



(12) **EUROPEAN PATENT APPLICATION**  
published in accordance with Art. 153(4) EPC

(43) Date of publication:  
**30.11.2022 Bulletin 2022/48**

(51) International Patent Classification (IPC):  
**A24F 40/40** <sup>(2020.01)</sup> **A24F 40/53** <sup>(2020.01)</sup>

(21) Application number: **20915177.8**

(52) Cooperative Patent Classification (CPC):  
**A24F 40/40; A24F 40/53**

(22) Date of filing: **21.01.2020**

(86) International application number:  
**PCT/JP2020/001794**

(87) International publication number:  
**WO 2021/149125 (29.07.2021 Gazette 2021/30)**

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**  
Designated Extension States:  
**BA ME**  
Designated Validation States:  
**KH MA MD TN**

(72) Inventors:  
• **ONO, Yasuhiro**  
**Tokyo 130-8603 (JP)**  
• **TEZUKA, Hiroshi**  
**Tokyo 130-8603 (JP)**

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

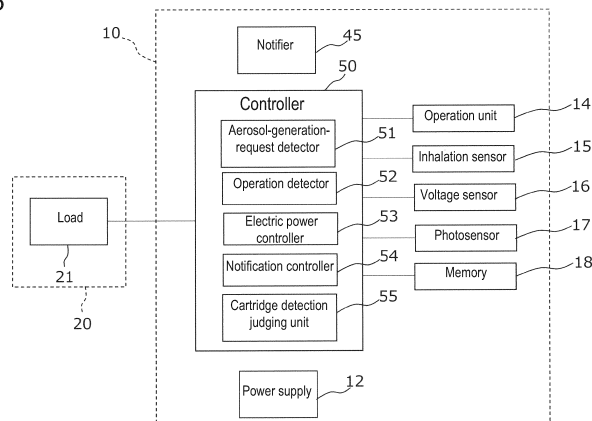
(71) Applicant: **Japan Tobacco Inc.**  
**Tokyo 105-6927 (JP)**

(54) **CARTRIDGE AND POWER UNIT FOR AEROSOL GENERATING DEVICE, AND METHOD FOR DETERMINING CARTRIDGE TYPE**

(57) The present invention: enables the type of an element to be easily determined when an element is attached to an aerosol generating device; and enables the operation of the aerosol generating device to be controlled in accordance with the type. A power unit (10) for an aerosol generating device is provided. The power unit (10) comprises: a light emitting element (171) that emits

light to a reflection part (220) provided to a cartridge (200) when the power unit is connected to the cartridge or after the power unit has been connected thereto; a light receiving element (172) that receives light reflected by the reflection part; and a control unit that determines the cartridge type on the basis of the light received by the light receiving element.

Fig. 5



## Description

### TECHNICAL FIELD

**[0001]** The present disclosure relates to a power supply unit and a cartridge of an aerosol generation device and a method for judging types of cartridges.

### BACKGROUND ART

**[0002]** Aerosol generation devices, such as an electronic cigarette, a nebulizer, and so on which generate gases, to which flavor components which are to be inhaled by users have been added, have been widely spread. Components which contribute to generation of a flavor-component-added gas, for example, an aerosol source for generating aerosol, a flavor source for adding flavor to the aerosol, and so on, are attached to an aerosol generation device. The contents stored in the above components are consumed every time when a gas is generated. By sucking a flavor-component-added gas (in the following description, this action may also be referred to as puffing) which has been generated by the aerosol generation device, a user can taste the flavor together with the gas.

### CITATION LIST

#### PATENT LITERATURE

##### [0003]

- PTL 1: Japanese Patent Application Public Disclosure No. 2018-512141
- PTL 2: Japanese Patent Application Public Disclosure No. 2017-538420
- PTL 3: Japanese Patent Application Public Disclosure No. 2012-513750
- PTL 4: Japanese Patent Application Public Disclosure No. 2015-535760

### SUMMARY OF INVENTION

#### TECHNICAL PROBLEM

**[0004]** It is desirable to effectively utilize components while providing a user with sufficient suction experience; and, for the above purpose, it is preferable to make it possible to judge the type of a component when the component is attached to an aerosol generation device. For example, in Patent Literature 3, a to-be-sucked article is distinguished from the other article by detecting identification information printed on the to-be-sucked article. However, such a detection method often relies on the state of printing. That is, it is necessary to clearly print identification information on a to-be-sucked article, and it is also necessary to adopt a precise process for reading identification information without misrecognition. Thus,

one of objects of the present disclosure is to make it possible, by improving mechanisms of components and an aerosol generation device, to judge types of the components easily when a component is attached to the aerosol generation device. Further, one of objects is to make it possible to control operation of the aerosol generation device according to the type.

#### SOLUTION TO PROBLEM

**[0005]** For achieving the above-explained object, according to a first aspect, a power supply unit for an aerosol generation device is provided. The power supply unit comprises: a light emitting element which emits light toward a reflector installed in a cartridge, when or after the power supply unit is connected to the cartridge; a light receiving element for receiving light reflected by the reflector; and a controller for judging the type of the cartridge based on the light received by the light receiving element.

**[0006]** According to the power supply unit of the aerosol generation device, the type of a cartridge can be judged easily, at low cost, and precisely, compared with, for example, a case wherein an element for precisely reading certain printed information is arranged. Further, operation of the aerosol generation device can be controlled according to the type. Thus, it becomes possible to provide a user with sufficient suction experience.

**[0007]** A power supply unit according to a second aspect comprises the power supply unit according to the first aspect, wherein: the reflector of the cartridge is installed in a connection surface that is to be connected to the power supply unit; light reflection factors of members of the reflectors are different according to the types of the cartridges, respectively; and the type of a cartridge is judged based on signal strength of the received light.

**[0008]** A power supply unit according to a third aspect comprises the power supply unit according to the second aspect, wherein degrees of brightness of colors of the members may be different according to the types of the cartridges, respectively.

**[0009]** A power supply unit according to a fourth aspect comprises the power supply unit according to the second aspect or the third aspect, wherein appearances of the members, that have been formed by processing the members, may be different according to the types of the cartridges, respectively.

**[0010]** A power supply unit according to a fifth aspect comprises the power supply unit according to one of the second aspect to the fourth aspect, wherein: arrangement patterns of the members in the reflectors may be different according to the types of the cartridges, respectively; and the arrangement pattern may comprise a combination of plural kinds of the members having plural reflection factors.

**[0011]** A power supply unit according to a sixth aspect comprises the power supply unit according to the fifth aspect, wherein the plural kinds of the members may

comprise a light-nonreflective member.

**[0012]** A power supply unit according to a seventh aspect comprises the power supply unit according to the fifth aspect or the sixth aspect, wherein, when the power supply unit is connected to the cartridge, the controller may start operation for detecting a cartridge in response to reception of light, that has first signal strength, by the light receiving element via the member of a first kind, and, thereafter, the controller may terminate the operation in response to reception of light, that has second signal strength, by the light receiving element via the member of a second kind.

**[0013]** A power supply unit according to a eighth aspect comprises the power supply unit according to one of the first aspect to the seventh aspect, and further comprises a physical switch, wherein the physical switch may be pressed by the cartridge when the power supply unit is connected to the cartridge, and the controller may make the light emitting element start emission of light in response to an event that the physical switch is pressed.

**[0014]** A power supply unit according to a ninth aspect comprises the power supply unit according to the eighth aspect, wherein the controller may make the light emitting element terminate emission of light in response to an event that the physical switch is pressed again by the cartridge.

**[0015]** A power supply unit according to a tenth aspect comprises the power supply unit according to one of the first aspect to the eighth aspect, wherein the controller may make the light emitting element terminate emission of light in response to completion of judgment of the type of the cartridge.

**[0016]** A power supply unit according to an eleventh aspect comprises the power supply unit according to one of the first aspect to the tenth aspect, wherein the controller may judge, when light is not received by the light receiving element for a predetermined period of time after starting of light emission by the light emitting element, that connection of the power supply unit to the cartridge is failed, and may make the light emitting element terminate emission of the light.

**[0017]** A power supply unit according to a twelfth aspect comprises the power supply unit according to the eleventh aspect, and further comprises a notifier, wherein the controller may make the notifier notify the failure of connection.

**[0018]** A power supply unit according to a thirteenth aspect comprises the power supply unit according to the twelfth aspect, wherein the notifier may use the notification of the failure of connection to prompt a user to again perform action to connect the power supply unit to the cartridge.

**[0019]** A power supply unit according to a fourteenth aspect comprises the power supply unit according to one of the first aspect to the thirteenth aspect, wherein the controller may prohibit supplying of electric power to the cartridge in the case that the type of the cartridge cannot be judged.

**[0020]** According to a fifteenth aspect, a cartridge for an aerosol generation device is provided. The cartridge comprises a reflector which comprises a member, wherein the members of the reflectors are different according to the types of the cartridges, respectively; wherein, when or after the cartridge is connected to a power supply unit of the aerosol generation device, the reflector reflects light emitted from a light emitting element of the power supply unit to make the reflected light be received by a light receiving element of the power supply unit, and the type is judged based on the light received by the light receiving element.

**[0021]** According to the cartridge for the aerosol generation device, the type of a cartridge can be judged easily, at low cost, and precisely, compared with, for example, a case wherein an element for precisely reading certain printed information is arranged. Further, operation of the aerosol generation device can be controlled according to the type. Thus, it becomes possible to provide a user with sufficient suction experience.

**[0022]** A cartridge according to a sixteenth aspect comprises the cartridge according to the fifteenth aspect, wherein the aerosol generation device may comprise a cartridge case which holds the cartridge and is attached to the power supply unit in an axial direction; when viewed from the axial direction, a cross section of the cartridge may have a concave shape that may correspond to a convex shape of a cross section of part of a hollow part of the cartridge case; and the cross section of the cartridge may be aligned, in a circumferential direction, with the cross section of the part of the hollow part of the cartridge case, so that the cartridge may be inserted in the hollow part of the cartridge case in the axial direction.

**[0023]** According to a seventeenth aspect, a method for judging the type of a cartridge is provided. The method comprises steps, that are performed when or after the cartridge is connected in an axial direction to a power supply unit, for: emitting, by a light emitting element of a power supply unit of an aerosol generation device, light toward a reflector installed in a cartridge; receiving, by a light receiving element of the power supply unit, the light reflected by the reflector; and judging the type of the cartridge based on the light received by the light receiving element; wherein light reflection factors of members of the reflectors are different according to the types of the cartridges, respectively.

**[0024]** According to the method, the type of a cartridge can be judged easily, at low cost, and precisely, compared with, for example, a case wherein an element for precisely reading certain printed information is arranged. Further, operation of the aerosol generation device can be controlled according to the type. Thus, it becomes possible to provide a user with sufficient suction experience.

**[0025]** A method according to an eighteenth aspect comprises the method according to the seventeenth aspect, wherein the colors and/or the processed appearances of the members may be different according to the

types of the cartridges, respectively.

**[0026]** A method according to a nineteenth aspect comprises the method according to the seventeenth aspect or the eighteenth aspect, wherein arrangement patterns of the members in the reflectors may be different according to the types of the cartridges, respectively; and the arrangement pattern may comprise a combination of plural kinds of the members having plural reflection factors.

**[0027]** A method according to an twentieth aspect comprises the method according to the nineteenth aspect, wherein the members may comprise a light-nonreflective member.

## BRIEF DESCRIPTION OF DRAWINGS

### [0028]

Fig. 1 is a perspective view of an aerosol generation device.

Fig. 2 is the other perspective view of the aerosol generation device in Fig. 1.

Fig. 3 is a cross-section view of the aerosol generation device in Fig. 1.

Fig. 4 is a perspective view of a power supply unit in an embodiment.

Fig. 5 is a block diagram of a power supply unit in an embodiment.

Fig. 6 is an exploded view of an aerosol generation device.

Fig. 7 shows schematically-represented operation of a photosensor installed in a power supply unit and a cartridge in an embodiment.

Fig. 8A is a schematic perspective view of a power supply unit in an embodiment.

Fig. 8B is a top view of the power supply unit in Fig. 8A viewed from an axial direction.

Fig. 9A is an example of a top view of a cartridge viewed from an axial direction in an embodiment.

Fig. 9B is an example of a top view of a cartridge viewed from an axial direction in an embodiment.

Fig. 10A is an example of a top view of a cartridge viewed from an axial direction in an embodiment.

Fig. 10B is an example of a top view of a cartridge viewed from an axial direction in an embodiment.

Fig. 11 is a flowchart showing operation for judging the type of a cartridge according to an embodiment.

Fig. 12A is a modification example of a top view of a cartridge viewed from an axial direction in an embodiment.

Fig. 12B is a modification example of a top view of a cartridge viewed from an axial direction in an embodiment.

Fig. 12C is a modification example of a top view of a cartridge viewed from an axial direction in an embodiment.

Fig. 13A is a cross-section view of a cartridge case 27 in a modification example viewed from an axial

direction.

Fig. 13B is a cross-section view of a cartridge 200 in a modification example viewed from an axial direction.

Fig. 14 is a modification example of a power supply unit which is provided with a physical switch.

Fig. 15 is a block diagram of a power supply unit in a different embodiment.

## DESCRIPTION OF EMBODIMENTS

**[0029]** In the following description, embodiments of the present disclosure will be explained with reference to figures. In the attached figures, the same or similar reference symbols are assigned to the same or similar components, and overlapping explanation of the same or similar components may be omitted in the explanation of respective embodiments. Further, a characteristic shown in each embodiment can be applied to the other embodiment as long as they are not contradictory to each other. Further, the figures are drawn in a schematic manner, so that actual sizes, ratios, and so on may not always coincide with those in the figures. Also, in the figures, a figure may include a part wherein relationship in terms of the size, the ratio, or the like is different from that relating to a corresponding part in the other figure.

**[0030]** It should be reminded that, although aerosol generation devices comprise an electronic cigarette and a nebulizer in the embodiments of the present disclosure, the aerosol generation devices are not limited to those listed above. That is, the aerosol generation devices may comprise various inhalers, each generating aerosol or flavor-added aerosol sucked by a user. Further, the generated inhaled component source may include invisible vapor, in addition to aerosol.

### (1) Construction of Aerosol Generation Device

**[0031]** Each of Fig. 1 to Fig. 5 shows an aerosol generation device 1 to which a power supply unit 10 has been attached. Each of Figs. 1 and 2 is a perspective view of the aerosol generation device 1, and Fig. 3 is a cross-section view of the aerosol generation device 1. Fig. 4 is a perspective view of the power supply unit 10 included in the aerosol generation device 1, and Fig. 5 is a block diagram showing a construction example of the power supply unit 10.

**[0032]** The aerosol generation device 1 is an apparatus for making a user suck flavor without requiring combustion, and has a stick shape extending in a predetermined direction (hereinafter, the direction will be referred to as a longitudinal direction A). As shown in Figs. 1 and 2, the aerosol generation device 1 comprises the power supply unit 10, a cartridge unit 20, and a capsule unit 30 arranged in the longitudinal direction A in this order. The cartridge unit 20 is attachable/detachable to/from the power supply unit 10, and the capsule unit 30 is attachable/detachable to/from the cartridge unit 20. In other words, the cartridge

unit 20 and the capsule unit 30 are exchangeable with each other.

#### (1-1) Power Supply Unit

**[0033]** As shown in Figs. 3 and 4, the power supply unit 10 in the present embodiment includes, in the inside of a power supply unit case 11 having a cylindrical shape, a power supply 12, a charger 13, a controller 50, various kinds of sensors, and so on. The power supply 12 is a chargeable secondary battery, an electric double layer capacitor, or the like, and, preferably, is a lithium-ion battery.

**[0034]** A top part 11a positioned in the side of one of ends, in the longitudinal direction A, of the power supply unit case 11 (the side close to the cartridge unit 20) is provided with discharging terminals 41. The discharging terminals 41 are constructed in such a manner that they protrude toward the cartridge unit 20 from the top surface of the top part 11a, and can be electrically connected to a load 21 in the cartridge unit 20.

**[0035]** Further, an air supplying part 42 for supplying air to the load 21 in the cartridge unit 20 is constructed in a part close to the discharging terminals 41 on the top surface of the top part 11a. As will be explained later, in the power supply unit 10 of the present embodiment, the top surface of the top part 11a is further provided with a photosensor 17 which comprises a pair of a light emitting element 171 and a light receiving element 172.

**[0036]** The top part 11a is capped by a connection cap (not shown in the figure). The connection cap forms a connection surface whereat the power supply unit 10 connects to the cartridge unit 20 in the longitudinal direction A. The connection cap is formed by using resin material that is softer than silicon resin and has elasticity; and the tip side of each of the discharging terminals 41, the air supplying part 42, and the photosensor 17 protrudes toward the cartridge unit 20 from the connection cap.

**[0037]** A bottom part 11b positioned in the side of the other of the ends, in the longitudinal direction, of the power supply unit case 11 (the side opposite to the cartridge unit 20) is provided with a charging terminal 43 which can be electrically connected to an external electric power source (not shown in the figure) which can charge the power supply 12. The charging terminal 43 is constructed in the side surface of the bottom part 11b, and can be connected to at least one of a USB terminal, a microUSB terminal, and a Lightning terminal.

**[0038]** In this regard, the charging terminal 43 may be an electric power receiver which can receive, in a non-contact manner, electric power transmitted from an external electric power source. In such a case, the charging terminal 43 (the electric power receiver) may comprise an electric power receiving coil. The type of the system for transmitting electric power in a noncontact manner (Wireless Power Transfer) may be an electromagnetic induction type or a magnetic resonance type. Further,

the charging terminal 43 may be an electric power receiver which can receive, in a contactless manner, electric power transmitted from an external terminal. In a different example, the charging terminal 43 may be that which can be connected to at least one of a USB terminal, a microUSB terminal, and a Lightning terminal, and also has the above-explained electric power receiver.

**[0039]** That is, in the power supply unit 10, the discharging terminal 41 and the charging terminal 43 are constructed as separate components and positioned apart from each other in the longitudinal direction A, so that it is constructed in such a manner that an external electric power source can be electrically connected to the charging terminal 43 during the state that discharging of the power supply 12 via the discharging terminals 41 is possible.

**[0040]** Further, in the power supply unit case 11, an operation unit 14, which can be manipulated by a user, is constructed in a side surface of the top part 11a in such a manner that it faces a side opposite to a side to which the charging terminal 43 faces. In more detail, the operation unit 14 and the charging terminal 43 have point symmetric relationship with respect to an intersection point of a straight line connecting the operation unit 14 and the charging terminal 43 and a center axial line L of the power supply unit 10 in the longitudinal direction A. The operation unit 14 comprises a button-type switch, a touch panel, or the like, and is used when operation for activating/shutting-down the controller 50 and various kinds of sensors, or other operation, is performed to reflect intention, with respect to use, of a user. The controller 50 and an inhalation sensor 15 for detecting a puff action are arranged in a position close to the operation unit 14.

**[0041]** The charger 13 is positioned close to the charging terminal 43, and controls charging electric power inputted from the charging terminal 43 to the power supply 12. The charger 13 comprises a converter for converting direct current from an inverter and so on, which are installed on a charging cable connected to the charging terminal 43 and convert alternate current to direct current, to direct current having different magnitude, a voltmeter, an ammeter, a processor, and so on.

**[0042]** As shown in Fig. 5, the controller 50 is connected to the operation unit 14, the inhalation sensor 15 for detecting a puff (inhalation) action, a voltage sensor 16 for measuring a voltage of the power supply 12, various kinds of sensors such as the photosensor 17 and so on, and a memory 18 for storing the number of times of puff actions or the length of time of energization to the load 21, and so on, and performs control of various kinds of operation of the aerosol generation device 1. The inhalation sensor 15 may be constructed by using a condenser microphone, a pressure sensor, or the like. Although it is preferable that the photosensor 17 be constructed to include the light emitting element 171 and the light receiving element 172, the construction is not limited thereto.

**[0043]** Specifically, the controller 50 is a processor (computer). More specifically, the structure of the processor comprises an electric circuit formed by combining circuit elements such as a semiconductor element and so on. Details of the controller 50 will be explained later.

**[0044]** Further, the power supply unit case 11 is provided with an air taking-in opening (not shown in the figure) for taking the outside air in the inside thereof. In this regard, the air taking-in opening may be formed in a circumference area of the operation unit 14, or may be formed in a circumference area of the charging terminal 43.

#### (1-2) Cartridge Unit

**[0045]** As shown in Fig. 3, the cartridge unit 20 comprises, in the inside of a cylindrical cartridge case 27, a reservoir 23 for storing an aerosol source 22, the electrical load 21 for atomizing the aerosol source 22, a wick 24 for drawing the aerosol source from the reservoir 23 to the load 21, an aerosol flow path 25 through which aerosol, that is generated as a result of atomization of the aerosol source 22, flows toward the capsule unit 30, and an end cap 26 which can house a part of the capsule unit 30.

**[0046]** In the present case, a member comprising the reservoir 23, the load 21, the wick 24, and the aerosol flow path 25 may be constructed as a cartridge 200. Regarding the cartridge 200, one end thereof can be connected to the power supply unit 10 and the other end thereof can be connected to the end cap 26.

**[0047]** The compartment for the reservoir 23 is formed to surround the periphery of the aerosol flow path 25, and stores the aerosol source 22. A porous body comprising a resin web, cotton, or the like may be included in the reservoir 23, and the porous body may be impregnated with the aerosol source 23. The aerosol source 22 includes a liquid such as glycerin, propylene glycol, water, or the like.

**[0048]** The wick 24 is a liquid holding member for drawing the aerosol source 22 from the reservoir 23 to the load 21 by capillary effect, and comprises glass fibers, porous ceramics, or the like, for example.

**[0049]** The load atomizes, without combustion, the aerosol source 22 by using electric power supplied from the power supply 12 via the discharging terminals 41. The load 21 comprises a wound electric heating wire (a coil) having a predetermined winding pitch. In this regard, the load 21 can be any element which can generate aerosol by atomizing the aerosol source 22, for example, a heater element or an ultrasonic generator. Examples of the heater elements that can be listed are a heating resistor, a ceramic heater, an induction-heating-type heater, and so on.

**[0050]** The aerosol flow path 25 is formed in the area downstream the load 21 and along the axial line L of the power supply unit 10.

**[0051]** The end cap 26 comprises a cartridge housing

part 26a for housing a part of the capsule unit 30 and a communication path 26b for communication between the aerosol flow path 25 and the cartridge housing part 26a.

#### 5 (1-3) Capsule Unit

**[0052]** An end of the capsule unit 30, which is in the side close to the cartridge unit 20, is housed in an attachable/detachable manner in the cartridge housing part 26a formed in the end cap 26 of the cartridge unit 20. The other end of the capsule unit 30, which is opposite to the side close to the cartridge unit 20, is constructed as a mouthpiece 32 for a user. In this regard, the mouthpiece 32 is not limited to that integrally formed with the capsule unit 30, and may be that constructed to be attachable/detachable to/from the capsule unit 30. By constructing the mouthpiece 32 as a component separate from the power supply unit 10 and the cartridge unit 20 as explained above, the sanitary state of the mouthpiece 32 can be maintained.

**[0053]** The capsule unit 30 adds flavor to the aerosol, which has been generated as a result of atomization of the aerosol source 22 by the load 21, by making the aerosol pass through a flavor source 31. Shredded tobacco or formed products, which are made by processing tobacco raw material to have granular forms, may be used as raw-material pieces which are components of the flavor source 31. The flavor source 31 may also be constructed by using plant other than tobacco (for example, mint, a Chinese medicine, a herb, or the like). An aromatic such as menthol or the like may also be added to the flavor source 31.

**[0054]** The aerosol generation device 1 can generate flavor-added aerosol by using the aerosol source 22, the flavor source 31, and the load 21. That is, the aerosol source 22 and the flavor source 31 can be regarded as an aerosol generation source from which aerosol is generated.

**[0055]** Instead of the construction wherein the aerosol source 22 and the flavor source 31 are constructed as separate components, the construction of the aerosol generation source used in the aerosol generation device 1 may be a construction wherein the aerosol source 22 and the flavor source 31 are integrally constructed, a construction wherein the flavor source 31 is omitted and material which may be included in the flavor source 31 is added to the aerosol source 22, a construction wherein medicine or the like is added, in place of the flavor source 31, to the aerosol source 22, or the like.

**[0056]** As shown by an arrow B in Fig. 3, in the aerosol generation device 1 constructed as explained above, the air flown therein through a taking-in opening (not shown in the figure) constructed in the power supply unit case 11 passes, from the air supplying part 42, through a space near the load 21 in the cartridge unit 20. The load 21 atomizes the aerosol source 22 drawn by the wick 24 from the reservoir 23. The aerosol generated as a result of atomization flows through the aerosol flow path 25

together with the air taken from the taking-in opening, and is supplied to the capsule unit 30 via the communication path 26b. Regarding the aerosol supplied to the capsule unit 30, flavor is added thereto as a result that it has passed through the flavor source 31, and the resultant aerosol is supplied to the mouthpiece 32.

#### (1-4) Controller in Power Supply Unit

**[0057]** Next, the construction of the controller 50 will be explained tangibly with reference to Fig. 5. The controller 50 comprises an aerosol-generation-request detector 51, an operation detector 52, an electric power controller 53, a notification controller 54, and a cartridge detection judging unit 55.

**[0058]** The aerosol-generation-request detector 51 detects, based on output result of the inhalation sensor 15, a request for aerosol generation. The inhalation sensor 15 is constructed to output a value representing change in pressure, that occurs due to suction by a user through the mouthpiece 31, in the power supply unit 10. For example, the inhalation sensor 15 is a pressure sensor which outputs an output value (for example, a voltage value or a current value) corresponding to air pressure that changes in response to the quantity of the air sucked from the taking-in opening toward the mouthpiece 32 (i.e., puff action of a user).

**[0059]** The operation detector 52 detects manipulation of the operation unit 14 performed by a user.

**[0060]** The electric power controller 53 controls discharging, via the discharging terminals 41, of the power supply 12 when a request for aerosol generation is detected by the aerosol-generation-request detector 51. In an example, the electric power controller 53 performs control in such a manner that the quantity of aerosol generated as a result of atomization of an aerosol source by the load 21 is maintained to be that within a desired range, that is, the quantity of electric power supplied from the power supply 12 to the load 21 is maintained to be that within a certain range.

**[0061]** In more detail, the electric power controller 53 may perform control by performing PWN (Pulse Width Modulation) control or PFM (Pulse Frequency Modulation) control. Output result of the voltage sensor 16 may also be used.

**[0062]** Further, the electric power controller 53 detects electrical connection between the charging terminal 43 and the external electric power source 60, and controls charging of electric power via the charging terminal 43 to the power supply 12.

**[0063]** The notification controller 54 controls a notifier 45 to make it notify various kinds of information. For example, the notification controller 54 controls the notifier 45 to make it notify, in response to detection of the time when the capsule unit 30 is expected to be replaced, the time when the capsule unit 30 is expected to be replaced. The notification controller 54 makes, based on the number of times of puff actions or the accumulated length

of time of energization to the load 21 stored in the memory 18, the time when the capsule unit 30 is expected to be replaced be notified. Notification to be performed is not limited to that of the time when the capsule unit 30 is expected to be replaced, and the notification controller 54 may make the time when the cartridge 30 is expected to be replaced be notified, and may make the time when the power supply 12 is expected to be replaced, the time when the power supply 12 is expected to be charged, an error occurred during operation, and so on be notified.

**[0064]** It should be reminded that the aerosol generation device 1 is provided with the notifier 45, that cooperates with the notification controller 54, for providing notification of various kinds of information. The notifier 45 may comprise a light emitting element, or may comprise a vibration element, or may comprise a sound outputting element. Further, the notifier 45 may comprise a combination comprising two or more elements in a light emitting element, a vibration element, and a sound outputting element. Although it is possible to install the notifier 45 in one of the power supply unit 10, the cartridge unit 20, and the capsule unit 30, it is preferable that it be installed in the power supply unit 10. For example, it is constructed in such a manner that the periphery of the operation unit 14 is made to be translucent and light is emitted through it from a light emitting element such as an LED or the like.

**[0065]** As will be explained later, the cartridge detection judging unit 55 makes the photosensor 17 detect the cartridge 200 by making the light receiving element 172 receive, via a reflector 220 installed in the cartridge 200, light emitted from the light emitting element 171, when the power supply unit 10 and the cartridge 200 are connected to each other. Further, the cartridge detection judging unit 55 judges, based on result of detection of the cartridge 200, the type of the connected cartridge 200.

#### (2) Method for Assembling Aerosol Generation Device

**[0066]** A method for assembling the aerosol generation device 1 will be explained. Fig. 6 is an exploded view of the aerosol generation device 1. As shown in the figure, the aerosol generation device 1 is constructed by assembling the power supply unit 10, the cartridge case 27, the cartridge 200, the end cap 26, and the capsule unit (capsule) 30.

**[0067]** First, the cartridge case 27 of the cartridge unit 20 is attached to the power supply unit 10 (Procedure A). Specifically, the inner side of the cartridge case 27 is fitted, along the axial line L, to a first rotating connection part 110 of the power supply unit 10, and, thereafter, the cartridge case 27 is rotated about the axial line L relative to the power supply unit 10.

**[0068]** As a result, the power supply unit 10 and the cartridge case 27 are assembled with each other, in the state that alignment of them with respect to the axial direction and the circumferential direction has been completed. In this regard, a reverse procedure of the above procedure can be performed when removing the car-

tridge case 27 from the power supply unit 10.

**[0069]** Next, the cartridge 200 is inserted in the cartridge case 27 (Procedure B). Specifically, in the state that a connection electrode part 210 constructed on the bottom surface of the cartridge 200 faces the side of the cartridge 27, the cartridge 200 is inserted in the hollow part in the cartridge case 27. As a result, the cartridge 200 is attached to the power supply unit 10.

**[0070]** In more detail, as a result of contact between the discharging terminals 41 of the power supply unit 10 and the connection electrode part 210 of the cartridge 200, they are connected with each other. Via the connection electrode part 210, electric power can be supplied to the electric heating wire in the load 21. Further, a buffer space is formed between the power supply unit 10 and the cartridge 200, by the connection surface of the power supply unit 10, the electrode surface of the cartridge 200, and the cartridge case 27.

**[0071]** In this regard, for aligning the electrode surface of the cartridges 200 with the connection surface of the power supply unit 10 in the circumferential direction when the cartridge 200 is connected to the power supply unit 10, a guide (not shown in the figure) for alignment is constructed in the inner surface of the hollow part of the cartridge case 27.

**[0072]** Next, the end cap 26 is attached to the cartridge case 27 by using a second rotating connection part 260 (Procedure C). Specifically, a male screw part of the end cap 26 is screwed into a female screw part constructed in the inner wall of the cartridge case 27. As a result that the end cap 26 is fastened in the above state, the cartridge 200 is held in the cartridge case 27 in the state that the cartridge 200 is being pushed in the axial direction toward the side of the power supply unit 10.

**[0073]** In more detail, a surface, whereat the end cap 26 is to be brought into contact with the cartridge 200, is provided with an anti-slipping member 261 for making the cartridge 200 be rotated relative to the power supply unit 10 about the axial line L.

**[0074]** The anti-slipping member 261 comes in contact with the bottom surface of the cartridge 200 in the middle of the procedure for connecting the end cap 26 to the cartridge case 27. Thereafter, during the state that the anti-slipping member 261 is being in contact with the cartridge 200, the cartridge 200 can be rotated together with the end cap 26 about the axial line L.

**[0075]** In the present case, when the end cap 26 is fastened by rotating the end cap 26, the cartridge 200 rotates relative to the power supply unit 10, within a predetermined range, about the axial line L. As will be explained later, during the above procedure, a process for judging the cartridge 200 according to the present embodiment will be performed. It is constructed in such a manner that, as a result that the cartridge 200 rotates within a predetermined range, an engaging concave part (not shown in the figure) of the cartridge 200 and an engaging convex part (not shown in the figure) of the power supply unit 10 are aligned with each other, and the car-

tridge 200 and the power supply unit 10 are engaged with each other.

**[0076]** After engagement of the cartridge 200 and the power supply unit 10, movement of the cartridge 200 relative to the power supply unit 10 in the circumferential direction is restricted. That is, it is constructed in such a manner that, due to the frictional force existing between the anti-slipping member 261 of the end cap 26 and the cartridge 200, the cartridge 200 does not rotate together with the end cap 26.

**[0077]** Further, in the state that the end cap 26 has been screwed to the cartridge case 26 and attached thereto, the anti-slipping member 261 of the end cap 26 pushes the cartridge 200 to the power supply unit 10. As a result, the cartridge 200 is fixed relative to the power supply unit 10.

**[0078]** Finally, the capsule unit 30 is inserted to the end cap 26 (Procedure D). Specifically, in the state that a mesh-type opening 310 faces the end cap 26, the capsule unit 30 is fitted in the end cap 26. By performing the above procedures, assembling of the aerosol generation device 1 is completed.

### (3) Judgment of Type of Cartridge

**[0079]** Judgment of the type of the cartridge 200 connected to the power supply unit 10 will be explained, with reference to Fig. 7 to Fig. 11, by using the present embodiment. Fig. 7 is a schematic figure showing operation of the photosensor 17 and the reflector 220 of the cartridge 200. Fig. 8A is a schematic perspective view of the power supply unit 10, which comprises the photosensor 17, in the present embodiment; and Fig. 8B is a top view of the power supply unit 10 viewed, in the axial direction, from the side of the cartridge 200. Each of Fig. 9A to Fig. 10B is an example of a top view of a cartridge 200, that is to be connected to the power supply unit 10 and viewed from an axial direction, in an embodiment. Finally, Fig. 11 is a flowchart showing a method for judging the type of the cartridge 200 by using the power supply unit 10 and the cartridge 200 explained above.

**[0080]** According to the present embodiment, judging of the type of the cartridge 200 by the controller 50 is performed by emitting light having a predetermined signal strength from the light emitting element 171, receiving the light by the light receiving element 172 via the reflector 220 installed in the cartridge 200 (i.e., via a process that the reflector 200 reflects the light emitted from the light emitting element 171), and measuring signal strength of the received light.

### (3-1) Photosensor Installed in Power Supply Unit

**[0081]** The power supply unit 10 is provided with the photosensor 17. Specifically, as shown in Fig. 7, the photosensor 17 comprises a pair comprising the light emitting element 171 and the light receiving element 172, and is installed in a connection surface 80 (the above-explained



connection cap) of the power supply unit 10. In an example, it is preferable that the light emitting element 171 of the photosensor 17 comprise a GaAs infrared light emitting diode, and the light receiving element 172 comprise a phototransistor (photo-IC).

**[0082]** The light emitting element 171 and the light receiving element 172 are arranged in series in a direction of propagation of emitted light signal. The light emitting element 171 starts light emission for outputting light, that has predetermined signal strength, at predetermined angle, in response to reception, by the photosensor 17, of an instruction for starting light emission. Next, the cartridge 200 passes through a space that is positioned near the photosensor 17 and in a light emission direction. At the time, the reflector 220 of the cartridge 200 reflects, with a predetermined reflection factor (for example, 80%), the light from the light emitting element 171 to the light receiving element 171. Thereafter, the light receiving element 172 receives the reflected light, and, according thereto, the photosensor 17 detects passage of the cartridge 200.

**[0083]** In more detail, in the present embodiment, it is constructed in such a manner that, when the power supply unit 10 is connected to the cartridge 200, the photosensor 17 detects the cartridge 200. Specifically, as explained above, when the power supply unit 10 is connected to the cartridge 200, the cartridge 200 rotates relative to the power supply unit 10, within a predetermined range, about the axial line L (Fig. 6: Procedure C). As a result that a member of the reflector 220 constructed in the cartridge 200 moves through, during the above procedure, a space that is positioned near the photosensor 17 and in a light emission direction, passage of the cartridge 200 is detected as explained above.

**[0084]** As shown in Figs. 8A and 8B, the photosensor 17 is installed in the connection surface 80, that is to be connected to the cartridge 200, of the power supply unit 10. The photosensor 17 is positioned in an area that is close to the periphery of the connection surface 80 and does not overlap with the areas of the discharging terminals 41 and the air supplying part 42. Further, the light emitting element 171 and the light receiving element 172, which form a pair and are shown by using dotted lines, are arranged in series in a circumferential direction on the connection surface 80. In the connection surface 80, the distance from the axial line L to the photosensor 17 in a radial direction is set in relation to the distance from the axial line L on the electrode surface of the cartridge 200 to the reflector 220 (in more detail, a member of the reflector 200) in a radial direction, for allowing the reflector 220 to move along the arranged light emitting element 171 and the light receiving element 172.

**[0085]** As explained above, in the present embodiment, the photosensor 17 is installed in the power supply unit 10 rather than the cartridge 200 which is an article of consumption. That is, compared with the construction wherein the photosensor 17 is installed in the cartridge 200 side, the cost relating to the photosensor 17 (for ex-

ample, the initial cost and/or the running cost) can be reduced. Further, as a result that the photosensor 17 is installed in the power supply unit 10, the photosensor 17 is positioned apart from the positions of the load 21 and the reservoir 23 in the cartridge 200, and, accordingly, is less subject to heat, liquid leakage, and so on, and can operate stably. Further, the risk of failure thereof can be reduced.

**[0086]** Further, the photosensor 17 can be positioned in the connection surface 80 in such a manner that it is to be aligned with the position of the reflector 22 installed in the cartridge 200, so that photosensor 17 can be positioned easier and realized at lower cost, compared with the case wherein an element for accurately reading certain printed information is arranged. Further, since the reflector 200 can be installed on the surface of the cartridge 200, and, for example, printing of information is not required, detection of the cartridge 200 can be realized at low cost without deep consideration with respect to material of the cartridge 200.

**[0087]** In this regard, a person skilled in the art can understand that the position of the photosensor 17 on the connection surface 80 and the positional relationship between the light emitting element 171 and the light receiving element 172 in the pair and the shapes of the elements are not limited to those shown in the figures. Further, the number of pairs, each pair comprising the light emitting element 171 and the light receiving element 172, is not limited to one, and plural pairs may be adopted; that is, the power supply unit 10 may comprise plural photosensors 17. Further, a person skilled in the art can understand that it is possible to construct a pair of the light emitting element 171 and the light receiving element 172 as a single member, or that it is possible to construct the light emitting element 171 and the light receiving element 172 as separate members to be arranged individually, without housing them in a single housing.

### (3-2) Reflector Installed in Cartridge

**[0088]** As shown in Figs. 9A and 9B and Figs. 10A and 10B, the reflector 220 for reflecting illuminated light is installed in the electrode surface 280 of the cartridge 200. The reflector 220 is formed to include one or more members (two members 221<sub>1</sub> and 221<sub>2</sub> in the example shown in the figure). For example, the member of the reflector 220 may be constructed by using a light absorbing member. Further, the electrode surface 280 is provided with a pair of connection electrodes 210 that is to be brought in contact with a pair of the discharging terminals 41 in the side of the power supply unit 10 for electric conduction between them.

**[0089]** The reflector 220 is constructed in any area, in the electrode surface 280, that does not overlap with the area occupied by the connection electrode part 210. In the example shown in the figure, two reflector areas AR<sub>1</sub> and AR<sub>2</sub>, which are positioned opposite to each other with respect to the center of the electrode surface 280

(the axial line L), are provided, and the single member 221<sub>1</sub> is arranged in the reflector area AR<sub>i</sub> and the single member 221<sub>2</sub> is arranged in the reflector area AR<sub>2</sub>. In this regard, it is not necessary to arrange the members 221<sub>1</sub> and 221<sub>2</sub> in all of the reflector areas AR<sub>i</sub> and AR<sub>2</sub>, and they can be arranged in any positions. In the electrode surface 280, the distance in the radial direction from the axial line L to each of the members 221<sub>1</sub> and 221<sub>2</sub> relates to the distance in the radial direction from the axial line L to the photosensor 17 in the connection surface 80 of the power supply unit 10.

**[0090]** In the present embodiment, for judging the type of a cartridges 200, the members of the reflectors 220 respectively adopt, according to the respective types of the respective cartridges 200, different elements having different light reflection factors (or light absorption factors). In an example, it has been known to a person skilled in the art that the degree of brightness of a color relates to a reflection factor of mirror reflection of light, so that it is preferable to adopt a construct that the degrees of brightness of colors of the members are set to be different from one another according to the types of the cartridges 200, respectively. Specifically, in the case of a "mint-flavor cartridge" type, the color of the member is set to black for maintaining the degree of brightness to be low (Fig. 9A), to make the signal strength (or the light receiving rate) per unit area received by the light receiving element 172 relatively small (for example, 10%). Also, in the case of a "coffee-flavor cartridge" type, the color of the member is set to white for increasing the degree of brightness (Fig. 9B), to thereby make the signal strength (or the light receiving rate) per unit area received by the light receiving element 172 relatively large (for example, 90%).

**[0091]** In a different example, in addition to or in place of the above construction, it is preferable to adopt members which have been processed to have certain shapes, i.e., adopt modes of processing that makes reflection factors of diffuse reflection (irregular reflection) of light different from one another according to the types of the cartridges 200, respectively. Specifically, in the case of a "mint-flavor cartridge" type, the member is processed to have very fine texture (unsmooth texture) (Fig. 10A), to increase the diffuse reflection rate of light to make the signal strength (or the light receiving rate) of light received by the light receiving element relatively small (for example, 10%). Also, in the case of a "coffee-flavor cartridge" type, it is roughly processed (Fig. 10B) to lower the diffuse reflection rate of light to make the signal strength (or the light receiving rate) of light received by the light receiving element relatively large (for example, 90%).

**[0092]** Instead of the above constructions, it may also be possible to adopt a construction wherein the degrees of signal strength of light received by the light receiving element 172 of the photosensor 17 are adjusted to correspond to the respective types of the respective cartridges 200, by arbitrarily selecting shapes and/or materials of respective members 221. That is, in the above example, any construction can be adopted if the member

of the reflector 220 could be constructed to make the signal strength of light relatively small (for example, 10%) to correspond to the case of the "mint-flavor cartridge" type, and the member of the reflector 220 could be constructed to make the signal strength of light relatively large (for example, 90%) to correspond to the case of the "coffee-flavor cartridge" type.

**[0093]** As explained above, by constructing the members of reflectors to respectively have different light reflection factors according to the respective types of the respective cartridges 200, it becomes possible to judge, by the cartridge detection judging unit 55 of the controller 50, the type of a cartridge 200. That is, the cartridge detection judging unit 55 is constructed to judge the type of a cartridge 200 based on signal strength (per unit area) of light received by the light receiving element 172.

**[0094]** In this manner, in the present embodiment, the constructions of the reflectors 220 of the cartridges 200, especially, the constructions of the members 221, are made to be different from one another according to the types, respectively. That is, operation for judging the type of a cartridge 200, that is realized as a result of cooperation of the reflector 220 and the photosensor 17 in the power supply unit 10, can be facilitated, and accuracy of judgment can be improved. Further, since the type of a cartridge 200 can be judged by measuring signal strength of light, judging of the type of a cartridge 200 is facilitated, compared with the case wherein information relating to a type is printed on a surface of a refill and a recognition process relating thereto is performed.

**[0095]** In this regard, a person skilled in the art can understand that the positions of the reflector 220 and the members 221 on the electrode surface 280, the dimension of the reflector area, positional relationship between areas and the number of areas, positional relationship between respective members, the number of members, and the shapes of members are not limited to those shown in the figures.

### (3-3) Operation for Judging Type of Cartridge

**[0096]** Fig. 11 shows a series of actions relating to judgment of the type of a cartridge 200. The series of actions is performed by the cartridge detection judging unit 55 and the notification controller 54 in cooperation with the photosensor 17, the memory 18, and the notifier 45, when the cartridge 200 is connected to the power supply unit 10 of the aerosol generation device 1 in the direction of the axial line L.

**[0097]** First, in step S10, insertion of the cartridge 200 is detected. Specifically, in the state that the cartridge case 27 is being attached to the power supply unit 10 (Fig. 6: Procedure A), the cartridge 200 is inserted in the cartridge case 27, and a state that cartridge 200 is brought to be in contact with the power supply unit 10 (Fig. 6: Procedure B) is detected. More specifically, the cartridge detection judging unit 55 may detect a state that the discharging terminals 41 of the power supply unit 10

are brought in contact with the connection electrode part 210 of the cartridge 200 and energization to the electric heating wire of the load 21 is allowed. In this regard, the cartridge 200 is guided by the cartridge case 27 in such a manner that the electrode surface 280 is aligned relative to the connection surface 80 of the power supply unit 10 in the circumferential direction and the cartridge 200 is inserted in the cartridge case 27.

**[0098]** In response to detection of insertion of the cartridge 200 in step 10, the photosensor 17 is activated in step S20. Specifically, the state of the light emitting element 171 of the photosensor 17 is changed to a light emission state. More specifically, it is preferable that, by using an event that the power supply unit 10 is connected to the cartridge 200 as a trigger, the controller 50 makes the light emitting element 171 emit light, and, at the same time, the light receiving element 172 be set to a light reception waiting state.

**[0099]** Next, in step S30, detecting of the reflector 220 installed in the cartridge 200 is started. Thus, during action for fastening the end cap 26 and rotating the cartridge 200 relative to the power supply unit 10 about the axial line L by a predetermined distance (Fig. 6: Procedure C), the cartridge detection judging unit 55 makes the photosensor 17 detect the reflector 220.

**[0100]** In this regard, the timing to perform the action for activating the photosensor 17 in step S20 may be set to be the same as or different from the timing to perform action for starting detection of the reflector 220 in step S30. (An example wherein action in step S30 is performed in response to a specific trigger that is different from that for performing action in step S20 will be explained later as a modification example.)

**[0101]** Thereafter, in step S40, it is judged whether the light reflected by the reflector 220 is received by the light receiving element 172 as a result that the reflector 220 moves through a space near the photosensor 17, during the time when the cartridge 200 is being rotated relative to the power supply unit 10 by a predetermined distance (or by a predetermined angle).

**[0102]** If light reception by the light receiving element 172 is detected (S40: Yes), signal strength of the light is measured in step S50. The signal strength of the light measured herein is signal strength of the light, that is received by the light receiving element 172, per unit area; and, by using it, a relative light receiving rate of the light relating to the signal strength of the light emitted by the light emitting element 171 is determined. In an example, measuring of signal strength may be continued repeatedly until rotation of the cartridge 200 relative to the power supply unit 10 by a predetermined distance is completed.

**[0103]** Next, in response to completion of determination of the signal strength of the light in step S50, the type of the cartridge 200 is judged in step S60 based on the signal strength of the light measured in step S50. As explained above, light reflection factors of reflectors 220 are set to be different from one another according to the types of the cartridges 200, respectively, so that the car-

tridge detection judging unit 55 can judge the type of a cartridge 200 according to the signal strength of the light received by the light receiving element 172.

**[0104]** In this regard, a rule for judging types of cartridges 200 has been defined in advance; and, in an example, in terms of the respective types of respective cartridges 200, values of signal strength may be related by using ranges. For example, the rule may be constructed to have a table form, and stored in the memory 18 in advance. That is, in the present embodiment, if signal strength of light received by the light receiving element 172 could be determined, the cartridge detection judging unit 55 can easily judge the type of a cartridge 200 by determining a range within that the signal strength belongs. It should be reminded that matters stored in the memory is not limited to the ranges of values of signal strength, and other matters such as reflection factors of the members of the reflectors 220 of the cartridges 200 and so on may additionally be stored in the memory.

**[0105]** Next, in step S70, light emission by the light emitting element 171 is terminated. Specifically, in response to completion of judging of the type of the cartridge 200 in step S60, the cartridge detection judging unit 55 deactivates the photosensor 17 to terminate light emission by the light emitting element 171.

**[0106]** In this manner, by limiting the point in time when light emission by the light emitting element 171 is terminated to the point in time when judging of the type of the cartridge 200 is completed, light emission control of the photosensor 17 can be automated. By adopting the above construction, electric power consumption relating to light emission can be reduced. In this regard, the point in time when light emission is terminated may be set to any point in time, such as the point in time when rotation of the cartridge 200 by a predetermined distance is completed, or the like.

**[0107]** Subsequent to the above process, in step S80, judgment as to whether the result of judgment of the type of the cartridge 200 in step S60 is normal is performed. For example, there is a case that the result of judgment of the type is abnormal, in the case that the cartridge is a replica manufactured by a third person or the like. In more detail, the cartridge detection judging unit 55 performs additional judgment as to whether the type of the cartridge 200 was actually judged based on the rule stored in advance in the memory 18, i.e., whether the type was uniquely identified.

**[0108]** In the case that the type of the cartridge 200 was not normally judged (S80: No), the cartridge detection judging unit 55 cooperates with the electric power controller 53 to prohibit supplying of electric power to the load 21 in the connected cartridge 200, in step S85.

**[0109]** In the case that the type of the cartridge 200 cannot be judged although the cartridge 200 is being connected to the power supply unit 10 as explained above, there is a high possibility that the cartridge 200 is a replica or a defective product. If electric power is supplied to a cartridge 200 such as that explained above, occurrence

of failure in the aerosol generation device 1 may be considered. For preventing occurrence of such failure, it is preferable to prohibit supplying of electric power to the load 21 in the cartridge 200.

**[0110]** On the other hand, if it is judged that the type of the cartridge 200 was normally judged (S80: Yes), setting of profile information, that has been stored in the memory 18, according to the type is performed in following step S90. For example, it is preferable that the cartridge detection judging unit 55 perform setting of a heating profile corresponding to the type of the cartridge 200 and setting for managing the life. By adopting the above construction, operation of the aerosol generation device 1 can be differently controlled according to the type of the cartridge 200, and the cartridge can be effectively utilized while providing a user with sufficient suction experience.

**[0111]** Specifically, by controlling the temperature to heat the load 21 according to the type of the cartridge 200, an appropriate quantity of flavor components, that corresponds to the type of the cartridge 200, can be added and delivered to a user. Further, by managing the number of times of suction actions with respect to each cartridge 200, the life of each cartridge 200 can be notified at appropriate timing, even in the case that a cartridge 200 is replaced by the other by a user.

**[0112]** It should be reminded that, in the case that a cartridge 200 was not detected since the light receiving element 172 did not receive light for a predetermined period of time set in advance in the memory 18 (S40: No), it is judged that connecting of the cartridge 200 to the power supply unit 10 is failed. In such a case, the cartridge detection judging unit 55 makes the light emitting element 171 terminate light emission, in step S75. That is, even in the case that the cartridge 200 is not detected, electric power consumption relating to light emission can be reduced by automatically stopping light emission.

**[0113]** Subsequent to step S75, the notifier 45 is operated to notify failure with respect to connection of the cartridge 200 to the power supply unit 10, in step S95. Specifically, the cartridge detection judging unit 55 cooperates with the notification controller 54 to present a user with information representing occurrence of connection failure, through use of an arbitrarily selected combination of a light emitting element, a vibration element, a sound outputting element, and so on in the notifier 45. Especially, it is preferable to present a user with information that prompts a user to temporarily release connection between the power supply unit 10 and the cartridge 200 and perform action to connect them again.

**[0114]** As explained above, in the present embodiment, the type of the cartridge 200 can easily be judged by detecting the cartridge 200 by using, in cooperation with the reflector 220 installed in the cartridge 200, the photosensor 17 installed in the power supply unit 10. That is, a method for highly precisely judging the type of a cartridge, while reducing costs, can be provided.

#### (4) Modification Examples

##### (Modification Example 1)

**[0115]** It is explained in the above description that the members 221 of the reflectors 220 are constructed to have different light reflection factors corresponding to the types of the cartridges 200, respectively. In the present modification example, it is possible to adopt a construction that a pattern of arrangement of plural members 222 included in a reflector 220 on the electrode surface 280 is constructed to be different from patterns of arrangement of those in other reflectors, wherein the respective patterns are constructed to correspond to the respective types of the respective cartridges 200. For example, as shown in each of Fig. 12A to Fig. 12C, the arrangement pattern is formed to include a combination of plural kinds of members 222 having plural reflection factors.

**[0116]** In the example in Fig. 12A, the reflector 220 comprises an arrangement pattern formed to include a combination of five circular members 222<sub>1</sub>-222<sub>5</sub>. In an example, the arrangement pattern is that wherein the light reflection factor of the member 222<sub>1</sub> is 90%, the light reflection factor of the member 222<sub>2</sub> is 70%, the light reflection factor of the member 222<sub>3</sub> is 50%, the light reflection factor of the member 222<sub>4</sub> is 30%, and the light reflection factor of the member 222<sub>5</sub> is 10%. Since the respective members 222<sub>1</sub>-222<sub>5</sub> have light reflection factors that are different from one another, the light receiving element 172 receives light having plural degrees of signal strength during the period for detecting received light (Fig. 11: S40).

**[0117]** That is, the cartridge detection judging unit 55 compares a record of a pattern of signal strength of light, that was received by the light receiving element 172 during the period when the cartridge 200 is rotated relative to the power supply unit 10 by a predetermined distance (Fig. 6: Procedure C), with the rule defined and stored in advance in the memory 18. The rule herein, in the case of the above example, is "The light receiving element 172 has received light having the reflection factor of 90%, light having the reflection factor of 70%, light having the reflection factor of 50%, light having the reflection factor of 30%, and light having the reflection factor of 10% in this order." By performing such pattern matching, the type of the cartridge 200 is judged. That is, since patterns of signal strength of light can be diversified, the number of types of the cartridges 200 that can be judged can be increased.

**[0118]** The example in Fig. 12B is that constructed to have an arrangement pattern wherein plural kinds of members include non-reflective members. The non-reflective member is made by using material having a light reflection factor of 0%. In an example, the light reflection factor of the member 221<sub>1</sub> is 90%, and two circular members 222<sub>6</sub>, which are non-reflective members, are arranged within the arrangement area. That is, during a period when operation for detecting light reception is be-

ing performed (step S40 in Fig. 11), the state of the light receiving element 172 is switched between a state that the light is being received and a state that the light is not being received, in such a manner that two periods of time, during when the light is not received since the light is not reflected by the member 222<sub>6</sub>, exist during the period of time when operation for receiving light reflected by the member 221<sub>1</sub> is being performed by the light receiving element 172.

**[0119]** That is, the cartridge detection judging unit 55 compares a record of the pattern of switching between the light-is-received state and the light-is-not-received state of the light receiving element 172, during the period when the cartridge 200 is rotated relative to the power supply unit 10 by the predetermined distance (Fig. 6: Procedure C), with the rule defined and stored in advance in the memory 18. The rule herein, in the case of the above example, is "The light receiving element 172 has detected light in such an intermittent manner that the period of light reception includes a light received period, a no-light received period, a light received period, a no-light received period, and a light received period in this order." By performing such pattern matching, the type of the cartridge 200 is judged. That is, since patterns of signal strength of light can be diversified, the number of types of the cartridges 200 that can be judged can be increased. In this regard, in a further modification example, the light reflection factors of the members 221<sub>1</sub> and 222<sub>6</sub> may be replaced with each other, i.e., the member 221<sub>1</sub> may be constructed to be a non-reflective member and the member 222<sub>6</sub> may be constructed to be a reflective member (for example, set its reflection factor to 90%), so as to make a switching pattern of light reception/non-reception states corresponding thereto in the light receiving elements 172 be judged.

**[0120]** The example in Fig. 12C is that constructed to have an arrangement pattern wherein circular members 221<sub>1</sub> and 222<sub>5</sub> arranged in both end positions of the circular members 221<sub>1</sub>-222<sub>5</sub> are constructed to be those similar to the non-reflective members 222<sub>6</sub>. Especially, by including special members such as the non-reflective members 222<sub>6</sub> or the like in the reflector 220 as shown in the example in Fig. 12C, it becomes possible to provide triggers that make the cartridge detection judging unit 55 start and terminate operation for detecting and judging a cartridge 200. That is, in the example in Fig. 12C, it is preferable that the cartridge detection judging unit 55 start detecting of a cartridge 200 in step S30 in Fig. 11 by using, as a trigger, an event that the light was not received due to existence of one of the non-reflective members 222<sub>6</sub>. Similarly, it is preferable that the cartridge detection judging unit 55 terminate detecting of a cartridge 200 by using, as a trigger, an event that the light was not received again due to existence of the other of the non-reflective members 222<sub>6</sub>.

**[0121]** A person skilled in the art will understand that, in the present case, the members which provide the cartridge detection judging unit 55 with triggers relating to

detection of the cartridge 200 are not limited to the two non-reflective members 222<sub>6</sub>. That is, it is preferable to make the cartridge detection judging unit 55 start operation for detecting a cartridge 200, in response to an event that the light receiving element 172 has received, via a member of a first kind in the reflector 220, light having first signal strength. Further, it is preferable to make the cartridge detection judging unit 55 terminate operation for detecting a cartridge 200, in response to an event that the light receiving element 172 has received, via a member of a second kind in the reflector 220, light having second signal strength.

**[0122]** Further, the cartridge detection judging unit 55 compares a record of a pattern of signal strength of light received by the light receiving element 172, that is based on the arrangement pattern of the three members 222<sub>2</sub>, 222<sub>3</sub>, and 222<sub>4</sub> positioned between the two non-reflective members 222<sub>6</sub>, with the rule defined and stored in advance in the memory 18. The rule herein, in the case of the above example, is "The light receiving element 172 has received light having the reflection factor of 70%, light having the reflection factor of 50%, and light having the reflection factor of 30% in this order." By performing such pattern matching, the type of the cartridge 200 is judged.

**[0123]** By the above construction, patterns of signal strength of light can be diversified, so that the number of types of the cartridges 200 that can be judged can be increased. Further, by providing triggers for starting and terminating detection of the cartridge 200 performed by the cartridge detection judging unit 55, timing relating to detection of the cartridge 200 in above-explained step S20 in Fig. 11 can be further limited. That is, it becomes possible to prevent erroneous detection and improve accuracy of judgment of the type of a cartridge 200.

**[0124]** In addition to the above matters, the whole area (having a predetermined light reflection factor), except for the area of the connection electrode part 210, of the electrode surface 280 may be used as the reflector areas AR<sub>1</sub> and AR<sub>2</sub>, instead of those shown in Figs. 10A and 10B.

(Modification Example 2)

**[0125]** It is explained in the above description that the light emitting element 171 and the light receiving element 172 forming a pair in the photosensor 17 are constructed to protrude in the circumferential direction from the connection surface 80, which faces the cartridge 200, of the power supply unit 10. However, instead of adopting the above construction, it is possible to construct the pair of the light emitting element 171 and the light receiving element 172 in such a manner that they are positioned below the connection surface; and, in such a case, a groove through which the reflector 220 moves is constructed in the connection surface 80. More specifically, a groove extending in a downward direction from the connection surface 80 is constructed in the power supply

unit 10, and the elements in the photosensor 17 (a pair of the light emitting element 171 and the light receiving element 172) are installed on the side walls of the groove in such a manner that the elements face each other. Thus, when the cartridge 200 is connected to the power supply unit 10, the reflector 220 installed in the cartridge 200 moves in the groove or a space near the groove, and reflects light emitted from the photosensor 17 to return it to the photosensor. Thereafter, based on measurement of the signal strength of the received light, the type of the cartridge can be judged.

(Modification Example 3)

**[0126]** It is explained in the above description that the light emitting element 171 and the light receiving element 172 forming a pair in the photosensor 17 are constructed to protrude from the connection surface 80, which faces the cartridge 200, of the power supply unit 10. However, instead of adopting the above construction, it is possible to construct the photosensor 17 in an inner peripheral surface of the cartridge case 27. In such a case, the reflector 220 of the cartridge 200 is aligned and positioned on an outer peripheral surface of the cartridge 200 rather than the electrode surface 280 of the cartridge 200. That is, the reflector 220 of the cartridge 200 is arranged on the outer peripheral surface of the cartridge 200 in such a manner that it is aligned with the photosensor 17 in an axial direction so as to make it face the inner peripheral surface of the cartridge case 27. By adopting the above construction, the photosensor 17 and the reflector 220 cooperate with each other and the cartridge 200 is detected, when rotating of the cartridge 200 relative to the power supply unit 10 is started (Fig. 6: Procedure C).

(Modification Example 4)

**[0127]** It is explained in the above description that, when the cartridge 200 is inserted in the cartridge case 27 and connected to the power supply unit 10 (Fig. 6: Procedure B), the electrode surface 280 of the cartridge 200 is aligned, in the circumferential direction, relative to the connection surface 80 of the power supply unit 10. In the present modification example, for improving accuracy of alignment such as that explained above, mechanisms for alignment may further be provided in the cartridge 200 and the hollow part in the cartridge case 27 which holds the cartridge 200, as shown in Figs. 13A and 13B.

**[0128]** Fig. 13A is a cross-section view of a cartridge case 27' in a modification example viewed from an axial direction. Fig. 13B is a cross-section view of a cartridge 200' in a modification example viewed from an axial direction. The cartridge case 27' comprises two convex parts 27c<sub>1</sub> and 27c<sub>2</sub> which are formed, in an axial direction, in parts of the inner wall of the hollow part to face each other. It is preferable that the positions on the inner wall on which the convex parts 27c<sub>1</sub> and 27c<sub>2</sub> are ar-

ranged be positions in the side close to the end cap 26, which is opposite to the side of the power supply unit 10, in the axial direction (i.e., positions close to the opening for inserting the capsule unit 30).

**[0129]** Further, the cartridge 200' comprises, in the axial direction, two concave parts 200c<sub>1</sub> and 200c<sub>2</sub> which face each other. When viewed from the axial direction, the cartridge 200' is constructed in such a manner that the cross section thereof has concave shapes corresponding to the above convex shapes in the cross section of the cartridge case 27'. Thus, when inserting the cartridge 200', the cross section of the cartridge 200' is aligned with the cross section of the cartridge case 27' in the circumferential direction.

**[0130]** By adopting the above construction, it becomes possible to ensure alignment in the circumferential direction, when the cartridge 200' is inserted in the cartridge case 27' (Fig. 6: Procedure B). That is, the electrode surface 280 of the cartridge 200' can be aligned further surely with the connection surface 80 of the power supply unit 10 in the circumferential direction, and the position at the time of a start of light emission by the light emitting element 171 in the photosensor 17 that follows (Fig. 11: S20) can be aligned more accurately.

(Modification Example 5)

**[0131]** It is explained in the above description that light emission by the light emitting element 171 is started at timing when the electrode surface 280 of the cartridge 200 is aligned relative to the connection surface 80 of the power supply unit 10 in the circumferential direction and inserted in the cartridge case 27 (Fig. 11: S20). However, as shown on Fig. 14, instead of adopting the above construction, it is possible to adopt, in the present example, a construction that uses a physical switch to make timing of a start be identified.

**[0132]** Fig. 14 is a schematic perspective view of a modification example of the power supply unit 10 which is provided with a physical switch 19. Similar to the photosensor 17, the discharging terminals 41, and the air supplying part 42, the physical switch 19 is constructed on the connection surface 80 in such a manner that it protrudes in the axial direction L. It is preferable that the physical switch 19 be arranged in a position on the connection surface 80 in such a manner that it is pressed right after a start of rotation of the cartridge 200 relative to the power supply unit 10 (Fig. 6: Procedure C).

**[0133]** It is sufficient if the state that the physical switch 19 is being pressed can be perceived by the cartridge detection judging unit 55. Further, in step S20 in Fig. 11, it is preferable that the cartridge detection judging unit 55 makes the light emitting element 171 emit light, in response to pressing of the physical switch 19. Specifically, it is preferable to adopt a construction that the cartridge detection judging unit 55 makes a judgment affirming an event that the physical switch 19 is being pressed by the cartridge 200 when the power supply unit 10 is

being connected to the cartridge 200, and, by using the above event as a trigger, makes light emitting element 171 emit light.

**[0134]** In this regard, to correspond to the physical switch 19 in the power supply unit 10, it is preferable to provide the cartridge 200 with a protrusion for pressing the physical switch 19. By adopting the above construction, it becomes possible to limit timing to start activation of the photosensor 17, so that electric power consumption relating to light emission can be further reduced.

**[0135]** Similarly, in the case that the power supply unit 10 is provided with the physical switch 19, in response to an event that the physical switch 19 is pressed again after light is emitted by the light emitting element 171, the cartridge detection judging unit 55 may make the light emitting element 171 terminate emission of the light. Specifically, it may be constructed in such a manner that, when the cartridge 200 rotates relative to power supply unit 10, the physical switch 19 is pressed again by the protrusion in the cartridge 200.

**[0136]** A physical switch used for terminating light emission may be the same as, or may have a body separate from, the physical switch 19 used for making the light emitting element 171 emit light. In the case that the above switches are constructed to have separate bodies, the physical switch 19 is arranged in a position on the connection surface 80 in such a manner that the physical switch 19 is pressed again by the cartridge 200 just before occurrence of engagement between the cartridge 200 and the power supply unit 10 (Fig. 6: Procedure C). By adopting the above construction, the timing for terminating activating of the photosensor 17 can be limited, so that electric power consumption relating to light emission can be further reduced.

(Modification Example 6)

**[0137]** It is explained in the above description that light emission by the light emitting element 171 is started at timing when the electrode surface 280 of the cartridge 200 is aligned relative to the connection surface 80 of the power supply unit 10 in the circumferential direction and inserted in the cartridge case 27 (Fig. 11: S20). However, instead of adopting the above construction, it is possible to control operation in the modification example in such a manner that light emission by the light emitting element 171 is started in response to pressing of the operation unit 14 by a user, after the cartridge 200 is connected to the power supply unit 10. That is, after the cartridge 200 is connected to the power supply unit 10, the controller 50 may perform, at timing when a user presses the operation unit 14 for performing puff action, a series of processes for making the light emitting element 171 emit light and judging a cartridge.

< Different Embodiments >

**[0138]** A different embodiment of the present disclosure

will be explained with reference to Fig. 15. Fig. 15 is a block diagram showing a construction example of a power supply unit 10a in an aerosol generation device 1 in a different embodiment of the present disclosure. The power supply unit 10a comprises a controller 50a, a photosensor 17a, and a memory 18a.

**[0139]** For example, the photosensor 17a and the memory 18a correspond to the photosensor 17 and the memory 18 in the embodiment of the present disclosure shown in Fig. 5, respectively. Further, for example, the controller 50a corresponds to a part of the controller 50 in the embodiment of the present disclosure shown in Fig. 5. Especially, for example, the cartridge detection judging unit 55a corresponds to the cartridge detection judging unit 55 in the embodiment of the present disclosure shown in Fig. 5.

**[0140]** The photosensor 17a comprises a pair of a light emitting element and a light receiving element. The controller 50a is constructed in such a manner that, when the power supply unit 10a connects to the cartridge 200 or after completion of connection, the controller 50a makes the photosensor 17a detect a cartridge 200 through operation to make the light receiving element 172 receive, via the reflector 220 installed in the cartridge 200, light emitted from the light emitting element 171, and judges the type of the cartridge 200 based on result of detection.

**[0141]** In the above description, power supply units and cartridges of aerosol generation devices and methods for judging types of cartridges according to some embodiments have been explained with reference to the figures. It can be understood that the present disclosure can be implemented as a program for making a processor perform, when the program is executed by the processor, a method for judging the type of a cartridge, or a computer-readable storage medium which stores the program.

**[0142]** Further, it should be understood that the embodiments and the modification examples, that have been explained above, of the present disclosure are mere examples, and are not those for limiting the scope of the present disclosure. It should be understood that change, addition, modification, and so on with respect to the embodiments can be performed appropriately, without departing from the gist and the scope of the present disclosure. The scope of the present disclosure should not be limited by any of the above-explained embodiments, and should be defined by the scope of the claims and the equivalent thereof.

## REFERENCE SIGNS LIST

**[0143]** 1 ... Aerosol generation device: 10, 10a ... Power supply unit: 11 ... Power supply unit case: 110 ... First rotating connection part: 12... Power supply: 14 ... Operation unit: 15 ... Inhalation sensor: 16 ... Voltage sensor: 17, 17a ... Photosensor: 171 ... Light emitting element: 172 ... Light receiving element: 18, 18a ... Memory: 19 ... Physical switch: 45 ... Notifier: 50, 50a... Controller: 51 ...

Aerosol-generation-request detector 51: 52 ... Operation detector: 53 ... Electric power controller: 54 ... Notification controller: 55, 55a ... Cartridge detection judging unit: 80 ... Connection surface: 20 ... Cartridge unit: 27, 27' ... Cartridge case: 27c1, 27c2 ... Convex part: 200, 200' ... Cartridge: 200c1, 200c2 ... Concave part: 260 ... Second rotating connection part: 210... Connection electrode part: 220 ... Reflector: 221 (221<sub>1</sub>, 221<sub>2</sub>), 222 (222<sub>1-6</sub>) Reflector member: 222<sub>6</sub>... Non-reflective member: 280 ... Electrode surface: AR<sub>1</sub>, AR<sub>2</sub> ... Reflector area: 26 ... End cap: 261 ... Anti-slipping member: 30... Capsule unit: 310 ... Opening

## Claims

1. A power supply unit for an aerosol generation device comprising:

a light emitting element which emits light toward a reflector installed in a cartridge, when or after the power supply unit is connected to the cartridge;  
a light receiving element for receiving light reflected by the reflector; and  
a controller for judging the type of the cartridge based on the light received by the light receiving element.

2. The power supply unit as recited in Claim 1, wherein:

the reflector of the cartridge is installed in a connection surface that is to be connected to the power supply unit;  
light reflection factors of members of the reflectors are different according to the types of the cartridges, respectively; and  
the type of a cartridge is judged based on signal strength of the received light.

3. The power supply unit as recited in Claim 2, wherein degrees of brightness of colors of the members are different according to the types of the cartridges, respectively.

4. The power supply unit as recited in Claim 2 or 3, wherein appearances of the respective members, that have been formed by processing the respective members, are different according to the respective types of the respective cartridges.

5. The power supply unit as recited in any one of Claims 2-4, wherein:

arrangement patterns of the members in the reflectors are different according to the types of the cartridges, respectively; and  
the arrangement pattern comprises a combina-

tion of plural kinds of the members having plural reflection factors.

6. The power supply unit as recited in Claim 5, wherein the plural kinds of the members comprise a light-nonreflective member.

7. The power supply unit as recited in Claim 5 or 6, wherein, when the power supply unit is connected to the cartridge,

the controller starts operation for detecting a cartridge in response to reception of light, that has first signal strength, by the light receiving element via the member of a first kind, and, thereafter, the controller terminates the operation in response to reception of light, that has second signal strength, by the light receiving element via the member of a second kind.

8. The power supply unit as recited in any one of Claims 1-7 further comprising a physical switch; wherein

the physical switch is pressed by the cartridge when the power supply unit is connected to the cartridge, and  
the controller makes the light emitting element start emission of light in response to an event that the physical switch is pressed.

9. The power supply unit as recited in Claim 8, the controller makes the light emitting element terminate emission of light in response to an event that the physical switch is pressed again by the cartridge.

10. The power supply unit as recited in any one of Claims 1-8, wherein the controller makes the light emitting element terminate emission of light in response to completion of judgment of the type of the cartridge.

11. The power supply unit as recited in any one of Claims 1-10, wherein the controller judges, when light is not received by the light receiving element for a predetermined period of time after starting of light emission by the light emitting element, that connection of the power supply unit to the cartridge is failed, and makes the light emitting element terminate emission of the light.

12. The power supply unit as recited in Claim 11 further comprising a notifier, wherein  
the controller makes the notifier notify the failure of connection.

13. The power supply unit as recited in Claim 12, wherein the notifier uses the notification of the failure of connection to prompt a user to again perform action to connect the power supply unit to the cartridge.



14. The power supply unit as recited in any one of Claims 1-13, wherein the controller prohibits supplying of electric power to the cartridge in the case that the type of the cartridge cannot be judged.

15. A cartridge for an aerosol generation device, comprising

a reflector which comprises a member, wherein the members of the reflectors are different according to the types of the cartridges, respectively; wherein, when or after the cartridge is connected to a power supply unit of the aerosol generation device, the reflector reflects light emitted from a light emitting element of the power supply unit to make the reflected light be received by a light receiving element of the power supply unit, and the type is judged based on the light received by the light receiving element.

16. The cartridge as recited in Claim 15, wherein

the aerosol generation device comprises a cartridge case which holds the cartridge and is attached to the power supply unit in an axial direction;

when viewed from the axial direction, a cross section of the cartridge has a concave shape that corresponds to a convex shape of a cross section of part of a hollow part of the cartridge case; and

the cross section of the cartridge is aligned, in a circumferential direction, with the cross section of the part of the hollow part of the cartridge case, so that the cartridge is inserted in the hollow part of the cartridge case in the axial direction.

17. A method for judging the type of a cartridge comprising steps, that are performed when or after the cartridge is connected in an axial direction to the power supply unit, for:

emitting, by a light emitting element of a power supply unit of an aerosol generation device, light toward a reflector installed in a cartridge; receiving, by a light receiving element of the power supply unit, the light reflected by the reflector; and

judging the type of the cartridge based on the light received by the light receiving element; wherein

light reflection factors of members of the reflectors are different according to the types of the cartridges, respectively.

18. The method as recited in Claim 17, wherein the

colors and/or the processed appearances of the members are different according to the types of the cartridges, respectively.

19. The method as recited in Claim 17 or 18, wherein

arrangement patterns of the members in the reflectors are different according to the types of the cartridges, respectively; and the arrangement pattern comprises a combination of plural kinds of the members having plural reflection factors.

20. The method as recited in Claim 19, wherein the members comprises a light-nonreflective member.

Fig. 1

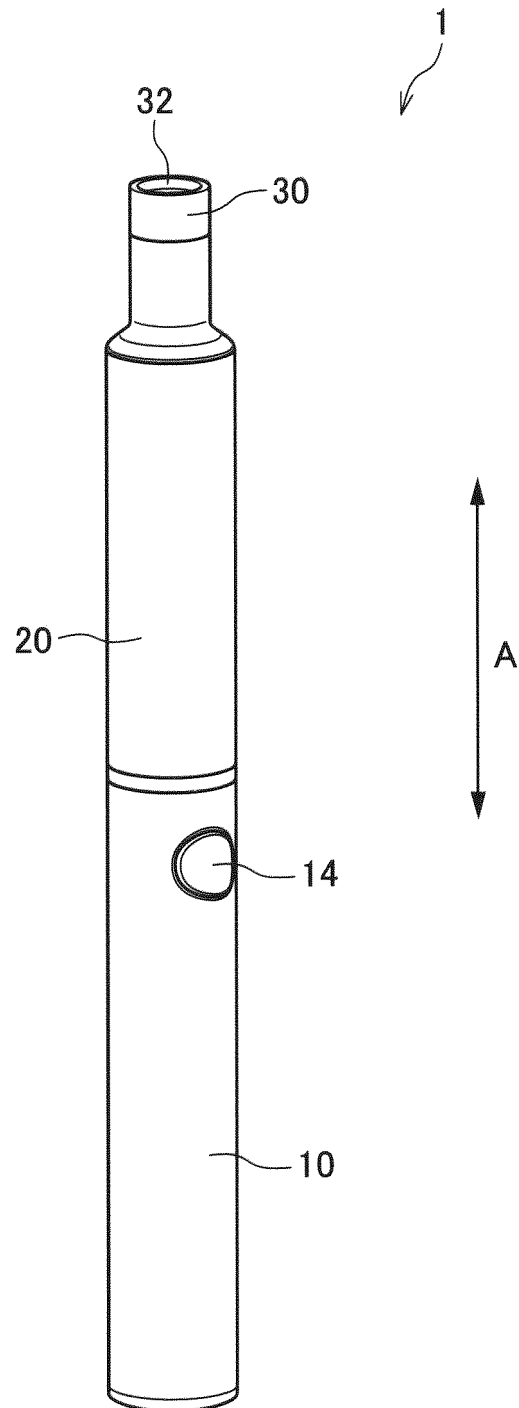


Fig. 2

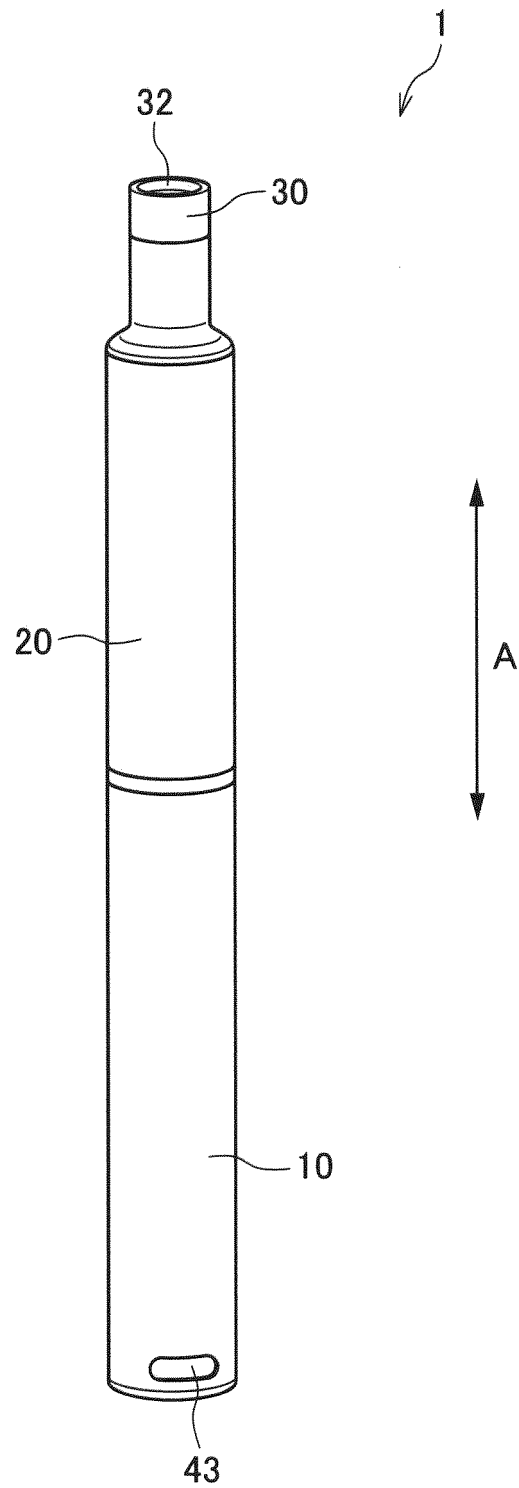


Fig. 3

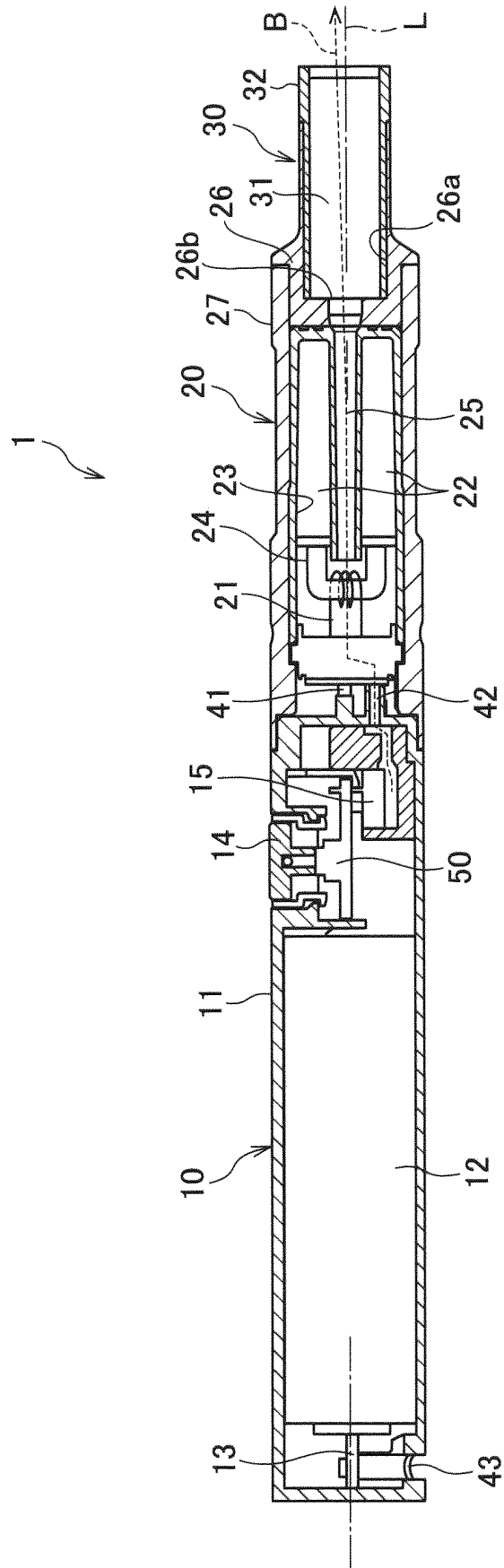


Fig. 4

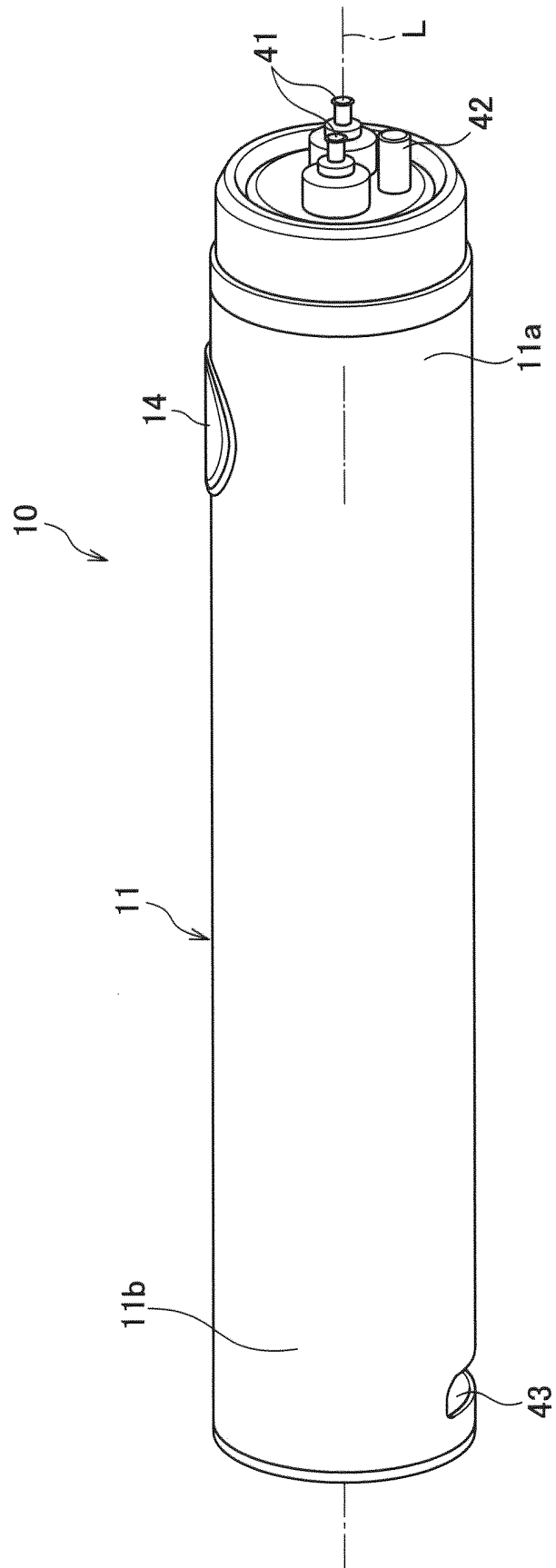


Fig. 5

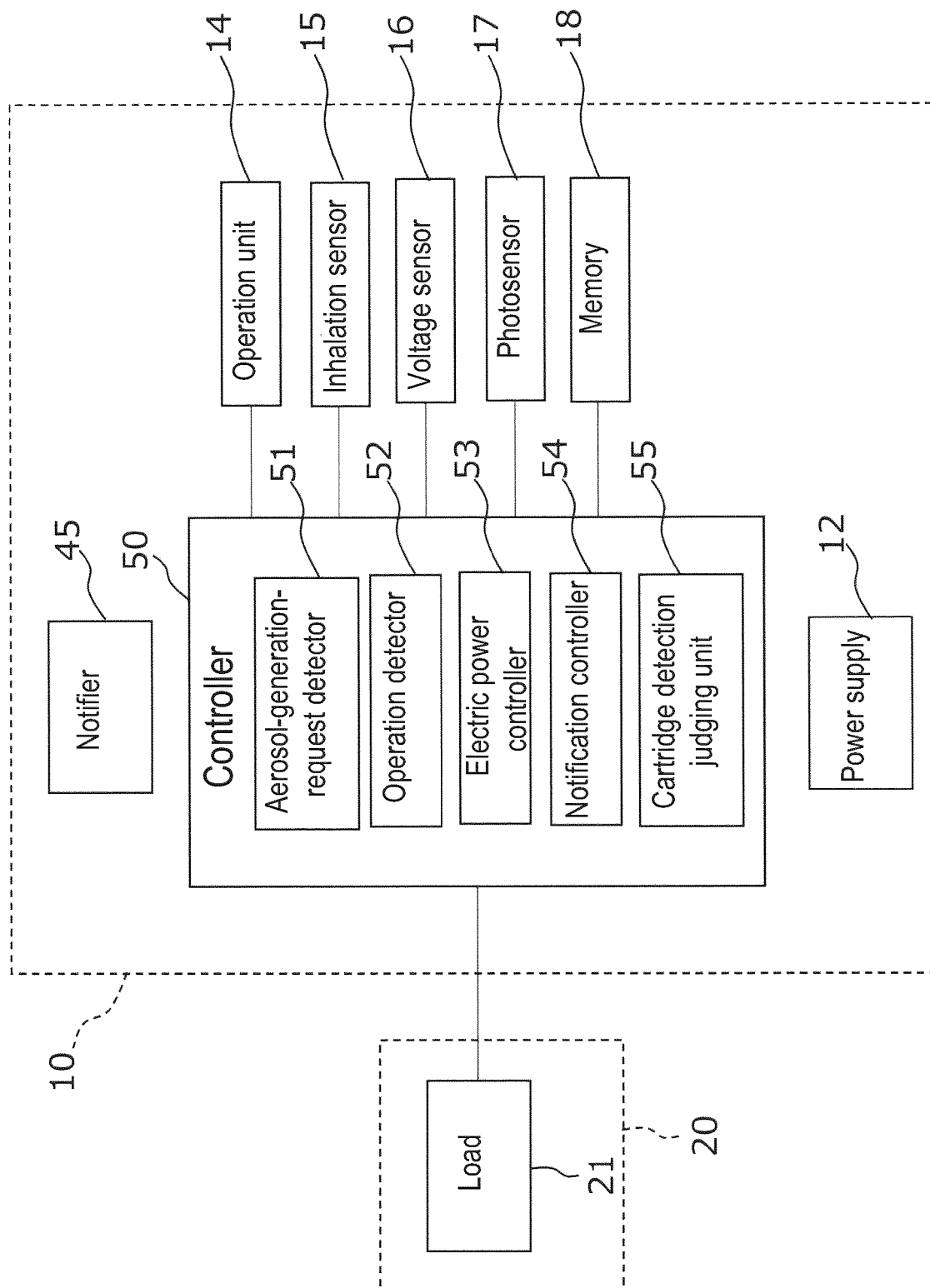


Fig. 6

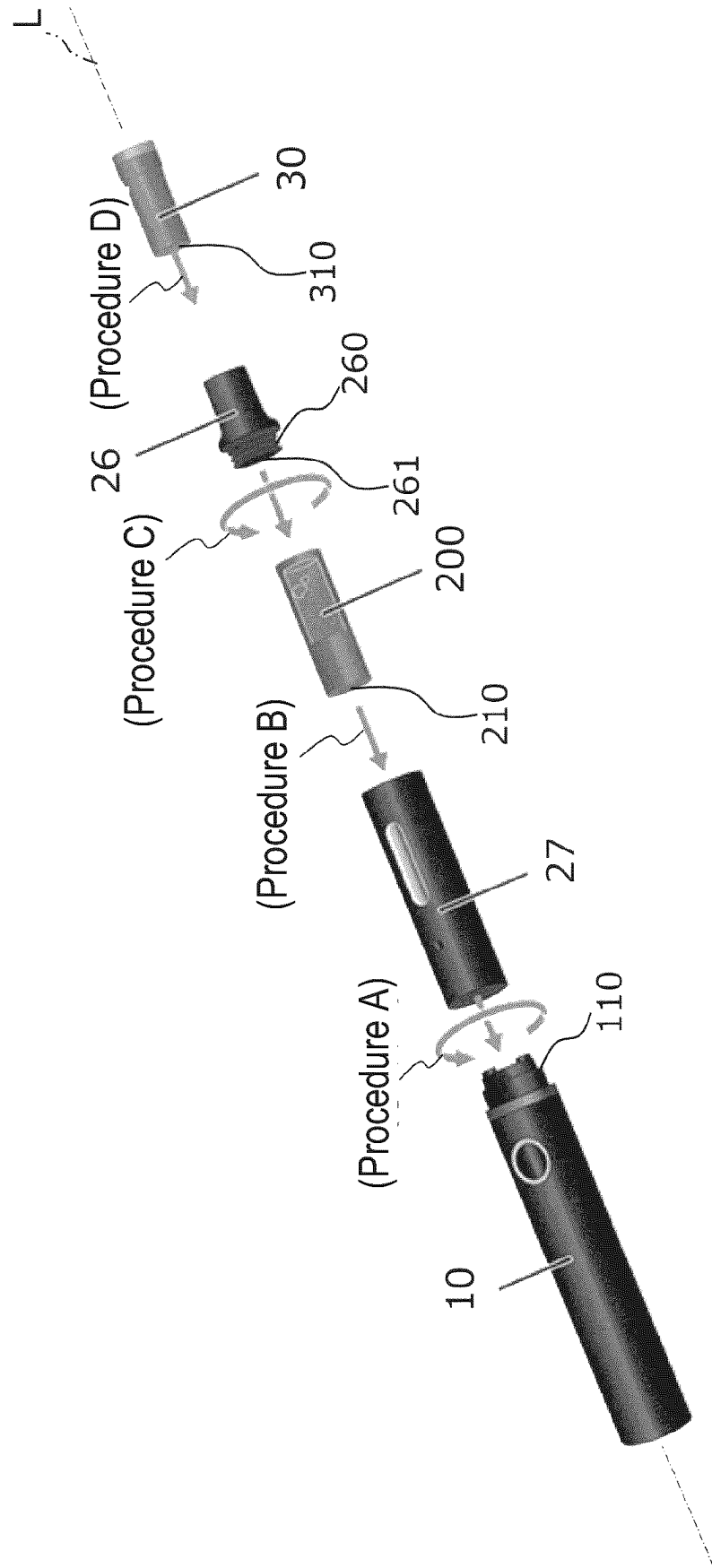


Fig. 7

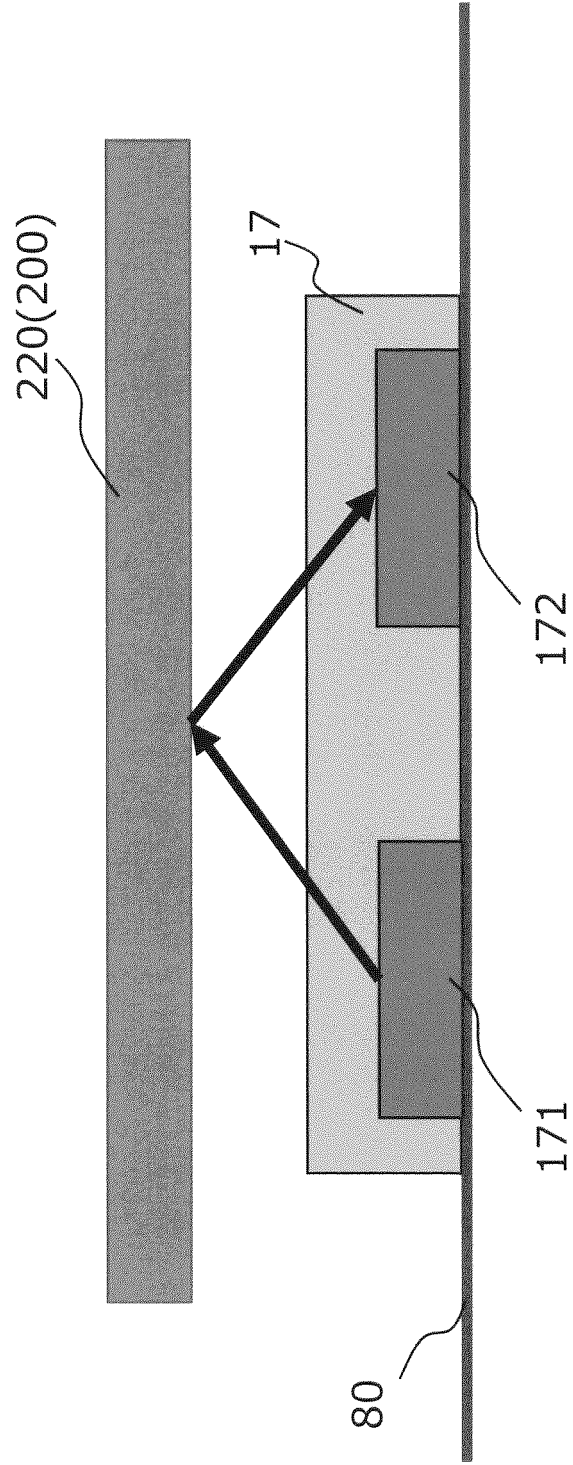




Fig. 8A

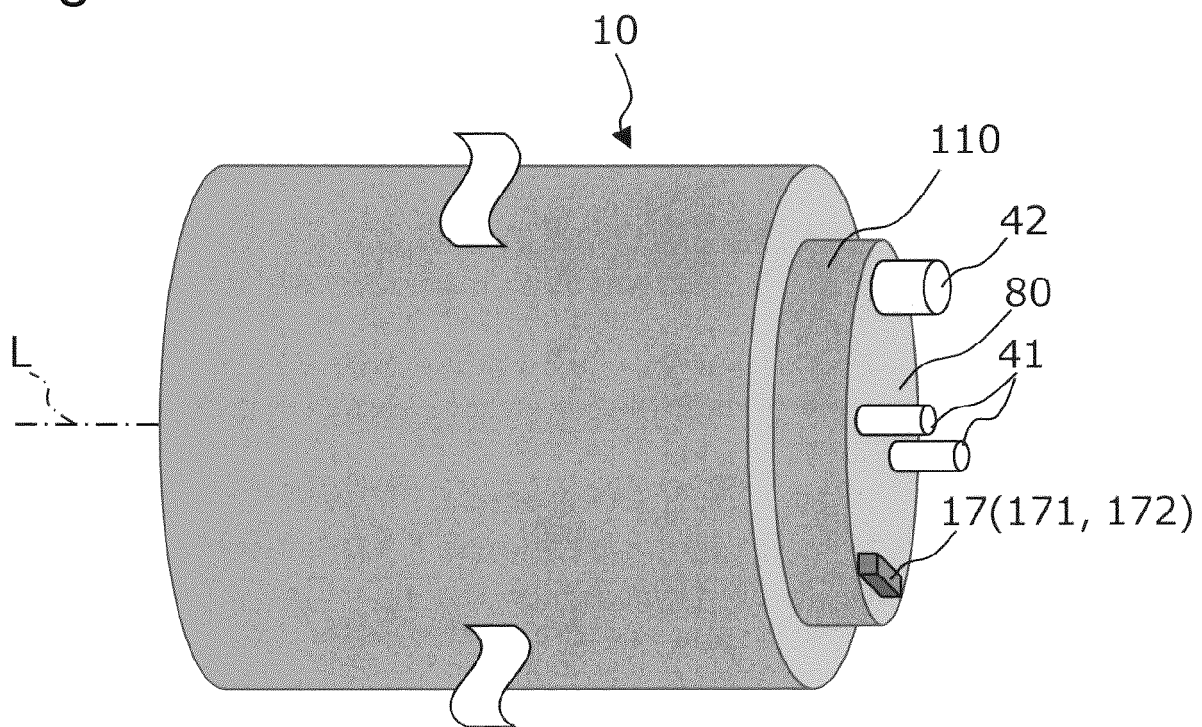


Fig. 8B

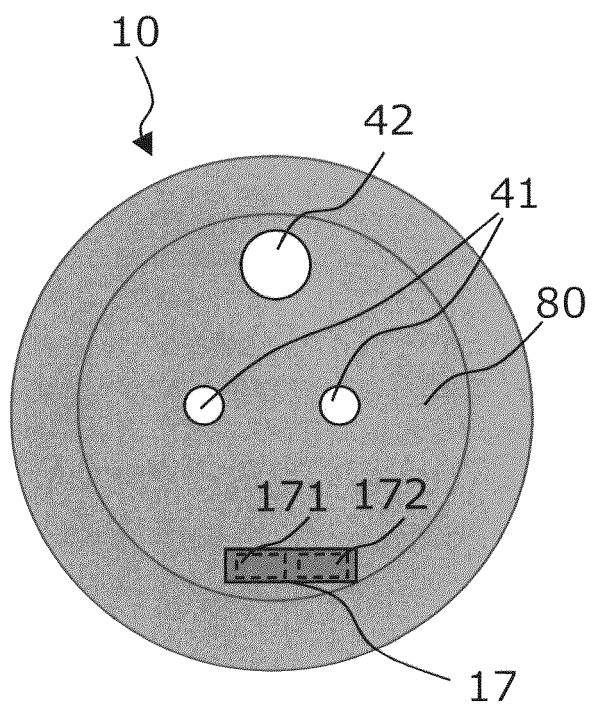


Fig. 9A

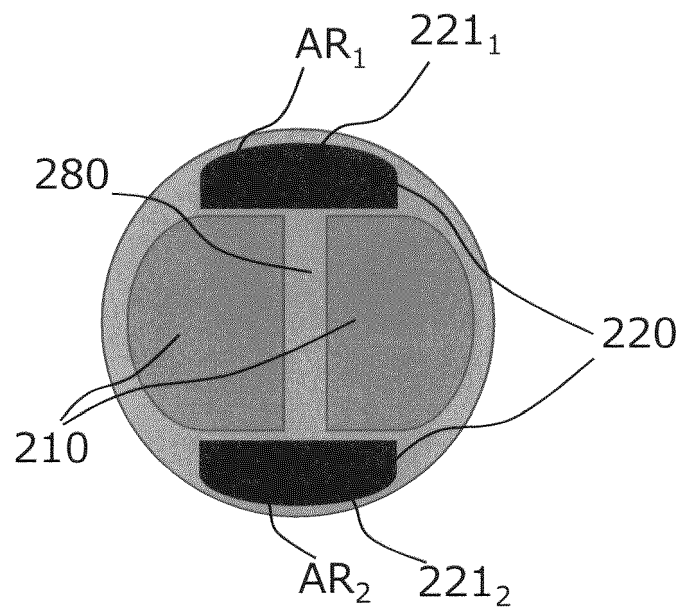


Fig. 9B

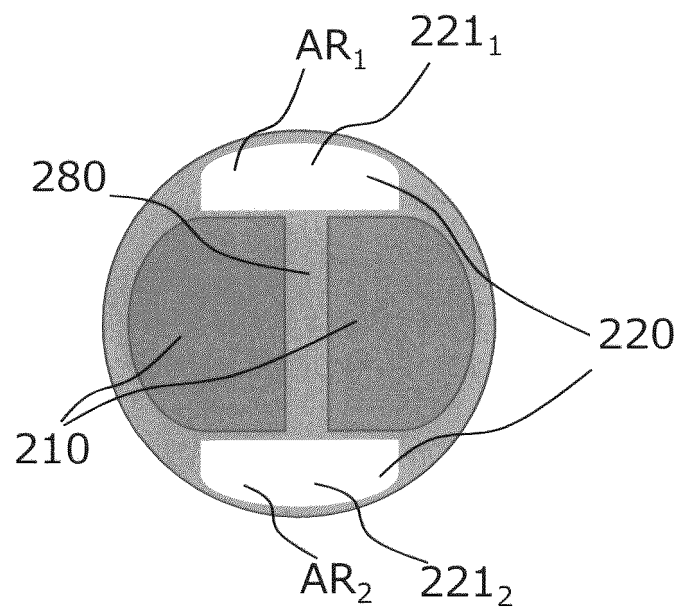


Fig. 10A

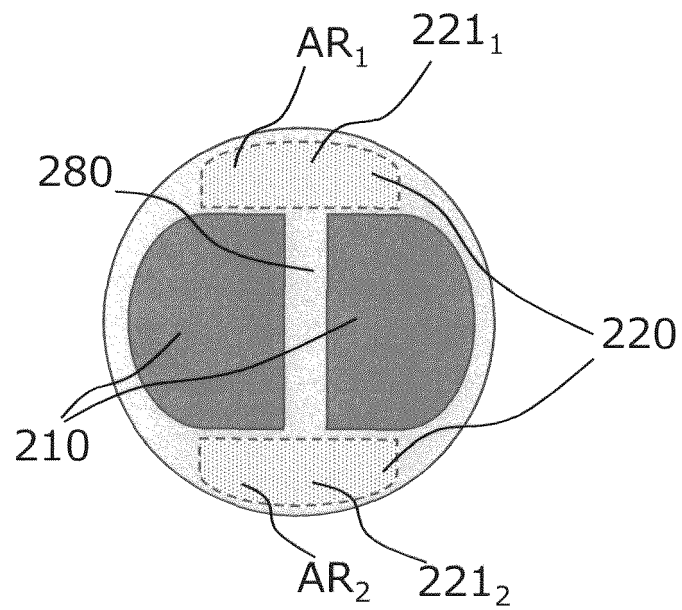


Fig. 10B

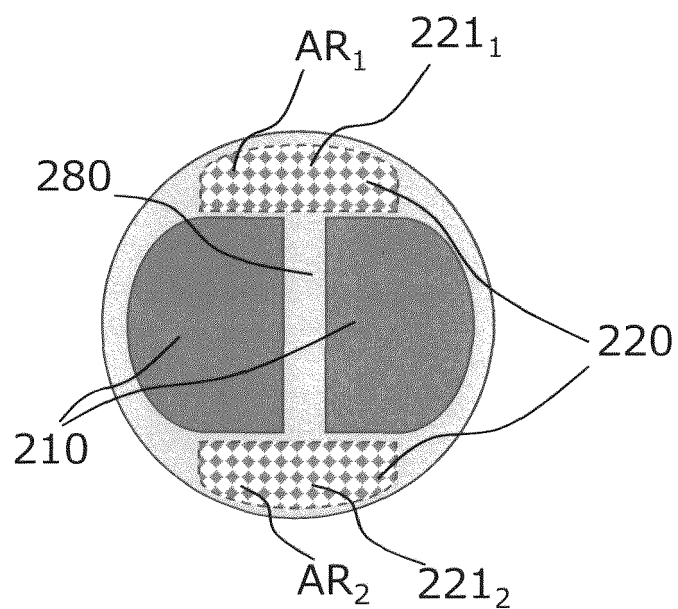


Fig. 11

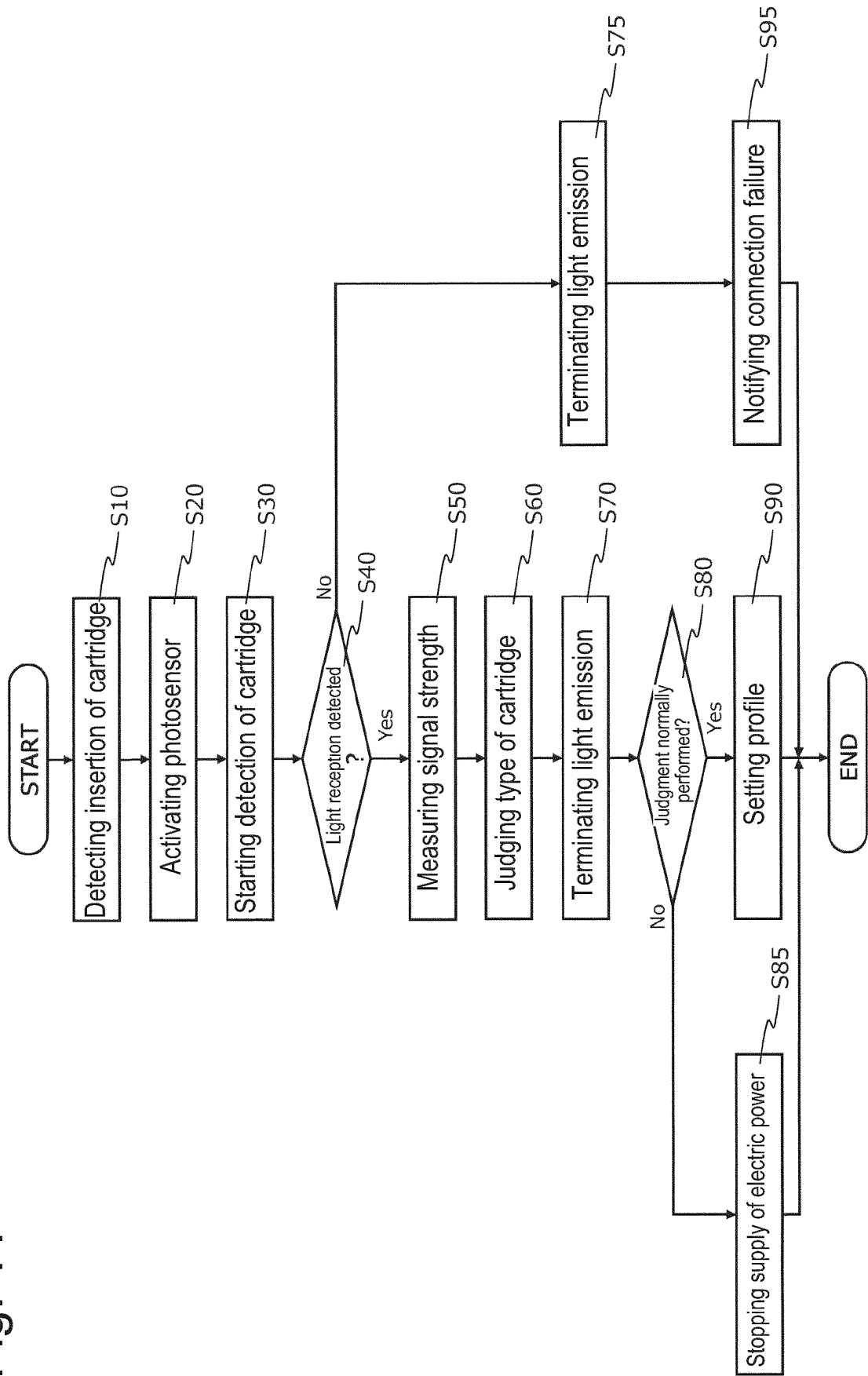


Fig. 12A

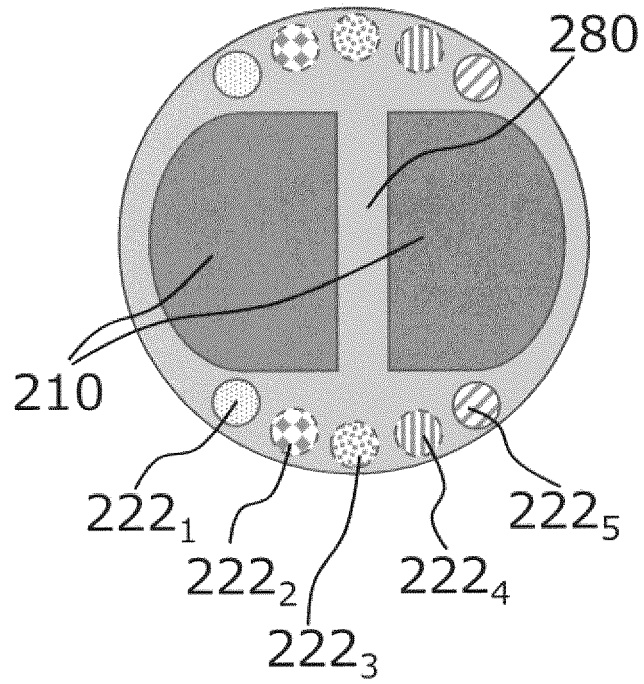


Fig. 12B

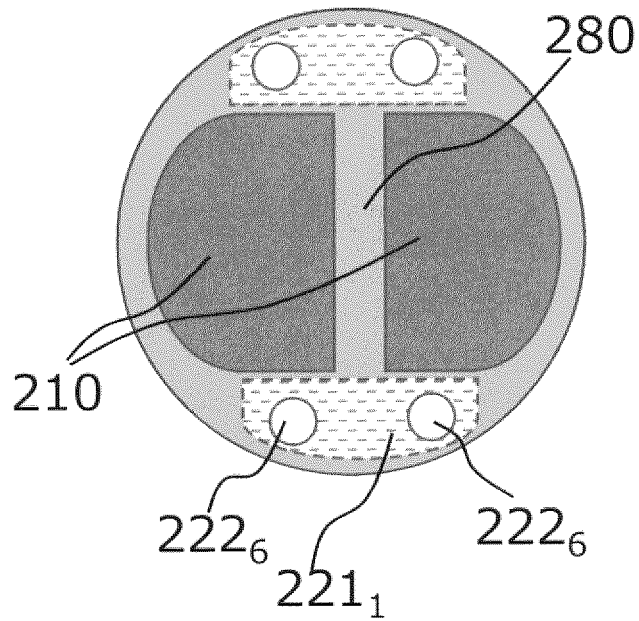


Fig. 12C

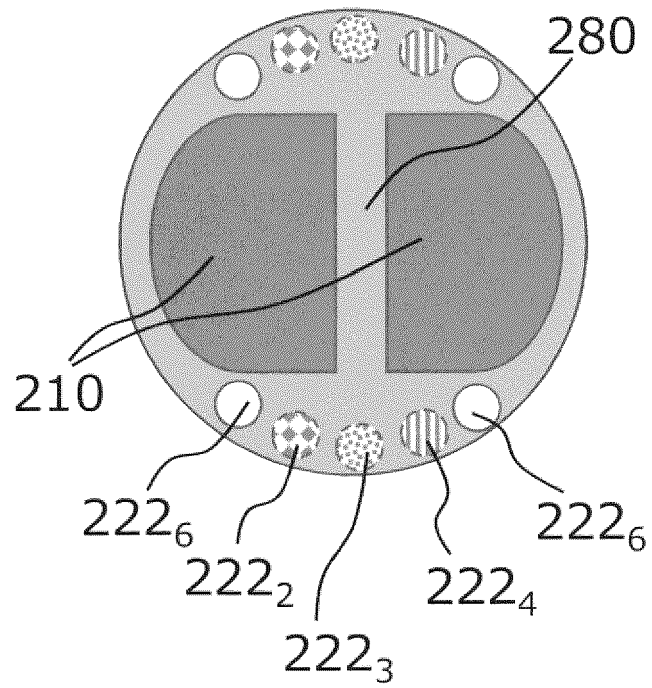


Fig. 13A

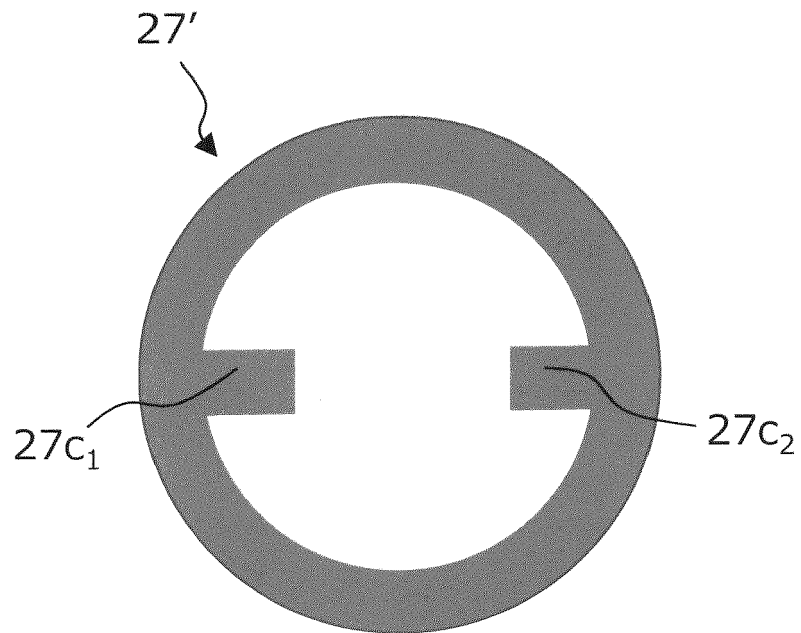
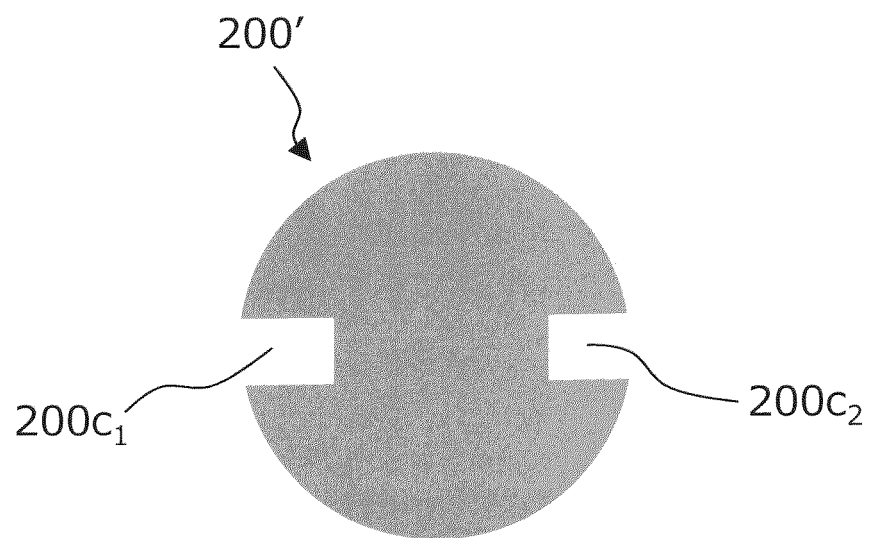


Fig. 13B



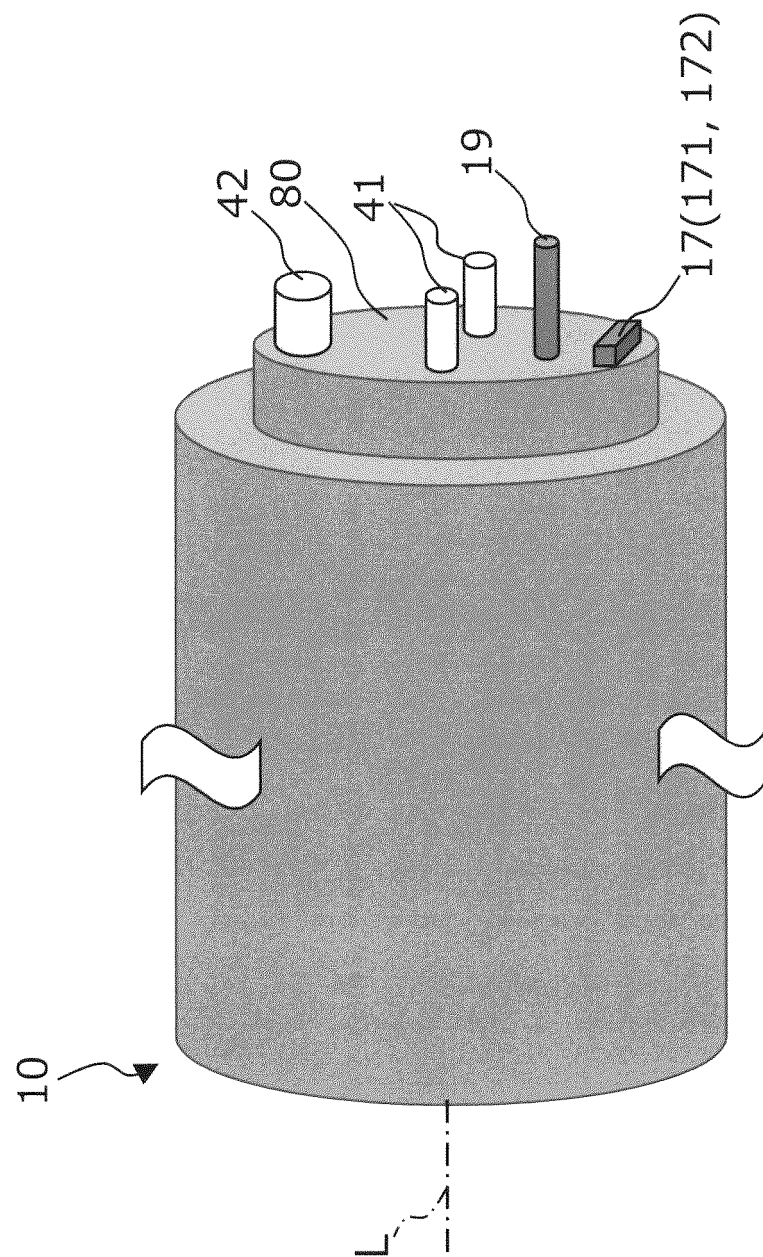
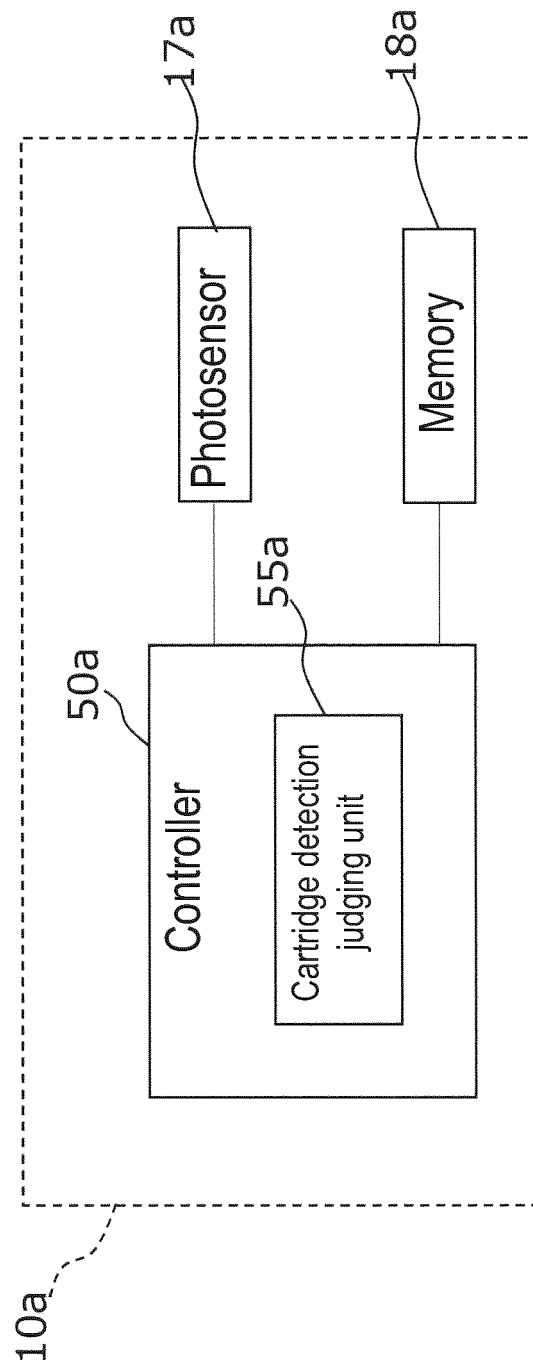


Fig. 14



Fig. 15



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/001794

## A. CLASSIFICATION OF SUBJECT MATTER

A24F 40/40 (2020.01) i; A24F 40/53 (2020.01) i

FI: A24F47/00

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

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A24F40/40; A24F40/53

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

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2020

Registered utility model specifications of Japan 1996-2020

Published registered utility model applications of Japan 1994-2020

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

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2019-528710 A (PHILIP MORRIS PRODUCTS S.A.) 17.10.2019 (2019-10-17) paragraphs [0028]-[0032], [0070]-[0082], fig. 1-3	1-7, 10-20 8-9
Y	JP 59-201176 A (NISSAN MOTOR CO., LTD.) 14.11.1984 (1984-11-14) page 2, upper left column, lines 2- 20, fig. 2	1-7, 10-20
Y	JP 11-213114 A (THE NIPPON SIGNAL CO., LTD.) 06.08.1999 (1999-08-06) paragraph [0022], fig. 4	1-7, 10-20
Y	WO 2018/163262 A1 (JAPAN TOBACCO INC.) 13.09.2018 (2018-09-13) paragraph [0080]	1-7, 10-20
Y	JP 2019-010038 A (TDK CORPORATION) 24.01.2019 (2019-01-24) paragraphs [0024]-[0038], [0070], fig. 1-6	14

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search  
13 February 2020 (13.02.2020)Date of mailing of the international search report  
25 February 2020 (25.02.2020)Name and mailing address of the ISA/  
Japan Patent Office  
3-4-3, Kasumigaseki, Chiyoda-ku,  
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/001794

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2016/0242463 A1 (LIU, Qiuning) 25.08.2016 (2016-08-25) paragraph [0021], fig. 1-2	16

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/JP2020/001794

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
JP 2019-528710 A	17 Oct. 2019	US 2019/0191783 A1 paragraphs [0028]- [0032], [0074]- [0087], fig. 1-3 WO 2018/050701 A1 EP 3512364 A1 CA 3030203 A1 CN 109688850 A KR 10-2019-0029702 A MX 2019002789 A RU 2711158 C1 (Family: none)	
JP 59-201176 A	14 Nov. 1984	(Family: none)	
JP 11-213114 A	06 Aug. 1999	(Family: none)	
WO 2018/163262 A1	13 Sep. 2018	US 2019/380394 A1 paragraph [0102] EP 3581038 A1 CA 3054492 A1 CN 109068736 A KR 10-2019-0113906 A TW 201838279 A	
JP 2019-010038 A	24 Jan. 2019	WO 2019/004240 A1 paragraphs [0024]- [0038], [0070], fig. 1-6	
US 2016/0242463 A1	25 Aug. 2016	WO 2015/021678 A1 CN 203523809 U	

**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- JP 2018512141 A [0003]
- JP 2017538420 A [0003]
- JP 2012513750 A [0003]
- JP 2015535760 A [0003]