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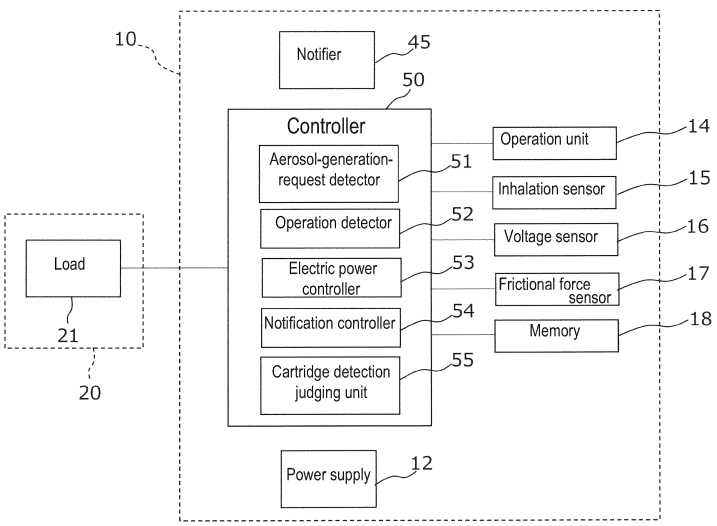
(54) CARTRIDGE AND POWER UNIT FOR AEROSOL GENERATING DEVICE, AND METHOD FOR DETERMINING CARTRIDGE TYPE

(57) The present invention: enables the type of an element to be easily determined when an element is attached to an aerosol generating device; and enables the operation of the aerosol generating device to be controlled in accordance with the type. A power unit (10) for an aerosol generating device is provided. The power unit (10) comprises: a friction force sensor (17) that is provided to a contact surface between the power unit and a cartridge; and a control unit that is configured so that when the power unit is connected to a cartridge (200) or after the power unit has been connected thereto, the control unit determines the cartridge type on the basis of friction resistance detected as a result of the friction force sensor making contact with a friction part (220) provided to the cartridge.

Fig. 5



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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
PTL 5: Japanese Patent Application Public Disclosure No. 2019-500898

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. Also, one of objects of the present disclosure is to make it possible to control, according to the type, operation of the aerosol generation device.

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 frictional force sensor installed in a contact surface, that is to be brought into contact with a cartridge, of the power supply unit; and a controller for judging, when or after the power supply unit is connected to the cartridge, the type of the cartridge based on frictional resistance that is detected as a result that the frictional force sensor is brought into contact with a friction part installed in the cartridge.

[0006] According to the power supply unit of the aerosol generation device, the type of a cartridge can be judged easily, at low cost, and precisely. Further, operation of the aerosol generation device can be controlled according to the type. Thus, it becomes possible to provide a user with sufficient suction experience.

[0007] A power supply unit according to a second aspect comprises the power supply unit according to the first aspect, wherein: the frictional force sensor detects frictional resistance generated by the friction part during above contact, wherein quantities of the generated frictional resistance are different according to the types of the cartridges, respectively; and the controller judges the type of the cartridge based on the quantity of frictional resistance.

[0008] A power supply unit according to a third aspect comprises the power supply unit according to the first aspect or the second aspect, wherein: the frictional force sensor detects a quantity of frictional resistance generated by friction parts arranged in an arrangement pattern during above contact, wherein arrangement patterns of the friction parts are different according to the types of the cartridges, respectively, and quantities of frictional resistance generated in relation to the arrangement patterns are accordingly different according to the types of the cartridges, respectively; the controller judges the type of the cartridge based on the quantity of frictional resistance; and each of the arrangement patterns is formed by a combination of plural kinds of members.

[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 frictional force sensor detects frictional resistance generated by a first friction part and a second friction part during above contact, wherein quantities of frictional resistance generated by the first friction parts and the second friction parts are different according to the types of the cartridges, respectively; the controller judges the type of the cartridge based on the quantities of frictional resistance; and, with respect to the friction parts, the quantity of frictional resistance generated by the first friction part and the quantity of frictional resistance generated by the second friction part are different from 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: when the power supply unit is connected to the cartridge, the controller makes, in response to detection of frictional resistance of a first quantity, the frictional force sensor start operation for detecting the cartridge, and, thereafter, makes, in response to detection of frictional resistance of a second quantity, the frictional force sensor terminate the above operation.

[0011] A power supply unit according to a sixth aspect comprises the power supply unit according to one of the first aspect to the fifth aspect, and further comprises 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 activates the frictional force sensor in response to an event that the physical switch is pressed.

[0012] A power supply unit according to a seventh aspect comprises the power supply unit according to the sixth aspect, wherein the controller deactivates the frictional force sensor in response to an event that the physical switch is pressed again by the cartridge.

[0013] A power supply unit according to a eighth aspect comprises the power supply unit according to one of the first aspect to the seventh aspect, wherein the controller makes, in response to completion of judgment of the type of the cartridge, the frictional force sensor terminate the operation for detecting the cartridge.

[0014] A power supply unit according to a ninth aspect comprises the power supply unit according to one of the first aspect to the eighth aspect, wherein the controller judges, when frictional resistance of a predetermined quantity is not detected by the frictional force sensor for a predetermined period of time after starting of the operation for detecting the cartridge, that connection of the power supply unit to the cartridge is failed, and makes the frictional force sensor terminate the operation for detecting the cartridge.

[0015] A power supply unit according to a tenth aspect comprises the power supply unit according to the ninth aspect, and further comprises a notifier, wherein the controller makes the notifier notify the failure of connection.

[0016] A power supply unit according to an eleventh aspect comprises the power supply unit according to the tenth aspect, wherein the notifier uses the notification of the failure of connection to prompt a user to again perform action to connect the power supply unit to the cartridge.

[0017] A power supply unit according to a twelfth aspect comprises the power supply unit according to one of the first aspect to the eleventh aspect, wherein the controller prohibits supplying of electric power to the cartridge in the case that the type of the cartridge cannot be judged.

[0018] A power supply unit according to a thirteenth aspect comprises the power supply unit according to one of the first aspect to the twelfth aspect, wherein the friction force sensor is a tactile sensor.

[0019] According to a fourteenth aspect, a cartridge, which is to be connected to the power supply unit according to the first aspect to the thirteenth aspect and has a friction part having a frictional characteristic, is provided; wherein the frictional characteristics of the friction parts are different according to the types of the cartridges, respectively.

[0020] Further, according to a fifteenth aspect, a cartridge for an aerosol generation device is provided. The cartridge comprises a friction part for generating frictional resistance, wherein quantities of frictional resistance generated by the friction parts are different according to the types of the cartridges, respectively, wherein: when or after the cartridge is connected to the power supply unit, the cartridge is detected as a result that a frictional force sensor installed on a contact surface, that is to be brought into contact with the cartridge, of the power supply unit is brought into contact with the friction part, and the type of the cartridge is judged based on detected frictional resistance.

[0021] A cartridge according to a sixteenth aspect comprises the cartridge according to the fifteenth aspect, wherein:

arrangement patterns of plural members in the friction parts are different according to the types of the cartridges, respectively; and

the arrangement patterns comprise combinations of different kinds of the members from which quantities of frictional resistance, that are different from one another, are generated at the time of above contact.

[0022] A cartridge according to a seventeenth aspect comprises the cartridge according to the fifteenth aspect or the sixteenth 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 is aligned, in a circumferential direction, with the cross section of the part of the hollow part of the cartridge case, so that the cartridge may be inserted in the hollow part of the cartridge case in the axial direction.

[0023] According to an eighteenth 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 or after the cartridge is connected in an axial direction to the power supply unit, for: detecting contact between a frictional force sensor installed on a contact surface, that is to be brought into contact with the cartridge, of the power supply unit and a friction part installed on the cartridge; and judging the type of the cartridge based on frictional resistance detected during above contact; wherein the respective friction parts are those from which quantities of frictional resistance, that are different from one another, are generated, according to the respective types of the

respective cartridges.

[0024] A method according to a nineteenth aspect comprises the method according to the eighteenth aspect, wherein: arrangement patterns of plural members in the friction parts are different according to the types of the cartridges, respectively; and the arrangement patterns comprise combinations of different kinds of the members from which quantities of frictional resistance, that are different from one another, are generated at the time of above contact.

[0025] A method according to a twentieth aspect comprises the method according to the eighteenth aspect or the nineteenth aspect, wherein: the power supply unit comprises a first friction part and a second friction part, and, in the friction parts, the quantity of frictional resistance generated by the first friction part and the quantity of frictional resistance generated by the second friction part are different from each other.

BRIEF DESCRIPTION OF DRAWINGS

[0026]

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

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

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

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

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

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

Fig. 7 shows schematic operation of a cartridge and a frictional force sensor constructed 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 an example of a top view of a cartridge viewed from an axial direction in an embodiment.

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

Fig. 10 is an example of an arrangement pattern of plural members which are components of a friction part.

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

Fig. 12A is a cross-section view of a cartridge case 27 in a modification example viewed from an axial direction.

Fig. 12B is a cross-section view of a cartridge 200 in a modification example viewed from an axial direction.

Fig. 13 is a modification example of a power supply unit which is provided with a physical switch.

Fig. 14 is a block diagram of a power supply unit in a different embodiment.

DESCRIPTION OF EMBODIMENTS

[0027] 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.

[0028] 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

[0029] 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.

[0030] The aerosol generation device 1 is an apparatus for making a user suck flavor without requiring combustion, and has a stick shape extending in a predetermined direction (hereinafter, the direction will be referred to as a longitudinal direction A). As shown in Figs. 1 and 2, the aerosol generation device 1 comprises the power supply unit 10, a cartridge unit 20, and a capsule unit 30 arranged in the longitudinal direction A in this order. The cartridge unit 20 is attachable/detachable to/from the power supply unit 10, and the capsule unit 30 is attachable/detachable to/from the cartridge unit 20. In other words, the cartridge unit 20 and the capsule unit 30 are exchangeable with each other.

(1-1) Power Supply Unit

[0031] 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.

[0032] 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.

[0033] 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 frictional force sensor 17 for detecting contact with an object.

[0034] 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 and the air supplying part 42 protrudes toward the cartridge unit 20 from the connection cap.

[0035] 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.

[0036] 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.

[0037] 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.

[0038] 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.

[0039] 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.

[0040] 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, the frictional force sensor 17, 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. As will be explained later, the frictional force sensor 17 measures stress in a sliding direction relative to a reference surface (shear stress), in addition to detecting contact with an object.

[0041] 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.

[0042] 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

[0043] 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.

[0044] 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.

[0045] 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.

[0046] 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.

[0047] 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.

[0048] 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.

[0049] 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

[0050] 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.

[0051] 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.

[0052] 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.

[0053] 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.

[0054] 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

[0055] 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.

[0056] 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).

[0057] The operation detector 52 detects manipulation of the operation unit 14 performed by a user.

[0058] 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.

[0059] 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.

[0060] Further, the electric power controller 53 detects electrical connection between the charging terminal 43 and the external electric power source 60, and controls charging of electric power via the charging terminal 43 to the power supply 12.

[0061] 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.

[0062] 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.

[0063] As will be explained later, when the power supply unit 10 and the cartridge 200 are connected to each other, the cartridge detection judging unit 55 detects the cartridge 200 when the frictional force sensor 17 is brought into contact with a friction part 220 constructed on the cartridge 200. Further, the cartridge detection judging unit 55 judges, based on frictional resistance detected during contact with the friction part 220, the type of the connected cartridge 200.

(2) Method for Assembling Aerosol Generation Device

[0064] 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.

[0065] 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.

[0066] 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.

[0067] Next, the cartridge 200 is inserted in the cartridge case 27 (Procedure B). Specifically, in the state that a connection electrode part 210 constructed on the

bottom surface of the cartridge 200 faces the side of the cartridge 27, the cartridge 200 is inserted in the hollow part in the cartridge case 27. As a result, the cartridge 200 is attached to the power supply unit 10.

[0068] 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.

[0069] 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.

[0070] 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.

[0071] 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.

[0072] 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 series of judgment processes, that is associated with detection of the cartridge 200, according to the present embodiment is 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.

[0073] 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.

[0074] 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.

[0075] 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

[0076] Judgment of the type of the cartridge 200 connected to the power supply unit 10 will be explained with reference to Fig. 7 to Fig. 11, by using the present embodiment. Fig. 7 is a schematic figure showing operation of a frictional force sensor 17 and a friction part 220 in a cartridge 200. Fig. 8A is a schematic perspective view of the power supply unit 10, which comprises the frictional force sensor 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, each of Figs. 9A and 9B is an example of a top view of the cartridge 200, which is connected to the power supply unit 10 in the present embodiment, viewed from an axial direction. Further, Fig. 10 is an example of an arrangement pattern of plural members which are components of a friction part 220. Finally, Fig. 11 is a flowchart showing a method for judging the type of the cartridge 200 by using the power supply unit 10 and the cartridge 200 explained above.

[0077] According the present embodiment, judging of the type of a cartridge 200 by the controller 50 is performed mainly through operation for detecting a cartridge in response to contact between the power supply unit 10 and the cartridge 200 (the friction part 220) at a contact surface, and, especially, measuring the quantity of frictional resistance generated during above contact.

(3-1) Frictional Force Sensor Constructed in Power Supply Unit

[0078] As shown in Fig. 7, in the power supply unit 10, the frictional force sensor 17 is constructed on a contact surface 80 (the above-explained connection cap) that is to be brought into contact with a cartridge. Regarding the contact surface 80 of the power supply unit 10, the frictional force sensor 17 detects contact with the friction part 220 which is constructed on the cartridge 200. Spe-

cifically, it detects force (that is, pressing force F1) in a direction along that the cartridge 200 is pushed. By the above construction, the power supply unit 10 can detect contact with the cartridge 200. Further, regarding the contact surface 80 of the power supply unit, stress (that is, sliding frictional resistance force F2) exerted in relation to a sliding direction (an arrow with a dotted line) is detected. Further, by measuring the sliding frictional resistance force F2, a frictional characteristic that the friction part 220 has can be identified.

[0079] In more detail, when the power supply unit 10 is connected to the cartridge 200, the cartridge 200 rotates relative to the power supply unit 10 about the axial line L within a predetermined range, while it is being brought into contact with the frictional force sensor 17 at the contact surface 80 (Fog. 6: Procedure C). During rotation, the friction part 220 of the cartridge 200 passes over the frictional force sensor 17. The respective friction parts 220 of the respective cartridges 200 are designed to have different frictional characteristics (for example, friction coefficients) corresponding to the respective types of respective cartridges 200, so that the respective quantities of the sliding frictional resistance force F2 are different from one another according to the respective types of the respective cartridges 200. That is, frictional resistance is generated during the time when the frictional force sensor 17 is being in contact with a friction part 220, wherein respective quantities of generated frictional resistance are set to be different from one another to make them correspond to the respective types of the respective cartridges 200. The frictional resistance in the present case is dynamic friction resistance. In this regard, it is designed in such a manner that, during the time when the frictional force sensor 17 is being in contact with a friction part 220, each of the pressing force F1 and the sliding frictional resistance force F2 is maintained to be constant. That is, the frictional force sensor 17 detects, during contact, frictional resistance generated by the friction part 220, wherein the quantities of frictional resistance are different from one another according to the types of the cartridges 200, respectively; and, based on the quantity of the frictional resistance, the type of the cartridge is judged.

[0080] In an example, it is preferable that the frictional force sensor 17 comprise a tactile sensor. Especially, a MEMS (Micro-Electro-Mechanical System) tactile sensor may be adopted. By using the above senor, the sliding frictional resistance force F2 can be measured more precisely.

[0081] Further, as shown in Figs. 8A and 8B, the frictional force sensor 17 is constructed on the connection surface 80, for connection with the cartridge 200, of the power supply unit 10. The frictional force sensor 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. In the connection surface 80, the distance from the axial line L to the frictional force sensor 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 friction part 220 in a radial direction.

[0082] As explained above, in the present embodiment, the frictional force sensor 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 frictional force sensor 17 is installed in the cartridge 200 side, the cost relating to the frictional force sensor 17 (for example, the initial cost and/or the running cost) can be reduced. Further, as a result that the frictional force sensor 17 is installed in the power supply unit 10, the frictional force sensor 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.

[0083] In this regard, a person skilled in the art can understand that the position where the frictional force sensor 17 is arranged on the connection surface 80 and the shape of the frictional force sensor 17 are not limited to those shown in the figures. Further, the power supply unit 10 may comprise plural frictional force sensors 17, and some of the plural frictional force sensors 17 may be positioned in the cartridge case 27 side.

(3-2) Friction Part Constructed in Cartridge

[0084] As shown in Figs. 9A, 9B, and 10, a friction part 220 is constructed on an electrode surface 280 of the cartridge 200, wherein the friction part 220 is that which generates frictional resistance when it is brought into contact with the frictional force sensor 17 installed on the connection surface 80 of the power supply unit 10. One or more friction parts 220 have a frictional characteristic, wherein the respective frictional characteristics are set to be different from one another according to the respective types of the respective cartridges. For example, it may be constructed to include one or more members (two members 221_1 and 221_2 in the example shown in the figure), and each member may be constructed by using a material having a specific frictional characteristic. 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.

[0085] The friction part 220 is positioned in an area, on the electrode surface 280, that does not overlap with the area occupied by the connection electrode part 210. In the example shown in Figs. 9A and 9B, friction part 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 member 221_1 is arranged in the friction part area ARi and the single member 221_2 is arranged in the friction part area AR_2. In this regard, it is not necessary to arrange the

members 221_1 and 221_2 in all of the friction part areas ARi and AR_2, and they can be constructed to have any sizes and can be arranged in any positions. In the electrode surface 280, the distance in the radial direction from the axial line L to each of the members 221_1 and 221_2 relates to the distance in the radial direction from the axial line L to the frictional force sensor 17 in the connection surface 80 of the power supply unit 10.

[0086] In the present embodiment, for judging the type of a cartridges 200, the respective friction parts 220 are designed to generate different quantities of frictional resistance corresponding to the respective types of respective cartridges 200, when each of the friction part 220 is being brought into contact with the frictional force sensor 17. In more detail, regarding materials of the friction parts 220, elements having different frictional characteristics (for example, friction coefficients) that are selected according to the respective types of respective cartridges 200 are adopted. Specifically, in the case of a "mint-flavor cartridge" type, a member having a large friction coefficient A is adopted in the friction parts 220; and, in the case of a "coffee-flavor cartridge" type, a member having a small friction coefficient B (<A) is adopted in the friction parts 220. Thereafter, by identifying the frictional characteristic, judgment as to whether the type is the "mint-flavor cartridge" type or the "coffee-flavor cartridge" type is performed.

[0087] In the example shown in Fig. 9A, both the members 221_1 and 221_2 in the friction parts 220 are constructed by using the same material. On the other hand, in the example shown in Fig. 9A, the members 221_1 and 221_2 in the friction parts 220 are constructed by using different materials. In more detail, in the example in Fig. 9B, it is constructed in such a manner that the frictional resistance generated by the member 221_1 of the first friction part 220 and the frictional resistance generated by the member 221_2 of the second friction part 220 are different from one another. That is, for example, the friction part(s) 220 can be constructed in such a manner that the type of a cartridge 200 can be judged precisely and efficiently, by identifying the quantity or quantities of frictional resistance of any one or more members in plural members which have specific friction coefficients.

[0088] Fig. 10 is an enlarged view of the member 221_1 of the first friction part 220 in Fig. 9A or 9B. In this example, it is constructed in the friction part area ARi that the arrangement patterns of three members $222_{a\text{-}c}$ are made to be different from one another according to the types of the cartridges, respectively. That is, the arrangement patter is constructed by a combination of three different kinds of members $221_{a\text{-}c}$ which generate different quantities of frictional resistance during the time when they are being in contact with the frictional force sensor 17. In an example, the member 221_a positioned in the left side area in the friction part area ARi has a friction coefficient a, the member 221_b positioned in the center area has a friction coefficient b (>a), and the member 221_c positioned in the right side area has a friction coefficient c (>b>a). By the above construction, the patters of combinations of members can be further increased, compared with the case of Fig. 9B. That is, for example, the friction part(s) 220 can be constructed in such a manner that the type of a cartridge 200 can be judged further precisely and efficiently, by identifying the quantity or quantities of frictional resistance of any one or more members in plural members which have specific friction coefficients. (In this regard, arrangement patterns of the members will be further explained later in relation to a modification example.)

[0089] In the present embodiment, as long as frictional resistance of different quantities corresponding to the respective types of respective cartridges 200 can be generated, any materials can be used in the members 221 and/or any arrangement patterns of the members 221 can be adopted. Further, by constructing the members of the friction part 220 as explained above, it becomes possible to make the cartridge detection judging unit 55 in the controller 50 be able to easily judge the type of a cartridge 200 based on the measured quantity of frictional resistance. That is, according to the present embodiment, operation for judging the type of a cartridge 200, that is realized as a result of cooperation of the friction part 220 and the frictional force sensor 17 in the power supply unit 10, can be facilitated, and accuracy of judgment can be improved.

[0090] In this regard, a person skilled in the art can understand that the positions of the friction parts 220 and the members 221 on the electrode surface 280, the dimension of the friction part area, positional relationship between areas and the number of areas, positional relationship between respective members, the number of members, and the shapes of members are not limited to those shown in the figures.

(3-3) Operation for Judging Type of Cartridge

[0091] Fig. 11 shows a series of actions relating to judgment of the type of a cartridge 200. The series of actions is performed by the cartridge detection judging unit 55 and the notification controller 54 mainly, in cooperation with the frictional force sensor 17, the memory 18, and the notifier 45, when the cartridge 200 is connected to the power supply unit 10 of the aerosol generation device 1 in the direction of the axial line L.

[0092] 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.

[0093] In response to detection of insertion of the cartridge 200 in step 10, the frictional force sensor 17 which is installed on the contact surface 80, that is to be brought into contact with the cartridge 200, of the power supply unit 10 is activated in step S20. That is, it becomes possible to perform detection of the pressing force F1 and/or the sliding frictional resistance force F2 generated in relation to the friction part 220 (Fig. 7), by using an event that the power supply unit 10 is connected to the cartridge 200 as a trigger to allow above detection.

[0094] In response to the event that the frictional force sensor 17 has detected contact between it and the friction part 220 of the cartridge 200, the cartridge detection judging unit 55 starts detection operation for judging the type of the cartridge 200. More specifically, 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 frictional force sensor 17 detect contact between it and the friction part 220.

[0095] In an example, as shown in Figs. 9A and 9B, in the electrode surface 280 of the cartridge, the quantity of frictional resistance detected by the frictional force sensor 17 in the friction part 220 is different from that in the part other than the friction part 220. Thus, during the time when the cartridge 200 rotates relative to the power supply unit 10, the state that the friction part 220 is being aligned with the frictional force sensor 17 can be detected.

[0096] In this regard, the timing to perform the action for activating the frictional force sensor 17 in step S20 may be set to be the same as or different from the timing to perform action for starting detection of the friction part 220 in step S30. (An example wherein action in step S30 is performed in response to a specific trigger that is different from that for performing action in step S20 will be explained later as a modification example.)

[0097] Thereafter, in step S40, it is judged whether the frictional force sensor 17 has detected, as a result that the friction part 220 has been aligned with and brought into contact with the frictional force sensor 17, frictional resistance of a predetermined quantity generated by the friction part 220. For example, it is preferable to judge whether a quantity, that is within a predefined quantity range of quantities, of frictional resistance is detected.

[0098] If frictional resistance generated by the friction part 220 is detected (S40: Yes), the quantity of the frictional resistance is measured in step S50. The quantity of the frictional resistance measured herein is the quantity of sliding frictional resistance force F2 in the sliding direction. Regarding measuring of the quantity of frictional resistance, it may be continued repeatedly until rotation of the cartridge 200 relative to the power supply unit 10 by a predetermined distance is completed.

[0099] Next, subsequent to completion of measurement of the quantity of the frictional resistance in step S50, the type of the cartridge 200 is judged based on the frictional resistance in step S60. As explained above, the friction parts 220 of the respective cartridges 200 generate frictional resistance, wherein generated quantities of the frictional resistance are different from one another according to the types of the cartridges 200, respectively. That is, the cartridge detection judging unit 55 can judged the type of a cartridge 200 by identifying the quantity of frictional resistance such as that explained above.

[0100] In this regard, a rule for judging types of cartridges 200 has been defined in advance; and, in an example, in terms of the respective types of the respective cartridges 200, values of strength of frictional resistance may be related by using ranges. For example, the rule may be constructed to have a table form, and stored in the memory 18 in advance. That is, in the present embodiment, if the value of a frictional characteristic (for example, the quantity of frictional resistance, or a friction coefficient), that the friction members 221 of the friction part 220 have, could be identified, the cartridge detection judging unit 55 can easily judge the type of a cartridge 200 by determining a range within that the identified value belongs. It should be reminded that matters stored in the memory is not limited to the ranges of values of signal strength, and matters such as ranges of values of friction coefficients associated with quantities of frictional resistance and so on may be stored, additionally or alternatively, in the memory.

[0101] Next, in step S70, in response to completion of judging of the type of the cartridge 200 in step S60, the cartridge detection judging unit 55 terminates operation for detecting the cartridge 200.

[0102] At the same time, the frictional force sensor 17 is deactivated. In this manner, by limiting the point in time when operation of the frictional force sensor 17 is terminated to the point in time when judging of the type of the cartridge 200 is completed, operation control of the frictional force sensor 17 can be automated. By adopting the above construction, electric power consumption relating to operation of the frictional force sensor 17 can be reduced.

[0103] 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.

[0104] In the case that the type of the cartridge 200 was not normally judged (S80: No), the cartridge detec-

tion 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.

[0105] 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.

[0106] 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.

[0107] 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.

[0108] 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 (S40: No), it is judged that connecting of the cartridge 200 to the power supply unit 10 is failed. In the present case, the case that a cartridge 200 is not detected for a predetermined period of time includes the case that frictional resistance of a predetermined quantity is not detected by the frictional force sensor 17 and judgment of the type of the cartridge 200 is not performed accordingly. In such a case, it is preferable that the cartridge detection judging unit 55 terminate operation for detecting the cartridge 200, and deactivate the frictional force sensor 17. That is, even in the case that the cartridge 200 is not detected, electric power consumption relating to operation of the frictional force sensor 17 can be reduced by deactivating the frictional force sensor 17.

[0109] 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.

[0110] As explained above, in the present embodiment, the type of the cartridge 200 can easily be judged, by detecting the cartridge 200 by the frictional force sensor 17 installed in the power supply unit 10 in cooperation with the friction part 220 of the cartridge 200. That is, a method for highly precisely judging the type of a cartridge, while reducing costs, can be provided.

(4) Modification Examples

(Modification Example 1)

[0111] It is explained in the above description that the members 221 in the friction parts 220 are constructed in such a manner that the generated quantities of frictional resistance thereof are different from one another according to the types of the cartridges 200. Especially, as shown in Fig. 10, it is explained that it is allowed to adopt the construction wherein arrangement patterns of plural members 221 are different from one another according to the types of the cartridges 200. Further, it is explained that the frictional force sensor 17 is activated (Fig. 11: S20), and, in response to detection of contact between it and the friction part 220, the cartridge detection judging unit 55 starts operation for detecting a cartridge 200 for judging the type thereof (Fig. 11: S30).

[0112] In the present modification example, it is possible to adopt a construction wherein the timing to start operation for detecting the cartridge 200 in step S30 is identified based on an arrangement pattern of plural members 221. In more detail, in the state that contact with the friction part 220 is being detected, the cartridge detection judging unit 55 performs operation, by using an event that frictional resistance of a specific (first) quantity such as that generated from the member 221_a in Fig. 10 is detected as a trigger of the operation, that makes the frictional force sensor 17 start operation for detecting a cartridge 200.

[0113] Similarly, in the present modification example, it is possible to adopt a construction wherein the timing to terminate operation for detecting the cartridge 200 in step S70 is identified based on an arrangement pattern of plural members 221. In more detail, the cartridge detection judging unit 55 performs operation, by using an event that frictional resistance of a specific (second) quantity such as that generated from the member 221_c in Fig. 10 is detected as a trigger of the operation, that makes the frictional force sensor 17 terminate operation for detecting a cartridge 200.

[0114] By adopting the above construction, the timing to start and terminate operation for detecting a cartridge

200 can be further restricted, so that operation for detecting the cartridge 200 and operation, that relates to the detection operation, for judging the type of the cartridge 200 can be performed precisely and efficiently.

(Modification Example 2)

[0115] It is explained in the above description that the frictional force sensor 17 is constructed on the connection surface 80, which faces the cartridge 200, of the power supply unit 10. However, in the present modification example, instead of adopting the above construction, it is possible to adopt a construction wherein a convex-shape groove for accepting the friction part 220 may be constructed in the connection surface 80, which faces the cartridge 200, of the power supply unit 10, and the frictional force sensor 17 may be installed on a surface of the groove. In more detail, it may be constructed in such a manner that a groove extending in a downward direction from the connection surface 80 is constructed in the connection surface 80 of the power supply unit 10, and the frictional force sensor(s) 17 is(are) installed on a bottom surface and/or a side surface of the groove. Thus, when the cartridge 200 is connected to the power supply unit 10, the friction part 220 of the cartridge 200 moves in the groove, while it is being in contact with the groove, and generates friction in a sliding direction. Thereafter, the type of the cartridge may be judged based on measurement of the quantity of the frictional resistance in the sliding direction at the time.

(Modification Example 3)

[0116] It is explained in the above description that, when the cartridge 200 is inserted in the cartridge case 27 and connected to the power supply unit 10 (Fig. 6: Procedure B), the electrode surface 280 of the cartridge 200 is aligned, in the circumferential direction, relative to the connection surface 80 of the power supply unit 10. In the present modification example, for improving accuracy of alignment such as that explained above, mechanisms for alignment may further be provided in the cartridge 200 and the hollow part in the cartridge case 27 which holds the cartridge 200, as shown in Figs. 12A and 12B.

[0117] Fig. 12A is a cross-section view of a cartridge case 27' in a modification example viewed from an axial direction. Fig. 12B 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).

[0118] 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.

[0119] 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 activation of the frictional force sensor 17 (Fig. 11: S20) can be aligned more accurately.

(Modification Example 4)

[0120] It is explained in the above description that the frictional force sensor 17 is activated in response to detection of insertion of a cartridge 200 (Fig. 11: step S20). However, in the present modification example, in addition to the above construction, it is possible to adopt a construction that uses a physical switch to make timing of activation of the frictional force sensor 17 be identified, as shown in Fig. 13.

[0121] Fig. 13 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 frictional force sensor 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).

[0122] It is sufficient if the state that the physical switch 19 is being pressed can be perceived by the cartridge detection judging unit 55. Further, in step S20 in Fig. 11, it is preferable that the cartridge detection judging unit 55 activate the frictional force sensor 17, 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, activates the frictional force sensor 17, that is, makes the frictional force sensor 17 start its operation.

[0123] In this regard, to correspond to the physical switch 19 in the power supply unit 10, it is preferable to provide the cartridge 200 with a protrusion for pressing the physical switch 19. By adopting the above construc-

tion, it becomes possible to limit timing to start operation for activating the frictional force sensor 17, so that electric power consumption relating to operation of the frictional force sensor can be further reduced.

[0124] Similarly, regarding the present modification example, in the case that the power supply unit 10 is provided with the physical switch 19, it may be constructed in such a manner that, in response to an event that the physical switch 19 is pressed again after activation of the frictional force sensor 17, the cartridge detection judging unit 55 deactivates the frictional force sensor 17. 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, and, as a result, the frictional force sensor 17 is deactivated and the operation of the frictional force sensor 17 is terminated.

[0125] A physical switch used for deactivating the frictional force sensor 17 may be the same as, or may have a body separate from, the physical switch 19 used for activating the frictional force sensor 17. 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 engagement between the cartridge 200 and the power supply unit 10 (Fig. 6: Procedure C). By adopting the above construction, the timing for terminating operation for deactivating the frictional force sensor 17 can be limited, so that electric power consumption relating to operation of the frictional force sensor can be further reduced.

(Modification Example 5)

[0126] It is explained in the above description that activation of the frictional force sensor 17 is commenced at timing when 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 and the cartridge 200 is inserted in the cartridge case 27 (Fig. 11: step S20). In addition to the above construction, in the present modification example, it may be constructed in such a manner that activation of the frictional force sensor 17 is commenced, after connection of the cartridge 200 to the power supply unit 10, in response to pressing of the operation unit 14 by a user. That is, after connection of the cartridge 200 to the power supply unit 10, the controller 50 may activate the frictional force sensor 17 at timing when the operation unit 14 is pressed by a user for performing puff action, and perform a series of actions for judging the type of the cartridge.

< Different Embodiments >

[0127] A different embodiment of the present disclosure will be explained with reference to Fig. 14. Fig. 14 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 frictional force sensor 17a, and a memory 18a.

[0128] For example, the frictional force sensor 17a and the memory 18a correspond to the frictional force sensor 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.

[0129] The frictional force sensor 17a is installed on a contact surface, that is to be brought into contact with the cartridge, of the power supply unit, and performs measuring of the quantity of sliding frictional resistance in the sliding direction, in addition to detecting of contact with an object. The controller 50a is constructed to judge the type of the cartridge 200, based on frictional resistance that is detected as a result that the frictional force sensor 17a is brought into contact with the friction part 220 constructed on the cartridge 200, when or after the power supply unit 10a is connected to the cartridge 200.

[0130] 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.

[0131] 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

[0132] 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 ... frictional force sensor: 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 judg-

ing unit: 80 ... Connection surface: 20 ... Cartridge unit: 27, 27' ... Cartridge case: 27ci, $27c_2$ ... Convex part: 200, 200'... Cartridge: 200ci, $200c_2$ ... Concave part: 260 ... Second rotating connection part: 210 ... Connection electrode part: 220 ... friction part: 221 (221_1, 221_2, 221_a, 221_b, 221_c) ... Member of the friction part: 280 ... Electrode surface: AR_1, AR_2 ... Friction part area: 26 ... End cap: 261 ... Anti-slipping member: 30 ... Capsule unit: 310 ... Opening

Claims

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

   a frictional force sensor installed in a contact surface, that is to be brought into contact with a cartridge, of the power supply unit; and
   a controller for judging, when or after the power supply unit is connected to the cartridge, the type of the cartridge based on frictional resistance that is detected as a result that the frictional force sensor is brought into contact with a friction part installed in the cartridge.

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

   the frictional force sensor detects frictional resistance generated by the friction part during above contact, wherein quantities of the generated frictional resistance are different according to the types of the cartridges, respectively; and the controller judges the type of the cartridge based on the quantity of frictional resistance.

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

   the frictional force sensor detects a quantity of frictional resistance generated by friction parts arranged in an arrangement pattern during above contact, wherein arrangement patterns of the friction parts are different according to the types of the cartridges, respectively, and quantities of frictional resistance generated in relation to the arrangement patterns are accordingly different according to the types of the cartridges, respectively;
   the controller judges the type of the cartridge based on the quantity of frictional resistance; and
   each of the arrangement patterns is formed by a combination of plural kinds of members.

4. The power supply unit as recited in any one of Claims 1-3, wherein:

   the frictional force sensor detects frictional resistance generated by a first friction part and a second friction part during above contact, wherein quantities of frictional resistance generated by the first friction parts and the second friction parts are different according to the types of the cartridges, respectively;
   the controller judges the type of the cartridge based on the quantities of frictional resistance; and
   with respect to the friction parts, the quantity of frictional resistance generated by the first friction part and the quantity of frictional resistance generated by the second friction part are different from each other.

5. The power supply unit as recited in any one of Claims 1-4, wherein: when the power supply unit is connected to the cartridge, the controller

   makes, in response to detection of frictional resistance of a first quantity, the frictional force sensor start operation for detecting the cartridge, and, thereafter,
   makes, in response to detection of frictional resistance of a second quantity, the frictional force sensor terminate the above operation.

6. The power supply unit as recited in any one of Claims 1-5, 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 activates the frictional force sensor in response to an event that the physical switch is pressed.

7. The power supply unit as recited in Claim 6, wherein: the controller deactivates the frictional force sensor in response to an event that the physical switch is pressed again by the cartridge.

8. The power supply unit as recited in any one of Claims 1-7, wherein:
   the controller makes, in response to completion of judgment of the type of the cartridge, the frictional force sensor terminate the operation for detecting the cartridge.

9. The power supply unit as recited in any one of Claims 1-8, wherein:
   the controller judges, when frictional resistance of a predetermined quantity is not detected by the frictional force sensor for a predetermined period of time after starting of the operation for detecting the cartridge, that connection of the power supply unit to the cartridge is failed, and makes the frictional force

sensor terminate the operation for detecting the cartridge.

10. The power supply unit as recited in Claim 9, further comprising a notifier, wherein:
the controller makes the notifier notify the failure of connection.

11. The power supply unit as recited in Claim 10, wherein:
the notifier uses the notification of the failure of connection to prompt a user to again perform action to connect the power supply unit to the cartridge.

12. The power supply unit as recited in any one of Claims 1-11, wherein:
the controller prohibits supplying of electric power to the cartridge in the case that the type of the cartridge cannot be judged.

13. The power supply unit as recited in any one of Claims 1-12, wherein the friction force sensor is a tactile sensor.

14. A cartridge, which is to be connected to the power supply unit as recited in any one of Claims 1-13, comprising a friction part, wherein the frictional characteristics of friction parts are different according to the types of the cartridges, respectively.

15. A cartridge for an aerosol generation device, comprising a friction part for generating frictional resistance, wherein quantities of frictional resistance generated by friction parts are different according to the types of the cartridges, respectively, wherein:
when or after the cartridge is connected to the power supply unit, the cartridge is detected as a result that a frictional force sensor installed on a contact surface, that is to be brought into contact with the cartridge, of the power supply unit is brought into contact with the friction part, and the type of the cartridge is judged based on detected frictional resistance.

16. The cartridge as recited in Claim 15, wherein:

arrangement patterns of plural members in the friction parts are different according to the types of the cartridges, respectively; and
the arrangement patterns comprise combinations of different kinds of the members from which quantities of frictional resistance, that are different from one another, are generated at the time of above contact.

17. The cartridge as recited in Claim 15 or 16, wherein:

the aerosol generation device comprises a cartridge case which holds the cartridge and is attached to the power supply unit in an axial direction;
when viewed from the axial direction, a cross section of the cartridge has a concave shape that corresponds to a convex shape of a cross section of part of a hollow part of the cartridge case; and
the cross section of the cartridge is aligned, in a circumferential direction, with the cross section of the part of the hollow part of the cartridge case, so that the cartridge is inserted in the hollow part of the cartridge case in the axial direction.

18. 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 or after the cartridge is connected in an axial direction to the power supply unit, for:

detecting contact between a frictional force sensor installed on a contact surface, that is to be brought into contact with the cartridge, of the power supply unit and a friction part installed on the cartridge; and
judging the type of the cartridge based on frictional resistance detected during above contact; wherein
the respective friction parts are those from which quantities of frictional resistance, that are different from one another, are generated, according to the respective types of the respective cartridges.

19. The method as recited in Claim 18, wherein:

arrangement patterns of plural members in friction parts are different according to the types of the cartridges, respectively; and
the arrangement patterns comprise combinations of different kinds of the members from which quantities of frictional resistance, that are different from one another, are generated at the time of above contact.

20. The method as recited in Claim 18 or 19, wherein:
the power supply unit comprises a first friction part and a second friction part, and
in the friction parts, the quantity of frictional resistance generated by the first friction part and the quantity of frictional resistance generated by the second friction part are different from each other.

Fig. 1

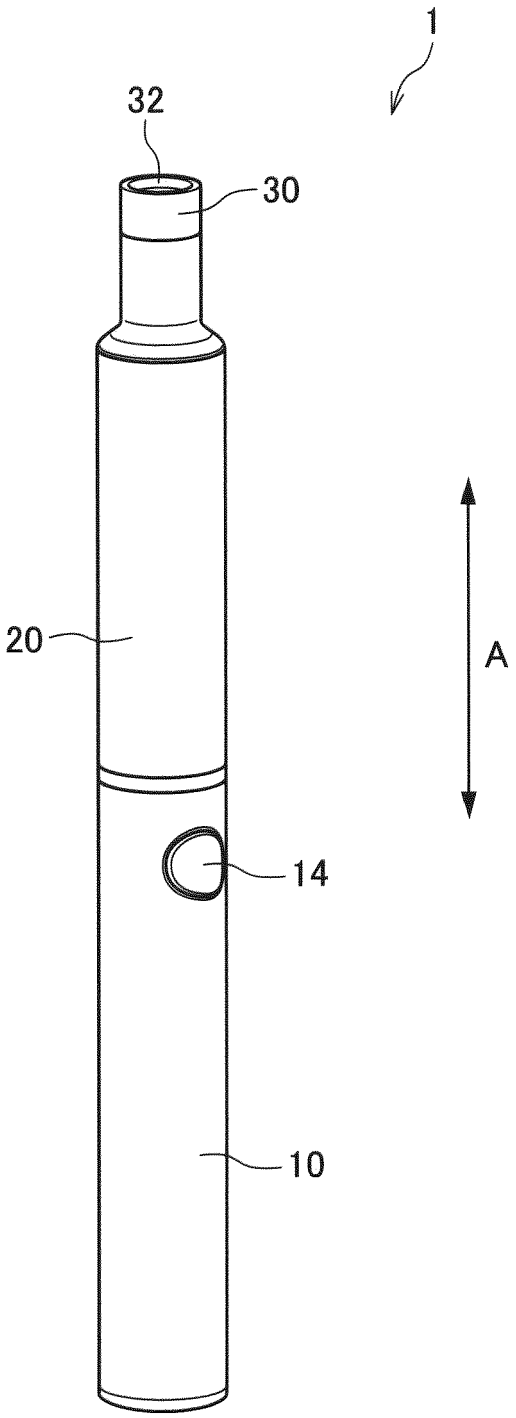


Fig. 2

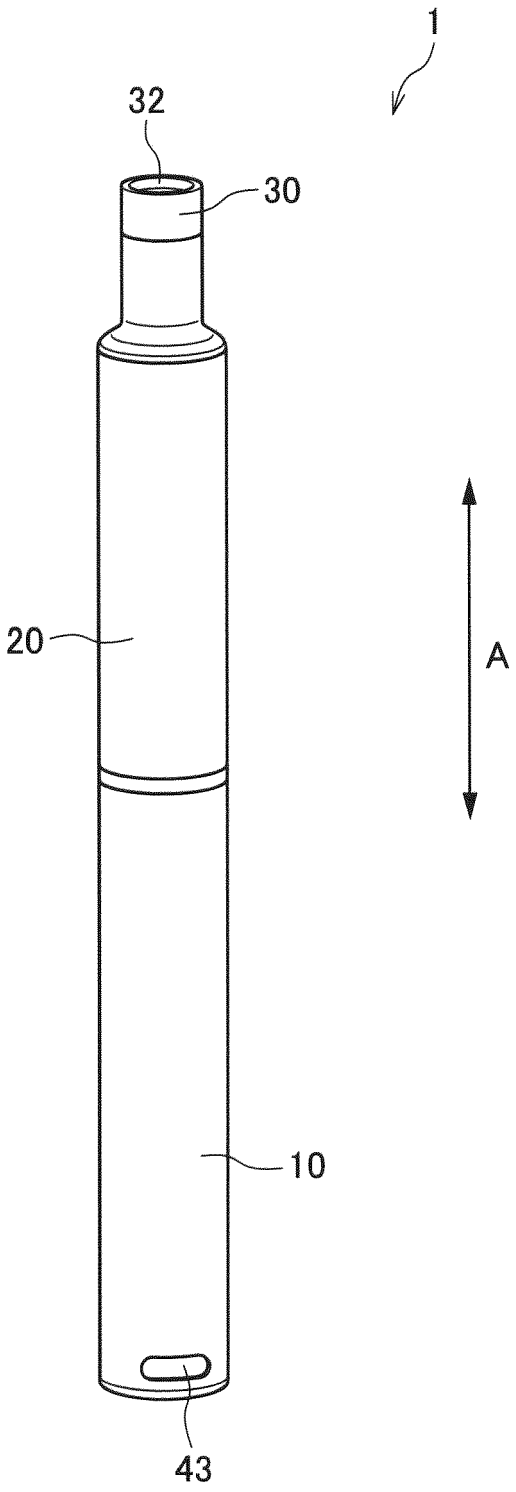
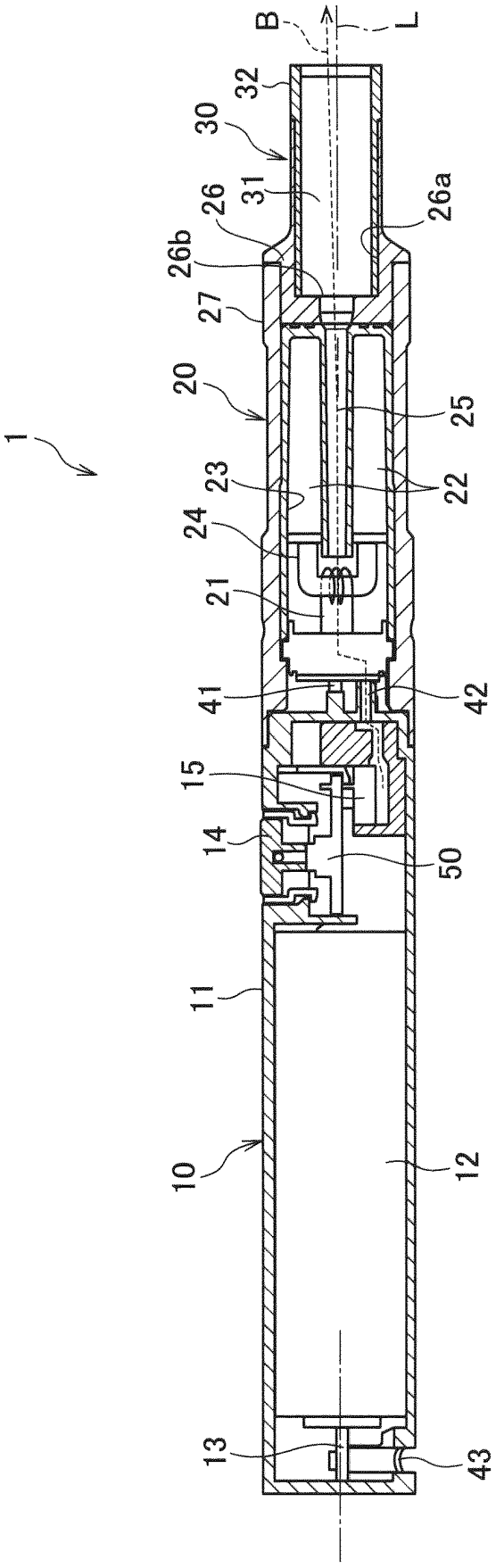


Fig. 3


B
L
32
30
31
26
26a
26b
27
20
25
1
23
22
24
21
41
42
15
14
50
11
10
12
13
43

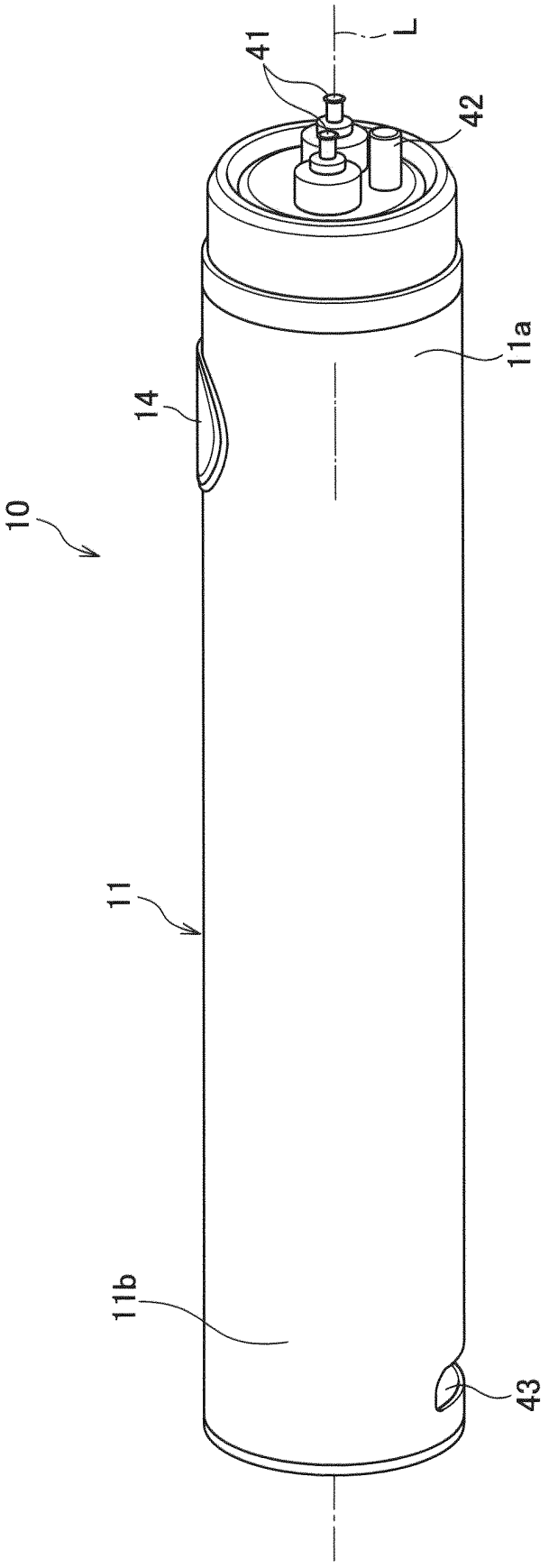


Fig. 4

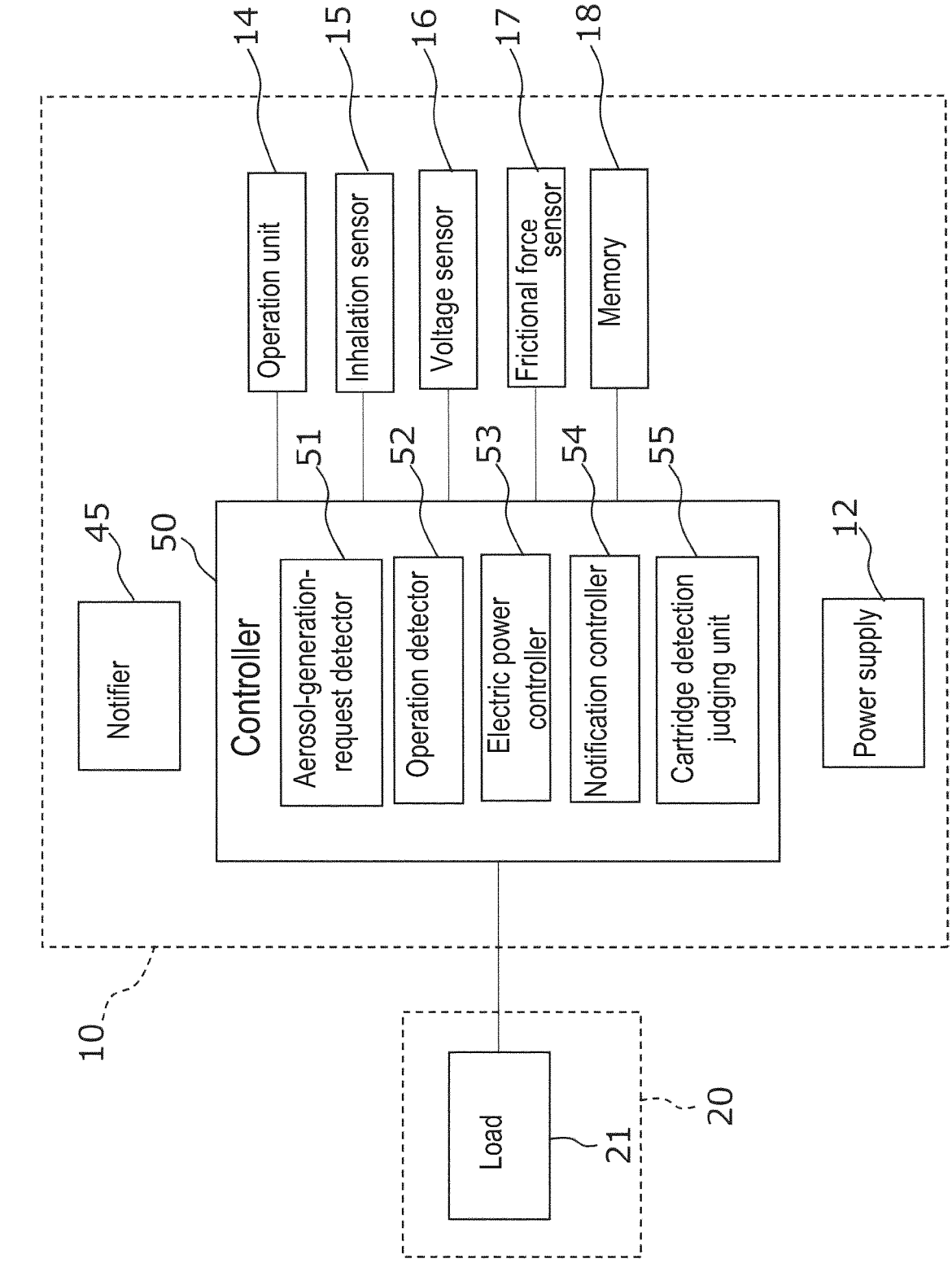

14
15
16
17
18
Operation unit
Inhalation sensor
Voltage sensor
Frictional force sensor
Memory
51
52
53
54
55
45
50
Notifier
Controller
Aerosol-generation-request detector
Operation detector
Electric power controller
Notification controller
Cartridge detection judging unit
12
Power supply
10
Load
21
20

Fig. 5

Fig. 6

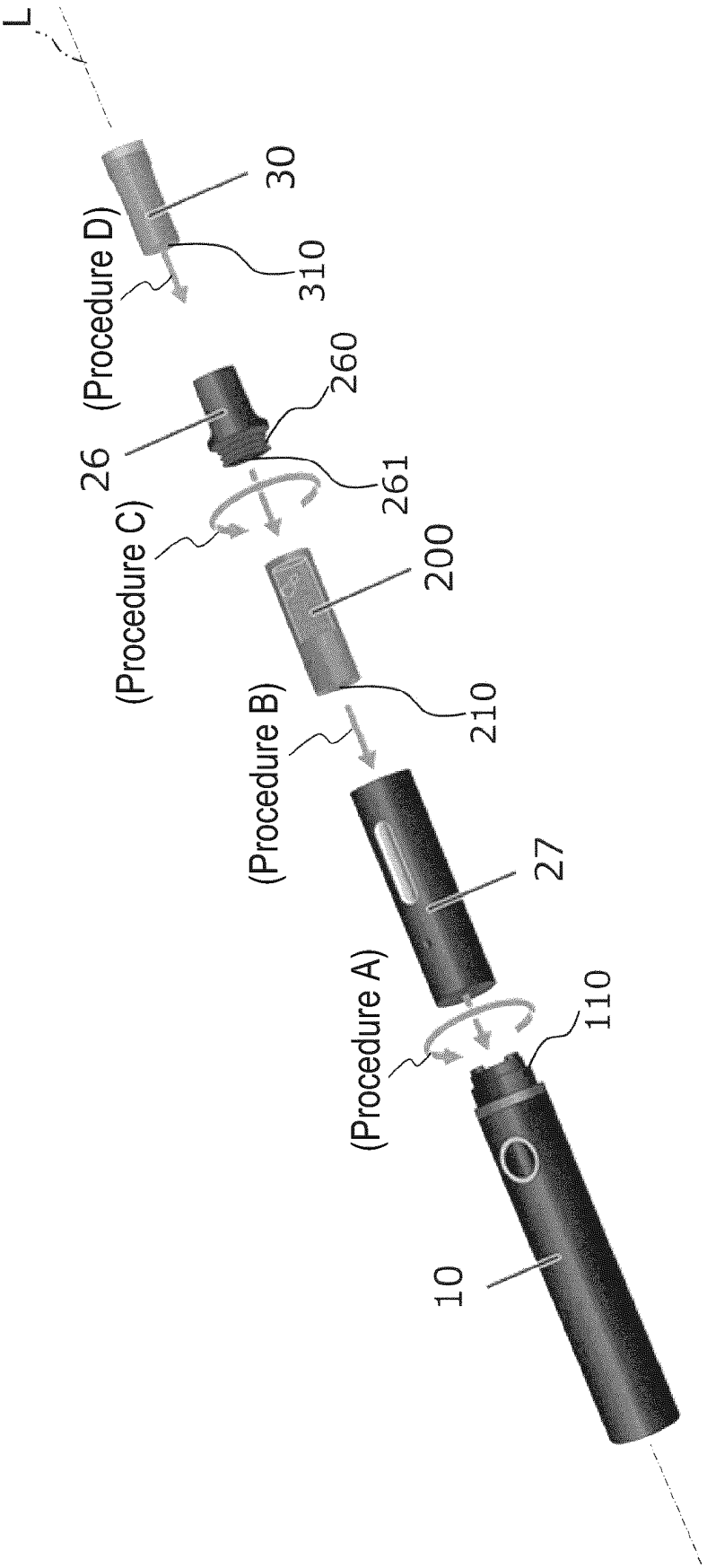

L
30
310
(Procedure D)
26
260
261
(Procedure C)
200
210
(Procedure B)
27
110
(Procedure A)
10

Fig. 7

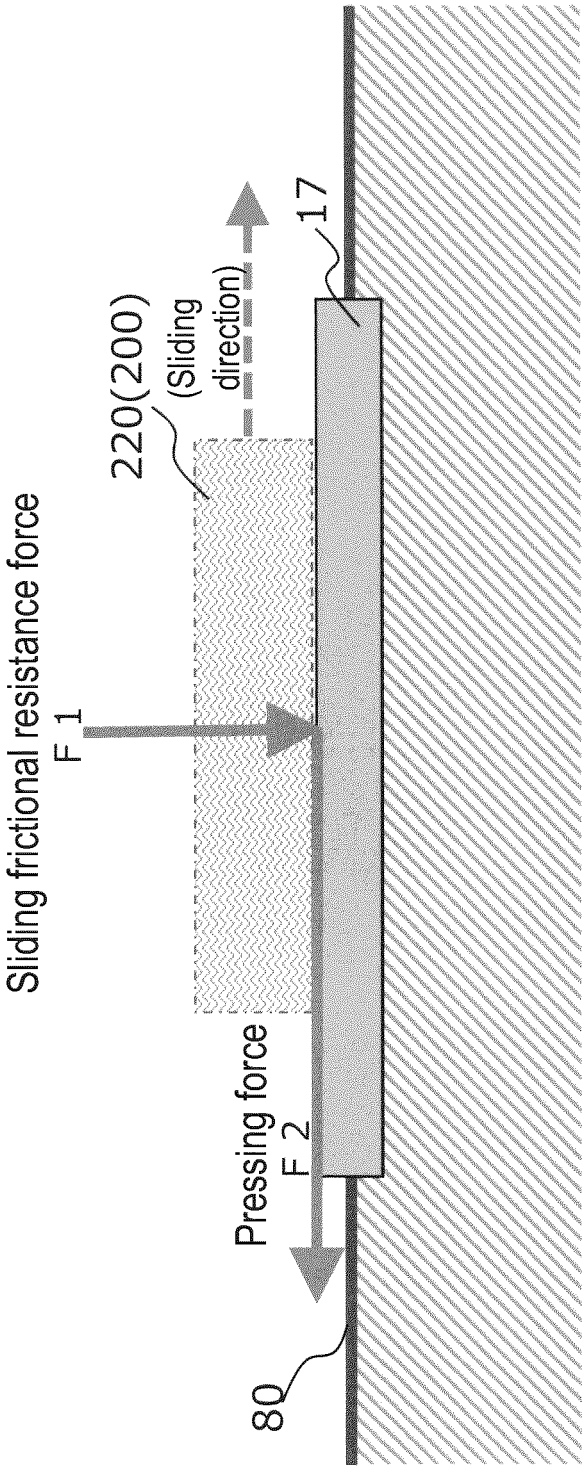

Sliding frictional resistance force
F 1
220(200)
(Sliding direction)
17
Pressing force
F 2
80

Fig. 8A

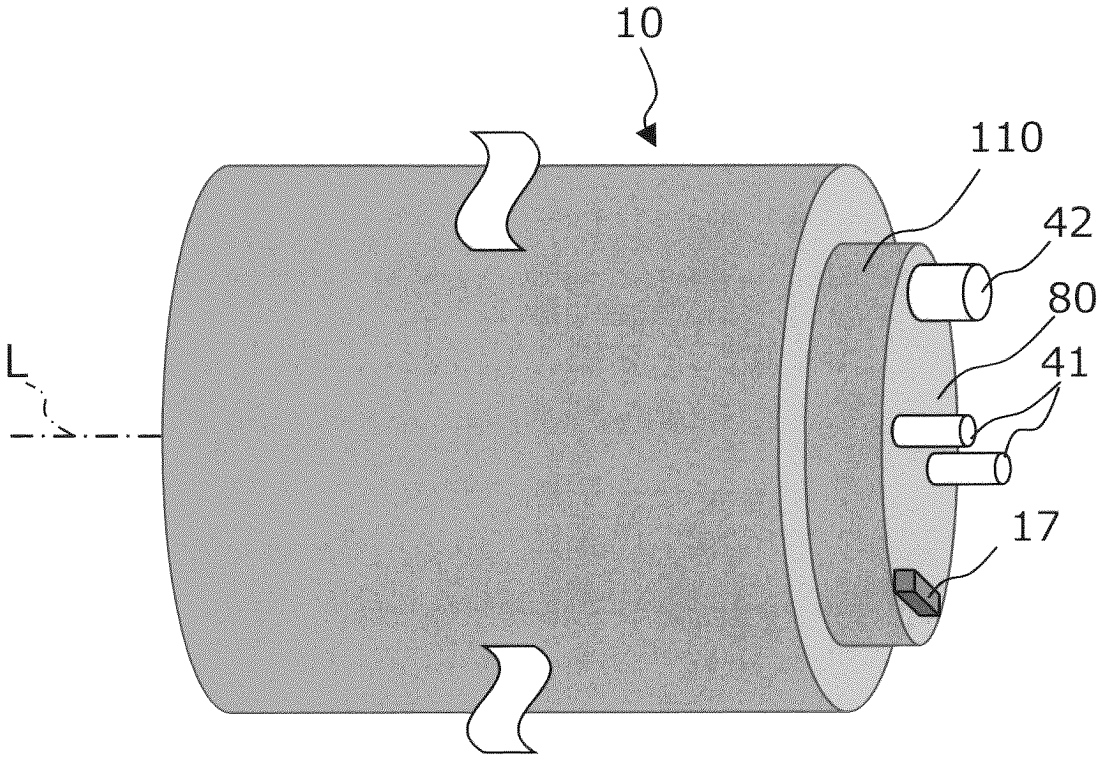


Fig. 8B

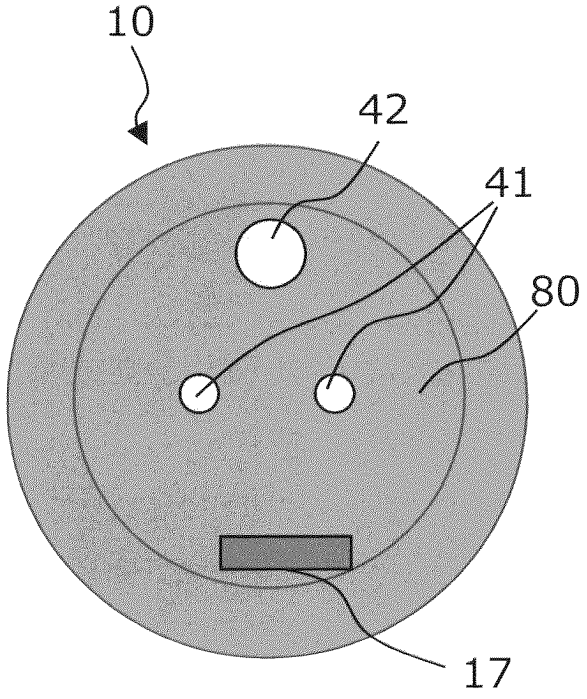


Fig. 9A

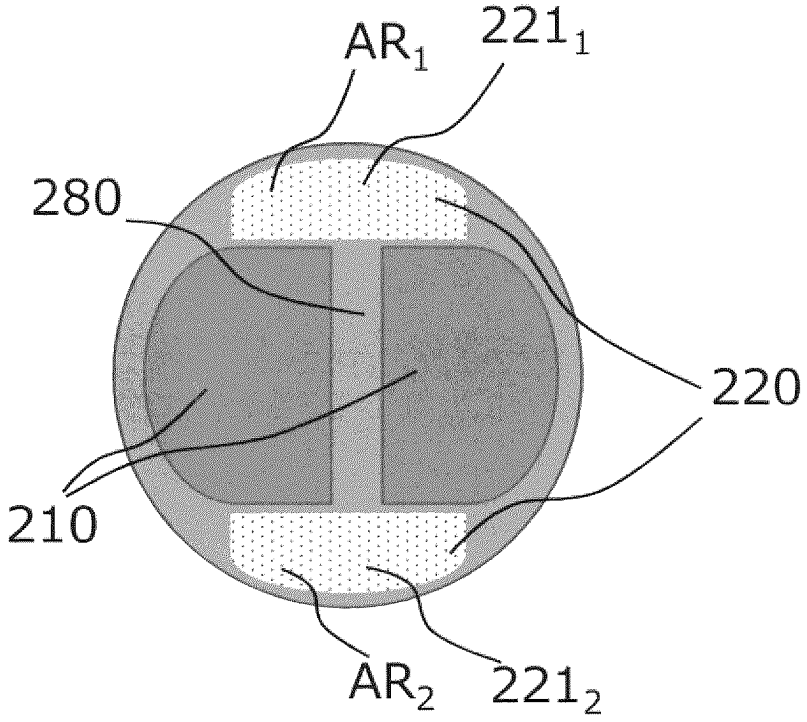


Fig. 9B

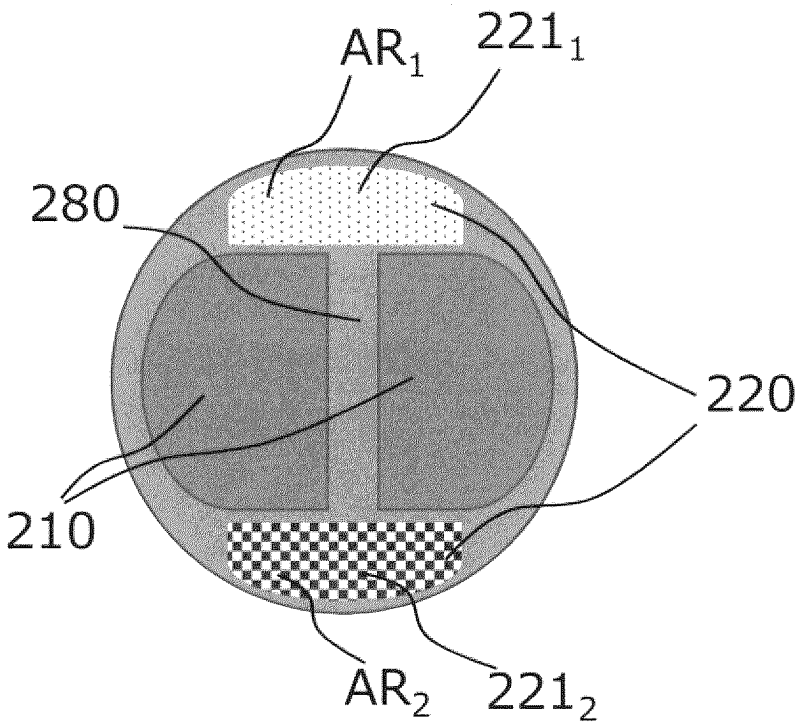


Fig. 10

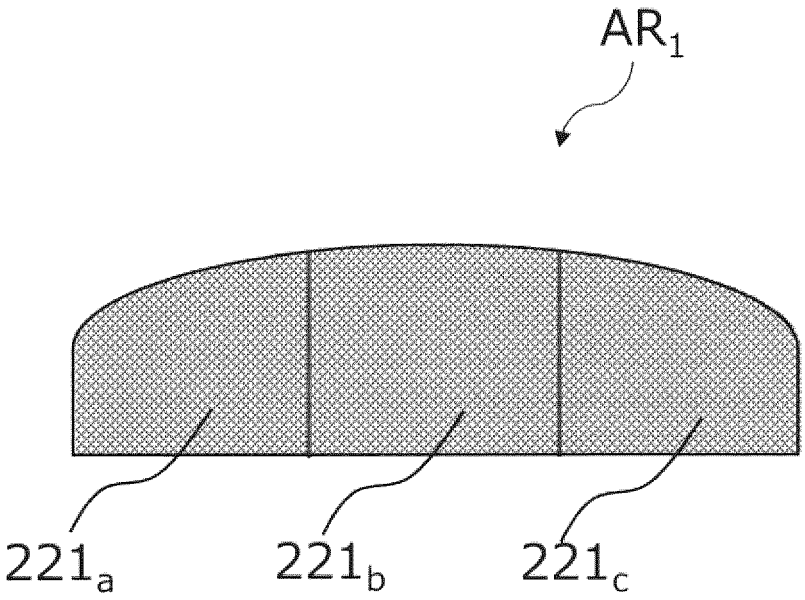


Fig. 11

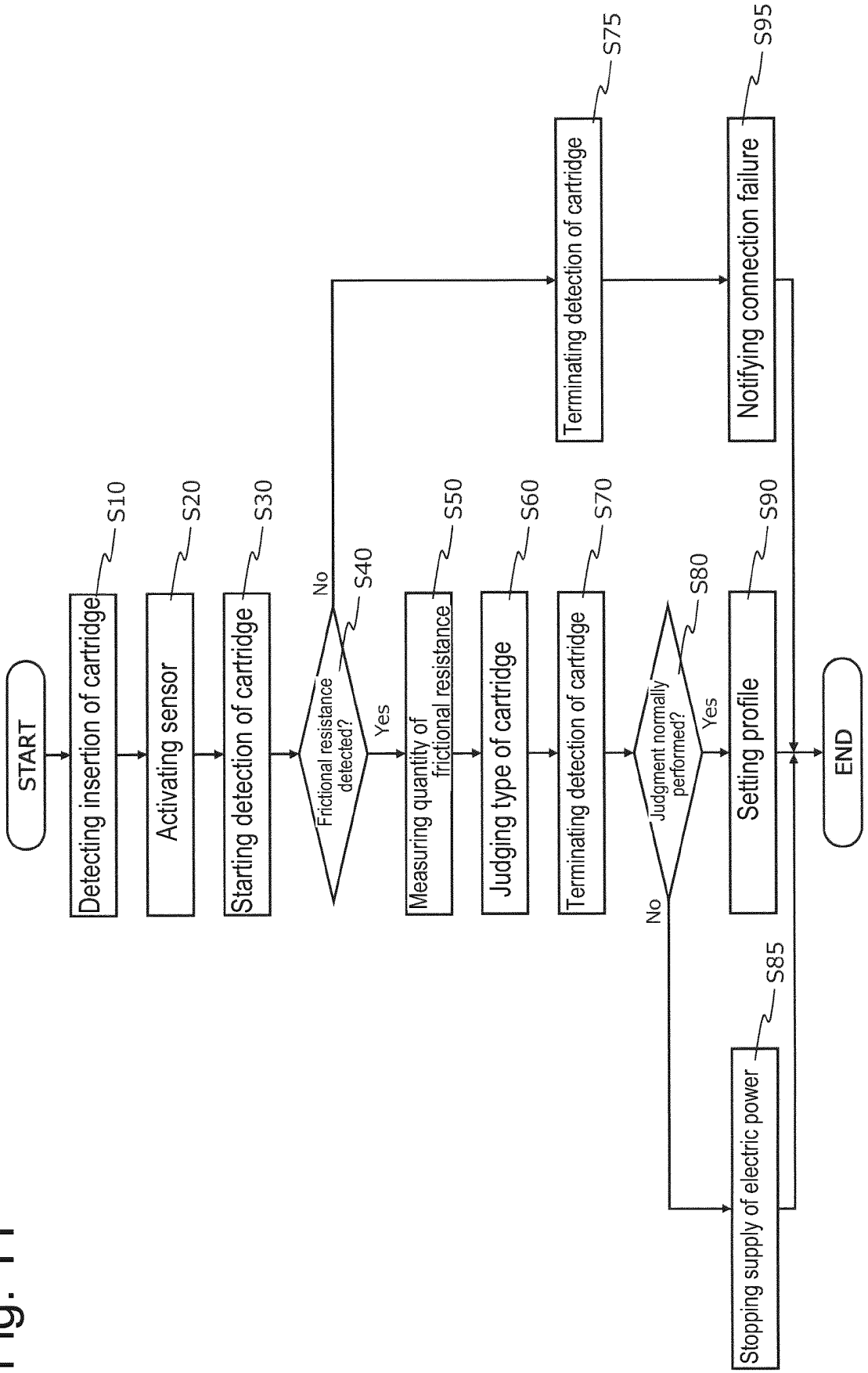

START
Detecting insertion of cartridge
S10
Activating sensor
S20
Starting detection of cartridge
S30
Frictional resistance detected?
S40
No
Yes
Terminating detection of cartridge
S75
Measuring quantity of frictional resistance
S50
Judging type of cartridge
S60
Terminating detection of cartridge
S70
Judgment normally performed?
S80
No
Yes
Notifying connection failure
S95
Setting profile
S90
Stopping supply of electric power
S85
END

Fig. 12A

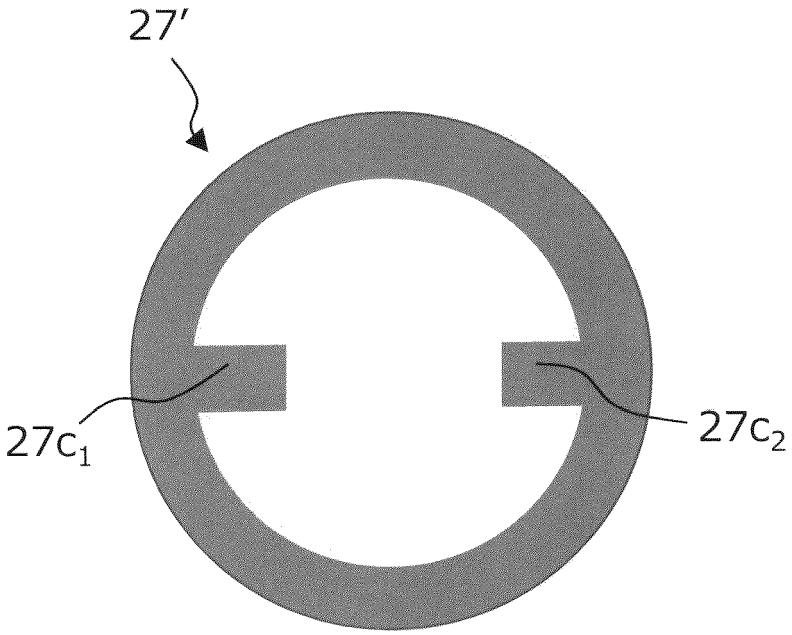
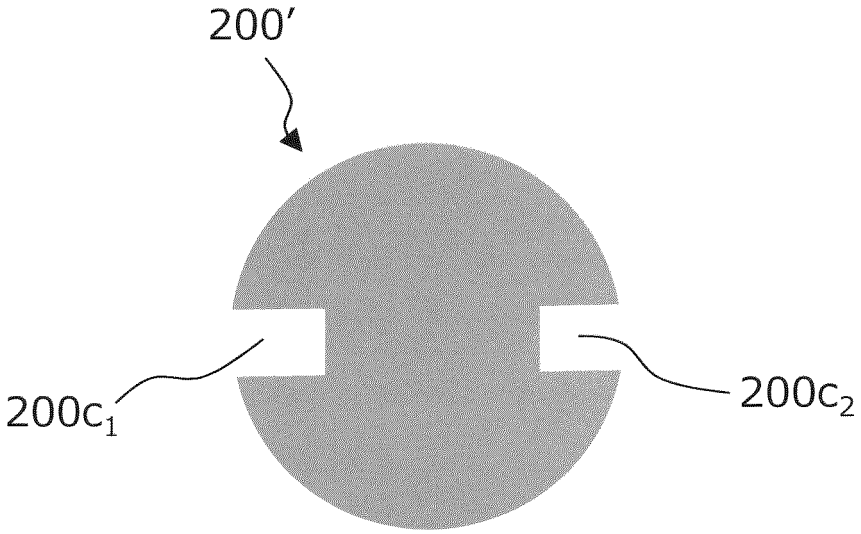


Fig. 12B



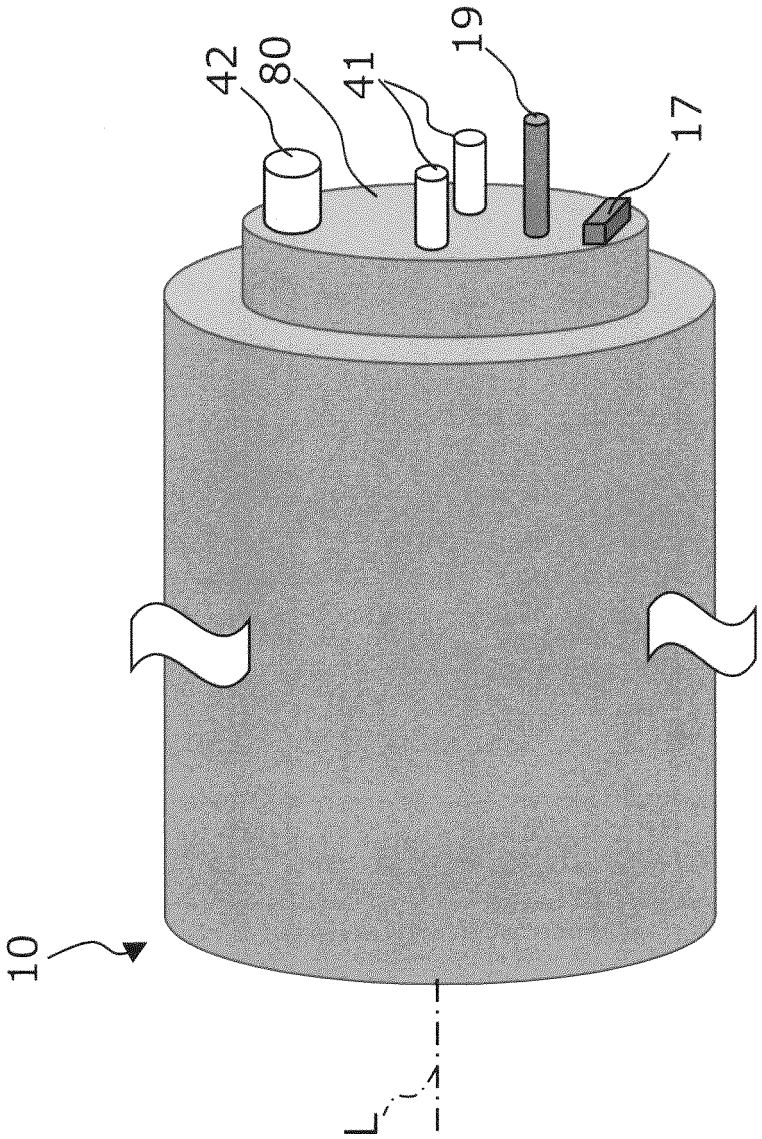


Fig. 13

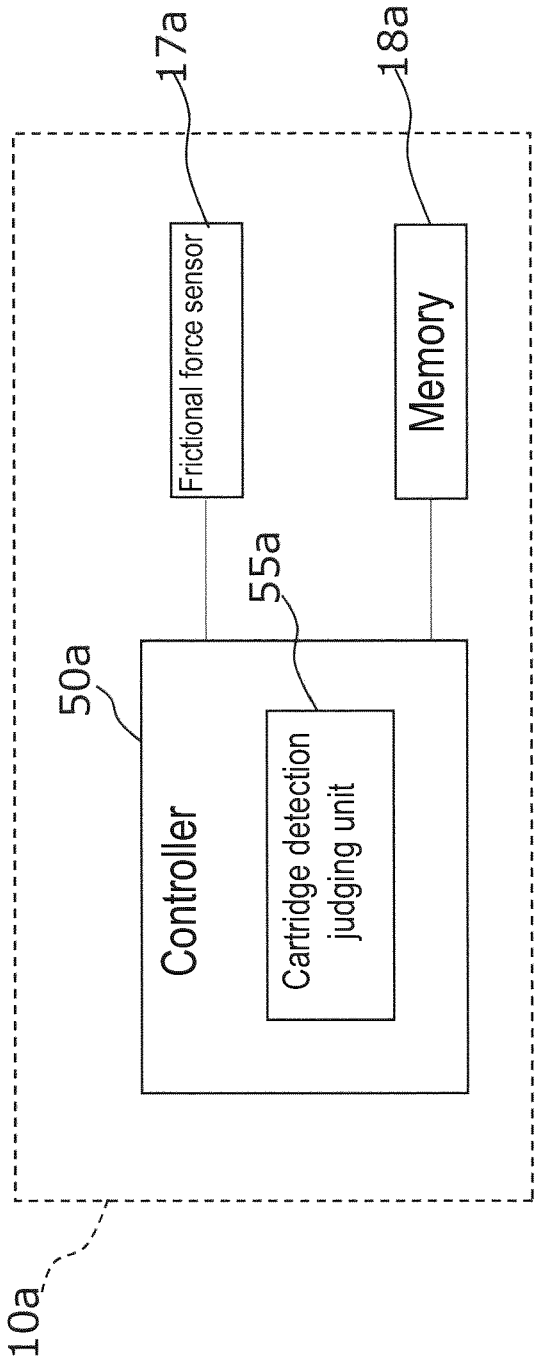

17a
18a
Frictional force sensor
Memory
55a
50a
Controller
Cartridge detection judging unit
10a

Fig. 14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2020/001796

A. CLASSIFICATION OF SUBJECT MATTER
A24F 40/40(2020.01)i; A24F 40/53(2020.01)i
FI: A24F47/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A24F40/40; A24F40/53

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2020
Registered utility model specifications of Japan	1996-2020
Published registered utility model applications of Japan	1994-2020

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2019-010038 A (TDK CORPORATION) 24.01.2019 (2019-01-24) paragraphs [0024]-[0038], [0070], fig. 1-6	1-2, 5, 8-15, 17-18 3-4, 6-7, 16, 19-20
Y A	JP 09-069960 A (BROTHER INDUSTRIES, LTD.) 11.03.1997 (1997-03-11) paragraph [0024]	1-2, 5, 8-15, 17-18 3-4, 6-7, 16, 19-20
Y	WO 2018/163262 A1 (JAPAN TOBACCO INC.) 13.09.2018 (2018-09-13) paragraph [0080]	10-12
Y	US 2016/0242463 A1 (LIU, Qiuming) 25.08.2016 (2016-08-25) paragraph [0021], fig. 1-2	17

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

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"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/JP2020/001796

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
JP 2019-010038 A	24 Jan. 2019	WO 2019/004240 A1 paragraphs [0024]-[0038], [0070], fig. 1-6	
JP 09-069960 A	11 Mar. 1997	US 5774146 A column 8, lines 33-41	
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	
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]**
- JP 2019500898 A **[0003]**