THIRD CHARGING TIME OR DISCHARGING TIME > THIRD DISCHARGING TIME?
NO
YES
DETECT REMOVAL OF AEROSOL GENERATING ARTICLE
3105
SUPPLY POWER TO HEATER SO AS TO REMOVE MATERIAL ATTACHED ONTO HEATER
3107
END

FIG. 32

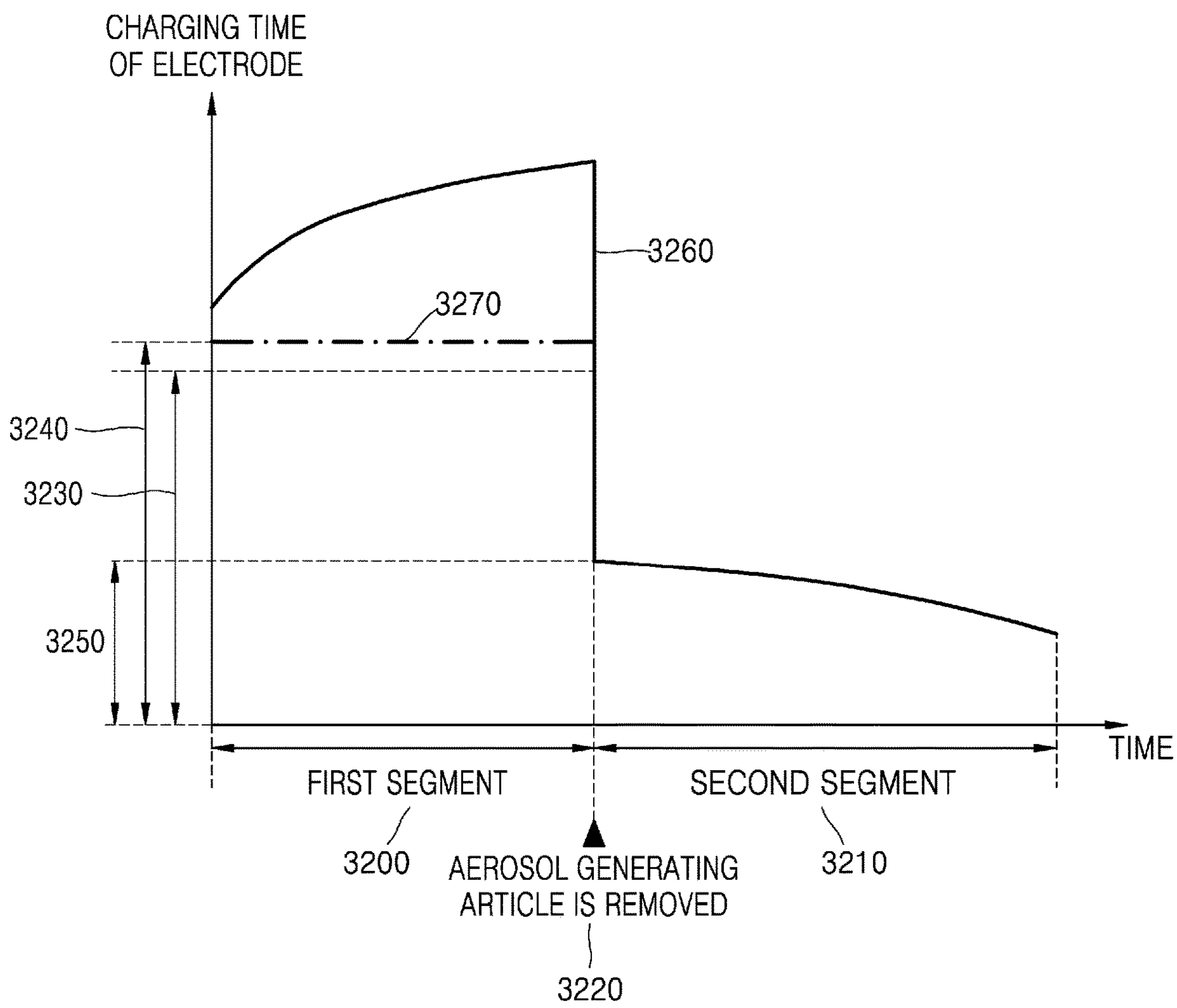

CHARGING TIME
OF ELECTRODE
3260
3270
3240
3230
3250
TIME
FIRST SEGMENT
SECOND SEGMENT
3200
AEROSOL GENERATING
ARTICLE IS REMOVED
3210
3220

FIG. 33A

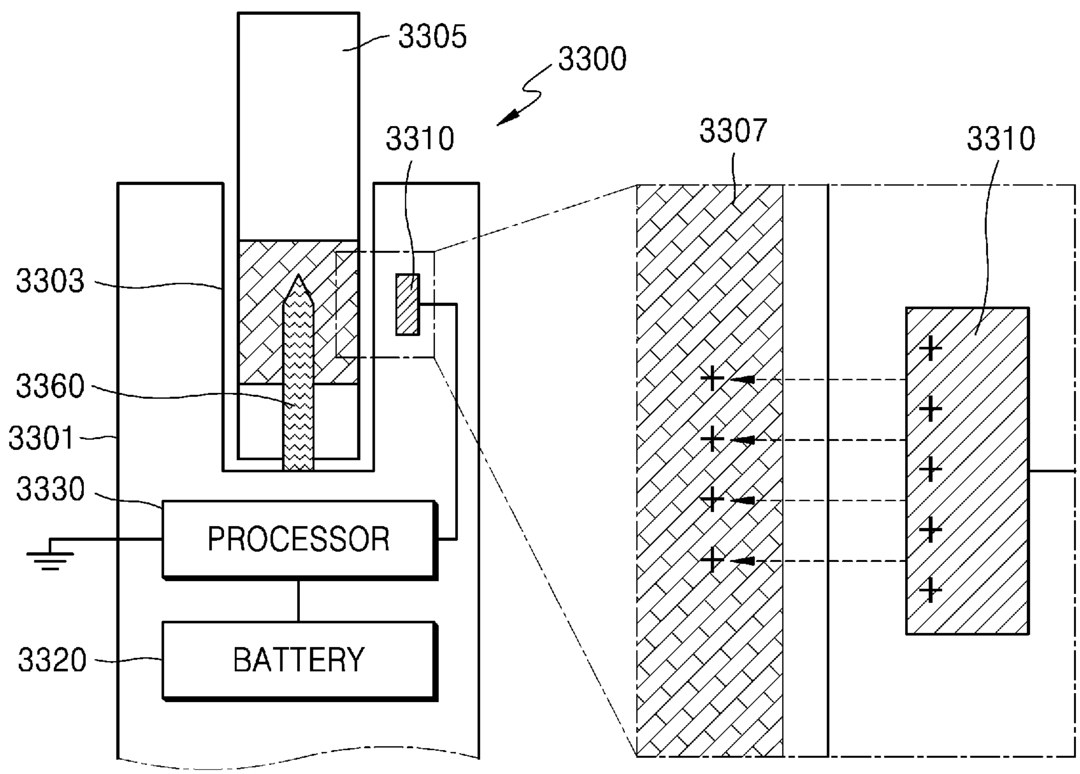

3305
3300
3310
3307
3310
3303
3360
3301
3330
PROCESSOR
3320
BATTERY

FIG. 33B

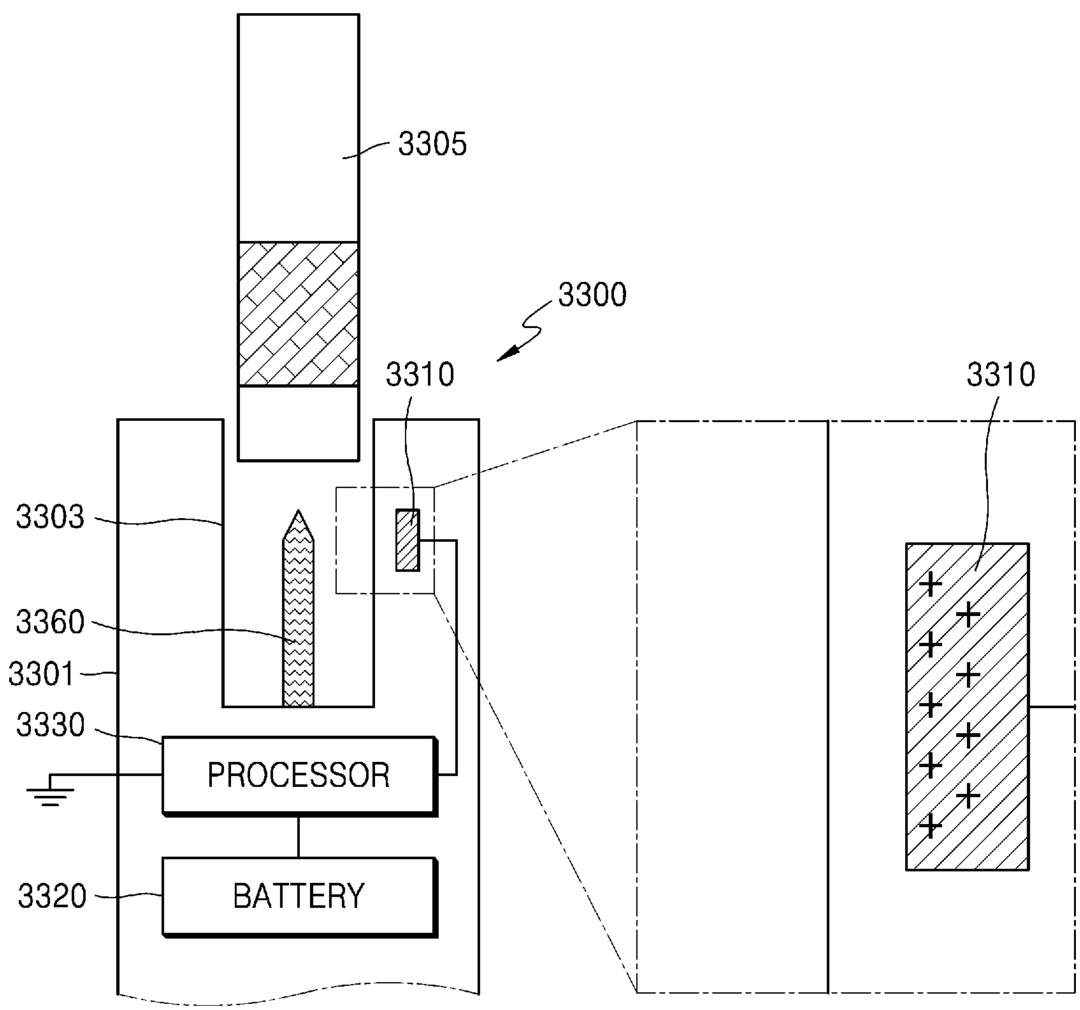
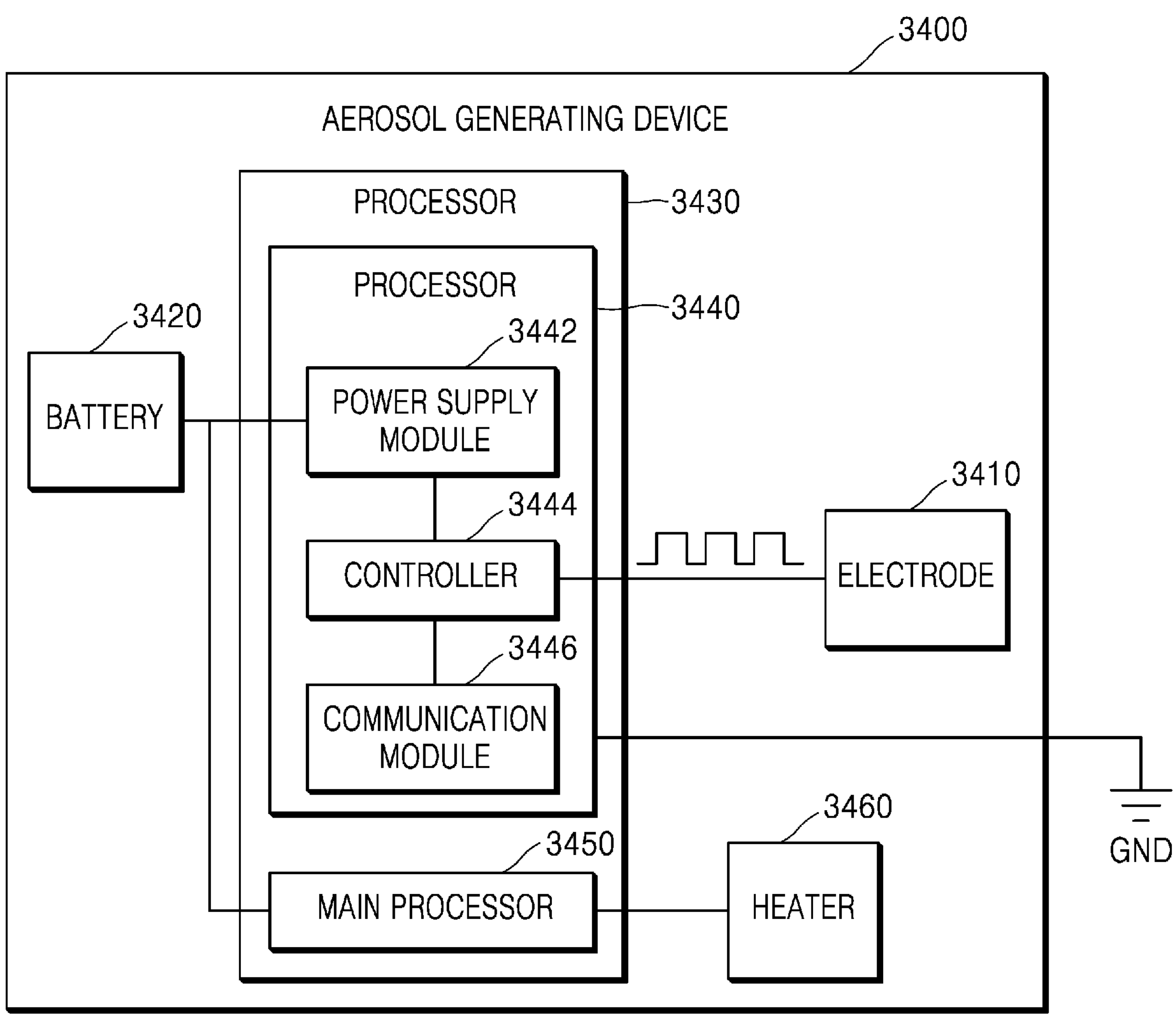

3305
3300
3310
3310
3303
3360
3301
3330
PROCESSOR
3320
BATTERY

FIG. 34


3400
AEROSOL GENERATING DEVICE
PROCESSOR
3430
PROCESSOR
3440
3420
BATTERY
3442
POWER SUPPLY MODULE
3444
CONTROLLER
3410
ELECTRODE
3446
COMMUNICATION MODULE
GND
3460
HEATER
3450
MAIN PROCESSOR

AEROSOL GENERATING DEVICE INCLUDING AN ELECTRODE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a National Stage of International Application No. PCT/KR2021/008567 filed Jul. 6, 2021, claiming priority based on Korean Patent Application No. 10-2020-0096398 filed Jul. 31, 2020 and Korean Patent Application No. 10-2021-0083117 filed Jun. 25, 2021.

TECHNICAL FIELD

One or more embodiments relate to an aerosol generating device including an electrode, and more particularly, to an aerosol generating device in which a change in charge amounts of an electrode according to permittivity of an aerosol generating article is detected so that various types of controls may be performed.

BACKGROUND ART

Recently, the demand for alternative methods to overcome the shortcomings of general cigarettes has increased. For example, there is increasing demand for a method of generating aerosol with a non-combustion method by heating an aerosol generating material in a cigarette. Thus, research on a heating type cigarette and a heating type aerosol generating device has been actively carried out.

DESCRIPTION OF EMBODIMENTS

Technical Problem

One or more embodiments of the present disclosure provide an aerosol generating device in which a change in charge amounts of an electrode according to permittivity of an aerosol generating article is detected so that various types of controls may be performed.

Technical goals to be achieved by embodiments of the present disclosure are not limited to the above-described goals, and goals that are not mentioned will be clearly understood by one of ordinary skill in the art from the present specification and the accompanying drawings.

Solution to Problem

According to an aspect of the present disclosure, an aerosol generating device includes a heater, a housing including an accommodation portion into which an aerosol generating article is inserted, an electrode apart from the aerosol generating article inserted into the accommodation portion and located to correspond to at least a part of the aerosol generating article, and a processor electrically connected to the heater and the electrode.

Advantageous Effects of Disclosure

According to one or more embodiments of the present disclosure, it may be detected whether an aerosol generating article is inserted regardless of the type of a wrapping material for wrapping at least a portion of the aerosol generating article.

According to one or more embodiments of the present disclosure, a design for other components may be eased as one electrode measures a change in charge amount caused by the insertion of the aerosol generating article.

According to one or more embodiments of the present disclosure, as the generation amount of aerosol is directly detected through the permittivity of the aerosol, the accuracy of data on the generation amount of aerosol and a user's puff operation may be enhanced.

BRIEF DESCRIPTION OF DRAWINGS

FIGS. **1** through **3** are views illustrating examples in which an aerosol generating article is inserted into an aerosol generating device;

FIGS. **4** and **5** are views illustrating examples of the aerosol generating article;

FIG. **6**A is a view schematically illustrating the relationship between an electrode and an aerosol generating article according to an embodiment;

FIG. **6**B is a view illustrating an example of the position of an electrode of an aerosol generating device according to an embodiment;

FIG. **7**A is a perspective view of a housing of an aerosol generating device according to an embodiment;

FIG. **7**B is a cross-sectional view of the housing of the aerosol generating device according to an embodiment taken along line A-A';

FIG. **8**A is a perspective view of a housing of an aerosol generating device according to another embodiment;

FIG. **8**B is a cross-sectional view of a housing of an aerosol generating device according to another embodiment taken along line A-A';

FIG. **9**A is a perspective view of a housing of an aerosol generating device according to another embodiment;

FIG. **9**B is a cross-sectional view of a housing of an aerosol generating device according to another embodiment taken along line A-A';

FIG. **10** is a view illustrating an example of the position of an electrode of an aerosol generating device according to another embodiment;

FIG. **11**A is a view illustrating an example of the position of an electrode of an aerosol generating device according to another embodiment;

FIG. **11**B is a view illustrating an example of the position of an electrode to a heater according to another embodiment;

FIG. **12**A is a view illustrating an example of the position of an electrode of an aerosol generating device according to another embodiment;

FIG. **12**B is a view illustrating an example of the position of an electrode of an aerosol generating device according to another embodiment;

FIG. **13**A is a view illustrating an example of the position of an electrode of an aerosol generating device according to another embodiment;

FIG. **13**B is a view illustrating an example of the position of an electrode of an aerosol generating device according to another embodiment;

FIG. **14** is a circuit diagram of the electrode of FIGS. **13**A and **13**B;

FIG. **15** is a block diagram of an aerosol generating device according to an embodiment;

FIGS. **16**A and **16**B are views illustrating examples of a method for determining the type of an aerosol generating article by using an electrode of an aerosol generating device according to an embodiment;

FIG. **17**A is a graph for describing a method, by which a processor according to an embodiment detects a change in a charging time of an electrode;

FIG. **17**B is a graph for describing a method, by which a processor according to the embodiment detects a change in a charging time of an electrode;

FIG. **18**A is a graph for describing a method, by which a processor according to another embodiment detects a change in a charging time of an electrode;

FIG. **18**B is a graph for describing a method, by which a processor according to the another embodiment detects a change in a charging time of an electrode;

FIG. **19**A is a graph for describing a charging time of an electrode of an aerosol generating device according to an embodiment;

FIG. **19**B is a graph for describing a discharging time of the electrode in FIG. **19**A;

FIG. **20** is a flowchart illustrating a case where an aerosol generating device according to an embodiment detects insertion of an aerosol generating article;

FIG. **21** is a graph showing a charging time of an electrode that varies as an aerosol generating article is inserted into an aerosol generating device according to an embodiment;

FIG. **22**A illustrates a state before an aerosol generating article is inserted into an aerosol generating device according to an embodiment;

FIG. **22**B illustrates a state after an aerosol generating article is inserted into an aerosol generating device according to an embodiment;

FIG. **23** is a flowchart illustrating a case where an aerosol generating device according to an embodiment detects a user's puff operation;

FIG. **24** is a graph illustrating a charging time of an electrode that varies as the user's puff operation is detected by an aerosol generating device according to an embodiment;

FIG. **25**A illustrates a state before a user's puff operation is detected by an aerosol generating device according to an embodiment;

FIG. **25**B illustrates a state after the user's puff operation is detected by an aerosol generating device according to an embodiment;

FIG. **26** is a flowchart illustrating a case where power supplied to a heater is controlled by an aerosol generating device according to an embodiment;

FIG. **27** is a graph illustrating power supplied to a heater that is controlled based on a charging time of an electrode in an aerosol generating device according to an embodiment;

FIG. **28** is a block diagram of an aerosol generating device according to another embodiment;

FIG. **29** is a graph illustrating a charging time of an electrode that varies according to a user's smoking pattern according to an embodiment;

FIG. **30** is a graph illustrating a charging time of an electrode that varies according to a user's smoking pattern according to another embodiment;

FIG. **31** is a flowchart illustrating a case where an aerosol generating device according to an embodiment detects the removal of an aerosol generating article;

FIG. **32** is a graph illustrating a charging time of an electrode that varies as an aerosol generating article is removed from an aerosol generating device according to an embodiment;

FIG. **33**A illustrates a state before an aerosol generating article is removed from an aerosol generating device according to an embodiment;

FIG. **33**B illustrates a state after an aerosol generating article is removed from an aerosol generating device according to an embodiment; and

FIG. **34** is a block diagram of an aerosol generating device according to another embodiment.

MODE OF DISCLOSURE

With respect to the terms used to describe in the various embodiments, the general terms which are currently and widely used are selected in consideration of functions of structural elements in the various embodiments of the present disclosure. However, meanings of the terms can be changed according to intention, a judicial precedence, the appearance of a new technology, and the like. In addition, in certain cases, a term which is not commonly used can be selected. In such a case, the meaning of the term will be described in detail at the corresponding portion in the description of the present disclosure. Therefore, the terms used in the various embodiments of the present disclosure should be defined based on the meanings of the terms and the descriptions provided herein.

In addition, unless explicitly described to the contrary, the word "comprise" and variations such as "comprises" or "comprising" will be understood to imply the inclusion of stated elements but not the exclusion of any other elements. In addition, the terms "-er", "-or", and "module" described in the specification mean units for processing at least one function and operation and can be implemented by hardware components or software components and combinations thereof.

In the specification, an aerosol generating device may be a device that generates aerosol by using an aerosol generating material so as to generate aerosol that may be directly inhaled into a user's lung through the user's mouth. For example, the aerosol generating device may be a holder.

In the specification, "puff" refers to the user's inhalation, and inhalation may refer to an action of drawing through the user's mouth or noise into the user's mouth, nasal cavity, or lungs.

Hereinafter, the present disclosure will now be described more fully with reference to the accompanying drawings, in which exemplary embodiments of the present disclosure are shown such that one of ordinary skill in the art may easily work the present disclosure. The disclosure may, however, be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein.

Hereinafter, embodiments of the present disclosure will be described in detail with reference to the drawings.

FIGS. **1** through **3** are diagrams showing examples in which an aerosol generating article is inserted into an aerosol generating device.

Referring to FIG. **1**, the aerosol generating device **1** may include a battery **11**, a controller **12**, and a heater **13**. Referring to FIGS. **2** and **3**, the aerosol generating device **1** may further include a vaporizer **14**. Also, the aerosol generating article **2** may be inserted into an inner space of the aerosol generating device **1**.

FIGS. **1** through **3** illustrate components of the aerosol generating device **1**, which are related to the present embodiment. Therefore, it will be understood by one of ordinary skill in the art related to the present embodiment that other general-purpose components may be further included in the aerosol generating device **1**, in addition to the components illustrated in FIGS. **1** through **3**.

Also, FIGS. **2** and **3** illustrate that the aerosol generating device **1** includes the heater **13**. However, as necessary, the heater **13** may be omitted.

FIG. **1** illustrates that the battery **11**, the controller **12**, and the heater **13** are arranged in series. Also, FIG. **2** illustrates that the battery **11**, the controller **12**, the vaporizer **14**, and the heater **13** are arranged in series. Also, FIG. **3** illustrates that the vaporizer **14** and the heater **13** are arranged in parallel. However, the internal structure of the aerosol generating device **1** is not limited to the structures illustrated in FIGS. **1** through **3**. In other words, according to the design of the aerosol generating device **1**, the battery **11**, the controller **12**, the heater **13**, and the vaporizer **14** may be differently arranged.

When the aerosol generating article **2** is inserted into the aerosol generating device **1**, the aerosol generating device **1** may operate the heater **13** and/or the vaporizer **14** to generate aerosol from the aerosol generating article **2** and/or the vaporizer **14**. The aerosol generated by the heater **13** and/or the vaporizer **14** is delivered to a user by passing through the aerosol generating article **2**.

As necessary, even when the aerosol generating article **2** is not inserted into the aerosol generating device **1**, the aerosol generating device **1** may heat the heater **13**.

The battery **11** may supply power to be used for the aerosol generating device **1** to operate. For example, the battery **11** may supply power to heat the heater **13** or the vaporizer **14**, and may supply power for operating the controller **12**. Also, the battery **11** may supply power for operations of a display, a sensor, a motor, etc. mounted in the aerosol generating device **1**.

The controller **12** may generally control operations of the aerosol generating device **1**. In detail, the controller **12** may control not only operations of the battery **11**, the heater **13**, and the vaporizer **14**, but also operations of other components included in the aerosol generating device **1**. Also, the controller **12** may check a state of each of the components of the aerosol generating device **1** to determine whether or not the aerosol generating device **1** is able to operate.

The controller **12** may include at least one processor. A processor can be implemented as an array of a plurality of logic gates or can be implemented as a combination of a general-purpose microprocessor and a memory in which a program executable in the microprocessor is stored. It will be understood by one of ordinary skill in the art that the processor can be implemented in other forms of hardware.

The heater **13** may be heated by the power supplied from the battery **11**. For example, when the aerosol generating article **2** is inserted into the aerosol generating device **1**, the heater **13** may be located outside the aerosol generating article **2**. Thus, the heated heater **13** may increase a temperature of an aerosol generating material in the aerosol generating article **2**.

The heater **13** may include an electro-resistive heater. For example, the heater **13** may include an electrically conductive track, and the heater **13** may be heated when currents flow through the electrically conductive track. However, the heater **13** is not limited to the example described above and may include all heaters which may be heated to a desired temperature. Here, the desired temperature may be pre-set in the aerosol generating device **1** or may be set by a user.

As another example, the heater **13** may include an induction heater. In detail, the heater **13** may include an electrically conductive coil for heating an aerosol generating article in an induction heating method, and the aerosol generating article may include a susceptor which may be heated by the induction heater.

For example, the heater **13** may include a tube-type heating element, a plate-type heating element, a needle-type heating element, or a rod-type heating element, and may heat the inside or the outside of the aerosol generating article **2**, according to the shape of the heating element.

Also, the aerosol generating device **1** may include a plurality of heaters **13**. Here, the plurality of heaters **13** may be inserted into the aerosol generating article **2** or may be arranged outside the aerosol generating article **2**. Also, some of the plurality of heaters **13** may be inserted into the aerosol generating article **2** and the others may be arranged outside the aerosol generating article **2**. In addition, the shape of the heater **13** is not limited to the shapes illustrated in FIGS. **1** through **3** and may include various shapes.

The vaporizer **14** may generate aerosol by heating a liquid composition and the generated aerosol may pass through the aerosol generating article **2** to be delivered to a user. In other words, the aerosol generated via the vaporizer **14** may move along an air flow passage of the aerosol generating device **1** and the air flow passage may be configured such that the aerosol generated via the vaporizer **14** passes through the aerosol generating article **2** to be delivered to the user.

For example, the vaporizer **14** may include a liquid storage, a liquid delivery element, and a heating element, but it is not limited thereto. For example, the liquid storage, the liquid delivery element, and the heating element may be included in the aerosol generating device **1** as independent modules.

The liquid storage may store a liquid composition. For example, the liquid composition may be a liquid including a tobacco-containing material having a volatile tobacco flavor component, or a liquid including a non-tobacco material. The liquid storage may be formed to be detachable from the vaporizer **14** or may be formed integrally with the vaporizer **14**.

For example, the liquid composition may include water, a solvent, ethanol, plant extract, spices, flavorings, or a vitamin mixture. The spices may include menthol, peppermint, spearmint oil, and various fruit-flavored ingredients, but are not limited thereto. The flavorings may include ingredients capable of providing various flavors or tastes to a user. Vitamin mixtures may be a mixture of at least one of vitamin A, vitamin B, vitamin C, and vitamin E, but are not limited thereto. Also, the liquid composition may include an aerosol forming substance, such as glycerin and propylene glycol.

The liquid delivery element may deliver the liquid composition of the liquid storage to the heating element. For example, the liquid delivery element may be a wick such as cotton fiber, ceramic fiber, glass fiber, or porous ceramic, but is not limited thereto.

The heating element is an element for heating the liquid composition delivered by the liquid delivery element. For example, the heating element may be a metal heating wire, a metal hot plate, a ceramic heater, or the like, but is not limited thereto. In addition, the heating element may include a conductive filament such as nichrome wire and may be positioned as being wound around the liquid delivery element. The heating element may be heated by a current supply and may transfer heat to the liquid composition in contact with the heating element, thereby heating the liquid composition. As a result, aerosol may be generated.

For example, the vaporizer **14** may be referred to as a cartomizer or an atomizer, but it is not limited thereto.

The aerosol generating device **1** may further include general-purpose components in addition to the battery **11**, the controller **12**, the heater **13**, and the vaporizer **14**. For example, the aerosol generating device **1** may include a display capable of outputting visual information and/or a motor for outputting haptic information. Also, the aerosol generating device **1** may include at least one sensor (a puff sensor, a temperature sensor, an aerosol generating article insertion detecting sensor, etc.). Also, the aerosol generating device **1** may be formed as a structure that, even when the aerosol generating article **2** is inserted into the aerosol generating device **1**, may introduce external air or discharge internal air.

Although not illustrated in FIGS. **1** through **3**, the aerosol generating device **1** and an additional cradle may form together a system. For example, the cradle may be used to charge the battery **11** of the aerosol generating device **1**. Alternatively, the heater **13** may be heated when the cradle and the aerosol generating device **1** are coupled to each other.

The aerosol generating article **2** may be similar to a general combustive cigarette. For example, the aerosol generating article **2** may be divided into a first portion including an aerosol generating material and a second portion including a filter, etc. Alternatively, the second portion of the aerosol generating article **2** may also include an aerosol generating material. For example, an aerosol generating material made in the form of granules or capsules may be inserted into the second portion.

The entire first portion may be inserted into the aerosol generating device **1**, and the second portion may be exposed to the outside. Alternatively, only a portion of the first portion may be inserted into the aerosol generating device **1**, or the entire first portion and a portion of the second portion may be inserted into the aerosol generating device **1**. The user may puff aerosol while holding the second portion by the mouth of the user. In this case, the aerosol is generated by the external air passing through the first portion, and the generated aerosol passes through the second portion and is delivered to the user's mouth.

For example, the external air may flow into at least one air passage formed in the aerosol generating device **1**. For example, opening and closing of the air passage and/or a size of the air passage formed in the aerosol generating device **1** may be adjusted by the user. Accordingly, the amount and the quality of smoking may be adjusted by the user. As another example, the external air may flow into the aerosol generating article **2** through at least one hole formed in a surface of the aerosol generating article **2**.

Hereinafter, the examples of the aerosol generating article **2** will be described with reference to FIGS. **4** and **5**.

FIGS. **4** and **5** illustrate examples of the aerosol generating article.

Referring to FIG. **4**, the aerosol generating article **2** may include a tobacco rod **21** and a filter rod **22**. The first portion described above with reference to FIGS. **1** through **3** may include the tobacco rod **21**, and the second portion may include the filter rod **22**.

FIG. **4** illustrates that the filter rod **22** includes a single segment. However, the filter rod **22** is not limited thereto. In other words, the filter rod **22** may include a plurality of segments. For example, the filter rod **22** may include a first segment configured to cool an aerosol and a second segment configured to filter a certain component included in the aerosol. Also, as necessary, the filter rod **22** may further include at least one segment configured to perform other functions.

The aerosol generating article **2** may be packaged using at least one wrapper **24**. The wrapper **24** may have at least one hole through which external air may be introduced or internal air may be discharged. For example, the aerosol generating article **2** may be packaged by one wrapper **24**. As another example, the aerosol generating article **2** may be doubly packaged by two or more wrappers **24**. For example, the tobacco rod **21** may be packaged by a first wrapper **241**, and the filter rod **22** may be packaged by wrappers **242**, **243**, **244**. Also, the entire aerosol generating article **2** may be re-packaged by another single wrapper **245**. When the filter rod **22** includes a plurality of segments, each segment may be packaged by wrappers **242**, **243**, **244**.

The tobacco rod **21** may include an aerosol generating material. For example, the aerosol generating material may include at least one of glycerin, propylene glycol, ethylene glycol, dipropylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol, and oleyl alcohol, but it is not limited thereto. Also, the tobacco rod **21** may include other additives, such as flavors, a wetting agent, and/or organic acid. Also, the tobacco rod **21** may include a flavored liquid, such as menthol or a moisturizer, which is injected to the tobacco rod **21**.

The tobacco rod **21** may be manufactured in various forms. For example, the tobacco rod **21** may be formed as a sheet or a strand. Also, the tobacco rod **21** may be formed as a pipe tobacco, which is formed of tiny bits cut from a tobacco sheet. Also, the tobacco rod **21** may be surrounded by a heat conductive material. For example, the heat conductive material may be, but is not limited to, a metal foil such as aluminum foil. For example, the heat conductive material surrounding the tobacco rod **21** may uniformly distribute heat transmitted to the tobacco rod **21**, and thus, the heat conductivity applied to the tobacco rod may be increased and taste of the tobacco may be improved. Also, the heat conductive material surrounding the tobacco rod **21** may function as a susceptor heated by the induction heater. Here, although not illustrated in the drawings, the tobacco rod **21** may further include an additional susceptor, in addition to the heat conductive material surrounding the tobacco rod **21**.

The filter rod **22** may include a cellulose acetate filter. Shapes of the filter rod **22** are not limited. For example, the filter rod **22** may include a cylinder-type rod or a tube-type rod having a hollow inside. Also, the filter rod **22** may include a recess-type rod. When the filter rod **22** includes a plurality of segments, at least one of the plurality of segments may have a different shape.

Also, the filter rod **22** may include at least one capsule **23**. Here, the capsule **23** may generate a flavor or an aerosol. For example, the capsule **23** may have a configuration in which a liquid containing a flavoring material is wrapped with a film. For example, the capsule **23** may have a spherical or cylindrical shape, but is not limited thereto.

Referring to FIG. **5**, the aerosol generating article **3** may further include a front-end plug **33**. The front-end plug **33** may be located on one side of the tobacco rod **31** which is opposite to the filter rod **32**. The front-end plug **33** may prevent the tobacco rod **31** from being detached outwards and prevent the liquefied aerosol from flowing from the tobacco rod **31** into the aerosol generating device (**1** of FIGS. **1** through **3**), during smoking.

The filter rod **32** may include a first segment **321** and a second segment **322**. Here, the first segment **321** may correspond to the first segment of the filter rod **22** of FIG. **4**, and the second segment **322** may correspond to the second segment of the filter rod **22** of FIG. **4**.

A diameter and a total length of the aerosol generating article **3** may correspond to a diameter and a total length of the aerosol generating article **2** of FIG. **4**. For example, the length of The front-end plug **33** is about 7 mm, the length of the tobacco rod **31** is about 15 mm, the length of the first segment **321** is about 12 mm, and the length of the second segment **322** is about 14 mm, but it is not limited thereto.

The aerosol generating article **3** may be packaged using at least one wrapper **35**. The wrapper **35** may have at least one hole through which external air may be introduced or internal air may be discharged. For example, the front end plug **33** may be packaged by a first wrapper **351**, the tobacco rod **31** may be packaged by a second wrapper **352**, the first segment **321** may be packaged by a third wrapper **353**, and the second segment **322** may be packaged by a fourth wrapper **354**. Further, the entire aerosol generating article **3** may be repackaged by a fifth wrapper **355**.

In addition, at least one perforation **36** may be formed in the fifth wrapper **355**. For example, the perforation **36** may be formed in a region surrounding the tobacco rod **31**, but is not limited thereto. The perforation **36** may serve to transfer heat generated by the heater **13** illustrated in FIGS. **2** and **3** to the inside of the tobacco rod **31**.

In addition, at least one capsule **34** may be included in the second segment **322**. Here, the capsule **34** may generate a flavor or an aerosol. For example, the capsule **34** may have a configuration in which a liquid containing a flavoring material is wrapped with a film. For example, the capsule **34** may have a spherical or cylindrical shape, but is not limited thereto.

FIG. **6**A is a view schematically illustrating the relationship between an electrode and an aerosol generating article according to an embodiment.

Referring to FIG. **6**A, an aerosol generating device **600** may include an electrode **620** and a processor **640**. In an embodiment, the processor **640** may perform a function of detecting whether an aerosol generating article **605** is inserted into or removed from the aerosol generating device **600** based on a charging time or a discharging time of the electrode **620**, a function of detecting the user's puff operation, and a function of controlling power to be supplied to a heater according to a generation amount of aerosol. For example, the processor **640** may apply a specific voltage to the electrode **620** and measure a charging time of the electrode **620**. The processor **640** may perform various functions based on the measured charging time of the electrode **620** or a change in the measured charging time of the electrode **620**. In another example, the processor **640** may measure a discharging time of the electrode **620** as the electrode **620** is naturally discharged. That is, when a charging voltage of the electrode **620** is the same as an applied voltage, the processor **640** may measure the discharging time of the electrode **620** and may perform various functions based on the measured discharging time of the electrode **620** or a change in the discharging time.

In an embodiment, when an aerosol generating article **605** is inserted into a portion (e.g., an accommodation portion) of the aerosol generating device **600**, the electrode **620** may be apart from the inserted aerosol generating article **605** by a certain distance. For example, the certain distance may refer to a distance at which a change in a charging time or a discharging time of the electrode **620** that occurs due to the aerosol generating article **605** may be detected. In an embodiment, the electrode **620** may be located to correspond to at least a part of the inserted aerosol generating article **605**. For example, the electrode **620** may be located to correspond at least partially to a region in which an aerosol generating material of the aerosol generating article **605** is disposed.

FIG. **6**B is a view illustrating an example of the position of an electrode of an aerosol generating device according to an embodiment.

Referring to FIG. **6**B, the aerosol generating device **600** may include a housing **610**, an electrode **620**, and a heater **650**. In an embodiment, the aerosol generating device **600** may include an accommodation portion into which the aerosol generating article **605** may be inserted. For example, the housing **610** may have a shape of a cylinder including an outer circumferential surface and an inner circumferential surface. In this case, the accommodation portion may refer to a space surrounded by the inner circumferential surface of the housing **610** or a region corresponding to the inner circumferential surface of the housing **610**. However, the shape of the housing **610** is not limited thereto and may be variously modified according to the design of a manufacturer.

In an embodiment, the electrode **620** may be apart from the inner circumferential surface of the housing **610** in a direction of the outer circumferential surface of the housing **610**. For example, the housing **610** may extend in a first direction (e.g., +y-direction), and the electrode **620** may be apart from the inner circumferential surface of the housing **610** in a direction (e.g., +x-direction) perpendicular to the first direction. Also, as the electrode **620** is apart from the inner circumferential surface of the housing **610** by a certain distance x, the electrode **620** may be buried between the inner circumferential surface and the outer circumferential surface of the housing **610**.

As the electrode **620** is disposed inside the housing **610**, noise in the result of measuring data through the electrode **620** by the processor may be reduced. If the electrode **620** is disposed to be exposed to the outside and is in contact with the aerosol generating article **605**, the electrode **620** may be affected in data measurement due to an external material (e.g., a tobacco leaf, dust etc.). On the contrary, the electrode **620** according to the present disclosure may be buried in the housing **610** or may not be exposed to the outside by an additional protective layer so that contamination due to the external material does not occur and thus noise in data measurement may be reduced.

In an embodiment, the electrode **620** may be disposed to correspond to, at least partially, a region in which the aerosol generating material **630** is disposed. For example, the position of the electrode **620** may correspond to a region in which the aerosol generating material **630** is disposed when the aerosol generating article **605** is fully inserted into the accommodation portion of the aerosol generating device **600**.

In an embodiment, the heater **650** may correspond to an internal heating type heater. However, the type of the heater **650** is not limited thereto. The shape of the heater according to various embodiments of the present disclosure will be described below with reference to FIGS. **11**A through **13**B.

FIG. **7**A is a perspective view of a housing of an aerosol generating device according to an embodiment. FIG. **7**B is a cross-sectional view of a housing of an aerosol generating device according to an embodiment taken along line A-A'. FIGS. **7**A and **7**B may correspond to a specific example of the electrode **620** included in the aerosol generating device **600** of FIG. **6**.

In an embodiment, the electrode **720** may have a shape of a plate with no curvature. In an embodiment, the electrode **720** may be apart from the accommodation portion **715** by a certain distance. In this case, because the electrode **720** has a shape of a plate with no curvature, the central portion of the electrode **720** may be apart from the accommodation portion **715** by x, and an end portion of the electrode **720** may be apart from the accommodation portion **715** farther than x. In order to minimize a difference between a distance between the accommodation portion **715** and the central portion of the electrode **720** and a distance between the accommodation portion **715** and the end portion of the electrode **720**, a width of the electrode **720** may be substantially small.

FIG. **8**A is a perspective view of a housing of an aerosol generating device according to another embodiment. FIG. **8**B is a cross-sectional view of a housing of an aerosol generating device according to another embodiment taken along line A-A'. FIG. **9**A is a perspective view of a housing of an aerosol generating device according to another embodiment. FIG. **9**B is a cross-sectional view of a housing of an aerosol generating device according to another embodiment taken along line A-A'. FIGS. **8**A, **8**B, **9**A, and **9**B may correspond to a specific example of the electrode **620** included in the aerosol generating device **600** of FIG. **6**.

In an embodiment, the electrodes **820** and **920** may have a shape of a plate with a specific curvature. For example, the electrodes **820** and **920** may have curvatures that are less than those of inner circumferential surfaces of housings **810** and **910** and greater than those of outer circumferential surfaces of the housings **810** and **910**. When the electrodes **820** and **920** have shapes of plates with curvatures, all portions (e.g., a central portion, an end portion, etc.) of the electrodes **920** and **920** may be apart from accommodation portions **815** and **915** by a certain distance.

In an embodiment, the electrodes **820** and **920** may be disposed to be apart from the accommodation portions **815** and **915** by a certain distance x and to surround at least a portion of the accommodation portions **815** and **915**. For example, the electrode **820** may be disposed to surround only a region corresponding to a portion (e.g., 25%) of a circumference of the accommodation portion **815**. In another example, the electrode **920** may be disposed to surround a region corresponding to a portion (e.g., 90%) of a circumference of the accommodation portion **915**. However, a region surrounded by the electrode **620** is not limited thereto.

FIG. **10** is a view illustrating an example of the position of an electrode of an aerosol generating device according to another embodiment.

Referring to FIG. **10**, an aerosol generating device **1000** may include a housing **1010** and an electrode **1020**. In an embodiment, the aerosol generating device **1000** may include an accommodation portion into which an aerosol generating article **1005** may be inserted. For example, the housing **1010** may have a shape of a cylinder including an outer circumferential surface and an inner circumferential surface. However, the shape of the housing **1010** is not limited thereto and may be variously modified according to the design of a manufacturer.

In an embodiment, the electrode **1020** may be in contact with a region of the inner circumferential surface of the housing **1010**. In this case, an additional protective layer **1040** may be arranged on the inner circumferential surface of the housing **1010**. The protective layer **1040** may be formed to have a certain thickness x, and the electrode **1020** may be apart from the inner circumferential surface of the protective layer **1040** by a certain distance x.

The protective layer **1040** may be formed of a different material, color or pattern from that of the housing **1010**. For example, the protective layer **1040** may refer to a plating layer, an oxide layer or the like that is formed not to react with the aerosol generating article **1005** or the aerosol generated by the aerosol generating article **1005**.

In an embodiment, the electrode **1020** may be disposed to correspond to, at least partially, a region in which the aerosol generating material **1030** is disposed. For example, the position of the electrode **1020** may correspond to a region in which the aerosol generating material **1030** is disposed as the aerosol generating article **1005** is fully inserted into the accommodation portion of the aerosol generating device **1000**.

FIG. **11**A is a view illustrating an example of the position of an electrode of an aerosol generating device according to another embodiment. FIG. **11**B is a view illustrating an example of the position of an electrode to a heater according to another embodiment. FIGS. **11**A and **11**B may correspond to a specific example of a heater **650** included in the aerosol generating device **600** of FIG. **6**.

Referring to FIGS. **11**A and **11**B, an aerosol generating device **1100** may include a housing **1110**, an electrode **1120**, and a heater **1150**. In an embodiment, a heater **1150** may correspond to a film heater including patterns arranged at regular intervals. For example, the heater **1150** may include a heating pattern **1140** and an electrode **1120**. The heating pattern **1140** may be printed on the heater **1150** having a shape of a film (e.g., a polyimide film). The electrode **1120** may be attached to at least a portion of the heater **1150**.

In an embodiment, the electrode **1120** may be arranged such that the electrode **1120** does not overlap with the heating pattern **1140** of the heater **1150**. For example, the electrode **1120** may be arranged in at least one of the region A (e.g., an outer portion of the heating pattern) and the region B (an inner portion of the heating pattern).

FIG. **12**A is a view illustrating an example of the position of an electrode of an aerosol generating device according to another embodiment. FIG. **12**B is a view illustrating an example of the position of an electrode of an aerosol generating device according to another embodiment. FIGS. **12**A and **12**B may correspond to a specific example of the heater **650** included in the aerosol generating device **600** of FIG. **6**.

Referring to FIGS. **12**A and **12**B, an aerosol generating device **1200** may include a housing **1210**, an electrode **1220**, and a heater.

In an embodiment, a heater may include an internal heating type heater **1230** and an induction coil **1240**. For example, the induction coil **1240** may induce a variable magnetic field to heat the internal heating type heater **1230** of the aerosol generating device **1200**. In this case, the internal heating type heater **1230** may correspond to an example of a susceptor.

In another embodiment, the heater may also include only the induction coil **1240**. For example, the induction coil **1240** may induce the variable magnetic field to heat a susceptor **1250** included in a medium region of an aerosol generating article **1205**.

In an embodiment, the electrode **1220** may be arranged between the inner circumferential surface of the housing **1210** and the induction coil **1240**. In an embodiment, the electrode **1220** may be formed not to affect the variable magnetic field generated from the induction coil **1240**. For example, in order to prevent the intensity of the variable magnetic field generated by the induction coil **1240** from being reduced, the width of the electrode **1220** may be substantially small.

FIG. **13**A is a view illustrating an example of the position of an electrode of an aerosol generating device according to another embodiment. FIG. **13**B is a view illustrating an example of the position of an electrode of an aerosol generating device according to another embodiment. FIGS. **13**A and **13**B may correspond to a specific example of the electrode **620** and the heater **650** included in the aerosol generating device **600** of FIG. **6**.

Referring to FIGS. **13**A and **13**B, the aerosol generating device **1300** may include a housing **1310** and a heater.

In an embodiment, the heater may include an internal heating type heater **1330** and an induction coil **1340**. For example, the induction coil **1340** may induce the variable magnetic field to heat the internal heating type heater **1330** of the aerosol generating device **1300**.

In another embodiment, the heater may also include only the induction coil **1340**. For example, the induction coil **1340** may induce the variable magnetic field to heat the susceptor **1350** included in the medium region of the aerosol generating article **1305**.

In an embodiment, an electrode (e.g., the electrode **620** of FIG. **6**) may be formed integrally with the induction coil **1340**. That is, the induction coil **1340** may heat a heating object (e.g., an internal heating type heater or a susceptor) by inducing the variable magnetic field to perform a sensing function of the electrode. A detailed description of the sensing function of the electrode will be described below with reference to FIG. **15**.

FIG. **14** is a circuit diagram of the electrode of FIGS. **13**A and **13**B.

Referring to FIG. **14**, a processor (e.g., the processor of FIGS. **13**A and **13**B) may include an induction heating controller **1400** and a sensor controller **1410**. In an embodiment, the induction heating controller **1400** may induce the variable magnetic field through the induction coil to heat the heating object (e.g., the internal heating type heater **1330** or the susceptor **1350**). In an embodiment, the sensor controller **1410** may apply power to the induction coil to detect a change in a charging time of the induction coil and to perform a sensing operation.

In an embodiment, the induction coil may be selectively controlled by the induction heating controller **1400** or the sensor controller **1410**.

In an embodiment, the induction coil may perform a heating operation through the induction heating controller **1400**. In this case, connection between the sensor controller **1410** and the induction coil may be broken. For example, when the induction heating controller **1400** induces the variable magnetic field through the induction coil to perform a heating operation, a switch A and a switch C may be switched into an on state, and a switch B and a switch D may be switched into an off state.

In an embodiment, power may be applied to the induction coil through the sensor controller **1410**, and the induction coil may perform a sensing operation. For example, the sensing operation may include at least one of sensing whether an aerosol generating article (e.g., the aerosol generating article **605** of FIG. **6**A) is inserted or removed, sensing an atomization amount generated by the aerosol generating article **605**, and sensing a user's puff. In this case, connection between the induction heating controller **1400** and the induction coil may be broken. For example, when the sensor controller **1410** performs a sensing operation based on a change in a charging time of the induction coil, the switch A and the switch C may be switched into an off state, and the switch B and the switch D may be switched into an on state. In this case, when the induction coil performs the sensing operation through the sensor controller **1410**, one end of a circuit may be opened to serve as a ground GND terminal. When the switch C is switched into the off state, one end of the induction coil may be opened to serve as a ground GND terminal.

FIG. **14** illustrates that the sensor controller **1410** and the induction coil are connected to each other via two lines. However, embodiments are not limited thereto. In another embodiment, the sensor controller **1410** and the induction coil may also be connected via only one line including the switch B.

FIG. **15** is a block diagram of an aerosol generating device according to an embodiment.

Referring to FIG. **15**, an aerosol generating device **1500** may include an electrode **1510**, a battery **1520**, a processor **1530**, and a heater **1540**.

In the electrode **1510**, when a change caused by an aerosol generating article occurs, a charge amount may be changed. For example, the change caused by the aerosol generating article may include insertion and removal of the aerosol generating article, generation of aerosol caused by the aerosol generating article, and removal of aerosol by the user's puff

In an embodiment, when the aerosol generating article is inserted into the aerosol generating device **1500** and is disposed close to the electrode **1510**, the charge amount of the electrode **1510** may be changed according to permittivity ε of components included in the aerosol generating article. Permittivity that is a characteristic value indicating electrical characteristics of a nonconductor may refer to the degree of polarization generated with respect to an external electric field. In this case, even when the inserted aerosol generating article is removed, the charge amount of the electrode **1510** may be changed.

For example, the aerosol generating article may be a cigarette. In this case, the cigarette may include a wrapping material (e.g., an external wrapper, an internal wrapper, etc.) having a certain amount of moisture or hygroscopic moisture, and may also include a solid state smokeable material (e.g., a tobacco leaf, a granular tobacco material etc.) included in a medium portion. In this case, because the permittivity of moisture (H_2O) is about 80 times higher than the permittivity of air, the electrode **1510** may be affected by insertion of the cigarette even though the wrapping material and the smokeable material include a small amount of moisture.

As another example, when the aerosol generating article is a cartridge including a liquid state smokeable material, the electrode **1510** may be affected by insertion of the cartridge because the liquid has high permittivity.

In an embodiment, as the aerosol generating article is inserted into the aerosol generating device **1500**, the aerosol generating article is disposed close to the electrode **1510**, and thus the charge amount of the electrode **1510** may be reduced. In an embodiment, when the aerosol generating article is far away from the electrode **1510** as the aerosol generating article is removed from the aerosol generating device **1500**, the charge amount of the electrode **1510** may be increased.

In an embodiment, the processor **1530** may determine whether the aerosol generating article is inserted or removed by using the permittivity of components included in the aerosol generating article. Thus, the material of the aerosol generating article may be variously changed. In an aerosol generating device according to the related art, the insertion of the aerosol generating article has been determined through a wrapping paper of the aerosol generating article or an aluminum thin paper included in the wrapping paper. However, the aerosol generating device according to the present invention may detect insertion or removal of the aerosol generating article even when the aluminum thin paper is not included in the aerosol generating article. Therefore, the material of the wrapping paper may be variously changed.

In an embodiment, an aerosol is generated as the aerosol generating article is heated, the charge amount of the electrode **1510** may be changed according to the permittivity of aerosol.

For example, when the aerosol generating article is heated by the heater **1540**, the aerosol having uniform moisture may be generated. In this case, because the permittivity of aerosol is about 80 times higher than the permittivity of air, the electrode **1510** may be affected by the aerosol.

In an embodiment, when the aerosol is generated as the aerosol generating article is heated, the charge amount of the electrode **1510** may be reduced. In an embodiment, when the aerosol generated as the aerosol generating article is heated is removed by the user's puff, the charge amount of the electrode **1510** may be increased.

In an embodiment, a processor **1530** may determine the generation amount of aerosol and the user's puff by using the permittivity of aerosol generated as the aerosol generating article is heated. Thus, the aerosol generating device **1500** may provide a uniform atomization amount and may detect the user's puff without an additional sensor module (e.g., a puff detection sensor).

The battery **1520** may supply power required for operating the aerosol generating device **1500**. For example, the battery **1520** may supply power so that the processor **1530** may detect a change in the charge amount in the electrode **1510**. Also, the battery **1520** may supply power required for operations of other hardware components, for example, various sensors (not shown), a user interface (not shown), and a memory (not shown), included in the aerosol generating device **1500**. The battery **1520** may be a chargeable battery or disposable battery. For example, the battery **1520** may be a lithium polymer (LiPoly) battery. However, embodiments are not limited thereto.

The processor **1530** may control the overall operation of the aerosol generating device **1500**. For example, the processor **1530** may control operations of other components included in the aerosol generating device **1500** in addition to the battery **1520**. Also, the processor **1530** may check each of the components of the aerosol generating device **1500**, thereby determining whether the aerosol generating device **1500** is in an operable state.

In an embodiment, the processor **1530** may detect a change caused by an aerosol generating article based on the voltage of the electrode **1510**. For example, the processor **1530** may determine a change in the charging time of the electrode **1510** through an output voltage V_{out} and an input voltage V_{in} of the electrode **1510**. The processor **1530** may detect a change caused by the aerosol generating article based on a change in the charging time of the electrode **1510**. A method of checking the voltage of the electrode **1510** by using the processor **1530** will be described in detail below with reference to FIGS. **17**A, **17**B, **18**A and **18**B.

FIGS. **16**A and **16**B are views illustrating examples of a method for determining the type of an aerosol generating article by using an electrode of an aerosol generating device according to an embodiment. The aerosol generating device **1600** of FIGS. **16**A and **16**B may correspond to the aerosol generating device **1500** of FIG. **15**.

Referring to FIGS. **16**A and **16**B, different types of aerosol generating articles may be inserted into the aerosol generating device **1600** through an inner circumferential surface of a housing **1610**. For example, a first aerosol generating article **1650** may have a larger area including a tobacco material than a second aerosol generating article **1660**. In this case, the tobacco material may include at least one of a solid state tobacco material and a liquid state tobacco material, and may be in the form of a granule, a capsule, or the like.

In an embodiment, when the aerosol generating article is inserted, the processor **1630** may determine the type of the aerosol generating article through the electrode **1620**.

For example, the first aerosol generating article **1650** may include more moisture according to the tobacco material than the second aerosol generating article **1660**. When the aerosol generating article is inserted, if the charge amount of the electrode **1620** is further reduced, the processor **1630** may determine that the first aerosol generating article **1650** is inserted. The processor **1630** may store the charge reduction amount of the electrode **1620** according to the type of the aerosol generating article in a memory (not shown).

However, this is just an example, and the second aerosol generating article **1660** may include more moisture according to the tobacco material than the first aerosol generating article **1650**, depending on composition ratios of tobacco materials included in the first aerosol generating article **1650** and the second aerosol generating article **1660**.

FIG. **17**A and FIG. **17**B are graphs for describing a method of detecting a method, by which a processor according to an embodiment detects a change in a charging time of an electrode.

Referring to FIG. **17**A, a processor (e.g., the processor **1630** of FIGS. **16**A and **16**B) may be connected to an electrode (e.g., the electrode **1620** of FIGS. **16**A and **16**B) via one line. In an embodiment, the processor **1630** may apply an output voltage to the electrode **1620** at a certain period so as to charge the electrode **1620**. In this case, the output voltage may be adjusted by using a pulse width modulation (PWM) method. For example, the processor **1630** may apply the output voltage to the electrode **1620** every 50 ms so as to charge the electrode **1620**.

In an embodiment, the processor **1630** may detect an input voltage input from the electrode **1620** after applying the output voltage to the electrode **1620** at a preset number of times (e.g., twice). For example, a voltage value of the output voltage may be in a range of about 2.8 V to about 3.3 V. In another example, the voltage value of the output voltage may be about 5 V. In this case, when the input voltage input from the electrode **1620** is maintained as a reference voltage V_{ref}, it may be determined that an event (e.g., insertion of the aerosol generating article, the user's puff, etc.) did not occur. The number of times the processor **1630** applies the output voltage may be variously modified according to a design of a manufacturer.

Referring to FIG. **17**B, the processor **1630** may determine whether an event occurs by detecting a change in the input voltage input from the electrode **1620**. For example, when the input voltage input from the electrode **1620** is detected to be lower than the reference voltage V_{ref}, the processor **1630** may detect (**1700**) the occurrence of the event. For example, when the input voltage input from the electrode **1620** is first detected to be lower than the reference voltage V_{ref}, the processor **1630** may determine that an event in which the aerosol generating article is inserted has occurred.

In an embodiment, after the input voltage dropped below the reference voltage V_{ref} according to the occurrence of the event, as the processor **1630** applies an output voltage to the electrode **1620** at a certain period, the input voltage may reach the reference voltage V_{ref}.

FIG. **18**A and FIG. **18**B are graphs for describing a method, by which a processor according to another embodiment detects a change in a charging time of an electrode.

Referring to FIG. **18**A, the processor **1630** and the electrode **1620** may be connected to each other via at least two lines. For example, the at least two lines may include a line for applying an output voltage so that the processor **1630** charges the electrode **1620**, and a line for applying an input voltage to the processor **1630** so as to transmit the charging state of the electrode **1620**.

In an embodiment, the processor **1630** may apply the output voltage to the electrode **1620** at a certain period. In this case, the output voltage may be adjusted by using a PWM method. For example, the processor **1630** may apply the output voltage to the electrode **1620** every 50 ms so as to charge the electrode **1620**. Referring to FIG. **18**B, the processor **1630** may apply the output voltage to the electrode **1620** and simultaneously detect the input voltage input from the electrode **1620**. For example, when checking the charging state of the electrode **1620**, the processor **1630** may detect the input voltage without stopping output of the output voltage for charging the electrode **1620**.

However, FIG. **18**A and FIG. **18**B are just an example, and even when the processor **1630** and the electrode **1620** are connected to each other via two or more lines, the processor **1630** may stop output of the output voltage when detecting the input voltage input from the electrode **1620**.

FIG. **19**A is a graph for describing a charging time of an electrode of an aerosol generating device according to an embodiment.

Referring to FIG. **19**A, when an aerosol generating article (e.g., the aerosol generating article **605** of FIG. **6**) is inserted into an aerosol generating device (e.g., the aerosol generating device **600** of FIG. **6**) and the aerosol generating article **605** is removed after the user's puff is performed, a change in a charging time of the electrode (e.g., the electrode **620** of FIG. **6**) may be classified into an (i) segment, an (ii) segment, and an (iii) segment.

In an embodiment, the processor (e.g., the processor **1530** of FIG. **15**) may detect insertion of the aerosol generating article **605** based on the charging time of the electrode **620** in the (i) segment. In an embodiment, the processor **1530** may detect and count the user's puff based on the charging time of the electrode **620** in the (ii) segment and may control the heating temperature of the heater (e.g., the heater **1540** of FIG. **15**). In an embodiment, the processor **1530** may detect removal of the aerosol generating article **605** based on the charging time of the electrode **620** in the (iii) segment and may control a cleaning operation of the heater **1540**. A detailed operation of a processor in each segment will be described below with reference to FIGS. **20** through **33**B.

FIG. **19**B is a graph showing a discharging time of the electrode in FIG. **19**A.

Referring to FIG. **19**B, when an aerosol generating article (e.g., the aerosol generating article **605** of FIG. **6**) is inserted into an aerosol generating device (e.g., the aerosol generating device **600** of FIG. **6**) and the aerosol generating article **605** is removed after the user's puff is performed, a change in a discharging time of the electrode (e.g., the electrode **620** of FIG. **6**) may be classified into an (i) segment, an (ii) segment, and an (iii) segment.

In an embodiment, a processor (e.g., the processor **1530** of FIG. **15**) may detect insertion of the aerosol generating article **605** based on the discharging time of the electrode **620** in the (i) segment. In an embodiment, the processor **1530** may detect the user's puff and count based on the discharging time of the electrode **620** in the (ii) segment and may control the heating temperature of a heater (e.g., the heater **1540** of FIG. **15**). In an embodiment, the processor **1530** may detect removal of the aerosol generating article **605** based on the discharging time of the electrode **620** in the (iii) segment and may control a cleaning operation of the heater **1540**.

The graph showing the discharging time of the electrode in FIG. **19**B is the vertical flip of a graph showing the charging time of the electrode in FIG. **19**A, but embodiments are not limited thereto.

FIG. **20** is a flowchart illustrating a case where an aerosol generating device according to an embodiment detects insertion of an aerosol generating article. The flowchart of FIG. **20** may correspond to an operation of a processor in the (i) segment of FIG. **19**.

Referring to FIG. **20**, the processor (e.g., the processor **1530** of FIG. **15**) may obtain at least one of a charging time and a discharging time of the electrode (e.g., the electrode **1510** of FIG. **15**) in operation **2001**. In an embodiment, the processor **1530** may obtain the charging time of the electrode **1510** based on an input voltage (e.g., the input voltage in FIGS. **17**A, **17**B, **18**A and **18**B) input from the electrode **1510**. For example, the charging time of the electrode **1510** may refer to a time taken for the charging voltage of the electrode **1510** to reach a preset reference voltage (e.g., the reference voltage V_{ref} in FIGS. **17**A, **17**B, **18**A and **18**B). In another embodiment, the processor **1530** may obtain the discharging time of the electrode **1510** based on the input voltage input from the electrode **1510**. For example, the discharging time of the electrode **1510** may refer to a time taken for the charging voltage of the electrode **1510** to reach 0 V.

According to an embodiment, the processor **1530** may determine whether the charging time of the electrode is longer than a designated first charging time, or the discharging time of the electrode is shorter than a designated first discharging time in operation **2003**. For example, the designated first charging time and the designated first discharging time may refer to a charging time and a discharging time, respectively, which are taken for the charging voltage of the electrode **1510** to reach the preset reference voltage V_{ref} after having dropped by insertion of the aerosol generating article.

According to an embodiment, if the charging time of the electrode is longer than the designated first charging time or the discharging time of the electrode is shorter than the designated first discharging time, the processor **1530** may detect insertion of the aerosol generating article in operation **2005**. According to an embodiment, when the charging time of the electrode is shorter than the designated first charging time or the discharging time of the electrode is longer than the designated first discharging time, the processor **1530** may go back to operation **2001**.

According to an embodiment, the processor **1530** may supply power to the heater **1540** so as to preheat a heater (e.g., the heater **1540** of FIG. **15**) in operation **2007**. For example, when insertion of the aerosol generating article is detected, the processor **1530** may supply power to the heater **1540** so as to perform an automatic start function of the aerosol generating device (e.g., the aerosol generating device **1500** of FIG. **15**). In this case, the heater **1540** may be controlled to heat in the range of about 220° C. to about 230° C., about 290° C. to about 300° C., or about 330° C. to about 340° C. However, the range of a preheating temperature is illustrative and may be variously changed according to the design of the manufacturer.

FIG. **21** is a graph showing a charging time of an electrode that varies as an aerosol generating article is inserted into an aerosol generating device according to an embodiment.

Referring to FIG. **21**, a time segment in which it is determined whether an aerosol generating article is inserted into an aerosol generating device (e.g., the aerosol generating device **1500** of FIG. **15**) may be classified into a first segment **2100**, a second segment **2110**, and a third segment **2120**. The first segment **2100** may correspond to a segment in which the aerosol generating article waits before being inserted into the aerosol generating device. The second segment **2110** may correspond to a segment in which the aerosol generating article is prepared to be preheated immediately after the aerosol generating article is inserted into the aerosol generating device. The third segment **2120** may correspond to a segment in which the aerosol generating article is preheated.

According to an embodiment, a charging time required to charge an electrode (e.g., the electrode **1510** of FIG. **15**) in the first segment **2100** may be substantially uniform. Even when the electrode **1510** does not include an additional discharging circuit, the electrode **1510** may be continuously discharged. Thus, the electrode **1510** may require a uniform charging time to make up for the charge amount lost as the electrode **1510** is continuously discharged. Thus, the processor (e.g., the processor **1530** of FIG. **15**) of the aerosol generating device may apply a uniform voltage to the electrode **1510** continuously.

In an embodiment, the charging time of the electrode may be increased at a time point **2130** at which the aerosol generating article is inserted into the aerosol generating device. In this case, the charging time of the electrode may be rapidly increased. In an embodiment, when a charging time **2150** of the electrode **1610** is longer than the designated first charging time **2140**, the processor **1530** may determine that the aerosol generating article is inserted, and may control the heater (e.g., the heater **1540** of FIG. **15**) to be preheated.

According to an embodiment, while it is prepared to preheat the aerosol generating article in the second segment **2110**, the charging time of the electrode **1510** may be changed only within a certain range. According to an embodiment, while the aerosol generating article is preheated in the third segment **2120**, the charging time of the electrode **1510** may be gradually increased.

FIG. **22**A illustrates a state before an aerosol generating article is inserted into an aerosol generating device according to an embodiment. FIG. **22**B illustrates a state after an aerosol generating article is inserted into an aerosol generating device according to an embodiment.

Referring to FIGS. **22**A and **22**B, an aerosol generating device **2200** may include a housing **2201**, an electrode **2210**, a battery **2220**, a processor **2230**, and a heater **2260**.

The electrode **2210** of FIG. **22**A may include positive (+) charges of a first charge amount. Thereafter, when the aerosol generating article **2205** is inserted into an accommodation portion **2203** corresponding to an inner circumferential surface of the housing **2201**, the electrode **2210** of FIG. **22**B may lose some of the positive (+) charges taken by moisture of components (e.g., a tobacco material **2207**, an external wrapper, etc.) included in the aerosol generating article **2205**. Thus, the electrode **2210** of FIG. **22**B may include positive (+) charges of a second charge amount that is less than the first charge amount.

As shown in FIG. **22**B, when the positive (+) charges of the electrode **2210** are decreased from the first charge amount to the second charge amount, the charging time of the electrode **2210** may be increased. The processor **2230** may detect that the charging time of the electrode **2210** of FIG. **22**B is increased based on the input voltage input from the electrode **2210**.

In an embodiment, the processor **2230** may determine that the aerosol generating article **2205** is inserted, when detecting that the charging time of the electrode **2210** is increased. In another embodiment, the processor **2230** may determine that the charging voltage of the electrode **2210** is decreased based on the fact that the charging time of the electrode **2210** is increased, and may determine that the aerosol generating article **2205** is inserted based on the decreased charging voltage.

In an embodiment, when it is determined that the aerosol generating article **2205** is inserted, the processor **2230** may apply power to the heater **2260** from the battery **2220**. In this case, the heater **2260** may be an internal heating type heater. However, the heater **2260** is not limited thereto and may include at least one of an external heating type heater, an induction coil, and a susceptor.

FIG. **23** is a flowchart illustrating a case where an aerosol generating device according to an embodiment detects the user's puff. The flowchart of FIG. **23** may correspond to a first operation of the processor in the (ii) segment of FIG. **19**.

Referring to FIG. **23**, a processor (e.g., the processor **1530** of FIG. **15**) may obtain at least one of a change in a charging time and a change in a discharging time of the electrode (e.g., the electrode **1510** of FIG. **15**) in operation **2301**. In an embodiment, the processor **1530** may detect a change in the amount of aerosol generated by a heater (e.g., the heater **1540** of FIG. **15**) based on a change in the charging time or a change in the discharging time of the electrode. For example, the processor **1530** may obtain the change in the charging time of the electrode **1510** based on the input voltage (e.g., the input voltage in FIGS. **17**A, **17**B, **18**A and **18**B) input from the electrode **1510**. When the charging time to the electrode **1510** is decreased within a certain time, the processor **1530** may determine that the aerosol generated by the heater **1540** has been removed.

According to an embodiment, the processor **1530** may determine whether a change gradient in the charging time of the electrode **1510** is a negative value or a change gradient in the discharging time of the electrode **1510** is a positive value in operation **2303**. For example, when the change gradient in the charging time of the electrode **1510** is a negative value or a change gradient in the discharging time of the electrode **1510** is a positive value, the processor **1530** may determine that the aerosol generated by the heater **1540** is decreased by the user's puff.

According to an embodiment, when the change gradient in the charging time of the electrode **1510** is a negative value or a change gradient in the discharging time of the electrode **1510** is a positive value, the processor **1530** may detect the user's puff in operation **2305**. According to an embodiment, when the change gradient in the charging time of the electrode **1510** is 0 or more or the change gradient in the discharging time of the electrode **1510** is 0 or less, the processor **1530** may go back to operation **2301**.

According to an embodiment, when the user's puff is detected, the processor **1530** may supply power to the heater **1540** so as to generate the aerosol in operation **2307**. For example, the processor **1530** may supply certain power to the heater **1540** so as to generate the amount of aerosol decreased by the user's puff.

FIG. **24** is a graph showing a charging time of an electrode that varies as the user's puff is detected in an aerosol generating device according to an embodiment.

Referring to FIG. **24**, a processor (e.g., the processor **1530** of FIG. **15**) may obtain data on the user's puff by monitoring the charging time of the electrode (e.g., the electrode **1510** of FIG. **15**).

In an embodiment, the processor **1530** may detect the user's puff based on the change in the charging time of the electrode **1510**.

In an embodiment, when the change gradient in the charging time of the electrode **1510** is a negative value, the processor **1530** may detect the user's first puff. For example, when detecting the change gradient in the charging time of the electrode **1510** is switched from 0 to a negative value, the processor **1530** may determine that the user's first puff starts at the time point **2400**. When detecting the change gradient in the charging time of the electrode **1510** is switched from the negative value to 0, the processor **1530** may determine that the user's first puff is terminated at the time point **2410**. In another example, when the change gradient in the charging time of the electrode **1510** is maintained at a negative value for the certain time, the processor **1530** may determine that the certain time is a user's first puff segment.

In another embodiment, when a change **2405** in the charging time of the electrode **1510** exceeds a designated change amount or more, the processor **1530** may detect the user's first puff. For example, when the designated change amount is 0.5 seconds and the change **2405** in the charging time of the electrode **1510** is 0.8 seconds, the processor **1530** may determine that the user's puff has occurred. On the other hand, the processor **1530** may also detect the user's puff through a change in a charging voltage. That is, when the charging voltage of the electrode **1510** is increased by the designated change amount or more, the processor **1530** may detect the user's first puff.

In an embodiment, the charging time of the electrode **1510** may gradually increase from the time point **2410** at which the first puff is terminated to the time point **2420** at which a second puff starts. For example, when the user's first puff is terminated, the aerosol may be generated from the aerosol generating article before the next puff starts, and thus a capacitance of the electrode **1510** may be changed due to the generated aerosol. As the capacitance of the electrode **1510** is changed, the charging time of the electrode **1510** may gradually increase from the time point **2410** at which the first puff is terminated to the time point **2420** at which the second puff starts being performed, and thus a change gradient in the charging time of the electrode **1510** may be a positive value.

In an embodiment, when the change gradient in the charging time of the electrode **1510** is a negative value, the processor **1530** may detect the user's second puff. For example, when the processor **1530** detects that the change gradient in the charging time of the electrode **1510** after the time point **2410** at which the first puff is terminated is switched from 0 into a negative value, the processor **1530** may determine that the user's second puff starts at the time point **2420**. When the processor **1530** detects that the change gradient in the charging time of the electrode **1510** is switched from the negative value to 0, the processor **1530** may determine that the detection time point to be a time point **2430** at which the user's second puff is terminated. In another example, when a change gradient in the charging time of the electrode **1510** is maintained at a negative value for a certain time, the processor **1530** may detect the certain time to be the user's second puff segment.

FIG. **25**A illustrates a state before the user's puff is detected in an aerosol generating device according to an embodiment. FIG. **25**B illustrates a state after the user's puff is detected in an aerosol generating device according to an embodiment.

Referring to FIGS. **25**A and **25**B, an aerosol generating device **2500** may include a housing **2501**, an electrode **2510**, a battery **2520**, a processor **2530**, and a heater **2560**.

The electrode **2510** of FIG. **25**A may lose positive (+) charges by moisture of a component (e.g., a tobacco material **2507**) included in an aerosol generating article **2505**. For example, the aerosol may be generated as the aerosol generating article **2505** is heated by the heater **2560**, and the electrode **2510** of FIG. **25**A may lose positive (+) charges by the generated aerosol and may include positive (+) charges of a first charge amount. Thereafter, when the generated aerosol is removed by the user's puff **2550**, the electrode **2510** of FIG. **25**B may include positive (+) charges of a second charge amount that is greater than the first charge amount.

As shown in FIG. **25**B, when the positive (+) charges of the electrode **2510** are increased from the first charge amount to the second charge amount, the charging time of the electrode **2510** may be decreased. The processor **2530** may detect that the charging time of the electrode **2510** of FIG. **25**B is decreased based on the input voltage input from the electrode **2510**.

In an embodiment, the processor **2530** may determine that the user's puff **2550** has occurred, when detecting that the charging time of the electrode **2510** is decreased. In another embodiment, the processor **2530** may determine that the charging voltage of the electrode **2510** is increased based on a reduction in the charging time of the electrode **2510** and may also determine that the user's puff **2550** has occurred based on the increased charging voltage.

In an embodiment, the processor **2530** may count the number of the user's puff **2550**. In this case, when the number of counted puffs exceeds a maximum number of puffs preset for the aerosol generating article **2505**, the processor **2530** may limit the supply of power to the heater **2560**. For example, when the maximum number of puffs preset for the aerosol generating article **2505** is 15 times and the current number of counted puffs is 5 times, the processor **2530** may supply power so as to heat the aerosol generating article **2505** by using the heater **2560**. In another example, when the maximum number of puffs preset for the aerosol generating article **2505** is 15 times and the current number of counted puffs is 16 times, the processor **2530** may limit the supply of power to the heater **2560** so as to stop heating of the aerosol generating article **2505** by the heater **2560**.

FIG. **26** is a flowchart illustrating a case where power supplied to a heater is controlled by an aerosol generating device according to an embodiment. The flowchart of FIG. **26** may correspond to a second operation of the processor in the (ii) segment of FIG. **19**.

Referring to FIG. **26**, the processor (e.g., the processor **1530** of FIG. **15**) may obtain at least one of a charging time and a discharging time of the electrode (e.g., the electrode **1510** of FIG. **15**) in operation **2601**. In an embodiment, the processor **1530** may obtain the charging time of the electrode **1510** based on the input voltage (e.g., the input voltage in FIGS. **17**A, **17**B, **18**A and **18**B) input from the electrode **1510**. For example, the charging time of the electrode **1510** may refer to a charging time taken for the charging voltage of the electrode **1510** to reach a preset reference voltage (e.g., the reference voltage V_{ref} in FIGS. **17**A, **17**B, **18**A and **18**B). In another embodiment, the processor **1530** may obtain the charging time of the electrode **1510** based on the input voltage input from the electrode **1510**. For example, the discharging time of the electrode **1510** may refer to a discharging time taken for the charging voltage of the electrode **1510** to reach 0 V.

According to an embodiment, the processor **1530** may determine whether the charging time of the electrode **1510** is longer than a designated second charging time or whether the discharging time of the electrode **1510** is shorter than a designated second discharging time in operation **2603**. For example, the designated second charging time and the designated second discharging time may refer to a charging time and a discharging time, respectively, which are taken for the charging voltage of the electrode **1510** to reach a certain voltage with which the aerosol generating article may be heated and generate a reference atomization amount of aerosol. In this case, the reference atomization amount may refer to a reference generation amount that is determined such that a uniform aerosol amount is provided to the user by the aerosol generating article.

According to an embodiment, when the charging time of the electrode is longer than the designated second charging time or the discharging time of the electrode is shorter than the designated second discharging time, the processor **1530** may supply first power that is lower than reference power to the heater **1540** in operation **2605**. According to an embodiment, when the charging time of the electrode is not longer than the designated second charging time or the discharging time of the electrode is not shorter than the designated second discharging time, the processor **1530** may determine whether the charging time of the electrode is shorter than the second charging time or whether the discharging time of the electrode is longer than the designated second discharging time in operation **2607**. According to an embodiment, when the charging time of the electrode is shorter than the designated second charging time or the discharging time of the electrode is longer than the designated second discharging time, the processor **1530** may supply second power that is higher than reference power to the heater in operation **2609**. According to an embodiment, when the charging time of the electrode is equal to the designated second charging time or the discharging time of the electrode is equal to the designated second discharging time, the processor **1530** may terminate an operation without supplying power to the heater **1540**.

For example, the processor **1530** may supply reference power to the heater **1540** so that aerosol may be generated from the aerosol generating article. In this case, the heating temperature of the heater **1540** to which reference power is supplied may be 250° C.

The processor **1530** may obtain the charging time or the discharging time of the electrode, and may determine whether the obtained charging time of the electrode is longer than the designated second charging time or whether the discharging time of the electrode is shorter than the designated second discharging time. When the obtained charging time of the electrode is longer than the designated second charging time or the discharging time of the electrode is shorter than the designated second charging time, the processor **1530** may control power supplied to the heater **1540** so as to lower the heating temperature of the heater **1540**. That is, the processor **1530** may determine that the amount of generated aerosol is greater than the reference atomization amount, and may set power supplied to the heater **1540** to be first power that is lower than the reference power so as to lower the heating temperature of the heater **1540** from 250° C. to 230° C.

When the obtained charging time of the electrode is shorter than the designated second charging time or the discharging time of the electrode is longer than the designated second discharging time, the processor **1530** may control power supplied to the heater **1540** so as to increase the heating temperature of the heater **1540**. That is, the processor **1530** may determine that the amount of generated aerosol is less than the reference atomization amount, and may set power supplied to the heater **1540** to be second power that is higher than the reference power so as to increase the heating temperature of the heater **1540** from 250° C. to 270° C.

FIG. **27** is a graph illustrating power supplied to a heater that is controlled based on a charging time of an electrode in an aerosol generating device according to an embodiment.

Referring to FIG. **27**, a processor (e.g., the processor **1530** of FIG. **15**) may control power supplied to a heater (e.g., the heater **1540** of FIG. **15**) so that the uniform amount of aerosol is generated from the aerosol generating article.

In an embodiment, the processor **1530** may detect the charging time of an electrode that is shorter than the designated second charging time in a first segment **2700**. In this case, the processor **1530** may determine that the amount of aerosol generated from the aerosol generating article is less than the reference atomization amount, based on the detected charging time of the electrode. Thus, the processor **1530** may supply first power **2730** that is higher than the reference power to the heater **1540** so that the amount of aerosol may reach the reference atomization amount in the first segment **2700**. As the power supplied to the heater **1540** is set to be the first power **2730**, the charging time of the electrode may be gradually increased and may reach (**2705**) the designated second charging time. Then, the charging time of the electrode may exceed the designated second charging time after reaching (**2705**) the designated second charging time.

In this case, the processor **1530** may supply second power **2740** that is lower than the reference power to the heater **1540** so that the amount of aerosol may reach the reference atomization amount in a second segment **2710**. As the power supplied to the heater **1540** is set to be second power **2740**, the charging time of the electrode may be gradually decreased and may reach (**2715**) the designated second charging time. Then, the charging time of the electrode may become less than the designated second charging time after reaching (**2715**) the designated second charging time.

In this case, the processor **1530** may supply third power **2750** that is higher than the reference power and lower than the first power **2730** to the heater **1540** so that the amount of aerosol may reach the reference atomization amount in a third segment **2720**. As power supplied to the heater **1540** is set to be the third power **2750**, the charging time of the electrode may be gradually increased.

In an embodiment, from the first segment **2700** to the third segment **2720**, a difference between the amount of generated aerosol and the reference atomization amount may be gradually decreased. That is, as the processor **1530** controls the power supplied to the heater **1540** based on the charging time of the electrode, the amount of generated aerosol may converge to the reference atomization amount.

FIG. **28** is a block diagram of an aerosol generating device according to another embodiment.

Referring to FIG. **28**, an aerosol generating device **2800** may include an electrode **2810**, a battery **2820**, a processor **2830**, a heater **2840**, and a memory **2850**. The electrode **2810**, the battery **2820**, the processor **2830**, and the heater **2840** of FIG. **28** may correspond to the electrode **2510**, the battery **1520**, the processor **1530**, and the heater **1540** of FIG. **15**, respectively. Thus, a redundant description therewith may be omitted.

In an embodiment, the processor **2830** may store data on the user's smoking pattern in the memory **2850**. For example, data on the user's smoking pattern may include at least one of data on the user's puff period and data on the user's puff time (i.e., an inhalation time).

In an embodiment, the processor **2830** may obtain the data on the user's smoking pattern from the memory **2850**, thereby setting a reference atomization amount for the aerosol generating article. The processor **2830** may control power supplied to the heater **2840** so that the amount of aerosol may reach the reference atomization amount set based on the data on the user's smoking pattern.

In an embodiment, the processor **2830** may obtain data on the user's puff period from the memory **2850**. When a second puff will start after a first puff has occurred may be determined based on the obtained data on the user's puff period. Thus, after the first puff has occurred, the processor **2830** may control power supplied to the heater **2840** so that aerosol of the reference atomization amount may be generated from the aerosol generating article before the second puff starts.

In an embodiment, the processor **2830** may obtain data on the user's puff time (i.e., an inhalation time) from the memory **2850**. The reference atomization amount on the amount of aerosol may be set based on the obtained data on the user's puff time (i.e., the inhalation time). Thus, the processor **2830** may control power supplied to the heater **2840** so that aerosol of the reference atomization amount may be generated from the aerosol generating article.

In an embodiment, the processor **2830** may monitor the charging time of the electrode **2810** and may obtain puff data relating to the user's puff based on the result of monitoring. For example, the puff data relating to the user's puff may refer to puff data updated from the user's existing puff data. The processor **2830** may store "5.5 seconds" to the user's existing puff period in the memory **2850**. Thereafter, as a result of monitoring of the charging time of the electrode **2810**, when the user's puff period is changed to "7 seconds", the processor **2830** may reflect updated puff data "user's puff period=7 seconds" on the data on the user's smoking pattern and store the updated puff data in the memory **2850**.

FIG. **29** is a graph showing a charging time of an electrode that varies according to the user's smoking pattern according to an embodiment.

Referring to FIG. **29**, a processor (e.g., the processor **2830** of FIG. **28**) may monitor the charging time of an electrode (e.g., the electrode **2810** of FIG. **28**) to obtain data on the user's puff period and to store the obtained data on the user's puff period in the memory **2850**. For example, when a first user **2900** smokes through an aerosol generating device (e.g., the aerosol generating device **2800** of FIG. **28**), the processor **2830** may obtain a first puff period **2905** as data on the puff period of the first user **2900**. In another example, when the second user **2910** smokes through the aerosol generating device **2800**, the processor **2830** may obtain a second puff period **2915** that is longer than the first puff period **2905** as data on the puff period of the second user **2910**.

If aerosol of the same reference atomization amount is to be provided to the first user **2900** and the second user **2910** having different puff periods, the processor **2830** may control power supplied to a heater (e.g., the heater **2840** of FIG. **28**) based on the user's puff period.

For example, the processor **2830** may control power supplied to the heater **2840** to be first power so that aerosol of the reference atomization amount may be generated for a first puff period **2905** (e.g., 5 seconds) from a time point at which the puff of the first user **2900** starts. In another example, the processor **2830** may control power supplied to the heater **2840** to be second power that is lower than the first power, so that aerosol of the reference atomization amount may be generated for a second puff period **2915** (e.g., 8 seconds) from a time point at which the puff of the second user **2910** starts.

FIG. **30** is a graph illustrating a charging time of an electrode that varies according to a user's smoking pattern according to another embodiment.

Referring to FIG. **30**, a processor (e.g., the processor **2830** of FIG. **28**) may monitor the charging time of an electrode (e.g., the electrode **2810** of FIG. **28**) to obtain data on the user's puff time (i.e., an inhalation time) and to store the obtained data on the user's puff time in a memory (e.g., the memory **2850** of FIG. **28**). For example, when the first user **3000** smokes for a first puff period **3020** through an aerosol generating device (e.g., the aerosol generating device **2800** of FIG. **28**), the processor **2830** may obtain a first puff time **3005** as data on a puff time of the first user **3000**. In another example, when the second user **3010** smokes for the first puff period **3020** through the aerosol generating device **2800**, the processor **2830** may obtain a second puff time **3015** as data on a puff time of the second user **3010**.

When aerosol of the same atomization amount is to be provided to the first user **3000** and the second user **3010** having different puff times (i.e., inhalation times), the processor **2830** may set a reference atomization amount based on the user's puff time. For example, for the first user **3000** who inhales the aerosol for the first puff time **3005** (e.g., 1 second) at the first puff period **3020**, the processor **2830** may set a reference atomization amount on the first user **3000** to be a first reference atomization amount. In another example, for the second user **3010** who inhales the aerosol for the second puff time **3015** that is longer than the first puff time **3005** at the first puff period **3020**, the processor **2830** may set a reference atomization amount on the second user **3010** to be a second reference atomization amount that is less than the first reference atomization amount.

As the reference atomization amount is set based on the user's puff time, the maximum number of puffs (e.g., 15 times) of the aerosol generating article may be equally provided to users having different puff times.

FIG. **31** is a flowchart illustrating a case where an aerosol generating device according to an embodiment detects the removal of an aerosol generating article. The flowchart of FIG. **31** may correspond to an operation of a processor in the (iii) segment of FIG. **19**.

Referring to FIG. **31**, a processor (e.g., the processor **1530** of FIG. **15**) may obtain at least one of a charging time and a discharging time of an electrode (e.g., the electrode **1510** of FIG. **15**) in operation **3101**. In an embodiment, the processor **1530** may obtain the charging time of the electrode **1510** based on the input voltage (e.g., the input voltage in FIGS. **17**A, **17**B, **18**A and **18**B) input from the electrode **1510**. For example, the charging time of the electrode **1510** may refer to a time taken for the charging voltage of the electrode **1510** to reach a preset reference voltage (e.g., the reference voltage V_{ref} in FIGS. **17**A, **17**B, **18**A and **18**B). In another embodiment, the processor **1530** may obtain the discharging time of the electrode **1510** based on the input voltage input from the electrode **1510**. For example, the discharging time of the electrode may refer to a time taken for the charging voltage of the electrode **1510** to reach 0 V.

According to an embodiment, the processor **1530** may determine whether the charging time of the electrode is shorter than a designated third charging time or whether the discharging time of the electrode is longer than a designated third discharging time in operation **3103**. For example, the designated third charging time and the designated third discharging time may refer to a charging time and a discharging time, respectively, which are taken for the charging voltage of the electrode **1510** to reach a preset reference voltage V_{ref} after having increased as the aerosol generating article is removed.

According to an embodiment, when the charging time of the electrode is shorter than the designated third charging time or the discharging time of the electrode is longer than the designated third discharging time, the processor **1530** may detect removal of the aerosol generating article in operation **3105**. According to an embodiment, when the charging time of the electrode is longer than the designated third discharging time or the discharging time of the electrode is shorter than the designed third discharging time, the processor **1530** may go back to operation **3101**.

According to an embodiment, the processor **1530** may supply power to the heater **1540** so as to remove a material attached onto a heater (e.g., the heater **1540** of FIG. **15**) in operation **3107**. For example, when removal of the aerosol generating article is detected, the processor **1530** may perform a cleaning operation of removing the material attached onto the heater **1540** by heating the heater **1540** at a high temperature. In this case, the heating temperature of the heater **1540** for the cleaning operation may be higher than the heating temperature of the heater **1540** at which the aerosol generating article is heated. For example, in order to perform the cleaning operation, the processor **1530** may control power supplied to the heater **1540** so that the heater **1540** may have a temperature range of about 450° C. to about 550° C. More preferably, in order to perform the cleaning operation, the processor **1530** may control power supplied to the heater **1540** so that the heater **1540** may have a temperature range of about 500° C. to about 550° C. However, the heating temperature range for performing the cleaning operation of the heater **1540** is just an example and may be variously changed according to the design of the manufacturer.

In an embodiment, when removal of the aerosol generating article is detected, the processor **1530** may perform the cleaning operation of the heater **1540** automatically. For example, when removal of the aerosol generating article is detected from the aerosol generating device, the processor **1530** may automatically perform the cleaning operation of the heater **1540** after a designated time (e.g., 10 minutes) elapses from when the aerosol generating article is removed. In an embodiment, the processor **1530** may automatically stop the cleaning operation of the heater **1540** when insertion of the aerosol generating article is detected during the cleaning operation.

FIG. **32** is a graph illustrating a charging time of an electrode that varies as an aerosol generating article is removed from an aerosol generating device according to an embodiment.

Referring to FIG. **32**, a time segment at which insertion of an aerosol generating article into an aerosol generating device (e.g., the aerosol generating device **1500** of FIG. **15**) is determined may be classified into a first segment **3200** and a second segment **3210**. The first segment **3200** may correspond to a segment at which the aerosol generating article is inserted. The second segment **3210** may correspond to a segment after the aerosol generating article is removed.

In an embodiment, when smoking is performed before a time point **3220** at which the aerosol generating article is removed, the charging time of an electrode (e.g., the electrode **1510** of FIG. **15**) may be increased in the first segment **3200**. For example, as the aerosol generating article is heated in the first segment **3200**, the temperature of a region in which the electrode is disposed may also be increased. As the temperature rises, a charging time required for charging the electrode may be gradually increased.

When smoking is performed before the time point **3220** at which the aerosol generating article is removed, as the aerosol generating article is removed, the charging time of the electrode may be reduced. In this case, the charging time of the electrode may be rapidly decreased. In an embodiment, when the charging time **3250** of the electrode is shorter than the designed third charging time **3230**, the processor **1530** may determine that the aerosol generating article has been removed.

In another embodiment, when smoking is not performed (**3270**) before the time point **3220** at which the aerosol generating article is removed, the charging time of the electrode may be substantially uniform in the first segment **3200**. Because the electrode may be continuously discharged even when it does not include an additional discharging circuit, the electrode may require a charging time for charging a charge amount lost as the electrode is continuously discharged. Thus, the processor **1530** may continuously apply a constant voltage to the electrode.

When smoking is not performed (**3270**) before the time point **3220** at which the aerosol generating article is removed, the charging time of the electrode may be reduced as the aerosol generating article is removed. In this case, the charging time of the electrode may be rapidly reduced. In an embodiment, when the charging time **3250** of the electrode is shorter than the designated third charging time **3230**, the processor **1530** may determine that the aerosol generating article has been removed.

In an embodiment, the processor **1530** may determine whether to perform the cleaning operation of the heater **1540** in the second segment **3210** based on a change in the charging time of the electrode in the first segment **3200**. For example, when a substantial change in the charging time of the electrode occurred in the first segment **3200**, the processor **1530** may determine that smoking is performed (**3260**) before the time point **3220** at which the aerosol generating article is removed, and thus may perform a cleaning operation of the heater **1540** in the second segment **3210**. In another example, when a substantial change in the charging time of the electrode did not occur in the first segment **3200**, the processor **1530** may determine that smoking is not performed (**3270**) before the time point **3220** at which the aerosol generating article is removed, and thus may not perform the cleaning operation of the heater **1540** in the second segment **3210**.

FIG. **33**A illustrates a state before an aerosol generating article is removed from an aerosol generating device according to an embodiment. FIG. **33**B illustrates a state after an aerosol generating article is removed from an aerosol generating device according to an embodiment.

Referring to FIGS. **33**A and **33**B, an aerosol generating device **3300** may include a housing **3301**, an electrode **3310**, a battery **3320**, a processor **3330**, and a heater **3360**.

The electrode **3310** of FIG. **33**A may include positive (+) charges of a first charge amount. The first charge amount may refer to a charge amount remaining in the electrode

3310 after some of positive (+) charges have been lost by moisture of a component (e.g., a tobacco material **3307**) included in the aerosol generating article **3305** disposed close to the electrode **3310**, as shown in FIG. **33**A. Thereafter, when the aerosol generating article **3305** is removed from the accommodation portion **3303** corresponding to the inner circumferential surface of the housing **3301**, the electrode **3310** of FIG. **33**B may include positive (+) charges of a second charge amount that is greater than the first charge amount.

As shown in FIG. **33**B, when the positive (+) charges of the electrode **3310** are increased from the first charge amount to the second charge amount, the charging time of the electrode **3310** may be reduced. The processor **3330** may detect that the charging time of the electrode **3310** of FIG. **33**B is reduced based on the input voltage input from the electrode **3310**.

In an embodiment, the processor **3330** may determine that the aerosol generating article **3305** has been removed, when detecting that the charging time of the electrode **3310** is reduced. In another embodiment, the processor **3330** may determine that the charging voltage of the electrode **3310** is increased based on a reduction in the charging time of the electrode **3310**, and may determine that the aerosol generating article **3305** has been removed based on the increased charging voltage.

In an embodiment, when it is determined that the aerosol generating article **3305** has been removed, the processor **3330** may perform a cleaning operation of the heater **3360**. In an embodiment, when it is determined that the aerosol generating article **3305** has been removed, the processor **3330** may perform the cleaning operation of the heater **3360** after a designated time (e.g., 10 minutes) elapses from when the aerosol generating article **3305** is removed. In another embodiment, after it is determined that the aerosol generating article has been removed, when the user input for performing the cleaning operation of the heater **3360** is received, the processor **3330** may perform the cleaning operation of the heater **3360**.

FIG. **34** is a block diagram of an aerosol generating device according to another embodiment.

Referring to FIG. **34**, an aerosol generating device **3400** may include an electrode **3410**, a battery **3420**, a processor **3430**, and a heater **3460**. The electrode **3410**, the battery **3420**, the processor **3430**, and the heater **3460** of FIG. **34** may correspond to the electrode **1510**, the battery **1520**, the processor **1530**, and the heater **1540** of FIG. **15**. Thus, a redundant description therewith may be omitted.

In an embodiment, the processor **3430** may include a sensing processor **3440** and a main processor **3450**. The sensing processor **3440** may include a power supply module **3442**, a controller **3444**, and a communication module **3446**.

The power supply module **3442** may receive power from the battery **3420** and may supply the supplied power to the electrode **3410** through the controller **3444**.

The controller **3444** may apply an output voltage to the electrode **3410** and may detect the input voltage input from the electrode **3410**. In this case, the controller **3444** may adjust and apply the output voltage to the electrode **3410** in a PWM manner. In an embodiment, the controller **3444** and the electrode **3410** may be connected to each other via one line, and the controller **3444** may apply an output voltage to the electrode **3410** via the line and may detect the input voltage input from the electrode **3410**. In another embodiment, the controller **3444** and the electrode **3410** may be connected to each other via at least two lines, and the controller **3444** may apply the output voltage to the electrode **3410** via one of at least two lines and may detect the input voltage input from the electrode **3410** via another line.

The communication module **3446** may transmit data on a change in the charging time of the electrode **3410** detected based on the input voltage input from the electrode **3410** to the main processor **3450**.

In an embodiment, the main processor **3450** may determine insertion of the aerosol generating article based on data on the change in the charging time of the electrode **3410** received from the communication module **3446**. When the data includes information indicating that the charging time of the electrode **3410** is increased, the main processor **3450** may determine that the aerosol generating article is inserted into the aerosol generating device **3410**. When it is determined that the aerosol generating article is inserted, the main processor **3450** may apply power to the heater **3460** so as to perform a preheating operation by using the heater **3460**.

In an embodiment, while the sensing processor **3440** monitors the charging time of the electrode **3410** periodically, the main processor **3450** may correspond to a low power mode (a sleep mode). When receiving information indicating that the charging time of the electrode **3410** is increased from the sensing processor **3440**, the main processor **3450** may switch the power supply state of the main processor **3450** from a lower power mode to an active mode.

The description of the above-described embodiments is just an example, and those of ordinary skill in the art may understand that various changes and equivalent other embodiments can be made therefrom. Therefore, the true scope of protection of the present disclosure should be defined by the appended claims, and all differences within the scope of equivalents to those descried in the claims should be construed as being included in the protection scope defined by the claims.

What is claimed is:

1. An aerosol generating device comprising:

a heater;

a housing comprising an accommodation portion into which an aerosol generating article comprising a cigarette is to be inserted;

a single electrode disposed to be apart from the aerosol generating article inserted into the accommodation portion and located to correspond to at least a part of the aerosol generating article; and

a processor electrically connected to the heater and the single electrode,

wherein the processor obtains a change in charge amounts of the single electrode according to a permittivity of moisture in the aerosol generating article.

2. The aerosol generating device of claim **1**, wherein the heater comprises:

a susceptor configured to heat the aerosol generating article; and

a coil configured to induce a variable magnetic field to the susceptor,

wherein the single electrode is disposed between the accommodation portion and the coil.

3. The aerosol generating device of claim **1**, wherein the heater comprises:

a susceptor configured to heat the aerosol generating article; and

a coil configured to induce a variable magnetic field to the susceptor,

wherein the single electrode and the coil are integrally formed.

4. The aerosol generating device of claim 1, wherein the heater is configured to heat an inside or an outside of the aerosol generating article in a resistive heating manner, and the single electrode is located to correspond to an overlapping area of the aerosol generating article and the heater.

5. The aerosol generating device of claim 1, wherein the single electrode is located to correspond to at least a part of an area of the aerosol generating article where an aerosol generating material is disposed, when the aerosol generating article is inserted.

6. The aerosol generating device of claim 1, wherein the processor obtains at least one of a charging time and a discharging time of the single electrode according to the obtained change in the charge amount of the single electrode, and when the charging time is longer than a designated first charging time or the discharging time is shorter than a designated first discharging time, the processor determines that insertion of the aerosol generating article occurred.

7. The aerosol generating device of claim 6, wherein the processor supplies power to the heater for preheating when insertion of the aerosol generating article is detected.

8. The aerosol generating device of claim 1, wherein the processor obtains at least one of a change in a charging time of the single electrode and a change in a discharging time of the single electrode according to the obtained change in the charge amount of the single electrode, and detects a user's puff based on the obtained change in the charging time or the obtained change in the discharging time of the single electrode.

9. The aerosol generating device of claim 8, wherein the processor detects the user's puff when a change gradient in the charging time with respect to time is a negative value or a change gradient in the discharging time with respect to time is a positive value.

10. The aerosol generating device of claim 9, wherein the processor supplies power to the heater to generate an aerosol, when the user's puff is detected.

11. The aerosol generating device of claim 1, wherein the processor obtains at least one of a charging time and a discharging time of the single electrode according to the obtained change in the charge amount of the single electrode, and controls power supplied to the heater based on the obtained charging time or discharging time.

12. The aerosol generating device of claim 11, wherein the processor supplies first power that is lower than reference power to the heater when the charging time is longer than a designated second charging time or the discharging time is shorter than a designated second discharging time, and supplies second power that is higher than the reference power to the heater when the charging time is shorter than the designated second charging time or the discharging time is longer than the designated second discharging time.

13. The aerosol generating device of claim 1, wherein the processor obtains at least one of a charging time and a discharging time of the single electrode according to the obtained change in the charge amount of the single electrode, and determines that removal of the aerosol generating article occurred when the charging time is shorter than a designated third charging time or the discharging time is longer than a designated third discharging time.

14. The aerosol generating device of claim 13, wherein the processor supplies power to the heater to remove a material attached onto the heater, when removal of the aerosol generating article is detected.

15. The aerosol generating device of claim 13, wherein the processor supplies power to the heater to remove a material attached onto the heater after a designated time has passed from when removal of the aerosol generating article is detected.

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