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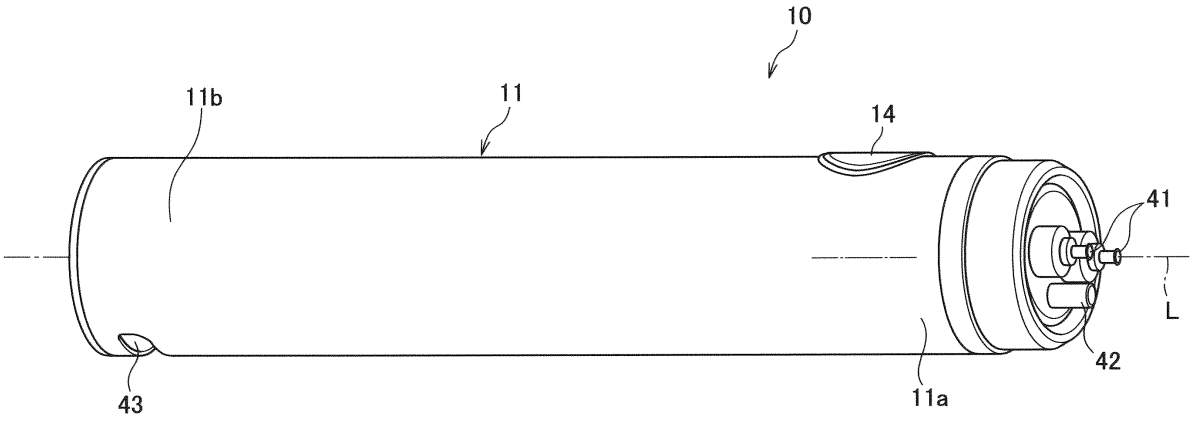
(54) **POWER SUPPLY UNIT AND CARTRIDGE FOR AEROSOL GENERATION DEVICE, AND METHOD FOR DETERMINING TYPE OF CARTRIDGE**

(57) The present invention enables easy determination of the type of an element when the element is to be mounted to an aerosol generation device, and enables control of the operation of the aerosol generation device in accordance with the type. Provided is a power supply unit (10) for an aerosol generation device. The power supply unit is provided with: a photo sensor (17) equipped with a light-emitting element (171) and a light-receiving element (172); and a control unit (50) that causes, when a cartridge (200) is to be connected to the power supply unit, the photo sensor to sense the cartridge through emission of light from the light-emitting element, and determines the type of the cartridge on the basis of the sensing result.

Fig. 4



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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. Accordingly, 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, and 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, a light receiving element, and a controller which makes, through operation that makes the light emitting element emit light, operation for detecting a cartridge be performed when the power supply unit is connected to the cartridge, and judges the type of the cartridge based on result of the detecting.

[0006] According to the power supply unit of the aerosol generation device, the type of a cartridge can be judged easily and precisely. 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 light emitted toward the light receiving element from the light emitting element is blocked as a result that a protrusion constructed in the cartridge moves between the light emitting element and the light receiving element; the numbers of protrusions of the cartridges are different according to the types of the cartridges, respectively; and result of the detecting may comprise the number of times that the light is blocked.

[0008] A power supply unit according to a third aspect comprises the power supply unit according to the first aspect, wherein signal strength of light emitted from the light emitting element and received by the light receiving element is adjusted as a result that a protrusion constructed in the cartridge moves between the light emitting element and the light receiving element; the shapes of the protrusions of the cartridges are different according to the types of the cartridges, respectively; and result of the detecting may comprise the signal strength of light adjusted through the shape of the protrusion in the cartridge.

[0009] A power supply unit according to a fourth aspect comprises the power supply unit according to one of the first aspect to the third aspect, wherein the light emitting element and the light receiving element may be arranged, on a surface whereat the power supply unit is connected to the cartridge in an axial direction, in such a manner that they are positioned along a circumferential direction to face each other.

[0010] A power supply unit according to a fifth aspect comprises the power supply unit according to one of the first aspect to the fourth aspect, wherein the controller may start operation for detecting the cartridge in response to reception, by the light receiving element, of light having first signal strength, and may terminate the operation for detecting the cartridge in response to reception, by the light receiving element, of light having second signal strength.

[0011] A power supply unit according to a sixth aspect comprises the power supply unit according to the fifth aspect, wherein the controller may judge, in response to reception of light having third signal strength that is smaller than the first signal strength and the second signal strength, that the light is blocked.

[0012] A power supply unit according to a seventh aspect comprises the power supply unit according to one of the first aspect to the sixth aspect, and comprises a first pair of a light emitting element and a light receiving element and a second pair of a light emitting element and a light receiving element; wherein the controller may judge the type of the cartridge, based on result of the detecting in the first pair of the light emitting element and the light receiving element and result of the detecting in the second pair of the light emitting element and the light receiving element.

[0013] A power supply unit according to an 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 based on result of the detecting.

[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 the cartridge is not detected for a predetermined period of time after starting of emission of the light 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 notification of the failure of connection may be used 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] A power supply unit according to a fifteenth aspect comprises the power supply unit according to the first aspect, wherein light from the light emitting element is reflected toward the light receiving element as a result that a protrusion constructed in the cartridge moves in a space close to the light emitting element and the light receiving element; the numbers of protrusions of the cartridges are different according to the types of the cartridges, respectively; and result of the detecting may comprise the number of times that the light emitted from the light emitting element is received by the light receiving element.

[0021] According to a sixteenth aspect, a cartridge, which is to be connected to the power supply unit according to one of the first aspect to the fifteenth aspect and comprises a protruding member, is provided, wherein the protruding members are different according to the types, respectively.

[0022] According to a seventeenth aspect, a cartridge for an aerosol generation device is provided. The cartridge is provided with a protruding member, wherein the protruding members are different according to the types, respectively; and, when the cartridge is connected to a power supply unit of the aerosol generation device, detection of the protruding member is performed by a photosensor included in the power supply unit, and the type is judged based on result of the detection.

[0023] According to the cartridge for the aerosol generation device, the type of a cartridge can be judged easily and precisely. 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.

[0024] A cartridge according to an eighteenth aspect comprises the cartridge according to the seventeenth aspect, wherein: the protruding member may comprise a number of protrusions, wherein the numbers of protrusions of the cartridges are different according to the types of the cartridges, respectively; when the cartridge is connected to the power supply unit, the protrusion may move between a light emitting element and a light receiving element which are included in the photosensor and may accordingly block light emitted toward the light receiving element from the light emitting element; and the type may be judged based on the number of times that the light is blocked by the protrusion.

[0025] A cartridge according to a nineteenth aspect comprises the cartridge according to the seventeenth aspect or the eighteenth aspect, 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 may be aligned, in a circumferential direction, with the cross section of the part of the hollow part of the cartridge case, so that said cartridge is inserted in the hollow part of the cartridge case in the axial direc-

tion.

[0026] According to a twentieth aspect, a method for judging the type of a cartridge is provided. The method comprises steps, that are performed by a power supply unit of an aerosol generation device when the cartridge is connected in an axial direction to the power supply unit, for: activating a photosensor included in the power supply unit; counting the number of times that light emitted toward a light receiving element from the light emitting element in the photosensor is blocked by a protruding member of the cartridge, wherein the light is blocked as a result that a protrusion of the protruding member moves between the light emitting element and the light receiving element in the photosensor during the time when the cartridge is rotated relative to the power supply unit about an axis by a predetermined distance; and judging the type of the cartridge based on the counted number of times; wherein the numbers of protrusions in the protruding members of the cartridges are different according to the types of the cartridges, respectively.

[0027] According to the method for judging the type of a cartridge, the type of a cartridge can be judged easily and precisely. 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.

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 is a schematic perspective view of a photosensor installed in a power supply unit 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 a schematic perspective view of a cartridge in an embodiment.

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

Fig. 10 is a flowchart showing operation for judging the type of a cartridge according to an embodiment.

Fig. 11A is a cross-section view of a cartridge case 27 in a modification example viewed from an axial direction.

Fig. 11B is a cross-section view of a cartridge 200 in a modification example viewed from an axial direction.

Fig. 12 is a schematic perspective view of a modification example of a power supply unit which is provided with a physical switch.

Fig. 13 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 attachable/detachable 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 comprising) 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 noncontact 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. The photosensor 17 may be constructed to include the light emitting element 171 and the light receiving element 172.

[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.

(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, 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 emitting element 171 emit light, 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 a result of detection, 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 cartridge case 27 from the power supply unit 10.

[0069] Next, the cartridge 200 is inserted in the car-

tridge 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. 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.

[0074] 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 cartridge 200 and the power supply unit 10 are engaged with each other.

[0075] 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.

[0076] 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.

[0077] 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

[0078] 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. 10, by using the present embodiment. Fig. 7 is a schematic perspective view showing the photosensor 17. 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. Further, Fig. 9A is a schematic perspective view of the cartridge 200 which is connected to the power supply unit 10 in the present embodiment; and Fig. 9B is a top view of the cartridge 200 viewed, in the axial direction, from the side of the power supply unit 10. Finally, Fig. 10 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.

[0079] According to the present embodiment, judging of the type of the cartridge 200 by the controller 50 is performed through operation to make the photosensor 17 installed in the power supply unit 10 detect a protruding member 220 installed in the cartridge 200.

(3-1) Photosensor Installed in Power Supply Unit

[0080] 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.

[0081] An example of the photosensor 17 is a transmissive photointerrupter. In more detail, it is preferable that the light emitting element 171 comprise a GaAs infrared light emitting diode, and the light receiving element

172 comprise a phototransistor (photo-IC). The light emitting element 171 and the light receiving element 172 are arranged to face each other, and, when the photosensor 17 is activated, light (infrared light) is emitted toward the light receiving element 172 from the light emitting element 171. Thereafter, the light emitting element 171 continues emission of light until it receives instruction to terminate emission.

[0082] 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). During the above procedure, the protruding member 220 constructed on the cartridge 200 moves through a space between the pair of the light emitting element 171 and the light receiving element 172, and, as a result, the light emitted toward the light receiving element 172 from the light emitting element 171 is blocked. As a result that the light is blocked, the quantity of transmitted light is reduced and the strength of the signal of the light received by the light receiving element 172 is lowered, so that insertion of the cartridge 200 is detected.

[0083] In more detail, as shown in Figs. 8A and 8B, in an example, the pair of the light emitting element 171 and the light receiving element 172 in the photosensor 17 is constructed in such a manner that it protrudes in the axial direction from the connection surface 80, for connection with 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, regarding the pair of the light emitting element 171 and the light receiving element 172, these elements are arranged along the circumferential direction to face each other. 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 protruding member 220 in a radial direction, for allowing the protruding member 220 to move through the space between the light emitting element 171 and the light receiving element 172.

[0084] 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 example, 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.

[0085] 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) Protruding Member Installed on Cartridge

[0086] As shown in Figs. 9A and 9B, the protruding member 220 is installed on an electrode surface 280. The protruding member 220 comprises one or more protrusions (two protrusions 220_1 and 220_2 in the example shown in the figure). Further, on the electrode surface 280, a pair of connection electrode parts 210 is constructed for making it be in contact with the pair of discharging terminals 41 in the side of the power supply unit 10 to allow electric conduction between them.

[0087] The protruding member 220 is positioned in an 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 protrusion arranging areas ARi and AR_2, 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 protrusion 220_1 is arranged in the protrusion arranging area ARi and the single protrusion 220_2 is arranged in the protrusion arranging area AR_2. In the electrode surface 280, the distance in the radial direction from the axial line L to each of the protrusions 220_1 and 220_2 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.

[0088] Further, for judging the type of a cartridge 200, it is constructed that the numbers of protrusions included in protruding members 220 in cartridges 200 are set differently according to the types of the cartridges 200, respectively. For example, a single protrusion is installed in the case of a "mint-flavor cartridge" type, and two protrusions are installed in the case of a "coffee-flavor cartridge" type. Further, it is possible to differentiate shapes and/or materials of protruding members 220 according to the respective types of respective cartridges 200, to adjust the signal strength of the light received by the light

receiving element 172 in the photosensor 17. For example, the shape of the protrusion in the case of a "mint-flavor cartridge" type may be set in such a manner that relative signal strength of the light becomes 80%, and the shape of the protrusion in the case of a "coffee-flavor cartridge" type may be set in such a manner that relative signal strength of the light becomes 50%.

[0089] As explained above, as a result that the protruding member 220 installed on the cartridge 200 moves through a space between the light emitting element 171 and the light receiving element 172, the light emitted from the light emitting element 171 to the light receiving element 172 is blocked. That is, regarding the number of times that the photosensor 17 of the power supply unit 10 detects a protruding member 220 of a cartridge 200 as a result that the protruding member 220 blocks the light, the numbers are different from one another according to the respective types of the respective cartridges 200. Based on result of detection that includes the number of times such as that explained above, the type of the cartridge 200 is judged.

[0090] In this manner, in the present embodiment, the constructions of the protruding members 220 of the cartridges 200 are made to be different from one another according to respective types. That is, operation for judging the type of the cartridge 200, that is realized as a result of cooperation of the protruding member 220 and the photosensor 17 in the power supply unit 10, can be facilitated, and accuracy of judgment can be improved.

[0091] In this regard, a person skilled in the art can understand that the position of the protruding member on the electrode surface 280, the dimension of the area in which the protrusion is arranged, positional relationship between areas, and the number of areas, positional relationship between respective protrusions, the number of protrusions, and the shapes of protrusions are not limited to those shown in the figures.

(3-3) Operation for Judging Type of Cartridge

[0092] Fig. 10 shows a series of actions relating to judgment of the type of a cartridge 200. 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, the cartridge detection judging unit 55 and the notification controller 54 are operated mainly, in cooperation with the photosensor 17, the memory 18, and the notifier 45.

[0093] 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 caser 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.

[0094] 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 cartridge detection judging unit 55 makes the photosensor 17 work to emit light from the light emitting element 171. Further, the state of the light receiving element 172 is set to a light reception waiting state.

[0095] Next, in step S30, detecting of the protruding member 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 protruding member 220. More specifically, in step S40, it is detected whether the light is blocked, as a result that the protruding member 220 moves through a space between the light emitting element 171 and the light receiving element 172 of 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).

[0096] If blocking of the light is detected (S40: Yes), the number of times of blocking is counted each time when the light is blocked, in step S50. The processes in steps S40 and S50 are repeated during the time when detection is being performed.

[0097] Next, in response to completion of rotating of the cartridge 200 relative to the power supply unit 10 by a predetermined distance, the type of the cartridge 200 is judged in step S60 based on the number of times of blocking counted in step S50. As explained above, since the numbers of the protrusions included in the protruding members 220 are set to be different from one another according to the types of cartridges 200, the cartridge detection judging unit 55 can judged the type of a cartridge 200 according to the counted number of times of blocking.

[0098] In this regard, with respect to each type of a cartridge 200, the number of times of blocking and the number of protrusions are related to each other based on a rule for judging types of cartridges 200. 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, the cartridge detection judging unit 55 can easily judge the type of the cartridge 200, if the number of times that the light is blocked could be deter-

mined.

[0099] 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 makes the photosensor 17 operate to terminate light emission by the light emitting element 171.

[0100] 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.

[0101] 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.

[0102] If it is judged 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.

[0103] 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.

[0104] 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.

[0105] 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.

[0106] It should be reminded that, in the case that a cartridge 200 is not detected for a predetermined period of time set in advance in the memory 18, 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.

[0107] 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.

[0108] As explained above, in the present embodiment, the type of the cartridge 200 can easily be judged by detecting the protruding member 220 constructed on the cartridge 200 by using 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

[0109]

a) It is explained in the above description that a transmissive photointerrupter is adopted as the photosensor 17; however, it may be possible to adopt an element other than the above, for example, a reflection-type photosensor. Specifically, in a reflection-type photosensor, a light emitting element and a light receiving element, which constitute a pair, are arranged in series, and the light emitting element emits light at a predetermined angle. Thereafter, when an object (the protruding member 220 of the cartridge 200) moves through a space near the pair of the light emitting element and the light receiving element in the direction of arrangement thereof, the object reflects the light emitted from the light emitting element to the light receiving element, and, as a result, the light receiving element receives the light. In the case of the reflection-type photosensor, the type of the cartridge 200 is judged based on the number of times that the light receiving element receives the light

emitted from the light receiving element, through reflection by the protrusion(s) in the protruding member 220.

b) It is explained in the above description that the power supply unit 10 comprises one photosensor set 17 comprising a pair of a light emitting element 171 and a light receiving element 172. However, instead of adopting the above construction, two or more photosensor sets 17 may be included. For example, the power supply unit 10 may comprise, in addition to a first pair of a light emitting element and a light receiving element, a second pair of a light emitting element and a light receiving element. In the above case, it is preferable that the cartridge detection judging unit 55 in the controller 50 judge the type of a cartridge, based on both a result of detection of the protruding member 220 by the first pair of the light emitting element and the light receiving element and a result of detection of the protruding member 220 by the second pair of the light emitting element and the light receiving element.

[0110] Further, in the case that plural photosensor sets are included, it is preferable that a light emitting element and a light receiving element in each pair be constructed to have shapes different from shapes of those in other pairs, to make respective pairs have different light transmission characteristics. For example, each of a light emitting element and a light receiving element in a first pair may be constructed to have short length, and each of a light emitting element and a light receiving element in a second pair may be constructed to have length longer than the length of each element in the first pair. Further, it is possible to construct protrusions in the protruding members 220 to have different length or include different material.

[0111] By adopting the above construction, the number of types of cartridges 200, that can be judged, can be increased. For example, it is assumed that a first pair is formed to include short sensors having relatively short length, a second pair is formed to include long sensors having relatively long length, and these photosensor sets are combined and used. Then, it is determined in such a manner that the type of a cartridge 200 is a first type in the case that the protruding member 220 is detected by both the short sensors and the long sensors, and, on the other hand, the type of a cartridge 200 is a second type in the case that the protruding member 220 is not detected by the long sensors and is detected by the short sensors. By adopting the above construction, the number of types of cartridges 200, that can be judged, can be increased, compared with the case that a single photosensor set comprising an element pair is used.

[0112] Further, variations of judgment can be increased. For example, with respect to a cartridge classified as "mint-flavor cartridge," types to be judged such as types "mint-flavor cartridge for men" and "mint-flavor cartridge for women" can be added. By adopting the above construction, it becomes possible to effectively utilize the cartridge while providing a user with sufficient suction experience.

c) 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 axial 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 protruding member 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, the protrusion (an object to be detected) constructed on the cartridge 200 moves in the groove, and blocks light emitted in the photosensor 17. By adopting the above construction, the type of the cartridge can be judged based on above-explained blocking of light.

d) 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. 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.

[0113] Fig. 11A is a cross-section view of a cartridge case 27' in a modification example viewed from an axial direction. Fig. 11B 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 27ci and $27c_2$ 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 27ci and $27c_2$ are arranged 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).

[0114] Further, the cartridge 200' comprises, in the axial direction, two concave parts $200c_1$ and $200c_2$ 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.

[0115] 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. 10: S20) can be made more accurate.

e) 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. 10: S20). However, instead of adopting the above construction, it is possible to adopt a construction that uses a physical switch to make timing of a start be identified.

[0116] Fig. 12 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).

[0117] 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. 10, 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.

[0118] 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. Also, the above protrusion may be substituted by the protrusion in the protruding member 220. 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.

f) 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.

[0119] 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.

g) It is explained in the above description that the timing to start detection of the protruding member 220 of the cartridge 200 is that relating to a start of light emission of the light emitting element 171 (Fig. 10: S30). However, instead of adopting the above construction, it is possible to adopt a construction that the protruding member 220 is provided with a triggering protrusion that defines timing to start detection of the protruding member 220.

[0120] For example, in protrusions in the protruding member 220 of the cartridge 200, a certain protrusion detected by the photosensor 17 may be used as a triggering protrusion for triggering using of the timing. In more detail, first signal strength of light received by the light receiving element 172, wherein the received light is that outputted from the light emitting element 171 and applied to the triggering protrusion before reception, is stored in the memory 18 in advance. Then, in step S30, operation for detecting the protruding member 220 may be started in response to reception, by the light receiving element 172, of light having the first signal strength.

[0121] In the above case, for clearly distinguishing the triggering protrusion from a protrusion(s) for blocking light in the protruding member 220 in steps S40 and S50, it is preferable to construct the protrusions to have different lengths, for example. By adopting the above construction, the timing to start detection of the protruding member 220 can be further clarified, so that an error in counting of the number of times can be prevented, and precision of counting of the number of times can be further improved. That is, accuracy of judgment of the cartridge 200 can be improved. Further, in steps S40 and S50, it is preferable to judge that the light is blocked by a protrusion when light having signal strength smaller than the

first signal strength is received.

h) Similarly, it is possible to adopt a construction that the protruding member 220 is provided with a triggering protrusion that defines timing to terminate detection of the protruding member 220. In more detail, second signal strength of light received by the light receiving element 172, wherein the received light is that outputted from the light emitting element 171 and applied to the triggering protrusion for termination before reception, is stored in the memory 18 in advance. Then, operation for detecting the protruding member 220 may be terminated in response to reception, by the light receiving element 172, of light having the second signal strength.

[0122] By adopting the above construction, the timing to terminate detection of the protruding member 220 can be further clarified, so that an error in counting of the number of times can be prevented, and precision of counting of the number of times can be further improved. That is, accuracy of judgment of the cartridge 200 can be improved. Also, regarding steps S40 and S50, it is preferable that the signal strength smaller than the first signal strength, that is explained above, be set to be smaller than the second signal strength. Alternatively, the value of the first signal strength may be set to be the same as the value of the second signal strength.

< Different Embodiments >

[0123] A different embodiment of the present disclosure will be explained with reference to Fig. 13. Fig. 13 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.

[0124] 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.

[0125] The photosensor 17a comprises a pair of a light emitting element and a light receiving element. The controller 50a is constructed to make the photosensor 17a detect a cartridge 200 through operation to make the light emitting element emit light, when the power supply unit 10a connects to the cartridge 200, and judge the type of the cartridge 200 based on result of detection.

[0126] 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.

[0127] 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

[0128] 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: $27c_1$, $27c_2$ ... Convex part: 200, 200'... Cartridge: 200ci, $200c_2$ ... Concave part: 260 ... Second rotating connection part: 210 ... Connection electrode part: 220 ... Protruding member: 220_1, 220_2 ... Protrusion: 280 ... Electrode surface: AR_1, AR_2 ... Protrusion arranging area: 26 ... End cap: 261 ... Anti-slipping member: 30 ... Capsule unit: 310 ... Opening

Claims

1. A power supply unit comprising:

a light emitting element;
a light receiving element; and
a controller which makes, through operation that makes the light emitting element emit light, operation for detecting a cartridge be performed when the power supply unit is connected to the cartridge, and judges the type of the cartridge based on result of the detecting.

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

light emitted toward the light receiving element from the light emitting element is blocked as a result that a protrusion constructed in the cartridge moves between the light emitting element and the light receiving element;

the numbers of protrusions of the cartridges are different according to the types of the cartridges, respectively; and result of the detecting comprises the number of times that the light is blocked.

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

signal strength of light emitted from the light emitting element and received by the light receiving element is adjusted as a result that a protrusion constructed in the cartridge moves between the light emitting element and the light receiving element;
the shapes of the protrusions of the cartridges are different according to the types of the cartridges, respectively; and result of the detecting comprises the signal strength of light adjusted through the shape of the protrusion in the cartridge.

4. The power supply unit as recited in any one of Claims 1-3, wherein
the light emitting element and the light receiving element are arranged, on a surface whereat the power supply unit is connected to the cartridge in an axial direction, in such a manner that they are positioned along a circumferential direction to face each other.

5. The power supply unit as recited in any one of Claims 1-4, wherein the controller

starts operation for detecting the cartridge in response to reception, by the light receiving element, of light having first signal strength, and
terminates the operation for detecting the cartridge in response to reception, by the light receiving element, of light having second signal strength.

6. The power supply unit as recited in Claim 5, wherein the controller judges, in response to reception of light having third signal strength that is smaller than the first signal strength and the second signal strength, that the light is blocked.

7. The power supply unit as recited in any one of Claims 1-6 comprising

a first pair of a light emitting element and a light receiving element and a second pair of a light emitting element and a light receiving element; wherein
the controller judges the type of the cartridge, based on result of the detecting in the first pair of the light emitting element and the light receiving element and result of the detecting in the second pair of the light emitting element and the light receiving element.

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, wherein 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 based on result of the detecting.

11. The power supply unit as recited in any one of Claims 1-10, wherein the controller judges, when the cartridge is not detected for a predetermined period of time after starting of emission of the light 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 notification of the failure of connection is used 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. The power supply unit as recited in Claim 1, wherein

light from the light emitting element is reflected toward the light receiving element as a result that a protrusion constructed in the cartridge moves in a space close to the light emitting element and the light receiving element;
the numbers of protrusions of the cartridges are different according to the types of the cartridges, respectively; and result of the detecting comprises the number of times that the light emitted from the light emitting element is received by the light receiving element.

16. A cartridge, which is to be connected to the power supply unit as recited in any one of Claims 1-15, comprising a protruding member, wherein the protruding members are different according to the types, respectively.

17. A cartridge for an aerosol generation device, wherein

the cartridge is provided with a protruding member, wherein the protruding members are different according to the types, respectively; and
when the cartridge is connected to a power supply unit of the aerosol generation device, detection of the protruding member is performed by a photosensor included in the power supply unit, and the type is judged based on result of the detection.

18. The cartridge as recited in Claim 17, wherein

the protruding member comprises a number of protrusions, wherein the numbers of protrusions of the cartridges are different according to the types of the cartridges, respectively;
when the cartridge is connected to the power supply unit, the protrusion moves between a light emitting element and a light receiving element which are included in the photosensor and accordingly blocks light emitted toward the light receiving element from the light emitting element; and
the type is judged based on the number of times that the light is blocked by the protrusion.

19. The cartridge as recited in Claim 17 or 18, 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 said cartridge is inserted in the hollow part of the cartridge case in the axial direction.

20. A method for judging the type of a cartridge, comprising steps, that are performed by a power supply unit of an aerosol generation device when the cartridge is connected in an axial direction to the power supply unit, for:

activating a photosensor included in the power supply unit;
counting the number of times that light emitted toward a light receiving element from the light emitting element in the photosensor is blocked by a protruding member of the cartridge, wherein the light is blocked as a result that a protrusion of the protruding member moves between the light emitting element and the light receiving element in the photosensor during the time when the cartridge is rotated relative to the power supply unit about an axis by a predetermined distance; and
judging the type of the cartridge based on the counted number of times; wherein
the numbers of protrusions in the protruding members of the cartridges are different according to the types of the cartridges, respectively.

Fig. 1

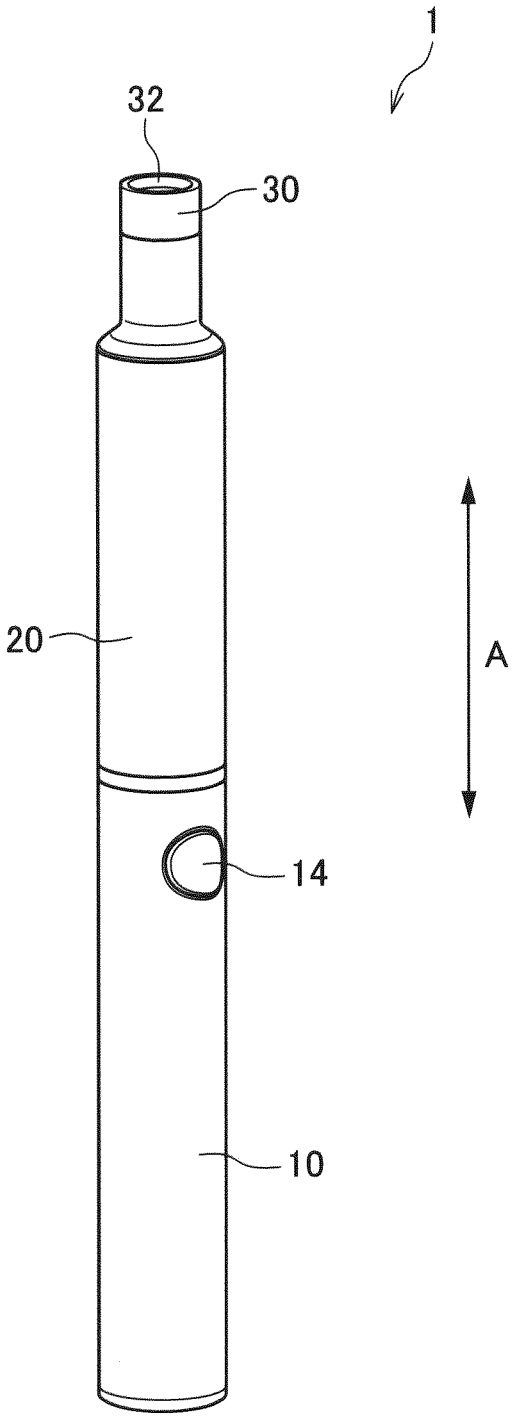
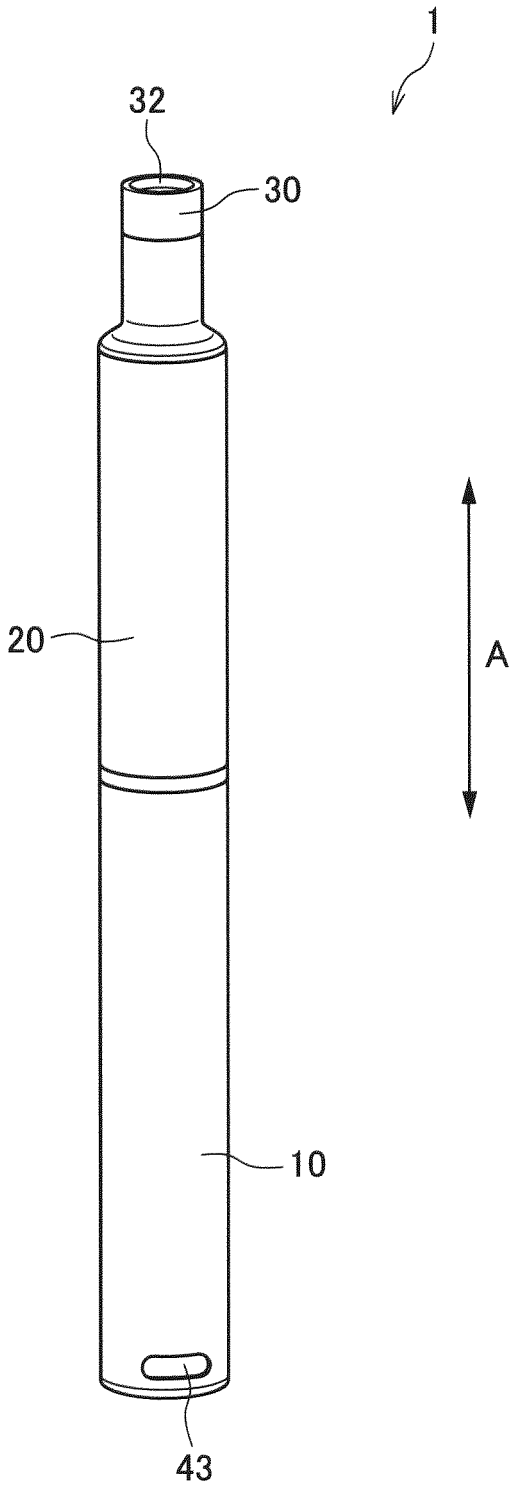
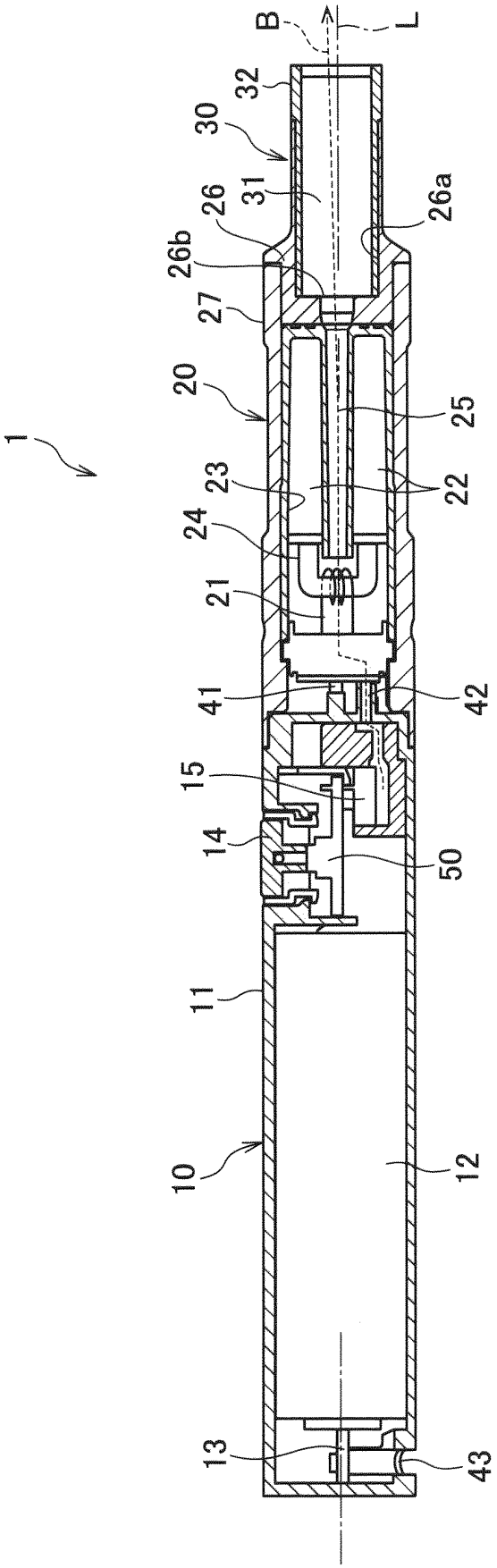


Fig. 2




B
L
32
30
31
26
26a
26b
27
20
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1
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22
24
21
41
42
15
14
50
11
10
12
13
43

Fig. 3

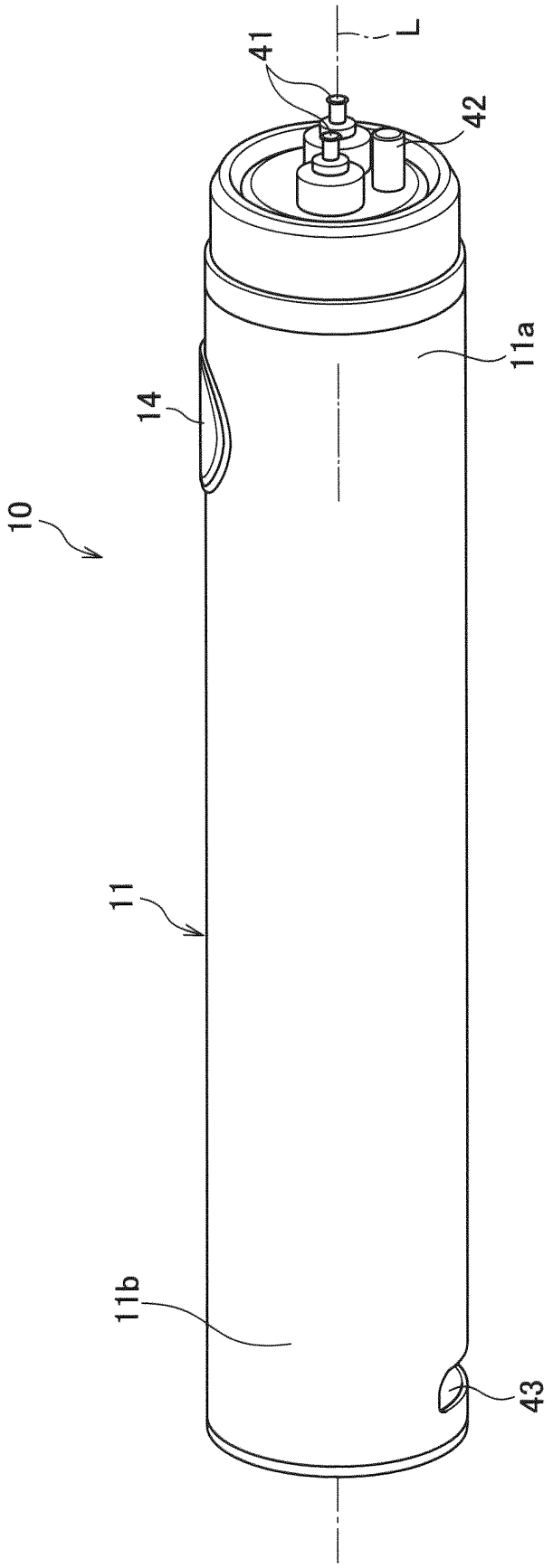


Fig. 4

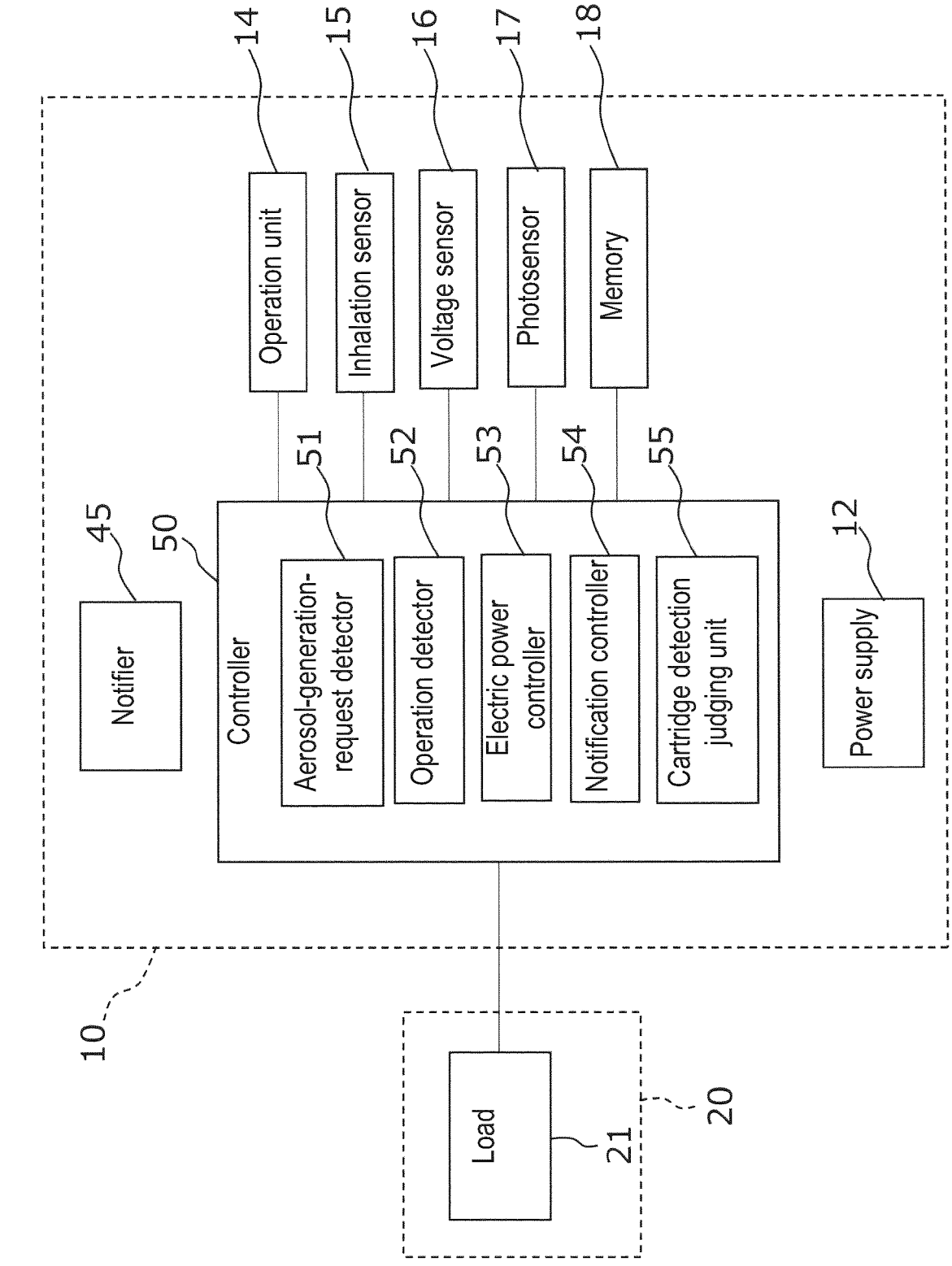
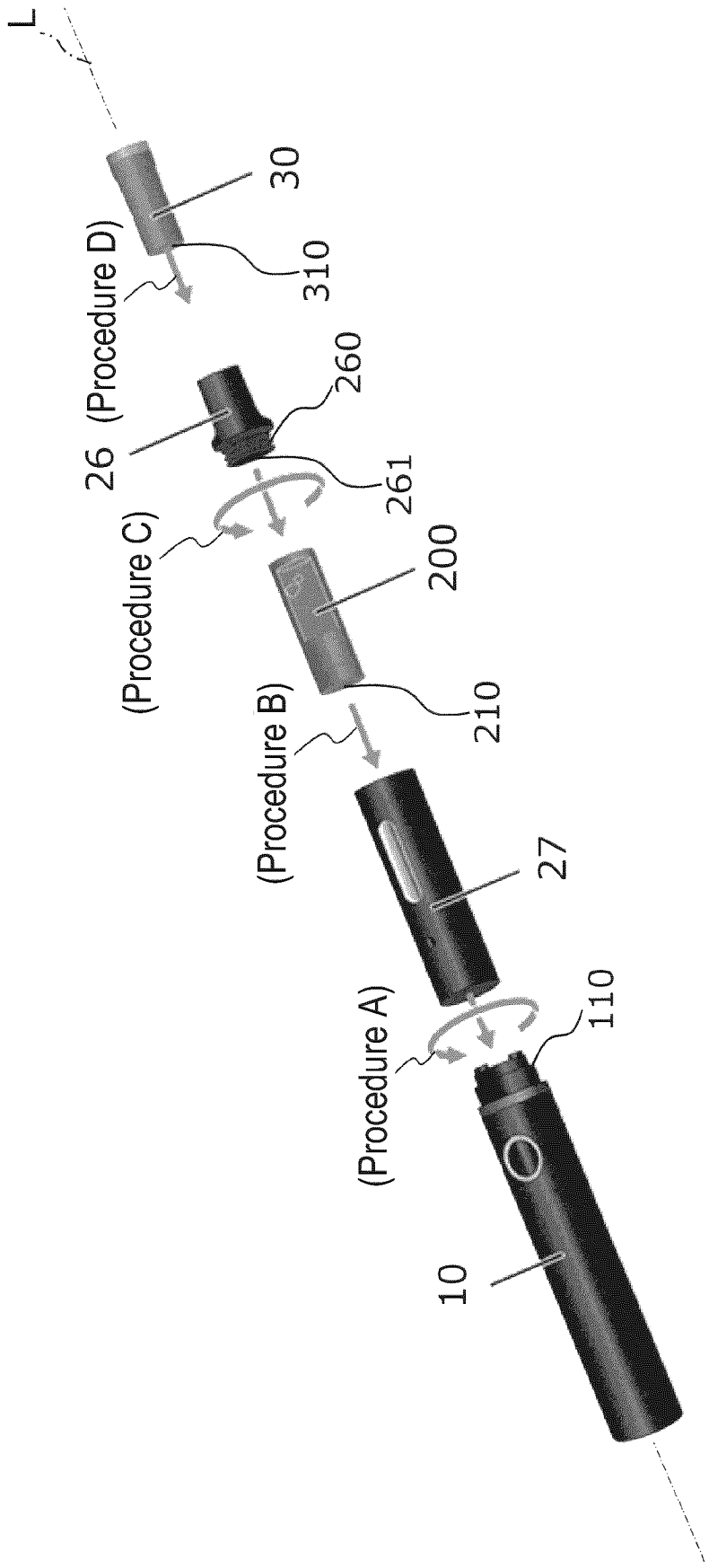

14
15
16
17
18
Operation unit
Inhalation sensor
Voltage sensor
Photosensor
Memory
51
52
53
54
55
45
50
12
Notifier
Controller
Aerosol-generation-request detector
Operation detector
Electric power controller
Notification controller
Cartridge detection judging unit
Power supply
10
Load
21
20

Fig. 5

Fig. 6


L
30
310
(Procedure D)
26
260
261
(Procedure C)
200
210
(Procedure B)
27
110
(Procedure A)
10

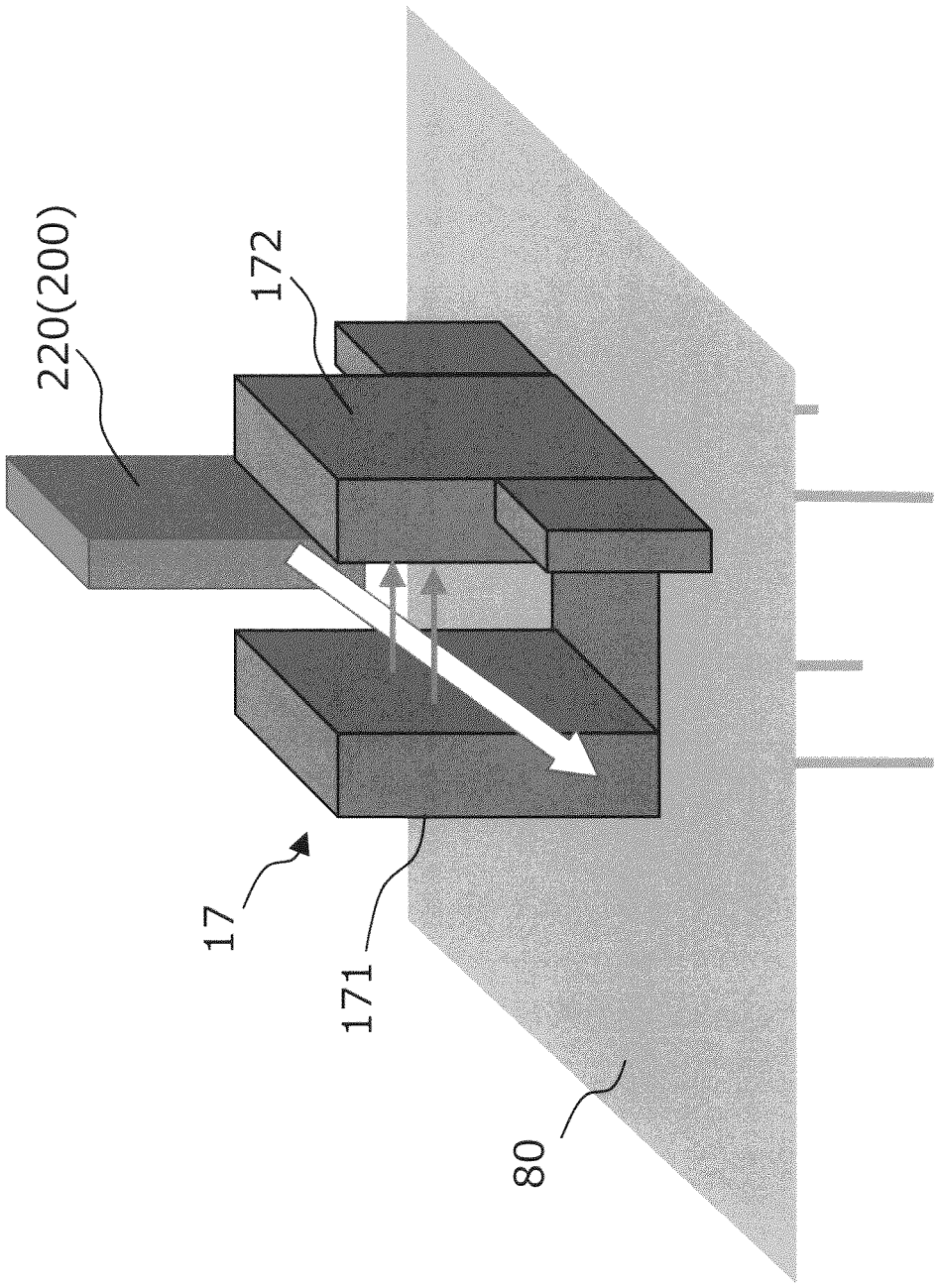


Fig. 7

Fig. 8A

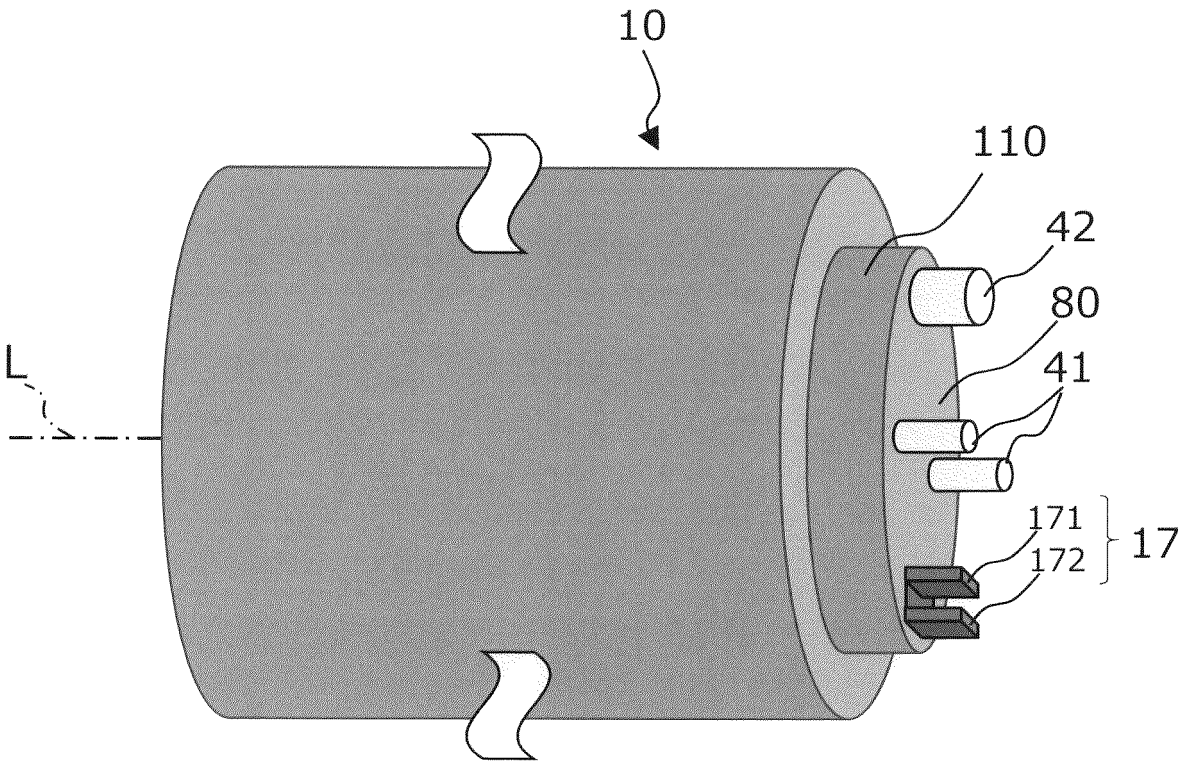


Fig. 8B

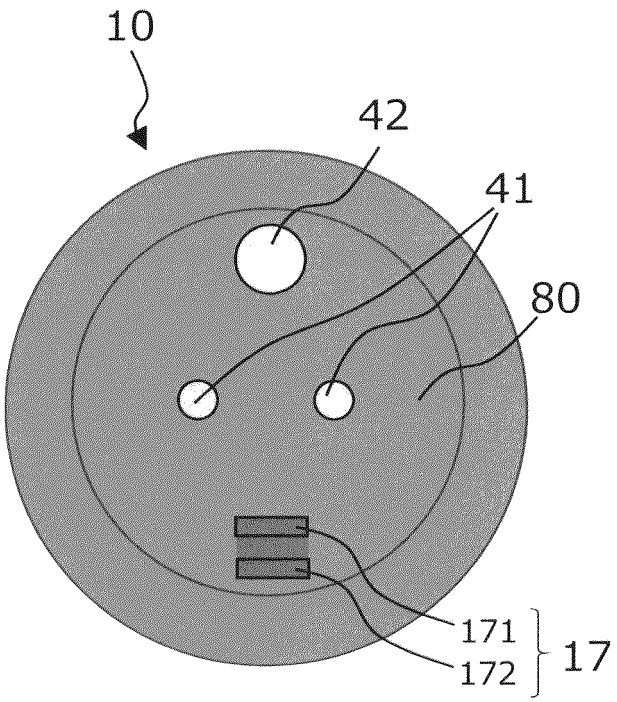


Fig. 9A

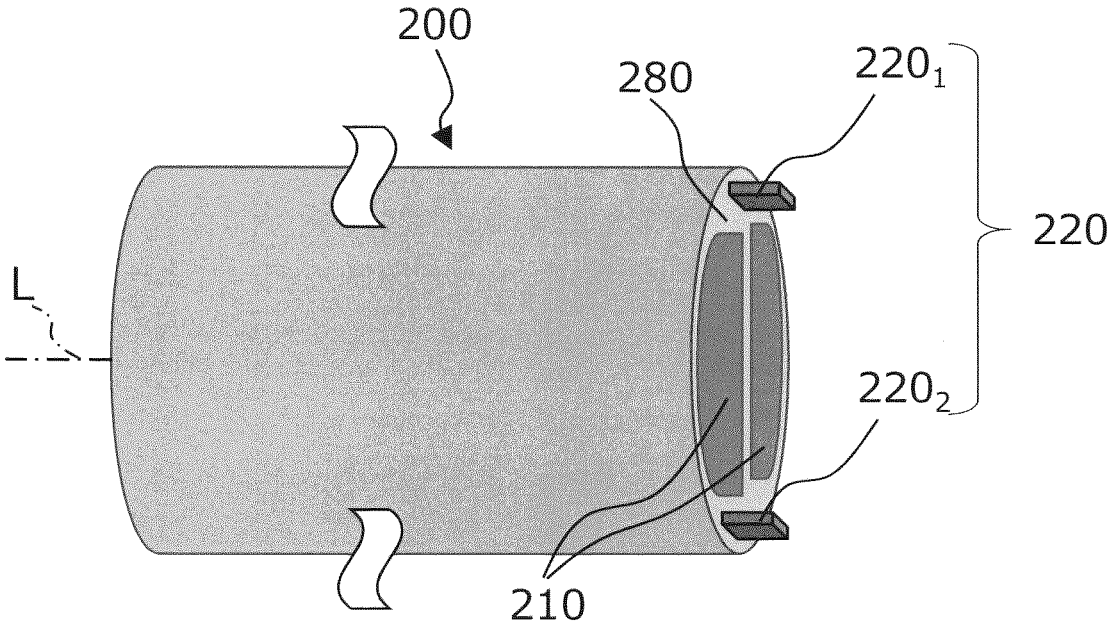


Fig. 9B

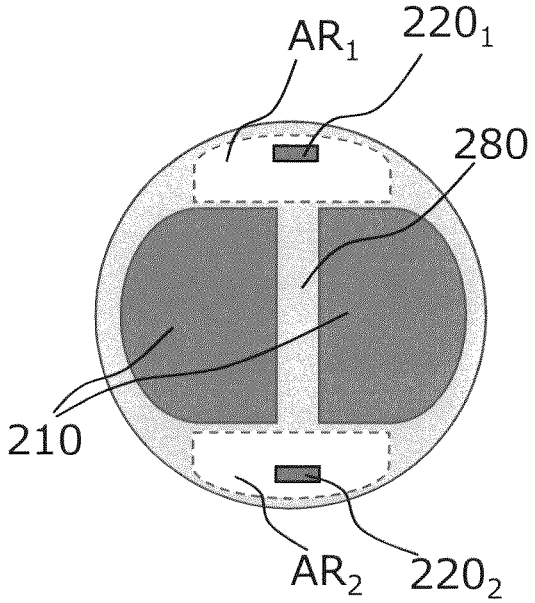


Fig. 10

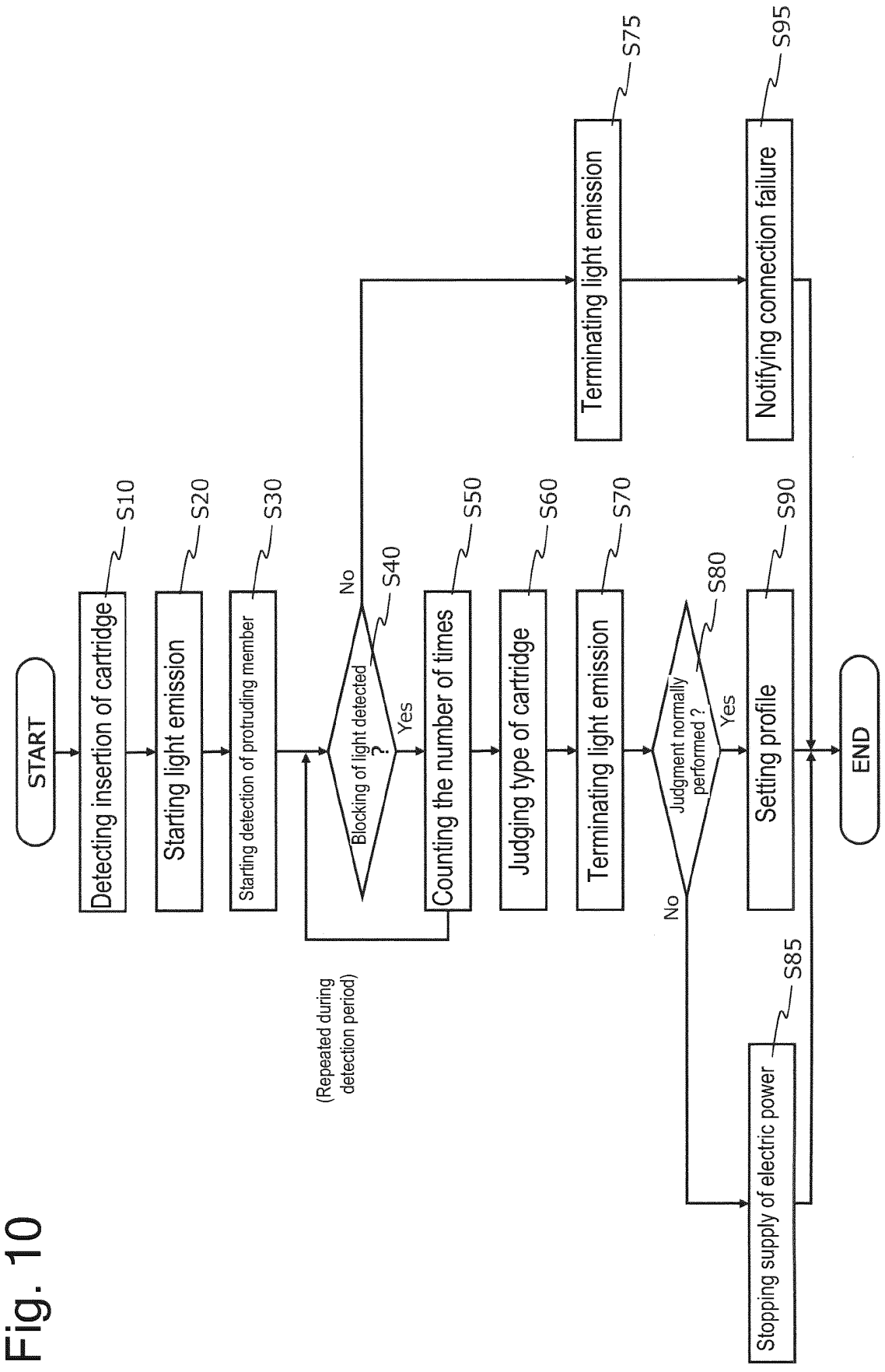

START
Detecting insertion of cartridge
S10
Starting light emission
S20
Starting detection of protruding member
S30
Blocking of light detected ?
S40
No
Yes
(Repeated during detection period)
Counting the number of times
S50
Judging type of cartridge
S60
Terminating light emission
S70
Judgment normally performed ?
S80
No
Yes
Setting profile
S90
Terminating light emission
S75
Notifying connection failure
S95
Stopping supply of electric power
S85
END

Fig. 11A

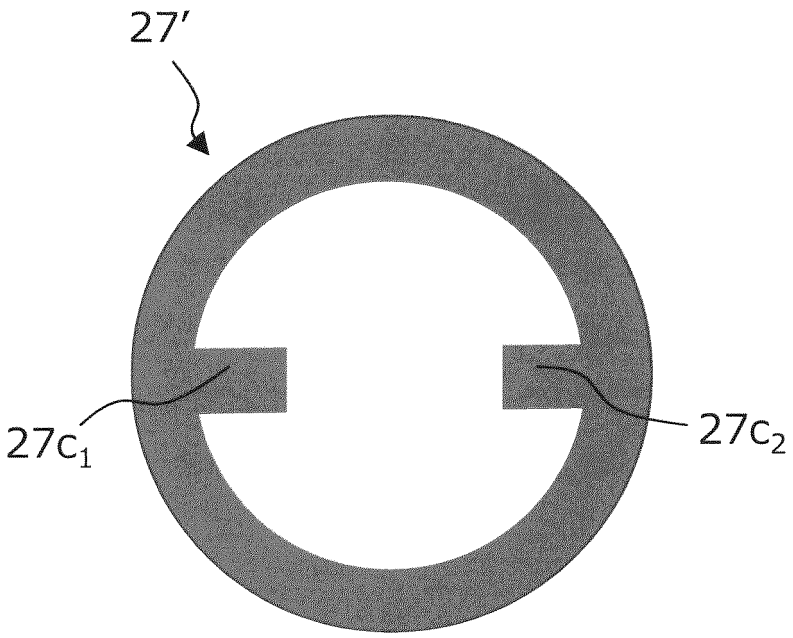
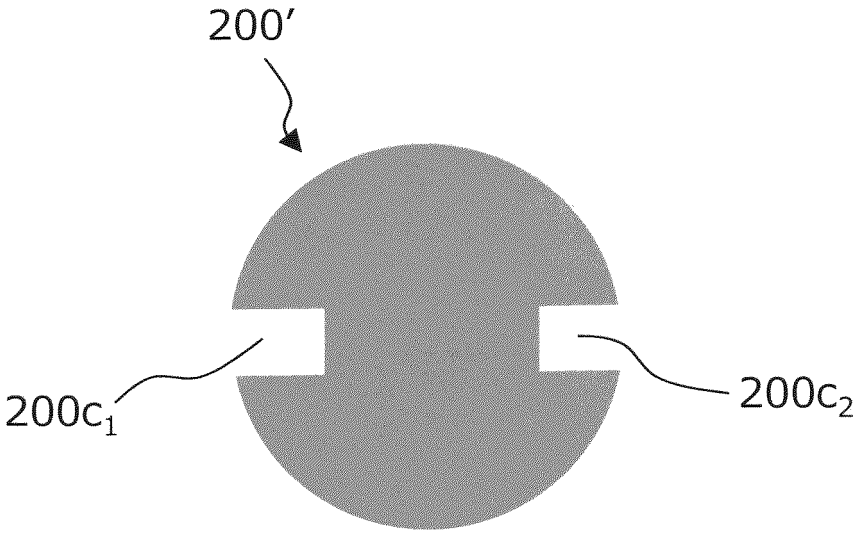


Fig. 11B



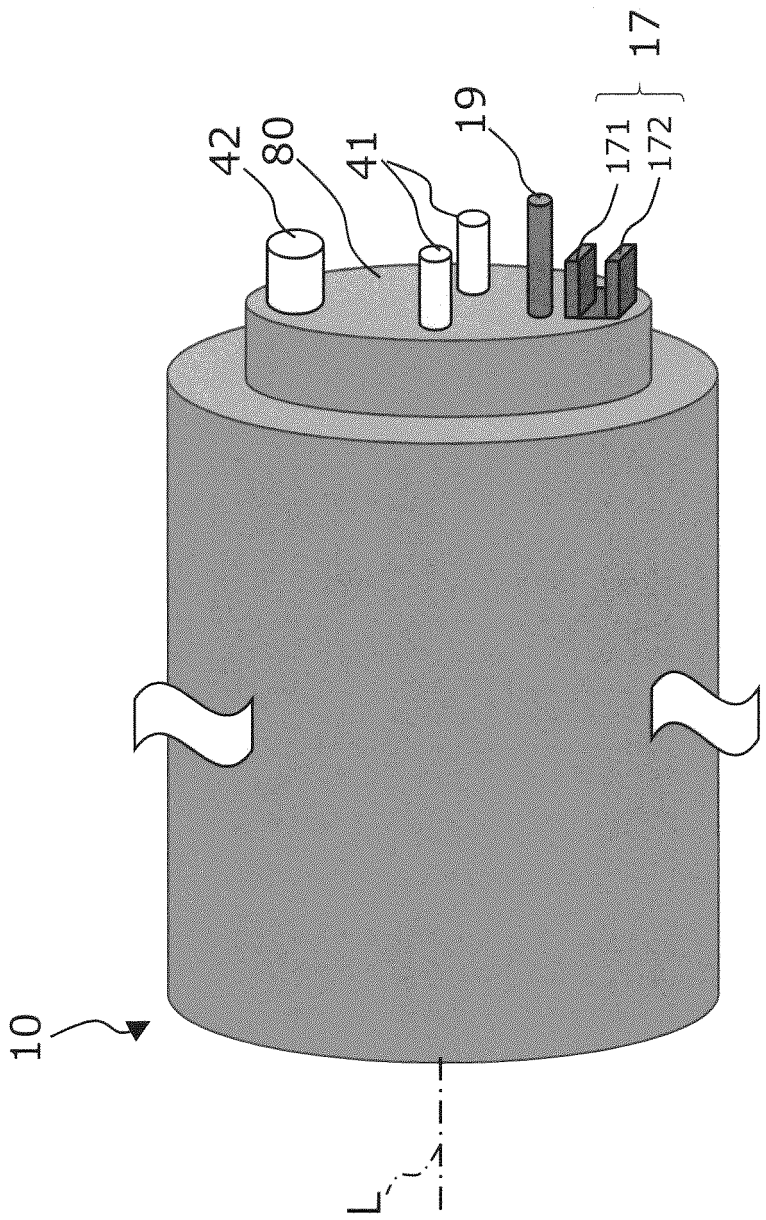


Fig. 12

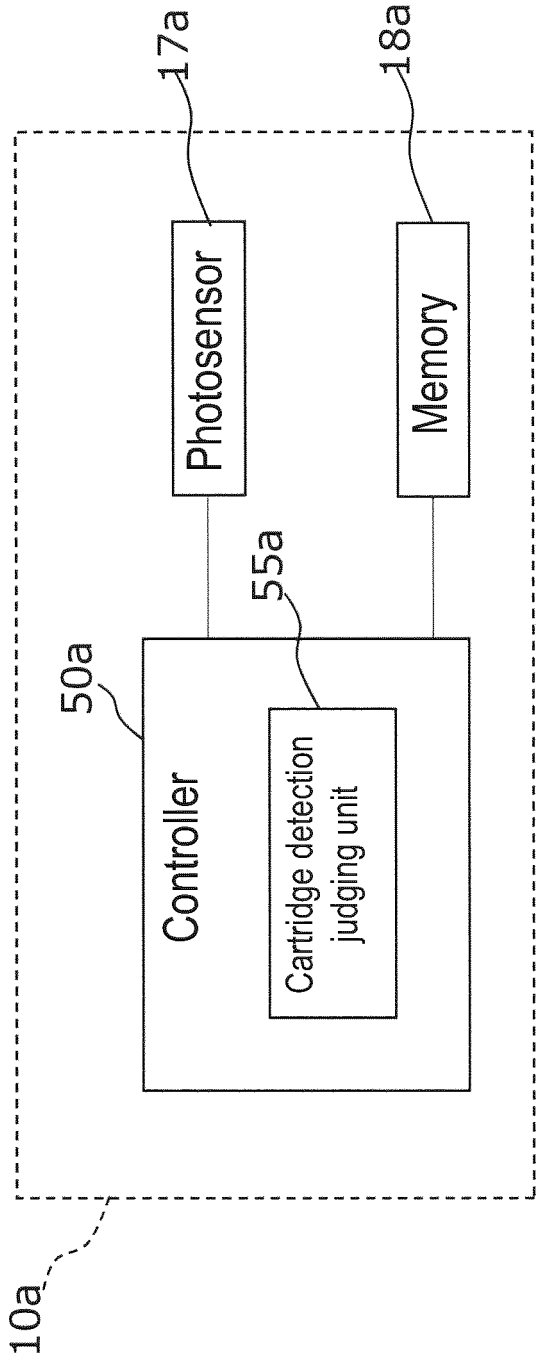

17a
18a
Photosensor
Memory
55a
50a
Controller
Cartridge detection judging unit
10a

Fig. 13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2020/001792

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.
X 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, 4-5, 7, 10-11 12-14 2-3, 6, 8-9, 15-20
Y	WO 2018/163262 A1 (JAPAN TOBACCO INC.) 13.09.2018 (2018-09-13) paragraph [0080]	12-14
Y	JP 2019-010038 A (TDK CORPORATION) 24.01.2019 (2019-01-24) paragraphs [0024]-[0038], [0070], fig. 1-6	14
A	US 2016/0242463 A1 (LIU, Qiuming) 25.08.2016 (2016-08-25) paragraph [0021], fig. 1-2	19

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

* Special categories of cited documents:
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"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 February 2020 (13.02.2020)	25 February 2020 (25.02.2020)

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2020/001792

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	
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	

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

REFERENCES CITED IN THE DESCRIPTION

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