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

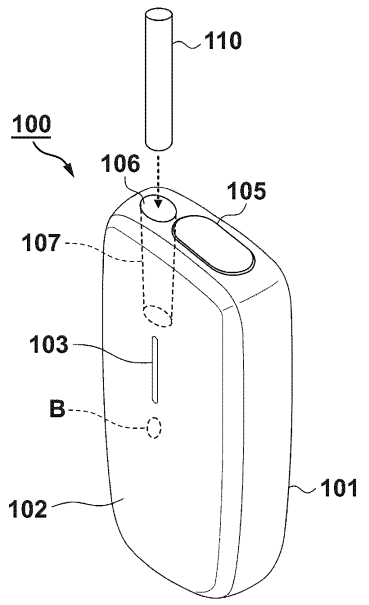
(72) Inventors:
- **YOSHIDA, Ryo**
  Tokyo 130-8603 (JP)
- **AOYAMA, Tatsunari**
  Tokyo 130-8603 (JP)
- **KAWANAGO, Hiroshi**
  Tokyo 130-8603 (JP)
- **NAGAHAMA, Toru**
  Tokyo 130-8603 (JP)
- **FUJIKI, Takashi**
  Tokyo 130-8603 (JP)

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

(54) INHALER POWER SOURCE UNIT

(57) An inhaler power source unit, that supplies electric power from a power supply to a heater configured to heat an aerosol source is provided. The power source unit includes a control unit configured to control an operation of the power source unit, a housing configured to accommodate the power supply and the control unit, a panel configured to be detachably attached to a surface of the housing, and a detection unit configured to detect attachment or detachment of the panel to or from the housing. The control unit is configured to impose, in a case where the detection unit detects the detachment of the panel, a function restriction on a plurality of functions controlled by the control unit. The control unit has a plurality of operation modes, and contents of the function restriction are different for each operation mode.

FIG. 1B



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Description

TECHNICAL FIELD

[0001] The present invention relates to an inhaler power source unit.

BACKGROUND ART

[0002] An inhaler such as a heated tobacco product can include a base material including an aerosol source and a flavor source, and a power source unit that accommodates the base material and heats the base material by supplying electric power from a power supply to a heater. The power source unit is a portion held by a user at the time of use, and can include an operation unit and a display unit. PTL 1 discloses an aerosol supply system in which a detachable member (panel) is attached to the surface of an assembly corresponding to a power source unit.

CITATION LIST

PATENT LITERATURE

[0003] PTL 1: Japanese Patent Laid-Open No. 2021-500032

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] It is general to impose a function restriction from a viewpoint of safety of an apparatus in a case where a specific component such as an exterior member is detached.

[0005] However, if the function restriction is not controlled in accordance with contents of the functions of the apparatus, the user convenience may deteriorate.

[0006] To cope with this, the present invention provides an inhaler power source unit, for example, advantageous in both safety and user convenience.

SOLUTION TO PROBLEM

[0007] According to one aspect of the present invention, there is provided an inhaler power source unit, that supplies electric power from a power supply to a heater configured to heat an aerosol source, characterized by comprising a control unit configured to control an operation of the power source unit, a housing configured to accommodate the power supply and the control unit, a panel configured to be detachably attached to a surface of the housing, and a detection unit configured to detect attachment or detachment of the panel to or from the housing, wherein the control unit is configured to impose, in a case where the detection unit detects the detachment of the panel, a function restriction on a plurality of functions controlled by the control unit, and the control unit has a plurality of operation modes, and contents of the function restriction are different for each operation mode.

[0008] According to one embodiment, the power source unit further comprises an operation button arranged in the housing, wherein in any of the plurality of operation modes, in a state in which the panel is detached, the control unit disables an operation of the operation button as the function restriction.

[0009] According to one embodiment, the power source unit further comprises a display unit, wherein the plurality of operation modes include a standby mode of standing by for detection of an unlock operation using the operation button while performing display by the display unit, and an aerosol generation mode of supplying electric power to the heater to generate aerosol, and in a case where the unlock operation is detected in the state in which the panel is detached in the standby mode, the control unit does not transition to the aerosol generation mode as the function restriction.

[0010] According to one embodiment, in a case where the detection unit detects the detachment of the panel in the aerosol generation mode, the control unit prohibits supplying the electric power to the heater as the function restriction.

[0011] According to one embodiment, in a case where the detection unit detects the attachment of the panel within a predetermined time after prohibiting supplying the electric power to the heater, the control unit cancels the prohibition of supplying the electric power to the heater.

[0012] According to one embodiment, the plurality of operation modes further include a sleep mode of stopping the display by the display unit and standing by in a power saving state in a case where a non-operation state in which no user operation is performed on the power source unit continues in the standby mode for a predetermined time, and a pairing mode capable of executing paring for associating the power source unit with an external communication device, and in a case where a pairing operation using the operation button is detected in the sleep mode in the state in which the panel is detached, the control unit does not transition to the pairing mode as the function restriction.

[0013] According to one embodiment, in a case where the detection unit detects the detachment of the panel in the paring mode, the control unit prohibits executing the pairing as the function restriction.

[0014] According to one embodiment, the plurality of operation modes further include an unlock setting mode capable of executing, in response to execution of an unlock setting operation using the operation button, setting of the unlock operation, and in a case where the unlock setting operation using the operation button is detected in the state in which the panel is detached, the control unit does not transition to the unlock setting mode as the function restriction.

[0015] According to one embodiment, in a case where

the detection unit detects the detachment of the panel in the unlock setting mode, the control unit prohibits executing the setting of the unlock operation.

[0016] According to one embodiment, the plurality of operation modes further include a charging mode of charging the power supply using an external power supply, and even in a case where the detection unit detects the detachment of the panel in the charging mode, the control unit continues charging the power supply.

[0017] According to one embodiment, in the operation modes other than a sleep mode of stopping the display by the display unit and standing by in a power saving state, even in a case where the detection unit detects the detachment of the panel, the control unit continues the display by the display unit.

[0018] According to one embodiment, the power source unit further comprises a setting unit configured to set contents of the function restriction on the plurality of functions.

ADVANTAGEOUS EFFECTS OF INVENTION

[0019] According to the present invention, an inhaler power source unit, for example, advantageous in both safety and user convenience can be provided.

[0020] Other features and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying drawings. Note that the same reference numerals denote the same or like components throughout the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0021] The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention and, together with the description, serve to explain principles of the invention.

Fig. 1A is a perspective view of the outer appearance of an inhaler;
Fig. 1B is a perspective view of the outer appearance of the inhaler;
Fig. 2 is a view of the internal arrangement of the inhaler;
Fig. 3A is a view showing an arrangement example for attachment of an outer panel;
Fig. 3B is a view showing the arrangement example for attachment of the outer panel;
Fig. 4A is a view showing an arrangement example for attachment of the outer panel;
Fig. 4B is a view showing the arrangement example for attachment of the outer panel;
Fig. 5 is a block diagram showing the functional arrangement of a power source unit;
Fig. 6 is a view showing an example of transition of the state of the power source unit;
Fig. 7 is a flowchart illustrating an example of the operation of the power source unit in a sleep mode;
Fig. 8 is a flowchart illustrating an example of the operation of the power source unit in an active mode;
Fig. 9 is a flowchart illustrating an example of the operation of the power source unit in an aerosol generation mode;
Fig. 10 is a flowchart illustrating an example of the operation of the power source unit in a pairing mode;
Fig. 11 is a flowchart illustrating an example of the operation of the power source unit in a charging mode;
Fig. 12 is a flowchart illustrating an example of the operation of the power source unit in an unlock setting mode; and
Fig. 13 is a view showing an example of a setting screen in which the operation of each function in a state in which the outer panel is detached is selectable.

DESCRIPTION OF EMBODIMENTS

[0022] Hereinafter, embodiments will be described in detail with reference to the attached drawings. Note, the following embodiments are not intended to limit the scope of the claimed invention, and limitation is not made to an invention that requires a combination of all features described in the embodiments. Two or more of the multiple features described in the embodiments may be combined as appropriate. Furthermore, the same reference numerals are given to the same or similar configurations, and redundant description thereof is omitted.

<Arrangement of Inhaler>

[0023] Figs. 1A and 1B show an example of the outer appearance of an inhaler 100 according to an embodiment. The inhaler 100 provides, to a user via a stick 110, flavored aerosol, a gas containing aerosol and a flavor material, aerosol, or aerosol containing a flavor material in accordance with an operation of requesting aerosol (to be also referred to as an "aerosol generation request" hereinafter) such as an inhalation operation by the user. Therefore, the inhaler 100 may be understood as an aerosol generation device.

[0024] The inhaler 100 can be formed by a power source unit 101 and the stick 110. The stick 110 is, for example, a base material including an aerosol source and a flavor source. The aerosol source can be, for example, a liquid such as a polyhydric alcohol such as glycerin or propylene glycol. Alternatively, the aerosol source may contain a drug. The aerosol source may be a liquid, a solid, or a mixture of a liquid and a solid. A vapor source such as water may be used in place of the aerosol source. The flavor source can be, for example, a formed body obtained by forming a tobacco material. Alternatively, the flavor source may be formed by a plant (for example, mint, herb, Chinese medicine, coffee beans, or the like) other than tobacco. A fragrance such as menthol may be

added to the flavor source. The flavor source may be added to the aerosol source.

[0025] The power source unit 101 has a substantially rectangular parallelopiped shape with round corners that is elongated in the vertical direction of the sheet surface of each of Figs. 1A and 1B, and can be formed in a size which the user can grasp with one hand. The power source unit 101 can include an outer panel 102, an action button B, and a slider 105.

[0026] The outer panel 102 is a flexible panel member that covers at least part of the front surface of the power source unit 101. The outer panel 102 is an exterior member of the power source unit 101, that is detachable for replacement, and may be understood as a decorative panel. For example, a plurality of outer panels different in color and pattern are prepared, and the user can replace the outer panel by a preferred outer panel. The outer panel 102 may be understood as a heat-insulating panel that insulates heat generated in the power source unit 101, or as a protection panel that protects the inside of the power source unit 101 from an impact or compression at the time of falling.

[0027] A display window 103 is formed in the outer panel 102. The display window 103 can be a band-like window extending along the longitudinal direction (the vertical direction of the sheet surface) in substantially the center of the outer panel 102. The power source unit 101 includes a display D (display unit) (see Fig. 2). The display D can include, for example, one or more LEDs (Light-Emitting Diodes). Light emitted by the LED passes through the display window 103. The display D can display, for example, a residual battery amount by a bar graph.

[0028] The action button B is an operation button formed by a physical push button. The action button B is covered with the outer panel 102. However, since the outer panel 102 is flexible, the user can operate the action button B via the outer panel 102. When the user presses the action button B via the outer panel 102, a corresponding signal is transmitted to a control unit (to be described later). Note that this embodiment will describe, as an example, a case where the action button B formed by a physical button is covered with the outer panel 102 but another arrangement may be adopted as long as a user operation can be accepted. For example, instead of the action button B, another arbitrary type of input device such as a switch or a touch sensing surface exposed from the outer panel 102 may be provided.

[0029] Note that the outer panel 102 may be imparted with such rigidity that the user needs to push the outer panel 102 using a plurality of fingers to operate the action button B via the outer panel 102. This can prevent, for example, the action button B from being erroneously pressed in a bag or an unintended erroneous operation by the user. This is also advantageous in terms of prevention of child mischief (child resistance).

[0030] The slider 105 is a cover member (shutter) slidably disposed on the upper surface of the power source unit 101 along a direction 105a indicated by an arrow. The slider 105 is configured to open/close an opening into which the stick 110 is inserted. Fig. 1A shows a state in which an opening 106 is covered with the slider 105. This state will also be referred to as a "shutter closed state" hereinafter. Fig. 1B shows a state in which the opening 106 is exposed by sliding the slider 105 to the near side. This state will also be referred to as a "shutter open state" hereinafter.

[0031] When inhaling aerosol using the inhaler 100, the user operates the slider 105 to the shutter open state. After that, the user inserts the stick 110 into the opening 106. The inserted stick 110 is held by a tubular holding portion 107 communicating with the opening 106. A section perpendicular to the longitudinal direction of the holding portion 107 can be, for example, circular, elliptical, or polygonal, and the sectional area of the section gradually reduces toward the bottom surface. With this arrangement, the inner surface of the holding portion 107 pushes the outer surface of the stick 110 inserted into the holding portion 107, thereby making it possible to prevent a fall of the stick 110 by the frictional force. After that, the user can perform an unlock operation using the action button B. If the unlock operation is performed, the power source unit 101 is unlocked to start heating the stick 110, thereby setting an inhalation enable state. When the inhalation enable state is thus set, the user can hold, in the mouth, a mouthpiece portion formed at the distal end of the stick 110 and inhale flavored aerosol. After the end of the inhalation of the aerosol, the user performs an operation of pulling out the stick 110 from the holding portion 107, and closing the slider 105 (shutter closed state).

[0032] Fig. 2 is a view showing the internal arrangement of the inhaler 100. Note that Fig. 2 does not illustrate the outer panel 102. As described above, the power source unit 101 includes the holding portion 107 that communicates with the opening 106 and holds the stick 110. Furthermore, the power source unit 101 can include a heater H, an electrical component E, and a user interface 116. The user interface 116 may be understood to be included in the electrical component E. The heater H forms a heating unit that heats the stick 110. The heater H can include, for example, a resistive heat generating component that generates aerosol by heating an aerosol source included in the stick 110. As a resistive heat generating material of the resistive heat generating component, for example, a mixture of one or more of copper, a nickel alloy, a chromium alloy, stainless steel, and platinum rhodium can be used. The heater H is arranged to cover the periphery of the holding portion 107, and generates heat by electric power supplied from the electrical component E. The heat of the heater H is transmitted to the stick 110 via the holding portion 107, thereby heating the stick 110. When the stick 110 is heated, the stick 110 generates aerosol. The user interface 116 can include the action button B, the display D, and a vibration generation unit V The vibration generation unit V can be formed by a vibration motor (vibrator) for vibrating the

housing of the power source unit 101. By vibrating the housing by the vibration motor, it is possible to notify the user, who holds the power source unit 101, of the state.

[0033] If the user holds the mouthpiece portion at the distal end of the stick 110 in the mouth and performs an inhalation operation, air flows into the stick through an opening (not shown), as exemplified by a broken arrow A. When the heater H heats the stick 110, the vaporized and/or aerosolized aerosol source is transported toward the mouthpiece portion by air. In the process in which the aerosol source is transported toward the mouthpiece portion, the vaporized and/or aerosolized aerosol source is cooled to form fine liquid droplets, thereby promoting aerosolization. In the arrangement in which the flavor source is also included in the stick 110, a flavor material generated from the flavor source is added to the aerosol, and the resultant flavored aerosol is transported to the mouthpiece portion, and inhaled by the user's mouth.

[0034] Note that the example in which the heater H is incorporated in the power source unit 101 has been described above. An arrangement in which a heater (atomizer), an aerosol source, and a flavor source are provided in the form of a cartridge, instead of the stick 110, may be adopted.

[0035] Arrangement examples for attachment of the outer panel 102 to the power source unit 101 will be described with reference to Figs. 3A and 3B and Figs. 4A and 4B.

[0036] Fig. 3A is a view showing the inner surface of the outer panel 102. Fig. 3B is a view showing a portion exposed to the front surface of the power source unit 101 in a state in which the outer panel 102 is detached. The power source unit 101 includes a housing 101a that accommodates a power supply and an electric component (including a control unit to be described later), and an inner panel 202. Referring to Fig. 3B, the inner panel 202 is arranged around the action button B to expose the action button B, and is arranged to cover the front surface of the housing 101a. In a state in which the outer panel 102 is attached to the power source unit 101, the inner surface of the outer panel 102 and the outer surface of the inner panel 202 face each other.

[0037] As shown in Fig. 3A, on the inner surface of the outer panel 102, a magnet 11 is arranged above the display window 103, a projection 12 is arranged below the display window 103, and magnets 13A and 14 are arranged below the projection 12. If the outer panel 102 is brought closer to the inner panel 202 to be attached to the inner panel 202, the magnetic force (magnetic attraction force) of the magnets 11 and 14 attracts the outer panel 102 to the inner panel 202. This causes the outer panel 102 to be held by the inner panel 202. When the outer panel 102 is held by the inner panel 202, the projection 12 is at such position facing the action button B that the action button B can be pressed. A magnetic sensor 23A is arranged on the rear surface of the inner panel 202. The magnet 13A is formed as a magnetic field application unit for the magnetic sensor 23A. When the magnetic sensor 23A detects a magnetic force by a magnetic field applied from the magnet 13A, it is possible to detect the attachment of the outer panel 102.

[0038] As shown in Fig. 3B, on the outer surface of the inner panel 202, a display window 25 is formed above the action button B, a magnet 21A is arranged above the display window 25, and a magnet 24 is arranged below the action button B. Furthermore, the magnetic sensor 23A is arranged at a position between the action button B and the magnet 24 on the inner surface (more correctly, on a substrate with an approximately zero distance to the inner surface) of the inner panel 202. The magnetic sensor 23A forms a magnetic force detection region 26A indicated by a broken line on the outer surface of the inner panel 202. The magnet 21A, the display window 25, the action button B, the magnetic sensor 23A, and the magnet 24 on the side of the inner panel 202 correspond to the magnet 11, the display window 103, the projection 12, the magnet 13A, and the magnet 14 on the side of the outer panel 102, respectively. That is, when the outer panel 102 is attached to the inner panel 202, the panels are aligned with respect to the respective components so that they face each other.

[0039] The magnets 21A and 24 of the inner panel 202 can be attracted to the magnets 11 and 14 of the outer panel 102 by the magnetic forces (magnetic attraction forces), respectively. That is, when the magnets 11 and 21A are attracted to each other and the magnets 14 and 24 are attracted to each other, the inner panel 202 can hold the outer panel 102. Note that each of the magnets 11 and 14 of the outer panel 102 and the magnets 21A and 24 of the inner panel 202 can be formed by a permanent magnet.

[0040] The action button B arranged in the central portion of the inner panel 202 is covered with the outer panel 102 when the outer panel 102 is attached to the inner panel 202. The user can press the action button B via the projection 12 of the outer panel 102 by pressing a portion around the central portion of the outer panel 102. This can switch, for example, power-on/off of the inhaler 100.

[0041] The magnetic sensor 23A detects a magnetic force based on a magnetic field applied from the magnet 13A in the outer panel 102. For example, the magnetic sensor 23A can be a Hall sensor formed using a Hall element. This can detect the attachment of the outer panel 102 to the inner panel 202. In the state in which the outer panel 102 is attached to the inner panel 202, light from the display D is transmitted through the display window 25 of the inner panel 202 and the display window 103 of the outer panel 102.

[0042] The magnetic sensor 23A of the inner panel 202 is arranged to face the magnet 13A of the outer panel 102 via the inner surface of the inner panel 202 in the state in which the outer panel 102 is attached to the inner panel 202. That is, when the outer panel 102 is attached to the inner panel 202, the distance between the magnetic sensor 23A of the inner panel 202 and the magnet 13A

of the outer panel 102 is minimum.

[0043] Furthermore, the magnetic sensor 23A of the inner panel 202 is configured not to detect a magnetic field generated by each of the two magnets 21A and 24 of the inner panel 202. For example, on the inner surface of the inner panel 202, the magnetic sensor 23A is arranged at a position separated from the two magnets 21A and 24 on the outer surface of the inner panel 202. This can set the influence of the magnetic fields from the two magnets 21A and 24 on the magnetic sensor 23A to approximately zero.

[0044] The distance between the magnetic sensor 23A and the magnet 24 (or the magnet 21A) of the inner panel 202 can be set to be larger than the distance between the magnetic sensor 23A and the magnet 13A in the state in which the outer panel 102 is attached to the inner panel 202. Thus, when detecting the attachment of the outer panel 102 to the inner panel 202, it is possible to appropriately consider only the influence of the magnetic field applied from the magnet 13A on the magnetic sensor 23A without considering the influence of the magnetic field of the magnet 24.

[0045] In an example, the outer panel 102 can be configured so that data measured by the magnetic sensor 23A changes depending on the type of the outer panel 102 when the outer panel 102 is attached to the inner panel 202. More specifically, the outer panel 102 is configured so that the magnitude of the magnetic force concerning the magnet 13A of the magnetic field application unit, which is detected by the magnetic sensor 23A of the inner panel 202, changes depending on the type of the panel.

[0046] For example, the outer panel 102 can be configured so that the distance between the magnet 13A as the magnetic field application unit and its facing magnetic sensor 23A changes depending on the type of the outer panel in the state in which the outer panel 102 is attached to the inner panel 202. That is, the shape of the curved surface may be adjusted for each type of outer panel so that the height of the inner surface of the outer panel 102 changes depending on the type. Note that those skilled in the art generally understand that the magnitude of the magnetic force changes depending on the distance from the magnet (more specifically, the magnitude of the magnetic force is inversely proportional to the square of the distance). Thus, it is possible to use the common magnet 13A in any type of the outer panel 102, which is advantageous in manufacturing.

[0047] In another example, the position of the magnet 13A may be shifted so as to change depending on the type of the outer panel along the inner surface of the facing outer panel 102. This can change the distance between the magnet 13A and the magnetic sensor 23A in accordance with the type of the outer panel. That is, the magnitude of the magnetic force detected by the magnetic sensor 23A can be changed in accordance with the type of the panel.

[0048] In still another example, the outer panel 102 can be configured so that the type of the magnet 13A as the magnetic field application unit changes depending on the type of the outer panel. The magnet 13A is formed by, for example, a permanent magnet. More specifically, one of a Ferrite magnet, an Al-Ni-Co magnet, a cobalt magnet, a Neodymium magnet, and the like is selected in accordance with the type of the outer panel. This can change the magnitude of the magnetic force detected by the magnetic sensor 23A in accordance with the type of the outer panel.

[0049] Figs. 4A and 4B show an arrangement example different from that shown in Figs. 3A and 3B. Fig. 4A is a view showing the inner surface of the outer panel 102. Fig. 4B is a view showing a portion exposed to the front surface of the power source unit 101 in a state in which the outer panel 102 is detached. Fig. 4B is a view of the outer appearance of the outer surface of the inner panel 202. In the state in which the outer panel 102 is attached to the power source unit 101, the inner surface of the outer panel 102 and the outer surface of the inner panel 202 face each other.

[0050] As shown in Fig. 4A, on the inner surface of the outer panel 102, a magnetic body 13B is arranged above the display window 103, the projection 12 is arranged below the display window 103, and a magnet 15 is arranged below the projection 12. Furthermore, the magnetic body 13B includes a circular base portion 11B, and a leg portion 12B that linearly extends from the base portion 11B approximately in the longitudinal direction. The magnetic body 13B is made of a material that becomes magnetized, when a magnetic field is applied from the outside, by the action of the magnetic field, and applies a magnetic field. The magnetic body 13B is formed as a magnetic field application unit for a magnetic sensor 23B (to be described later) of the inner panel 202. The magnetic body 13B can be made of, for example, a metal. More specifically, the magnetic body 13B can be made of a paramagnetic material or a ferromagnetic material as a non-permanent magnet. "Ferromagnetic" indicates the property of a material that becomes strongly magnetized, when a magnetic field is applied from the outside, in the same direction as that of the magnetic field, and is still magnetized even if the magnetic field from the outside is set to zero. Examples of the ferromagnetic material are iron, cobalt, and nickel. In addition, "paramagnetic" indicates the property of a material that becomes weakly magnetized, when a magnetic field is applied from the outside, in the same direction as that of the magnetic field, and is not magnetized when the magnetic field from the outside is set to zero. An example of the paramagnetic material is aluminum.

[0051] The magnetic body 13B is formed as an acted upon unit that changes in a state (that is, is magnetized) in accordance with the action of a magnetic field applied from the outside. In addition, the magnetic body 13B is formed as a magnetic field application unit that applies a magnetic field to the inner panel 202. More specifically, if the outer panel 102 is attached to the inner panel 202,

the magnetic body 13B functions as an acted upon unit that a magnet 21B of the inner panel 202 acts upon. As a result, the magnetic body 13B is magnetized, and functions as a magnetic field application unit for the magnet 21B and the magnetic sensor 23B of the inner panel 202. More specifically, the outer panel 102 can be attracted to and held by the inner panel 202 by a magnetic force based on a magnetic field generated and applied by the magnetic body 13B (particularly, the base portion 11B). Furthermore, with respect to a magnetic field generated and applied by the magnetic body 13B (particularly, the leg portion 12B), the magnetic sensor 23B of the inner panel 202 can be made to detect the state of the leg portion 12B (that is, a magnetic force based on the magnetic field from the leg portion 12B). This can cause the power source unit 101 to detect the attachment of the outer panel 102.

[0052] As shown in Fig. 4B, on the outer surface of the inner panel 202, the display window 25 is formed above the action button B, the magnet 21B is arranged above the display window 25, and a magnet 27 is arranged below the action button B. Furthermore, the magnetic sensor 23B is arranged on a side of the display window 25 on the inner surface of the inner panel 202 (more correctly, on a substrate with an approximately zero distance to the inner surface). The magnetic sensor 23B forms a magnetic force detection region 26B indicated by a broken line on the outer surface of the inner panel 202. The magnet 21B, the magnetic sensor 23B, the display window 25, the action button B, and the magnet 27 on the side of the inner panel 202 correspond to the base portion 11B of the magnetic body 13B, the leg portion 12B of the magnetic body 13B, the display window 103, the projection 12, and the magnet 15 on the side of the outer panel 102, respectively. That is, when the outer panel 102 is attached to the inner panel 202, the panels are aligned with respect to the respective components so that they face each other. When the outer panel 102 is attached to the inner panel 202, they are arranged so that the magnetic body 13B of the outer panel 102 is aligned with both the magnet 21B and the magnetic sensor 23B of the inner panel 202. More specifically, the outer panel 102 and the inner panel 202 are arranged so that the base portion 11B of the magnetic body 13B of the outer panel 102 is aligned with the magnet 21B of the inner panel 202 and the leg portion 12B of the magnetic body 13B of the outer panel 102 is aligned with the magnetic sensor 23B of the inner panel 202. In particular, when the outer panel 102 is attached to the inner panel 202, the magnetic sensor 23B faces the leg portion 12B of the magnetic body 13B via the inner surface of the inner panel 202, and thus the distance between the magnetic sensor 23B and the leg portion 12B of the magnetic body 13B is minimum.

[0053] The magnet 21B of the inner panel 202 is formed as an acting unit that generates a magnetic field. A magnetic force based on the magnetic field acts to magnetize the magnetic body 13B in the outer panel 102, thereby attracting the base portion 11B of the magnetic body. That is, the magnet 21B and the base portion 11B of the magnetic body 13B attract each other by the magnetic attraction force, and thus the inner panel 202 can hold the outer panel 102.

[0054] The magnetic sensor 23B detects the magnetic force of the leg portion 12B of the magnetic body 13B magnetized in the outer panel 102. For example, similar to the magnetic sensor 23A, the magnetic sensor 23B can be a Hall sensor formed using a Hall element. This can detect the attachment of the outer panel 102 to the inner panel 202.

[0055] The magnetic sensor 23B of the inner panel 202 is configured not to detect a magnetic field generated by each of the two magnets 21B and 27 of the inner panel 202. For example, on the inner surface of the inner panel 202, the magnetic sensor 23B is arranged at a position separated from the two magnets 21B and 27 on the outer surface of the inner panel 202. This can set the influence of the magnetic fields from the two magnets 21B and 27 on the magnetic sensor 23B to approximately zero.

[0056] The distance between the magnetic sensor 23B and the magnet 21B (or the magnet 27) of the inner panel 202 can be set to be larger than the distance between the magnetic sensor 23B and the magnetic body 13B in the state in which the outer panel 102 is attached to the inner panel 202. Thus, when detecting the attachment of the outer panel 102 to the inner panel 202, it is possible to appropriately consider only the magnetic field applied from the leg portion 12B of the magnetic body 13B in the magnetic sensor 23B without considering the influence of the magnetic field of the two magnets 21B and 27.

[0057] In an example, the outer panel 102 can be configured so that data measured by the magnetic sensor 23B changes depending on the type of the outer panel 102 when the outer panel 102 is attached to the inner panel 202. More specifically, the outer panel 102 is configured so that data concerning the magnetized magnetic body 13B (that is, the magnitude of the magnetic force detected by the magnetic sensor 23B), which is detected by the magnetic sensor 23B of the inner panel 202, changes depending on the type of the panel.

[0058] For example, the outer panel 102 is configured so that the distance between the leg portion 12B of the magnetic body 13B and its facing magnetic sensor 23B changes depending on the type of the outer panel in the state in which the outer panel 102 is attached to the inner panel 202. That is, the shape of the curved surface may be adjusted for each type of panel so that the height of the inner surface of the outer panel 102 changes depending on the type. Thus, the common magnetic body 13B is used in any type of the outer panel 102, which is advantageous in manufacturing.

[0059] In another example, the position of the magnetic body 13B may be shifted so as to change depending on the type of the panel along the inner surface of the facing outer panel 102. This can change the distance between the magnetic body 13B and the magnetic sensor 23B in

accordance with the type of the panel. That is, the magnitude of the magnetic force detected by the magnetic sensor 23B can be changed in accordance with the type of the panel.

[0060] The arrangement examples for the attaching the outer panel 102 to the inner panel 202 using the magnets have been described above but the present invention is not limited to them. Another arrangement may be adopted as long as it is possible to detachably attach the outer panel 102 to the inner panel 202 and to detect an attached/detached state.

[0061] An example of the functional arrangement of the power source unit 101 will be described next with reference to Fig. 5. Note that functional blocks to be described may be integrated or separated, and each function to be described may be implemented by another block. A component to be described as a hardware component may be implemented by a software component and vice versa.

[0062] A control unit 120 controls the operation of the power source unit 101. The control unit 120 may include one or more processors and a volatile memory. The processor may be, for example, a CPU (Central Processing Unit) or a microcontroller. The control unit 120 controls all the functions of the inhaler 100 by loading a computer program (also called software or firmware) stored in a storage unit 121 into the memory and executing the loaded program. The storage unit 121 can be, for example, a nonvolatile memory. The storage unit 121 stores one or more computer programs, and data describing a control sequence (heating profile) for controlling a heating unit 130. Note that the heating unit 130 is a functional unit that heats the stick 110, and is formed by the above-described heater H.

[0063] The control unit 120 can control communication (pairing or connection in a normal state) with an external communication device. Furthermore, the control unit 120 can control transition of the state of the inhaler 100 to be described later in accordance with a user operation on the action button B or the slider 105. The control unit 120 controls supply of electric power from a battery 132 to the heating unit 130. In response to an aerosol generation request, the control unit 120 can start to supply electric power from the battery 132 as a power supply to the heating unit 130. The control unit 120 controls the temperature of the heating unit 130 by adjusting the duty ratio of a control pulse by pulse width modulation (PWM). Note that the control unit 120 may use pulse frequency modulation (PFM) instead of PWM.

[0064] An input detection unit 122 detects, for example, an operation input to the action button B. The input detection unit 122 detects a user operation performed by, for example, pushing the outer panel 102, and outputs an input signal indicating this user operation to the control unit 120. Note that the inhaler 100 may detect pushing itself of the outer panel 102, instead of detecting the pressing of the action button B.

[0065] A state detection unit 123 detects the open/closed state of the slider 105. The state detection unit 123 can be formed by, for example, a Hall sensor including a Hall element. The state detection unit 123 outputs, to the control unit 120, a state detection signal indicating whether the slider 105 is open or closed. Furthermore, the state detection unit 123 can also detect an attached/detached state of the outer panel 102. Therefore, the state detection unit 123 can include, for example, magnetic sensors 23A and 23B described above. The state detection unit 123 can output a state detection signal indicating the attached/detached state of the outer panel 102 to the control unit 120.

[0066] An inhalation detection unit 124 (puff sensor) can detect inhalation (puff) of the stick 110 by the user. For example, the inhalation detection unit 124 can include a thermistor disposed near the opening 106. In this case, the inhalation detection unit 124 can detect inhalation by the user based on a change in resistance value of the thermistor resulting from a temperature change caused by the inhalation. As another example, the inhalation detection unit 124 may include a pressure sensor disposed on the bottom of the holding portion 107. In this case, the inhalation detection unit 124 can detect inhalation based on a reduction in atmospheric pressure resulting from an air current caused by the inhalation. The inhalation detection unit 124 outputs, to the control unit 120, for example, an inhalation detection signal indicating whether inhalation is performed.

[0067] A light emitting unit 125 includes one or more LEDs and a driver for driving the LEDs, thereby forming the display D. The light emitting unit 125 turns on each LED in accordance with an instruction signal input from the control unit 120. A vibration unit 126 forms the above-described vibration generation unit V. The vibration unit 126 can include a vibrator (for example, an eccentric motor) and a driver for driving the vibrator. The vibration unit 126 vibrates the vibrator in accordance with an instruction signal input from the control unit 120. The control unit 120 may control at least one of the light emitting unit 125 and the vibration unit 126 in an arbitrary pattern, in order to notify the user of a certain status (for example, the status of pairing or detachment of the outer panel 102) of the inhaler 100. For example, the light emission patterns of the light emitting unit 125 can be distinguished by elements such as the light emission state (always on/blinking/off), the blinking period, and the light color of each LED. The vibration patterns of the vibration unit 126 can be distinguished by elements such as the vibration state (vibration/stop) and the vibration strength of the vibrator.

[0068] A communication I/F 127 includes, for example, a communication circuit and an antenna, and serves as a communication interface with which the inhaler 100 wirelessly communicates with an external communication device (for example, a smartphone, a personal computer, or a tablet terminal owned by the user). The communication I/F 127 can be, for example, an interface complying with an arbitrary wireless communication protocol,

for example, short-range wireless communication such as Bluetooth®, near-field wireless communication such as NFC (Near Field Communication), or a wireless LAN (Local Area Network).

[0069] A connection I/F 128 is a wired interface having a terminal for connecting the inhaler 100 to another external device. The connection I/F 128 can be a chargeable interface such as a USB (Universal Serial Bus) interface. The connection I/F 128 may be used to charge the battery 132 from an external power supply (charger) (via a feeder (not shown)).

[0070] The battery 132 is a chargeable battery (secondary battery) such as a lithium-ion battery. Alternatively, the battery 132 may be formed by an electric double-layer capacitor such as a lithium-ion capacitor. A residual amount meter 133 can include an IC chip for monitoring the residual power amount and other statuses of the battery 132. The residual amount meter 133 can periodically measure the status values of the battery 132, such as the SOC (State Of Charge), the SOH (State Of Health), the RSOC (Relative SOC), and the power supply voltage, and can output the measurement results to the control unit 120.

<Operation Modes>

[0071] An example of transition of the state of the power source unit 101 will be described with reference to Fig. 6. The control unit 120 has a plurality of operation modes. The plurality of modes can include, for example, a sleep mode 61, an active mode 62, an aerosol generation mode 63, a charging mode 64, an unlock setting mode 65, and a pairing mode 66.

[0072] The sleep mode 61 is a state in which the operation by the control unit 120 is temporarily stopped to stand by in a power-saving state in which the power consumption is reduced. The speed mode is a state in which the inhaler 100 stops the main operation, and no electric power is supplied to the heater H. Display on the display D is not performed. In other words, in the sleep mode 61, the power source unit 101 is locked and the user cannot inhale aerosol. In the sleep mode 61, the control unit 120 can accept a predetermined user input, and can transition to another mode corresponding to the user input upon accepting the corresponding user input. Note that in the following description, the speed mode will sometimes be referred to as a standby state. In this embodiment, the sleep mode 61 can be started by a method of "suspend" or "standby" by which the standby state begins while the contents of the memory of the control unit 120 are maintained, and can also be started by a method of "hibernation" by which the standby state begins while the contents of the memory of the control unit 120 are copied to the storage unit 121. In the sleep mode 61, functions need not be operable except for the function of detecting a user operation on the slider 105 or the action button B, and the function of monitoring the residual battery amount.

[0073] In the sleep mode 61, for example, if an operation of opening the slider 105 (an operation of setting the shutter open state) is performed, the control unit 120 can transition to the active mode 62. The active mode 62 can be a standby mode of standing by for detection of an unlock operation using the action button B while performing at least display by the display D. In the active mode 62, if an operation of closing the slider 105 (an operation of setting the shutter closed state) is performed or if a non-operation state in which no user operation is performed for the power source unit 101 continues for a predetermined time, the control unit 120 can return to the sleep mode 61 in which display on the display D is stopped to stand by in the power-saving state.

[0074] In the active mode 62, upon detecting an unlock operation, the control unit 120 unlocks the locked state of the power source unit 101, and can transition to the aerosol generation mode 63 in which aerosol is generated. The unlock operation can be, for example, one pressing operation of the action button B. However, as will be described later, the unlock operation can be changed by setting. For example, the unlock operation can be an operation of repeatedly pressing the action button B a predetermined number of times (for example, three times) within a predetermined time, an operation of pressing the action button B for a predetermined time (for example, 3 sec), or a combination thereof. In the aerosol generation mode 63, the heating unit 130 performs heating (that is, supplies electric power to the heater H), and the user can inhale aerosol. Alternatively, the setting of the unlock operation may be disabled, and transition to the aerosol generation mode 63 may be performed in response to detection, by the inhalation detection unit 124 (puff sensor), of inhalation (puff) by the user. When the inhalation ends, or the inhalation time reaches a predetermined upper limit time (MaxLoadingTime), the control unit 120 can return to the active mode 62.

[0075] When an external power supply (charger) is connected to the connection I/F 128 in the sleep mode 61 or the active mode 62 (or the aerosol generation mode 63), the control unit 120 transitions to the charging mode 64 and the battery 132 is charged. When the external power supply is detached from the connection I/F 128 or the battery 132 is in a full charge state, the control unit 120 transitions to the sleep mode 61.

[0076] In the charging mode 64, for example, if a predetermined operation is performed on the action button B, the control unit 120 can transition to the unlock setting mode 65. In the unlock setting mode 65, the unlock operation is set. For example, the unlock operation in a default state can be, for example, one pressing operation of the action button B. In the unlock setting mode 65, the user can change this unlock operation to another operation. For example, the unlock operation can be set to an arbitrary pattern such as an operation of repeatedly pressing the action button B a predetermined number of times within a predetermined time, an operation of pressing the action button B for a predetermined time, or a

combination thereof. This can improve security performance of the power source unit 101. When the setting ends, the control unit 120 returns to the charging mode 64. Note that in this embodiment, transition to the unlock setting mode 65 is performed from the charging mode 64 but transition to the unlock setting mode 65 may be performed from an operation mode other than the charging mode 64.

[0077] If a predetermined pairing operation is performed in the sleep mode 61, the control unit 120 can transition to the pairing mode 66 for executing pairing with an external communication device. Pairing is processing of associating the power source unit 101 with an external communication device, and can be performed with, for example, the external communication device in compliance with Bluetooth'. The pairing operation can be, for example, an operation of pressing the action button B while the slider 105 is closed. In the pairing mode 66, if pairing with the external communication device succeeds, the control unit 120 registers identification information of the paired device in a white list stored in the storage unit 121. If registration in the white list succeeds or pairing fails, the control unit 120 can transition from the pairing mode 66 to the sleep mode 61.

<Operation of Power Source Unit in Each Operation Mode>

[0078] Examples of the operation of the power source unit 101 will be described with reference to Figs. 7 to 12. This operation is controlled by the control unit 120.

[0079] Fig. 7 shows a control sequence in the sleep mode 61. In the sleep mode 61, the power source unit 101 is in the standby state. In step S101, the control unit 120 determines whether the external power supply (charger) is connected to the connection I/F 128 to start charging of the battery 132. If charging is detected, the control unit 120 advances to step S104, and leaves the sleep mode 61 to transition to the active mode 62.

[0080] In step S102, the control unit 120 determines the open/closed state of the slider 105 based on a state detection signal from the state detection unit 123. If the shutter open state is detected, the control unit 120 advances to step S103, and leaves the sleep mode 61 to transition to the active mode 62.

[0081] In step S105, the control unit 120 determines whether a pairing operation of pressing the action button B is performed in the shutter closed state (NO in step S102). If no pairing operation is detected, the process returns to step S101. On the other hand, if a pairing operation is detected, the control unit 120 transitions to the pairing mode (step S107). However, in this embodiment, in step S106, it is confirmed based on the output signal of the state detection unit 123 that the outer panel 102 is attached to the power source unit 101, and the control unit 120 advances to step S107, and transitions to the pairing mode. In step S106, if the outer panel 102 is detached from the power source unit 101, the control unit 120 does not transition to the pairing mode as the function restriction, and the process returns to step S101. At this time, the pairing operation may be disabled.

[0082] Fig. 8 shows a control sequence in the active mode 62. After entering the active mode 62, the control unit 120 acquires the residual battery amount in step S201. For example, the control unit 120 can acquire the residual battery amount based on the output voltage of the battery 132. Alternatively, the control unit 120 can acquire the residual battery amount based on the number of times of puff after the completion of charging, which is acquired from the inhalation detection unit 124. Alternatively, if the power source unit 101 includes a management circuit that manages the battery 132, the control unit 120 can acquire the residual battery amount based on an output from the management circuit.

[0083] In step S202, the control unit 120 determines whether the residual battery amount exceeds a predetermined threshold. The predetermined threshold is a threshold for determining whether to permit the operation in the active mode 62 with respect to the residual battery amount. More specifically, the predetermined threshold can be set as, for example, the predetermined lower limit value of the residual battery amount with which even generation of aerosol corresponding to N (for example, N = 1) puff operations is impossible. If the residual battery amount is equal to or smaller than the predetermined threshold, the power source unit 101 cannot operate in the active mode 62. Therefore, in step S203, the control unit 120 makes a notification by the display D and/or the vibration generation unit V, and then returns to the sleep mode 61 in step S204.

[0084] If the residual battery amount exceeds the predetermined threshold, the process advances to step S205. In step S205, the control unit 120 displays the residual battery amount on the display D. After that, in step S206, the control unit 120 determines whether a condition for returning to the sleep mode 61 is satisfied. The condition for returning to the sleep mode 61 can be, for example, a condition that the slider 105 is operated to be set in the shutter closed state or a condition that a non-operation period exceeds a predetermined time. If this condition is satisfied, the control unit 120 transitions to the sleep mode 61 in step S204.

[0085] If it is determined in step S206 that the condition for returning to the sleep mode 61 is not satisfied, the control unit 120 determines in step S207 whether an unlock operation is performed. If an unlock operation is detected, the control unit 120 determines in step S208 whether the outer panel 102 is attached to the power source unit 101. If the outer panel 102 is attached to the power source unit 101, the control unit 120 transitions to the aerosol generation mode 63 in step S209.

[0086] On the other hand, if it is determined that the outer panel 102 is detached from the power source unit 101, the control unit 120 makes, in step S210, a notification by the display D and/or the vibration generation unit V, and the process returns to step S201. That is, even if

an unlock operation is detected in the state in which the outer panel 102 is detached, the control unit 120 does not transition to the aerosol generation mode 63 as the function restriction. At this time, the unlock operation may be disabled. Note that in this case, the control unit 120 may transition to the sleep mode 61 instead of returning to step S201.

[0087] An overview of the operation in the active mode 62 has been described above. According to the control sequence shown in Fig. 8, in the state in which the outer panel 102 is detached, even if an unlock operation is input, the control unit 120 cannot transition to the aerosol generation mode 63. At this time, the unlock operation may be disabled. However, even if the detachment of the outer panel 102 is detected in step S208, the active mode 62 is maintained, and the residual battery amount can continuously be displayed in step S205.

[0088] Note that in the sequence of Fig. 8, transition to the charging mode 64 is not illustrated. As described above, even in the active mode 62, it is monitored that the external power supply (charger) is connected to the connection I/F 128. If the external power supply (charger) is connected to the connection I/F 128 in the active mode 62, the battery 132 can also be charged.

[0089] Fig. 9 shows a control sequence in the aerosol generation mode 63. After transitioning to the aerosol generation mode 63, the control unit 120 first confirms, in step S301, that the outer panel 102 is attached to the power source unit 101 (the inner panel 202). If the outer panel 102 is attached to the power source unit 101, the control unit 120 starts, in step S302, to supply electric power to the heater H by the heating unit 130. Power supply to the heater H can be controlled in accordance with a predetermined control sequence (heating profile). After a preheating period in the heating profile, the inhaler 100 enters the inhalation enable state.

[0090] In step S303, the control unit 120 determines whether an aerosol generation end condition is satisfied. The aerosol generation end condition can be, for example, a condition that the number of times of puff after entering the inhalation enable state, which is acquired from the inhalation detection unit 124, has reached a predetermined number, a condition that a predetermined time has elapsed after transitioning to the aerosol generation mode 63, or the like. If the aerosol generation end condition is satisfied, the process advances to step S304, and the control unit 120 stops the power supply to the heater H. After that, in step S305, the control unit 120 transitions to the active mode 62.

[0091] If it is determined in step S301 that the outer panel 102 is detached from the power source unit 101, the control unit 120 makes, in step S306, a notification by the display D and/or the vibration generation unit V, and prohibits, in step S307, power supply to the heater H as the function restriction. After that, in step S308, the control unit 120 may determine whether the outer panel 102 is attached to the power source unit 101. While the outer panel 102 is not attached to the power source unit 101, the determination processing in step S308 can be repeated for a predetermined time. However, if the predetermined time elapses (YES in step S310), the control unit 120 transitions to the active mode 62 in step S311. If the attachment of the outer panel 102 to the power source unit 101 is detected within the predetermined time, the control unit 120 cancels, in step S309, the prohibition of the power supply to the heater H as the function restriction. After that, the process returns to step S301.

[0092] Note that although not illustrated, acquisition and display of the residual battery amount can appropriately be performed even in the aerosol generation mode 63, similar to the active mode 62. Even in the state in which the outer panel 102 is detached, display of the residual battery amount may be continued without being prohibited.

[0093] Fig. 10 shows a control sequence in the pairing mode 66. After entering the pairing mode 66, the control unit 120 acquires the residual battery amount in step S401. For example, the control unit 120 can acquire the residual battery amount based on the output voltage of the battery 132. Alternatively, the control unit 120 can acquire the residual battery amount based on the number of times of puff after the completion of charging, which is acquired from the inhalation detection unit 124. Alternatively, if the power source unit 101 includes a management circuit that manages the battery 132, the control unit 120 can acquire the residual battery amount based on an output from the management circuit.

[0094] In step S402, the control unit 120 determines whether the residual battery amount exceeds a predetermined threshold. The predetermined threshold is a threshold for determining whether to permit the operation in the pairing mode 66 with respect to the residual battery amount. More specifically, the predetermined threshold can be set as the predetermined lower limit value of the residual battery amount by assuming that electric power shortage does not occur during pairing processing. If the residual battery amount is equal to or smaller than the predetermined threshold, the power source unit 101 cannot operate in the pairing mode 66. Therefore, in step S403, the control unit 120 makes a notification by the display D and/or the vibration generation unit V, and then advances to step S413 to return to the sleep mode 61.

[0095] If the residual battery amount exceeds the predetermined threshold, the process advances to step S404. In step S404, the control unit 120 displays the residual battery amount on the display D. After that, in step S405, the control unit 120 determines whether the outer panel 102 is attached to the power source unit 101. If it is determined that the outer panel 102 is detached from the power source unit 101, the control unit 120 makes, in step S406, a notification by the display D and/or the vibration generation unit V, and advances to step S413 to return to the sleep mode 61. As described above, in this embodiment, if the detachment of the outer panel 102 is detected in the pairing mode 66, the control unit 120 prohibits execution of pairing as the function restric-

tion. In this case, the control unit 120 leaves the pairing mode 66, and transitions to the sleep mode 61. If it is determined that the outer panel 102 is detached from the power source unit 101 in the pairing mode 66, the pairing operation performed so far may be canceled.

[0096] If it is determined in step S405 that the outer panel 102 is attached to the power source unit 101, the control unit 120 executes, in step S407, pairing complying with Bluetooth' with an external communication device. In step S408, the control unit 120 determines whether the pairing processing has succeeded or failed. For example, if a time-out occurs before the completion of the pairing processing, an error is notified from the external communication device, or a cancel operation of the pairing processing is detected, the control unit 120 can determine a pairing failure. Furthermore, if it is detected that the outer panel 102 is detached from the power source unit 101 during the pairing processing, the control unit 120 interrupts the pairing processing, and determines a pairing failure.

[0097] If it is determined in step S408 that the pairing processing has succeeded, the control unit 120 makes, in step S409, a notification that the pairing processing has succeeded, by the display D and/or the vibration generation unit V. After that, in step S410, the control unit 120 determines whether a pairing cancellation condition is satisfied. The pairing cancellation condition can be, for example, a condition that the slider 105 is operated to be set in the shutter open state, a condition that the action button B is pressed, a condition that a pairing cancellation request is received from the external communication device, a condition that a non-operation period exceeds a predetermined time, or the like. If the pairing cancellation condition is satisfied, the control unit 120 performs, in step S411, processing of disconnecting Bluetooth connection from the external communication device, and transitions to the sleep mode 61 in step S413.

[0098] If it is determined in step S408 that the pairing processing has failed, the control unit 120 makes, in step S412, a notification that the pairing processing has failed, by the display D and/or the vibration generation unit V After that, in step S413, the control unit 120 transitions to the sleep mode 61.

[0099] Fig. 11 shows a control sequence in the charging mode 64. After entering the charging mode 64, the control unit 120 acquires the residual battery amount in step S501. For example, the control unit 120 can acquire the residual battery amount based on the output voltage of the battery 132. Alternatively, the control unit 120 can acquire the residual battery amount based on the number of times of puff after the completion of charging, which is acquired from the inhalation detection unit 124. Alternatively, if the power source unit 101 includes a management circuit that manages the battery 132, the control unit 120 can acquire the residual battery amount based on an output from the management circuit. After that, in step S502, the control unit 120 displays the residual battery amount on the display D.

[0100] In step S503, the control unit 120 determines whether an unlock setting operation is performed. The unlock setting operation can be, for example, a combination of an operation of opening/closing the slider 105 and a predetermined number of times of continuous pressing of the action button B. If no unlock setting operation is detected, the control unit 120 determines in step S504 whether charging has ended. If, for example, the external power supply (charger) is detached from the connection I/F 128 or the battery 132 is set in the full charge state, it can be determined that charging has ended. If it is determined that charging has not ended, the process returns to step S501. If it is determined that charging has ended, the control unit 120 transitions to the sleep mode 61 in step S507.

[0101] If the unlock setting operation is detected in step S503, the control unit 120 determines in step S505 whether the outer panel 102 is attached to the power source unit 101. If the outer panel 102 is attached to the power source unit 101, the control unit 120 transitions to the unlock setting mode 65 in step S506. If the outer panel 102 is not attached to the power source unit 101, the control unit 120 does not transition to the unlock setting mode 65, and the process advances to step S504. That is, even if the unlock setting operation is detected in the state in which the outer panel 102 is detached, the control unit 120 does not transition to the unlock setting mode 65 as the function restriction. The unlock setting operation may be disabled. Note that if the outer panel 102 is not attached to the power source unit 101, a notification of it may be made.

[0102] As described above, in this embodiment, even if the detachment of the outer panel 102 is detected in the charging mode 64, the battery 132 is continuously charged. However, transition to the unlock setting mode 65 in the state in which the outer panel 102 is detached is not permitted. In another embodiment, charging processing may also not be permitted in the state in which the outer panel 102 is detached.

[0103] Fig. 12 shows a control sequence in the unlock setting mode 65. After entering the unlock setting mode 65, the control unit 120 accepts the input of an unlock operation pattern in step S601. As described above, the unlock operation is an operation for transitioning from the active mode 62 to the aerosol generation mode 63. In step S601, for example, an unlock operation pattern input within a predetermined time (for example, 20 sec) after transition to the unlock setting mode 65 is accepted.

[0104] In step S602, the control unit 120 determines whether the outer panel 102 is attached to the power source unit 101. If the outer panel 102 is attached to the power source unit 101, the control unit 120 stores, in step S603, the unlock operation pattern accepted in step S601 in the storage unit 121. After that, the control unit 120 returns to the charging mode 64 in step S605.

[0105] If it is determined in step S602 that the outer panel 102 is not attached to the power source unit 101, the control unit 120 discards, in step S604, data of the

unlock operation pattern input in step S601. After that, the control unit 120 returns to the charging mode 64 in step S605. As described above, in this embodiment, if the detachment of the outer panel 102 is detected in the unlock setting mode 65, the control unit 120 prohibits execution of setting of the unlock operation as the function restriction, and cancels the unlock operation pattern input so far.

[0106] Note that although not illustrated, acquisition and display of the residual battery amount can appropriately be performed even in the unlock setting mode 65, similar to the active mode 62 or the like. Even in the state in which the outer panel 102 is detached, display of the residual battery amount may be continued without being prohibited. As described above, in the operation modes other than the sleep mode 61, even if the detachment of the outer panel 102 is detected, the control unit 120 can continue display by the display D.

[0107] The operation of the power source unit 101 in each operation mode has been explained above. In the above-described embodiment, in any of the plurality of operation modes, in the state in which the outer panel 102 is detached, the operation of the action button B can be disabled. However, in each operation mode, if the detachment of the outer panel 102 is detected, only the function associated with the operation mode is restricted, and the operations of the remaining functions can be continued. For example, in the active mode 62 (Fig. 8), even if the outer panel 102 is detached, display of the residual battery amount is not stopped. In the charging mode 64 (Fig. 11), even if the outer panel 102 is detached, charging is not stopped.

[0108] With respect to a function that can depend on user selection, a tool for prompting the user to make selection may be provided. At this time, the control unit 120 can function as a setting unit for setting contents of the function restriction on the plurality of functions. For example, in the pairing mode 66, a setting screen shown in Fig. 13 may be displayed on the display unit of a paired external communication device, and the user may be able to select, for each of the plurality of functions, prohibition/non-prohibition of the operation of the function in the state in which the outer panel 102 is detached. Referring to Fig. 13, a hatched portion indicates a selection result by the user. The selection result of each function is stored in the storage unit 121. The control unit 120 can execute control when the outer panel 102 is detached, in accordance with the selection information stored in the storage unit 121.

[0109] According to the above-described embodiment, the control unit 120 is configured to impose, if the detachment of the outer panel 102 is detected, a function restriction on the plurality of functions controlled by the control unit 120. Then, the control unit 120 has the plurality of operation modes, and contents of the function restriction are different for each operation mode. This can maintain user convenience. Among others, in the state in which the outer panel 102 is detached, heating by power supply to the heater H is prohibited, and thus safety is also ensured. Therefore, according to this embodiment, there is provided an inhaler power source unit advantageous in both safety and user convenience.

[0110] The invention is not limited to the foregoing embodiments, and various variations/changes are possible within the spirit of the invention.

[0111] This application claims priority from Japanese Patent Application No. 2021-076014 filed April 28, 2021, which is hereby incorporated by reference herein.

Claims

1. An inhaler power source unit, that supplies electric power from a power supply to a heater configured to heat an aerosol source, **characterized by** comprising:

   a control unit configured to control an operation of the power source unit;
   a housing configured to accommodate the power supply and the control unit;
   a panel configured to be detachably attached to a surface of the housing; and
   a detection unit configured to detect attachment or detachment of the panel to or from the housing,
   wherein the control unit is configured to impose, in a case where the detection unit detects the detachment of the panel, a function restriction on a plurality of functions controlled by the control unit, and
   the control unit has a plurality of operation modes, and contents of the function restriction are different for each operation mode.

2. The power source unit according to claim 1, **characterized by** further comprising an operation button arranged in the housing,
   wherein in any of the plurality of operation modes, in a state in which the panel is detached, the control unit disables an operation of the operation button as the function restriction.

3. The power source unit according to claim 2, **characterized by** further comprising a display unit,

   wherein the plurality of operation modes include a standby mode of standing by for detection of an unlock operation using the operation button while performing display by the display unit, and an aerosol generation mode of supplying electric power to the heater to generate aerosol, and
   in a case where the unlock operation is detected in the state in which the panel is detached in the standby mode, the control unit does not transition to the aerosol generation mode as the func-

tion restriction.

4. The power source unit according to claim 3, **characterized in that** in a case where the detection unit detects the detachment of the panel in the aerosol generation mode, the control unit prohibits supplying the electric power to the heater as the function restriction.

5. The power source unit according to claim 4, **characterized in that** in a case where the detection unit detects the attachment of the panel within a predetermined time after prohibiting supplying the electric power to the heater, the control unit cancels the prohibition of supplying the electric power to the heater.

6. The power source unit according to any one of claims 3 to 5, **characterized in that**

the plurality of operation modes further include a sleep mode of stopping the display by the display unit and standing by in a power saving state in a case where a non-operation state in which no user operation is performed on the power source unit continues in the standby mode for a predetermined time, and a pairing mode capable of executing paring for associating the power source unit with an external communication device, and
in a case where a pairing operation using the operation button is detected in the sleep mode in the state in which the panel is detached, the control unit does not transition to the pairing mode as the function restriction.

7. The power source unit according to claim 6, **characterized in that** in a case where the detection unit detects the detachment of the panel in the paring mode, the control unit prohibits executing the pairing as the function restriction.

8. The power source unit according to any one of claims 3 to 7, **characterized in that**

the plurality of operation modes further include an unlock setting mode capable of executing, in response to execution of an unlock setting operation using the operation button, setting of the unlock operation, and
in a case where the unlock setting operation using the operation button is detected in the state in which the panel is detached, the control unit does not transition to the unlock setting mode as the function restriction.

9. The power source unit according to claim 8, **characterized in that** in a case where the detection unit detects the detachment of the panel in the unlock setting mode, the control unit prohibits executing the setting of the unlock operation.

10. The power source unit according to any one of claims 3 to 9, **characterized in that**

the plurality of operation modes further include a charging mode of charging the power supply using an external power supply, and
even in a case where the detection unit detects the detachment of the panel in the charging mode, the control unit continues charging the power supply.

11. The power source unit according to claim 10, **characterized in that** in the operation modes other than a sleep mode of stopping the display by the display unit and standing by in a power saving state, even in a case where the detection unit detects the detachment of the panel, the control unit continues the display by the display unit.

12. The power source unit according to any one of claims 1 to 11, **characterized by** further comprising a setting unit configured to set contents of the function restriction on the plurality of functions.

FIG. 1A

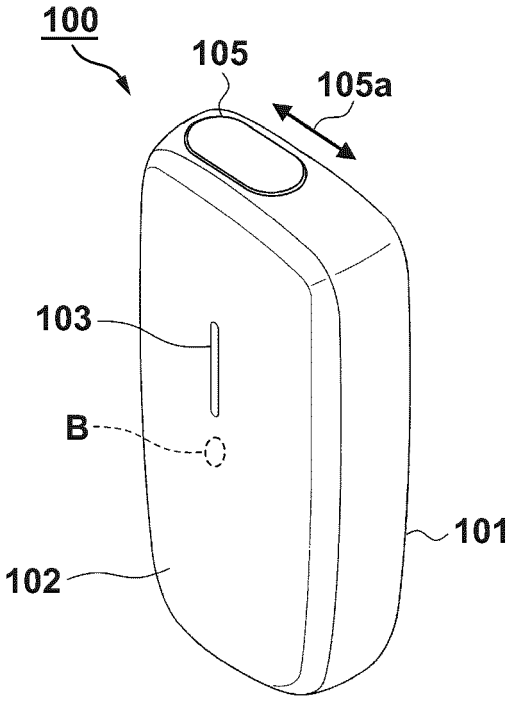

FIG. 1B

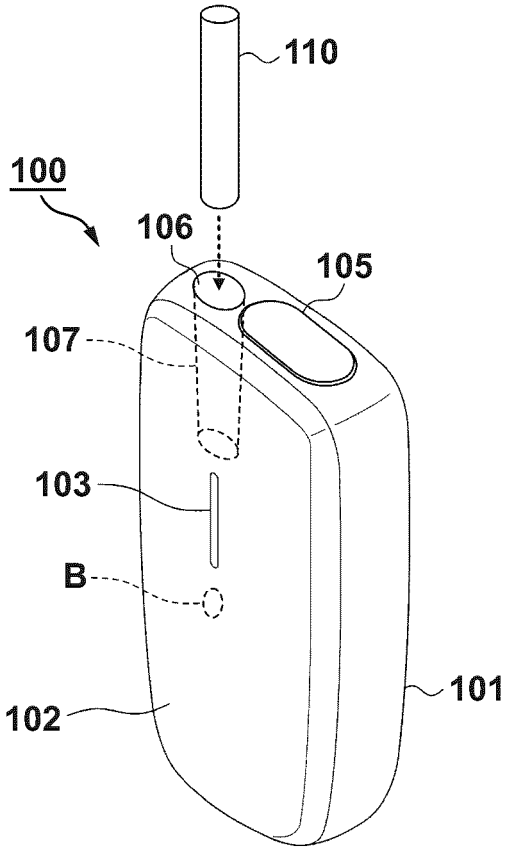

FIG. 2

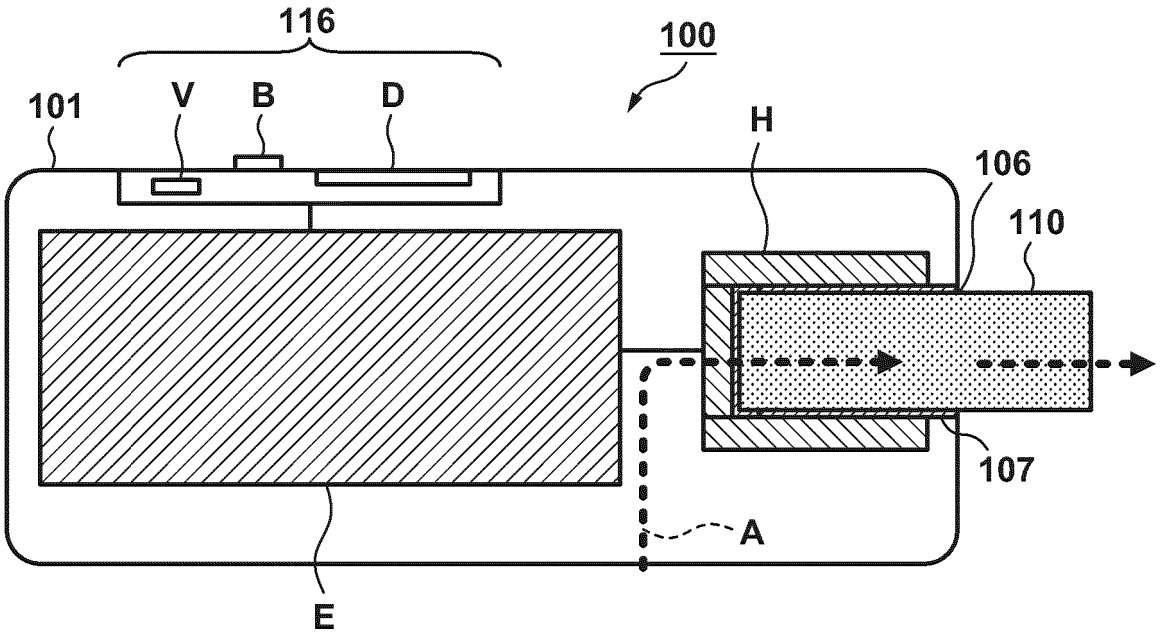

FIG. 3A

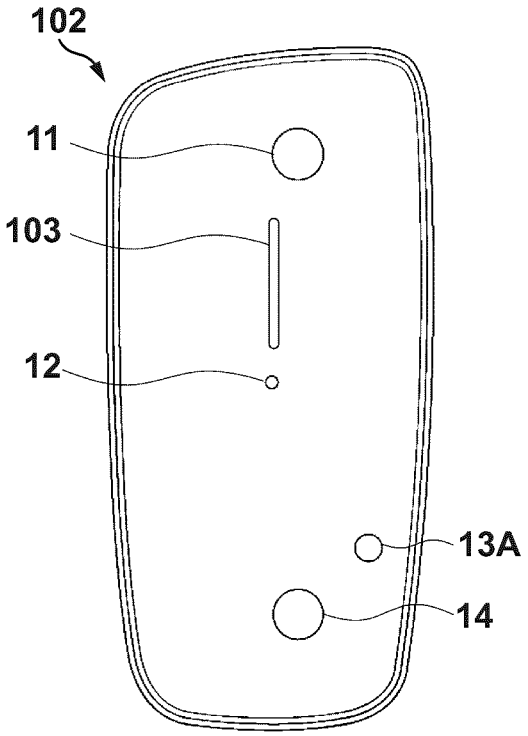

FIG. 3B

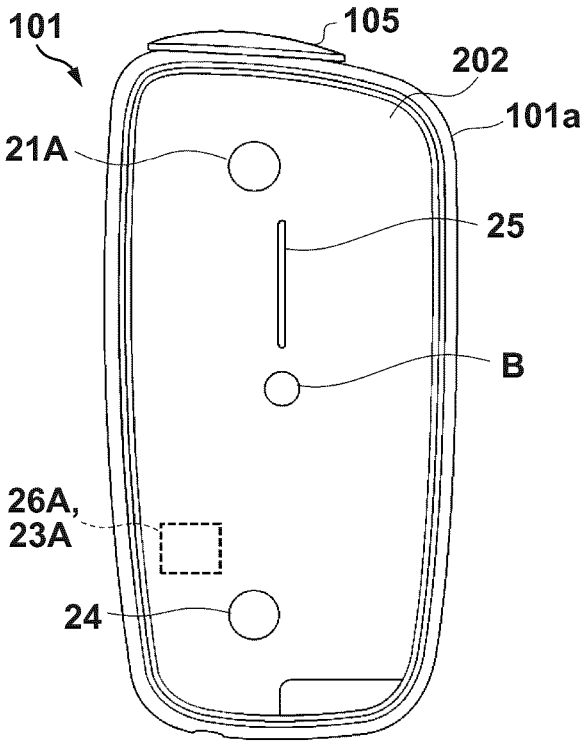

FIG. 4A

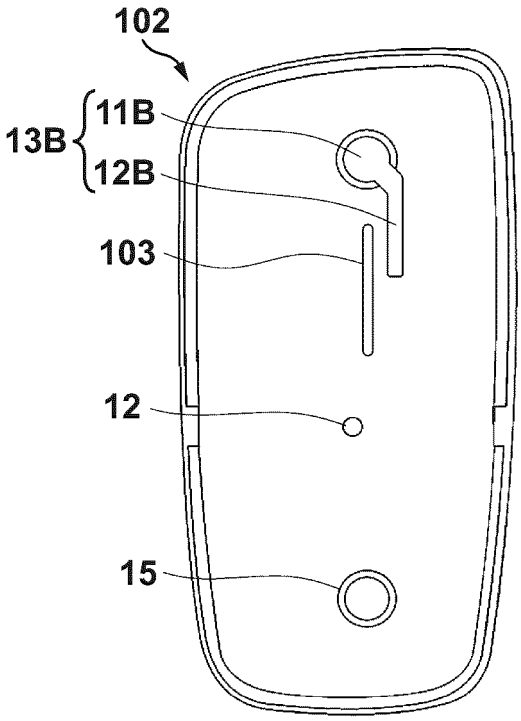

FIG. 4B

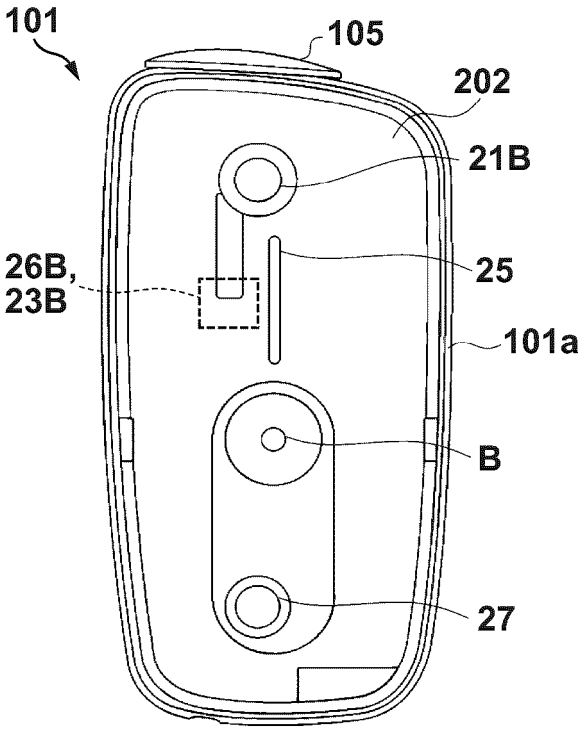

FIG. 5

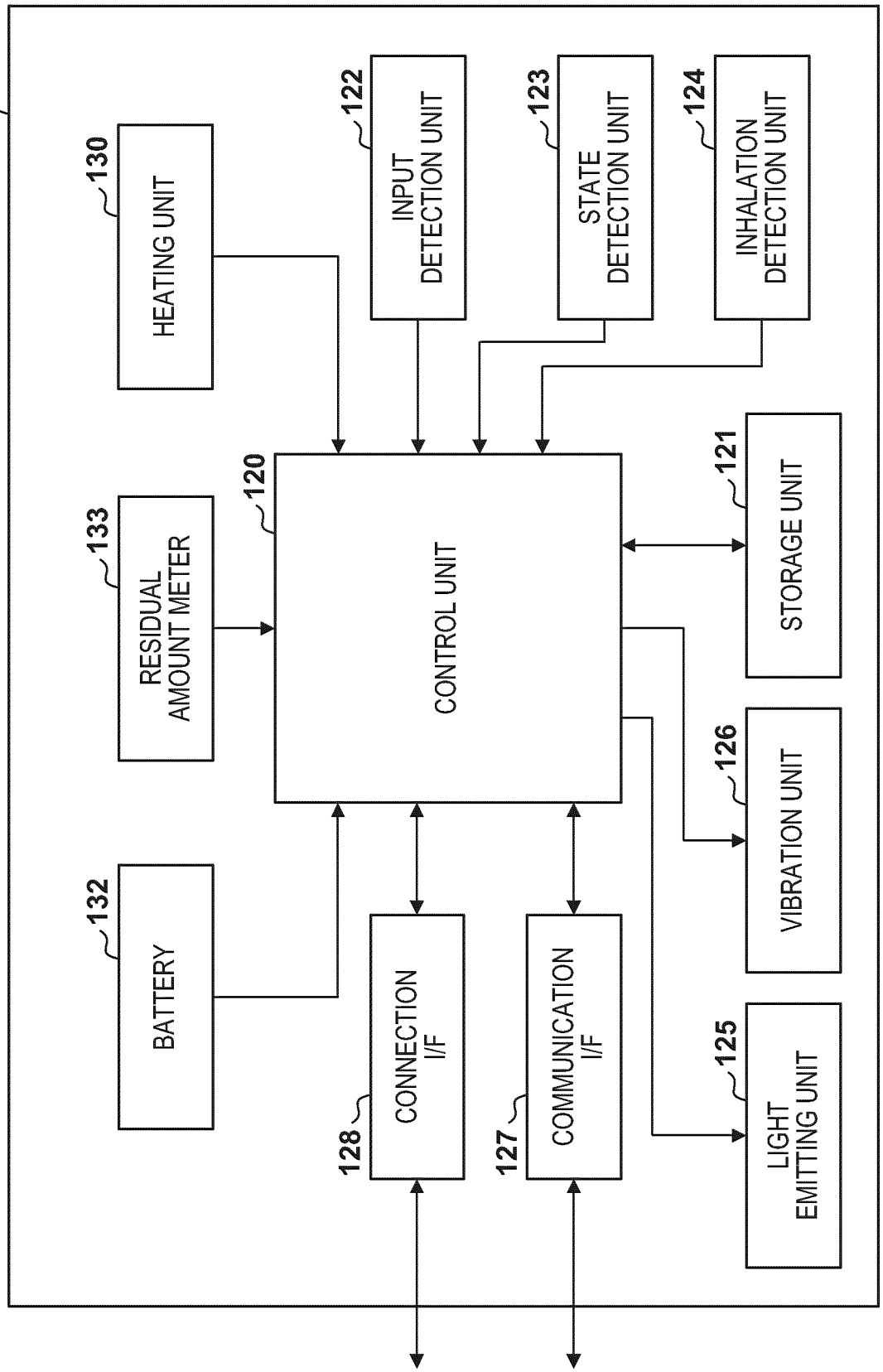
101
130
HEATING UNIT
122
INPUT DETECTION UNIT
123
STATE DETECTION UNIT
124
INHALATION DETECTION UNIT
133
RESIDUAL AMOUNT METER
120
CONTROL UNIT
121
STORAGE UNIT
132
BATTERY
126
VIBRATION UNIT
128
CONNECTION I/F
127
COMMUNICATION I/F
125
LIGHT EMITTING UNIT

FIG. 6

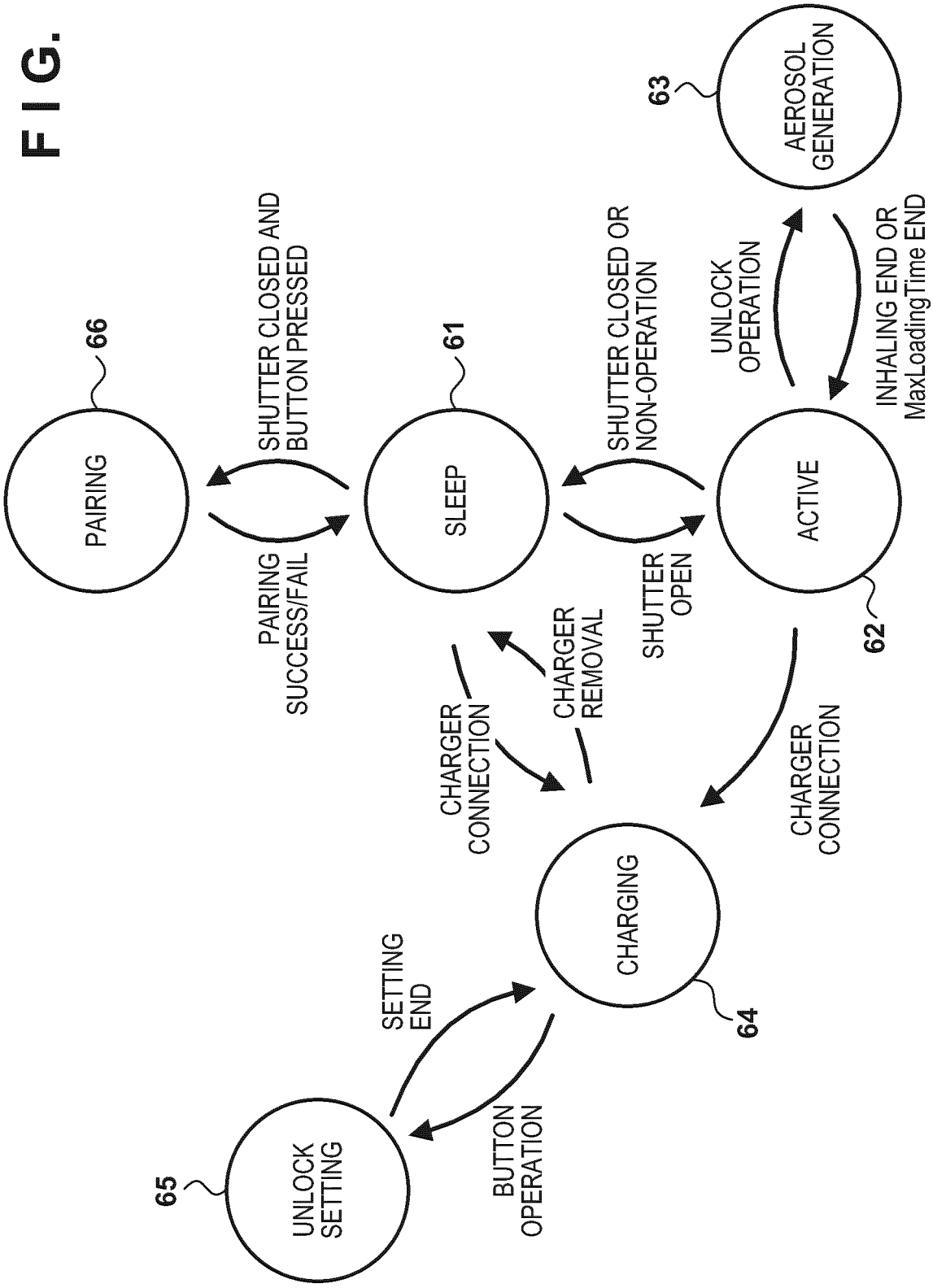
PAIRING
66
SLEEP
61
ACTIVE
62
AEROSOL GENERATION
63
CHARGING
64
UNLOCK SETTING
65
SHUTTER CLOSED AND BUTTON PRESSED
PAIRING SUCCESS/FAIL
SHUTTER CLOSED OR NON-OPERATION
SHUTTER OPEN
UNLOCK OPERATION
INHALING END OR MaxLoadingTime END
CHARGER CONNECTION
CHARGER REMOVAL
CHARGER CONNECTION
SETTING END
BUTTON OPERATION

FIG. 7

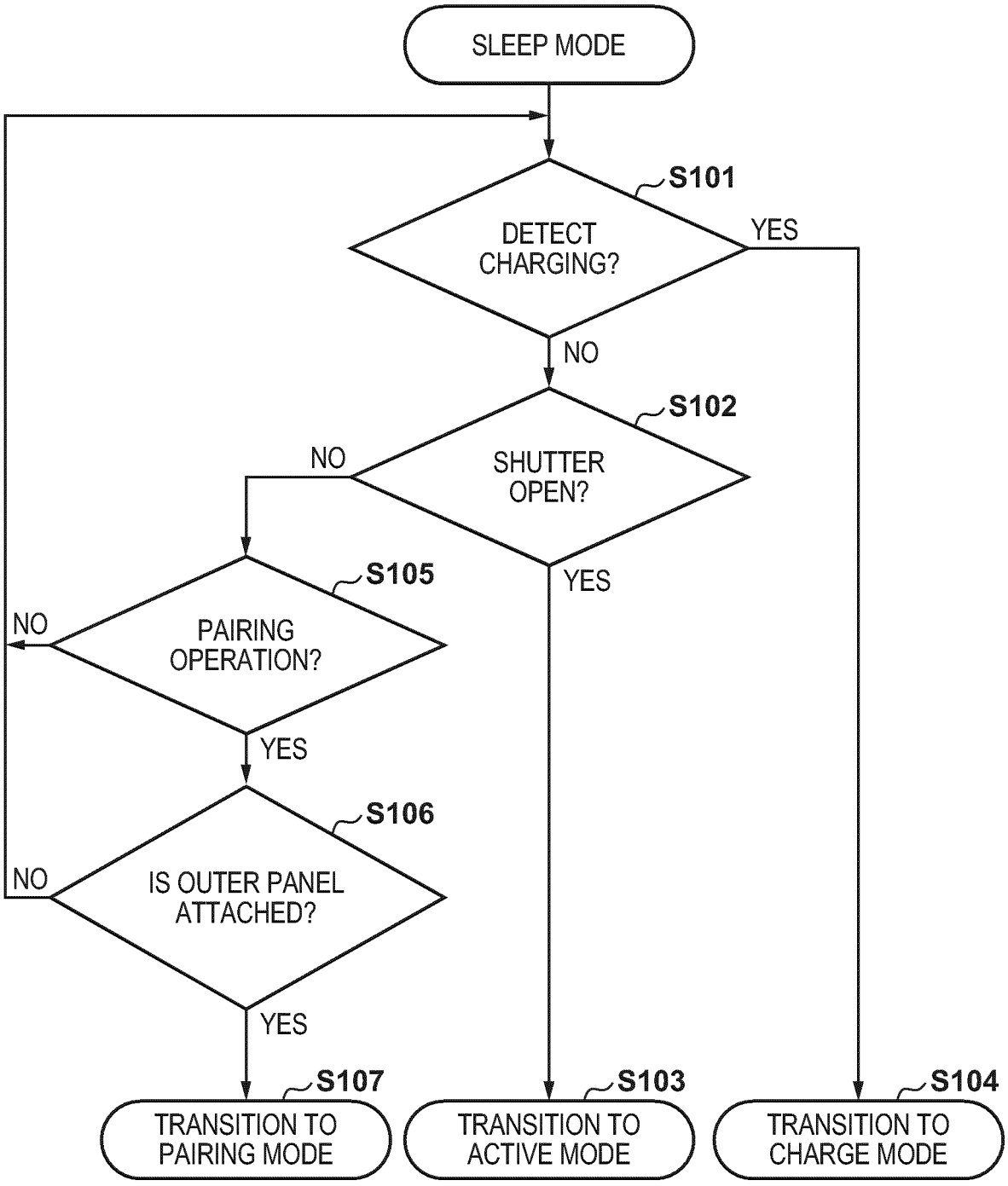
SLEEP MODE
S101
DETECT CHARGING?
YES
NO
S102
SHUTTER OPEN?
NO
YES
S105
PAIRING OPERATION?
NO
YES
S106
IS OUTER PANEL ATTACHED?
NO
YES
S107
TRANSITION TO PAIRING MODE
S103
TRANSITION TO ACTIVE MODE
S104
TRANSITION TO CHARGE MODE

FIG. 8

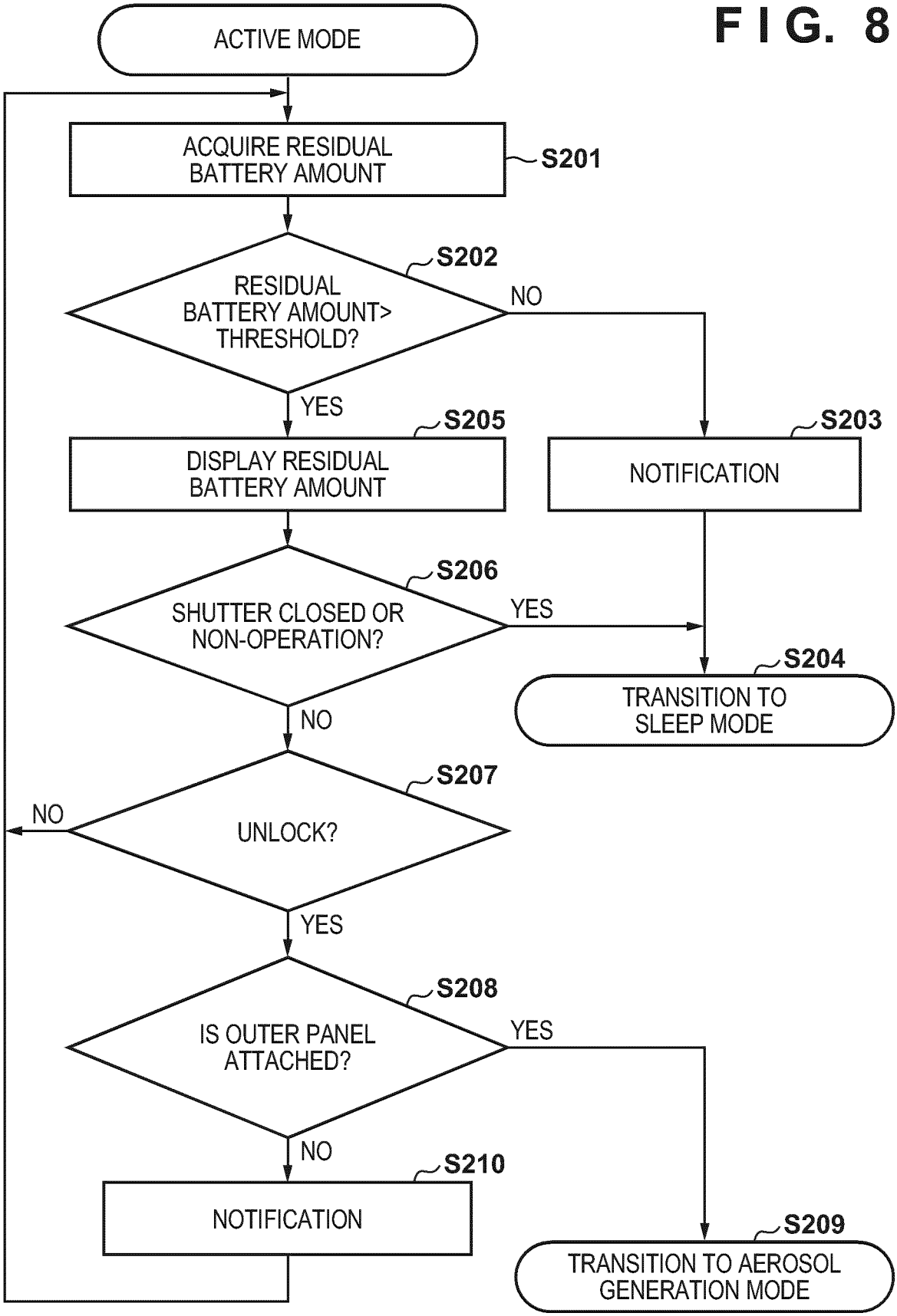
ACTIVE MODE
ACQUIRE RESIDUAL BATTERY AMOUNT
S201
RESIDUAL BATTERY AMOUNT> THRESHOLD?
S202
NO
YES
DISPLAY RESIDUAL BATTERY AMOUNT
S205
NOTIFICATION
S203
SHUTTER CLOSED OR NON-OPERATION?
S206
YES
NO
TRANSITION TO SLEEP MODE
S204
UNLOCK?
S207
NO
YES
IS OUTER PANEL ATTACHED?
S208
YES
NO
NOTIFICATION
S210
TRANSITION TO AEROSOL GENERATION MODE
S209

FIG. 9

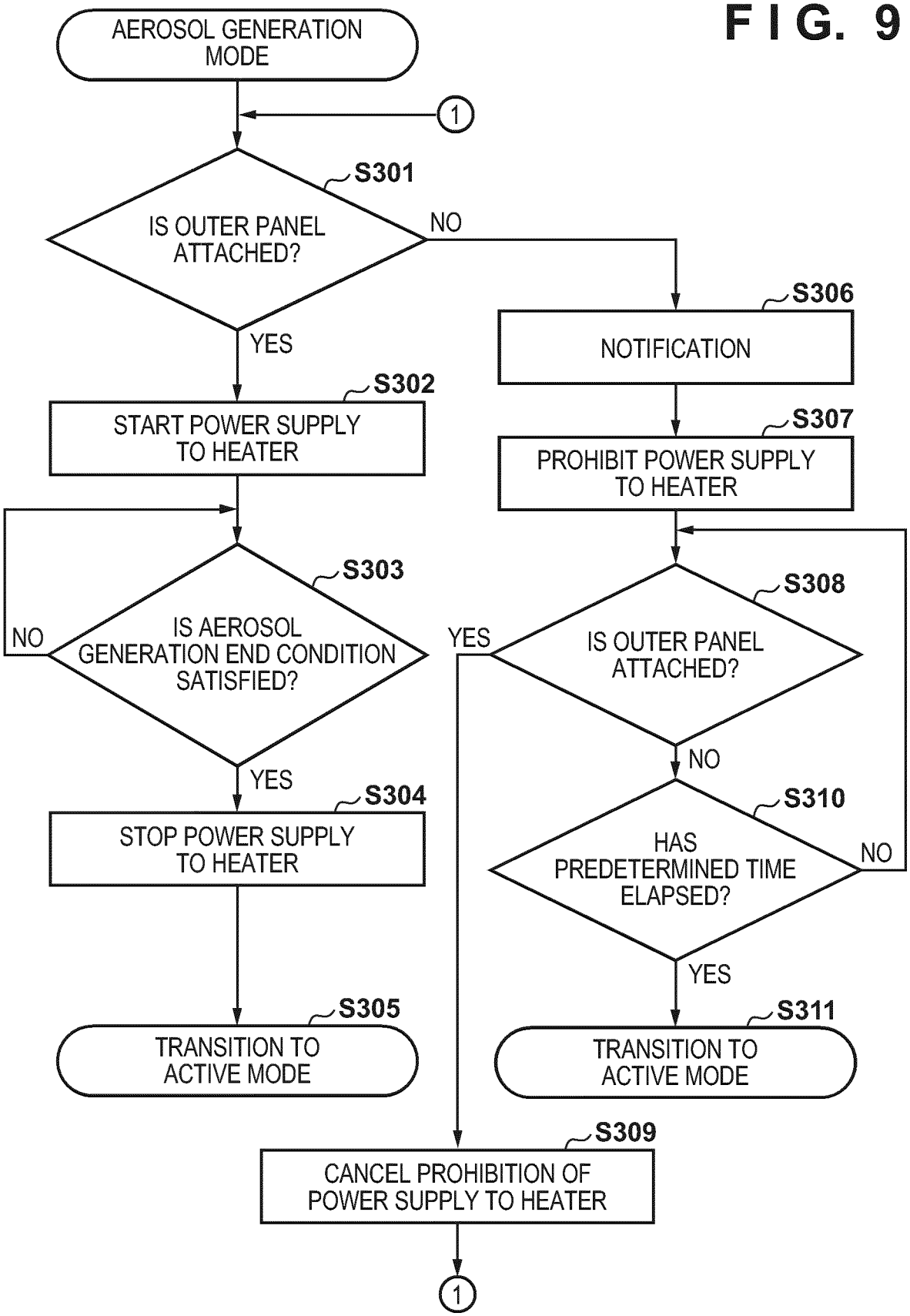
AEROSOL GENERATION MODE
1
S301
IS OUTER PANEL ATTACHED?
NO
YES
S302
START POWER SUPPLY TO HEATER
S303
IS AEROSOL GENERATION END CONDITION SATISFIED?
NO
YES
S304
STOP POWER SUPPLY TO HEATER
S305
TRANSITION TO ACTIVE MODE
S306
NOTIFICATION
S307
PROHIBIT POWER SUPPLY TO HEATER
S308
IS OUTER PANEL ATTACHED?
YES
NO
S310
HAS PREDETERMINED TIME ELAPSED?
NO
YES
S311
TRANSITION TO ACTIVE MODE
S309
CANCEL PROHIBITION OF POWER SUPPLY TO HEATER
1

FIG. 10

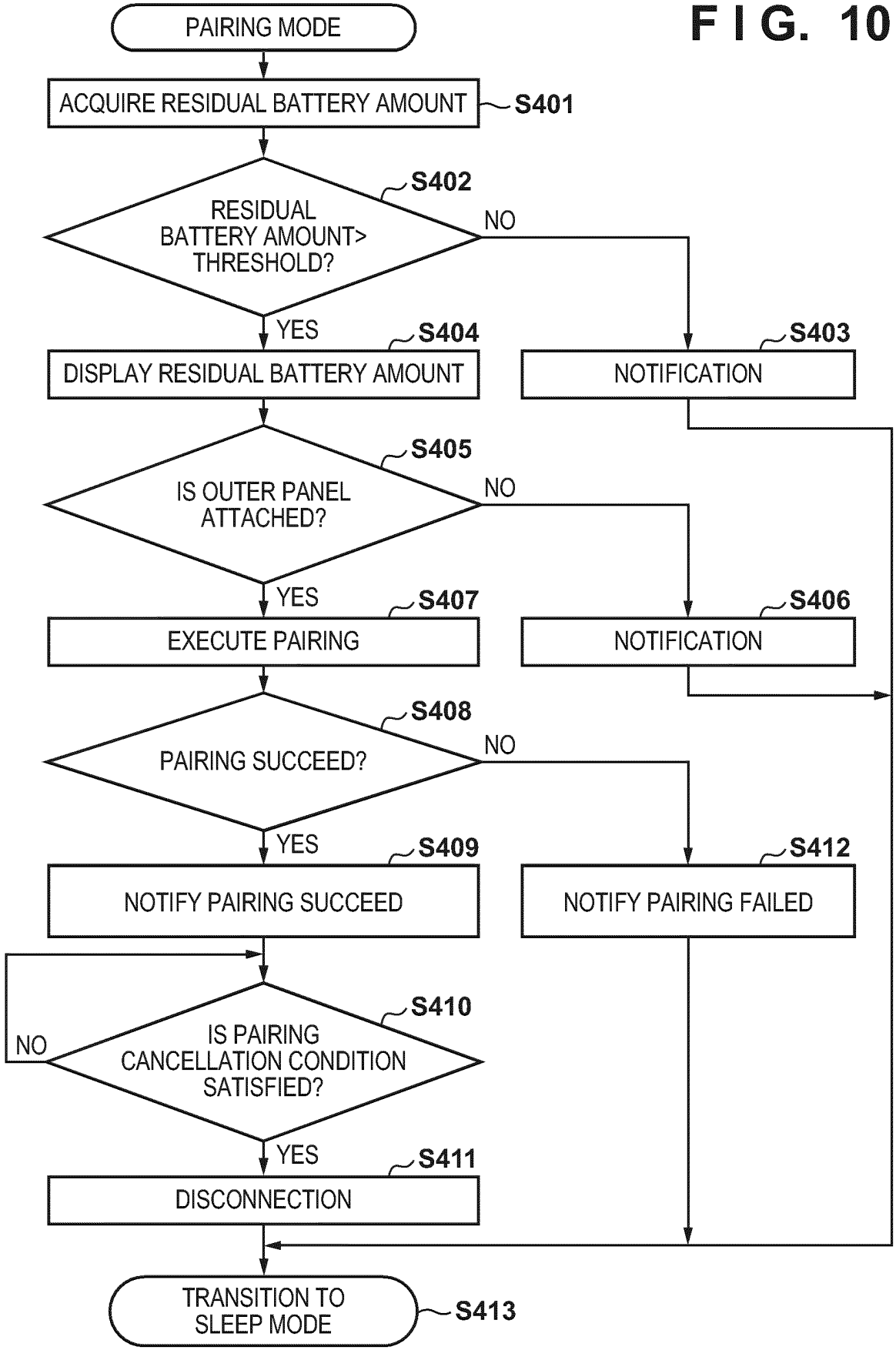
PAIRING MODE
ACQUIRE RESIDUAL BATTERY AMOUNT
S401
RESIDUAL BATTERY AMOUNT> THRESHOLD?
S402
NO
YES
S404
DISPLAY RESIDUAL BATTERY AMOUNT
S403
NOTIFICATION
IS OUTER PANEL ATTACHED?
S405
NO
YES
S407
EXECUTE PAIRING
S406
NOTIFICATION
PAIRING SUCCEED?
S408
NO
YES
S409
NOTIFY PAIRING SUCCEED
S412
NOTIFY PAIRING FAILED
IS PAIRING CANCELLATION CONDITION SATISFIED?
S410
NO
YES
S411
DISCONNECTION
TRANSITION TO SLEEP MODE
S413

FIG. 11

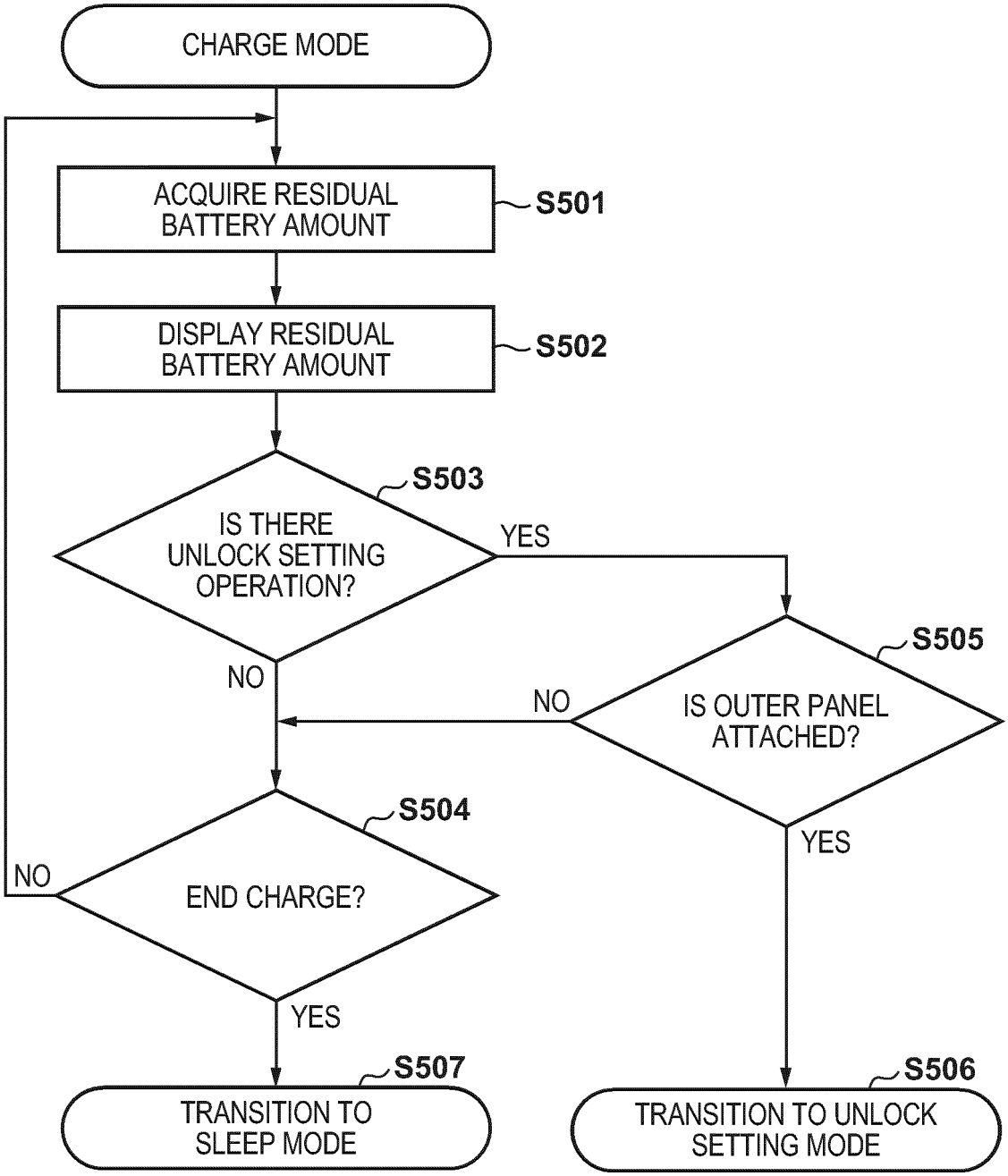
CHARGE MODE
ACQUIRE RESIDUAL BATTERY AMOUNT
S501
DISPLAY RESIDUAL BATTERY AMOUNT
S502
S503
IS THERE UNLOCK SETTING OPERATION?
YES
NO
S505
IS OUTER PANEL ATTACHED?
NO
YES
S504
END CHARGE?
NO
YES
S507
TRANSITION TO SLEEP MODE
S506
TRANSITION TO UNLOCK SETTING MODE

FIG. 12

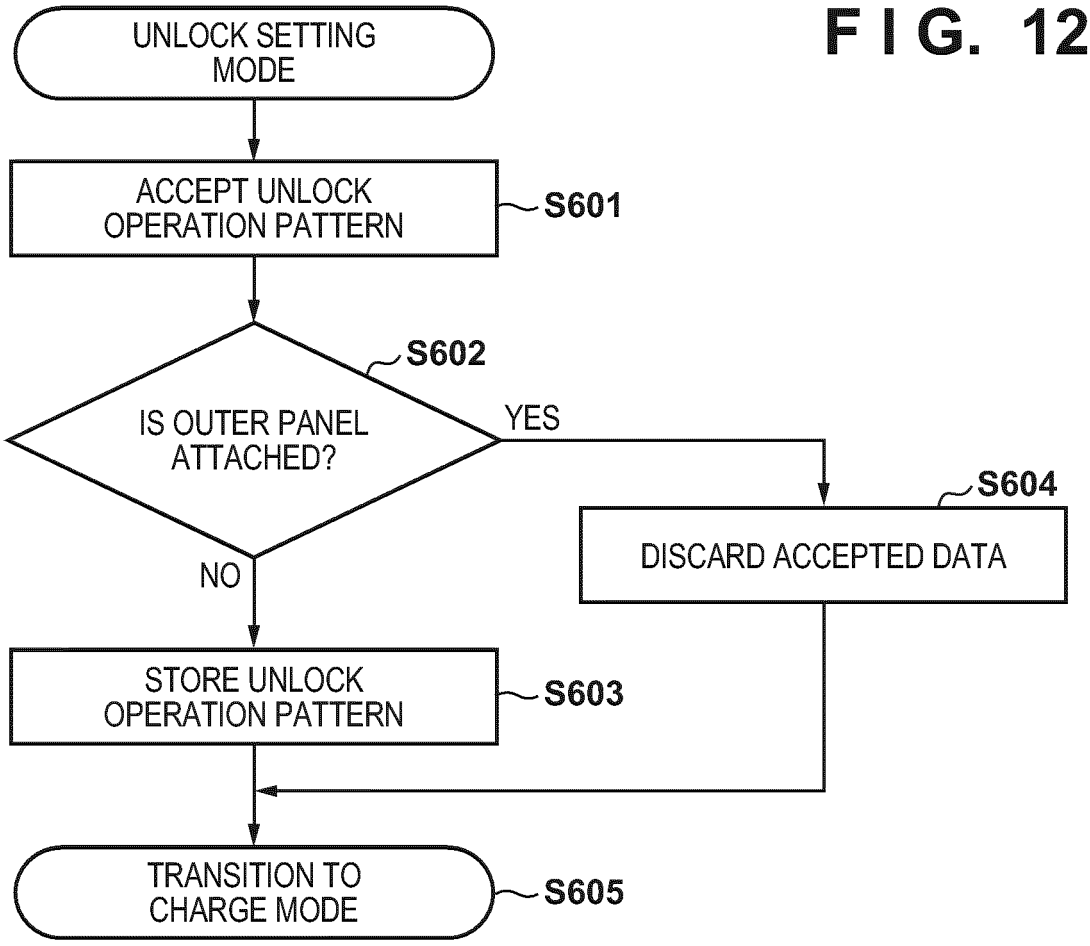

FIG. 13

	WHEN OUTER PANEL IS NONE	
PAIRING	NON PROHIBITION	PROHIBITION
UNLOCK SETTING	NON PROHIBITION	PROHIBITION
CHARGING	NON PROHIBITION	PROHIBITION
BATTERY REMAINING AMOUNT DISPLAY	NON PROHIBITION	PROHIBITION

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/012249

A. CLASSIFICATION OF SUBJECT MATTER

A24F 40/40(2020.01)i; ***A24F 40/50***(2020.01)i; ***A24F 40/51***(2020.01)i; ***A24F 40/65***(2020.01)i
FI: A24F40/51; A24F40/40; A24F40/50; A24F40/65

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; A24F40/50; A24F40/51; A24F40/65; A61M15/06

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 1971-2022
Registered utility model specifications of Japan 1996-2022
Published registered utility model applications of Japan 1994-2022

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.
A	CN 110693092 A (SHENZHEN YOUME NETWORK TECHNOLOGY CO., LTD.) 17 January 2020 (2020-01-17) paragraphs [0030]-[0034], fig. 1-3	1-12
A	WO 2019/170897 A1 (PHILIP MORRIS PRODUCTS S.A.) 12 September 2019 (2019-09-12) p. 21, lines 6-17, p. 23, lines 3-7, fig. 1-2, 6	1-12
A	WO 2020/225105 A1 (JT INTERNATIONAL S.A.) 12 November 2020 (2020-11-12) p. 8, line 18 to p. 18, line 1, fig. 1-19	1-12
E, A	WO 2022/059129 A1 (JAPAN TOBACCO INC) 24 March 2022 (2022-03-24) paragraphs [0070], [0077], [0082]-[0085], [0126]-[0152], fig. 1-5	1-12

☐ 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
11 May 2022	**31 May 2022**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2022/012249

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 110693092 A	17 January 2020	(Family: none)	
WO 2019/170897 A1	12 September 2019	JP 2021-516041 A	
		US 2021/0100288 A1	
		EP 3761818 A1	
		CN 111712150 A	
		KR 10-2020-0124664 A	
		BR 112020014331 A2	
		TW 201944910 A	
WO 2020/225105 A1	12 November 2020	EP 3962301 A1	
		KR 10-2022-0002979 A	
		CN 113766844 A	
		TW 202041158 A	
		CA 3137375 A1	
WO 2022/059129 A1	24 March 2022	(Family: none)	

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2021500032 A **[0003]**
- JP 2021076014 A **[0111]**