



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
15.05.2024 Bulletin 2024/20

(51) International Patent Classification (IPC):
A24F 40/40 ^(2020.01) **A24F 40/20** ^(2020.01)

(21) Application number: **22206052.7**

(52) Cooperative Patent Classification (CPC):
A24F 40/40; A24F 40/85; A24F 40/20

(22) Date of filing: **08.11.2022**

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

(72) Inventors:
• **MONTICONE, Pier Paolo**
1218 Le Grand-Saconnex (CH)
• **BOUCHUIGUIR, Layth Sliman**
1293 Bellevue (CH)
• **LEHOCKY, Juraj**
83102 Bratislava (SK)

(71) Applicant: **JT International S.A.**
1202 Genève (CH)

(74) Representative: **Bovard SA Neuchâtel**
Rue des Beaux-Arts 8
2000 Neuchâtel (CH)

(54) **AEROSOL-GENERATING DEVICE WITH MOVABLE LID**

(57) An aerosol-generating device (100) comprises a longitudinal heating cavity (120) provided with an opening (122) at one insertion end (120a) and adapted to receive at least part of an aerosol-generating article (1) inserted through said insertion opening (122), and a heating system (130) for heating an aerosol-generating article (1) received in said heating cavity (120). The aerosol-generating device further comprises a movable lid (150) longitudinally movable within the heating cavity (120) between a retracted position and a deployed position in which it obturates said heating cavity (120) at its insertion end (120a).

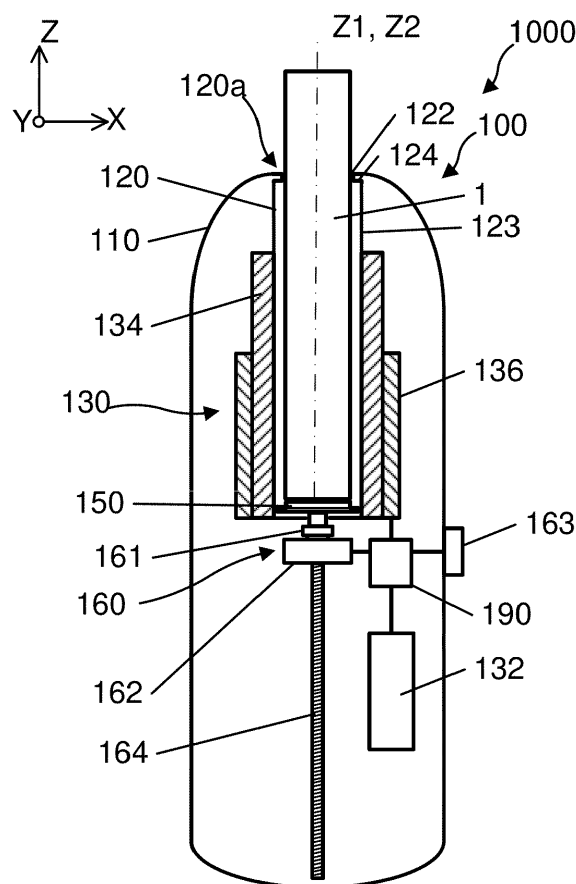


Fig. 1A

DescriptionTechnical field of the invention

[0001] The present invention relates to aerosol-generating devices.

Background of the invention

[0002] Aerosol-generating devices are nowadays increasingly used as a substitution for regular cigarettes. A particular type of aerosol-generating devices is heat-not-burn devices (HnB), which heat an aerosol-generating substrate rather than burn or combust it to generate an aerosol inhalable by a user.

[0003] A heat-not-burn aerosol-generating device typically comprises a heating cavity adapted to receive at least part of a consumable aerosol-generating article inserted therein, and a heating system for heating the article contained in said cavity.

[0004] External materials - such as dust - that may penetrate inside the heating cavity between uses, affect the flavour sensation of the aerosol as they may impart an unpleasant or bitter flavour to a user. These external materials can also diminish or block the required air flow of the device and so hinder optimal use of the aerosol-generating device, or even damage the heating system depending on how and where they are deposited.

[0005] Movable lids have been provided to HnB devices to manually close the opening to the heating cavity of such devices and prevent ingress of external materials therein between vaping sessions. However, these movable lids are often fragile and may be open involuntarily when the devices are held in bags or pockets of a user, thus missing on their expected protection functionality.

[0006] There is so a need to improve protection of the heating cavity between uses and more globally improve the user's experience and sustainability of the device. Another recurring issue of HnB devices is the potential clogging of the heating cavity of those devices in use due to breaking of aerosol-generating articles parts therein upon removal of the articles after use. For example when an aerosol-generating article has not been stored properly before use, or when such article is inserted several times into the device, the article may break during use and is then difficult to remove, preventing the user from smoking next session.

[0007] Removal of such broken parts stuck in the cavity is particularly difficult without external tools, and may cause injuries if the user proceeds while the device is still hot. Manual cleaning tools, such as metallic tweezers, may also deteriorate the interiors of the cavity when used.

[0008] There is thus a need for an improved material removal mechanism for heat-not-burn devices.

Summary of the invention

[0009] This is achieved with an aerosol-generating de-

vice, comprising

- a longitudinal heating cavity provided with an opening at one insertion end and adapted to receive at least part of an aerosol-generating article inserted through said insertion opening, and
- a heating system for heating an aerosol-generating article received in said heating cavity,

the aerosol-generating device being characterized in that it further comprises a movable lid longitudinally movable within the heating cavity between a retracted position and a deployed position in which it obturates said heating cavity at its insertion end.

[0010] According to the invention, the aerosol-generating device is provided with a closure element or lid longitudinally movable along the heating cavity. In its deployed position, the movable lid is arranged to fully close (i.e. close with no substantial hole or clearance remaining) the cavity near its insertion end, to prevent any ingress of external materials into the cavity between uses.

[0011] In its retracted position, the lid forms a bottom portion of the heating cavity, thus allowing the aerosol-generating article to take the required position inside said cavity for normal vaping use.

[0012] The movable lid is either automatically moved in its retracted position or it is moved manually, notably by being pushed by the aerosol-generating article upon insertion. Hence the device is ergonomic, as a specific step of manually opening the lid can be avoided.

[0013] The movable lid may also have other optional functions, such as guiding insertion or extraction of parts or the entirety of the stick, and/or allowing easier - even possibly automatic - insertion and/or ejection of the aerosol-generating article. In particular, the movable lid may allow to automatically remove broken sticks.

[0014] Apart from its main purpose of avoiding entry of undesired materials in the heating cavity, the movable lid may so allow many further improvements to both user's experience while vaping and maintenance of the device.

[0015] The heating system may include a heater configured to heat the heating cavity, which heater may either surround the heating cavity (external heater), or be arranged inside the heating cavity (internal heater).

[0016] Such heater may typically include a heater body in the form of a longitudinal metal sleeve, and a heating element, such as a thick or thin film heater comprising a layer of electrically insulating material and a layer of electrically conductive material outside or within the heater body.

[0017] As an alternative, the heating system may comprise an induction coil, typically surrounding the heating cavity, configured to heat by induction a ferromagnetic material forming part or the entirety of the heating cavity or contained in the aerosol-generating article.

[0018] According to an embodiment, the heater body may have a cup shape. That is, the heater body may

have a lateral tubular wall and a bottom wall.

[0019] According to an embodiment, the heater body may be solidary with a holder, typically made of high-temperature resistant plastic, configured to hold said heater body at its lower end. The holder may have a base orthogonal to the longitudinal direction of the heating cavity and holding means such as longitudinal tongues upwardly protruding from the base, configured to hold the heater body, for example by clamping.

[0020] In particular, the holding means may be configured to hold the heater body at a distance from the base.

[0021] The heating cavity is fixed with respect to an outer body of the device. It extends in a longitudinal direction, along a longitudinal axis, and is delimited, in a lateral direction orthogonal to said axis, by a lateral wall, typically the lateral wall of the heater body. The cavity has generally a tubular shape.

[0022] The heating cavity is provided with an insertion opening at its insertion end. This opening shall allow introduction of the aerosol-generating article inside the cavity.

[0023] The insertion opening may have a section (considered transversally to the longitudinal direction) similar to that of the rest of the cavity delimited by the lateral wall.

[0024] Or the heating cavity may be delimited at its insertion end by an end wall extending transversally to the longitudinal direction, and the insertion opening may be formed in said end wall. The insertion opening may then have a section smaller to that of the rest of the cavity.

[0025] In the present disclosure, and in the absence of specific statement to the contrary, the terms top, bottom, upper, lower, are considered with respect to the longitudinal axis of the heating cavity, top and upper portions being oriented towards the insertion end of said cavity, and bottom and lower portions being oriented towards the opposite end thereof.

[0026] The movable lid may have any adapted shape that allows its longitudinal movement inside the heating cavity and at the same time is adapted to obturate the heating cavity, at its insertion end, in the deployed position.

[0027] The lid is typically a solid disk-shaped piece, configured to conform to a circular section of the cavity.

[0028] Advantageously, the movable lid is arranged to obturate the insertion opening when in its deployed position.

[0029] As an alternative, the movable lid may be arranged to obturate the cavity at its insertion end but at a distance of the insertion opening.

[0030] "At the insertion end of the heating cavity" should generally be understood as meaning at its insertion opening or at a distance of the insertion opening equal to less than 10% of the length of the heating cavity.

[0031] According to an example, the movable lid may be provided at least at its periphery with a flexible part.

[0032] Said flexible part may help guiding effect the longitudinal movement of the lid along the heating cavity.

[0033] Preferably, the flexible part may extend contin-

uously along the entire circumference of the movable lid.

[0034] Still more preferably, the movable lid may be entirely made of a flexible material.

[0035] Such flexible part is advantageously arranged to cooperate with the lateral wall of the cavity or with an edge of the opening to provide a sealing effect in the deployed position of the lid. In particular, the lid may be dimensioned so that said flexible part is compressed laterally, thus forming a sealing gasket.

[0036] The movement of the movable lid inside the heating cavity may be actuated manually.

[0037] To start his smoking experience, the user may press an aerosol-generating article on the lid and towards inside the heating cavity. In this case, the movable lid may be simply pushed down by the user's force applied on the article, and towards the retracted position.

[0038] A locking mechanism may be provided to keep the movable lid in its retracted position. And once the vaping session is finished, the locking mechanism may be unlocked to allow that the lid recovers its deployed position.

[0039] According to an embodiment, the aerosol-generating device may comprise a spring-loaded ejection system for ejecting the movable lid from its retracted position towards its deployed position.

[0040] In that case, a spring is stretched when the article is inserted in the cavity, and released upon unlocking the locking mechanism.

[0041] For example, the aerosol-generating device may comprise at least one spring having one end fixed in the longitudinal direction and an opposite end moving solidary with the lid such that compression of the spring be adjusted upon moving the lid.

[0042] Advantageously, the spring may be mounted around a guiding rod, either solidary with the lid or fixed with respect to the heating cavity.

[0043] According to an embodiment, the movable lid may be solidary with a longitudinal rod extending downwards and arranged to move in and out from the heating cavity, depending on the position of the lid. In particular, the rod portion may be longer than the heating cavity to at least partially protrude downstream of the cavity in any position of the lid, and the spring may be mounted around said rod portion with the bottom end of the spring solidary with the bottom end of the rod and the top end of the spring fixed in the longitudinal direction.

[0044] According to another embodiment, at least one fixed rod may be provided along the heating cavity with a spring mounted around said rod, with a top end of the spring being fixed in the longitudinal direction and the bottom end thereof being solidary with the movable lid.

[0045] According to another embodiment, the aerosol-generating device may comprise an actuator, for example a mechanical linear actuator, for moving the lid between its retracted position and deployed position. This further facilitates insertion and/or rejection of the aerosol-generating article, and at the same time ensures that the heating cavity be fully closed when not in use.

[0046] According to an embodiment, the mechanical linear actuator may be a lead-screw actuator of the screw-nut type, comprising a screw extending in the longitudinal direction and a nut threadedly engaging said screw.

[0047] The actuator may further comprise a motor for driving the screw.

[0048] According to an advantageous embodiment, the actuator may further comprise a reduction gearing between the motor and the screw. Such reduction gearing may transfer the rotational movement of the motor axis to the screw while decreasing speed and increasing the torque delivered to the screw. The reduction gearing may for example comprise a first cogwheel solidary with the motor axis and a second cogwheel solidary with or engaging with the screw.

[0049] According to an embodiment, the nut is fixed in the longitudinal direction of the heating cavity, the screw is translatable in the longitudinal direction upon rotation of the nut, and the lid is solidary with the screw. In such type of actuator also known as a non-captive linear actuator, the lid rotates together with the screw while moving along the heating cavity. To allow the movement, the lid has typically a circular section to conform to a circular crosssection of the heating cavity.

[0050] In an embodiment including a reduction gearing as described hereabove, a cogwheel of said reduction gearing may be provided with a threaded hole for engaging with the screw and may so form the nut.

[0051] According to another embodiment, the screw is fixed in the longitudinal direction of the heating cavity, the nut is translatable in said longitudinal direction upon rotation of the screw, and the nut is formed by or solidary with the lid. This embodiment has the advantage of not cluttering up the space located under the heating cavity.

[0052] In an embodiment including a reduction gearing as described hereabove, a cogwheel of said reduction gearing may be fixedly attached to the screw.

[0053] According to an embodiment, the screw is laterally offset with respect to a center axis of the heating cavity. In particular, the threaded hole of the nut may be formed in a lateral supporting portion of the movable lid, offset with respect to a main part thereof intended to cover the opening in the deployed position.

[0054] According to another embodiment, the screw may be aligned with a center axis of the heating cavity. In such case, a threaded hole, adapted to cooperate with the screw, may be formed at a center of the movable lid. The screw may then have a sharp tip capable of piercing a bottom end of the aerosol-generating article. According to a further example, the screw may further act as an internal heater.

[0055] In an embodiment where the heater body is a cup, the screw may go through an opening formed in the bottom wall of the heater body.

[0056] The edges of the bottom wall around the screw opening may then advantageously be turned upwardly to prevent dirt from falling into the device. An additional

seal, for example a silicone seal, may further be placed around said opening to prevent the dirt from falling out.

[0057] According to an embodiment, the movable lid may include a magnetic element.

5 **[0058]** The aerosol-generating system may then comprise a magnetic actuator for moving the lid from its deployed towards its retracted position and vice versa.

10 **[0059]** As a particular embodiment, the lid may be lifted with the magnetic field generated by a coil of the heating system, in particular a coil of an inductive heater of said heating system.

15 **[0060]** According to an embodiment, the aerosol-generating device may further comprise a heat controlling system configured to disable deployment of the lid until the aerosol-generating article is considered cool enough after a vaping session. Such heat controlling system is typically configured to measure at least one parameter relating to the heating system, notably a period of time after the heating system has been shut off or a temperature, and disable deployment of the lid until said parameter has reached a predetermined threshold.

20 **[0061]** According to another embodiment, the aerosol-generating device may further comprise a position controlling system configured to assess a position of the movable lid and control actuation of the heating system based on said position. This shall ensure that the article is completely inserted before the heating system is actuated.

25 **[0062]** According to an embodiment, the movable lid may be configured to close an electrical or optical or impedance circuit in its retracted position, and the position controlling system is configured to monitor a parameter of said circuit.

30 **[0063]** According to an embodiment, the position controlling system may be configured to monitor a parameter of the movement of the movable lid, notably a resistance to the movement or an amplitude of movement as from the deployed position.

35 **[0064]** The invention further concerns an aerosol-generating system comprising an aerosol-generating device of the aforementioned type and an aerosol-generating article configured to be inserted at least partially in the heating cavity of said aerosol-generating device.

40 **[0065]** Recently, aerosol-generating articles containing ferromagnetic material, for example iron, nickel, manganese or the like, have been developed. Heating of such articles is achieved by induction heating.

45 **[0066]** In this context, an aerosol-generating system according to a particular embodiment comprises an aerosol-generating device wherein the movable lid includes a magnetic element, and the aerosol-generating article includes a heating portion made of ferromagnetic material.

50 **[0067]** The heating system of the aerosol-generating device may then comprise an induction coil for induction heating the heating portion of the aerosol-generating article.

55 **[0068]** According to an embodiment, the heating portion of the aerosol-generating article and the magnetic

element of the movable lid may be designed so that an automatically actuated movement of the movable lid towards its retracted position simultaneously pulls the article inside the cavity due to the magnetic force.

[0069] As an alternative, the heating portion of the aerosol-generating article and the magnetic element of the movable lid may further be designed so that a movement of the aerosol-generating article out of the heating cavity pulls the movable lid in its deployed position due to the magnetic force therebetween.

[0070] It is to be understood that the different embodiments mentioned hereabove can be realized singly or in any technically compatible combinations. In particular, the aforementioned technical features and those to be explained in the following can be used not only in the combinations indicated, but also in other combinations or alone, without departing from the scope of the present invention.

Brief description of the drawings

[0071]

Figure 1A is a schematical sectional view of an aerosol-generating system according to a first embodiment of the present invention; with the movable lid of the aerosol-generating device in its retracted position where it forms the bottom of the heating cavity;

Figure 1B is a partial sectional view of the aerosol-generating device of figure 1A, with the movable lid in its deployed position where it closes the opening of the cavity;

Figure 1C is a top view of the movable lid of figures 1A and 1B;

Figure 2 to 7 are schematical sectional views of alternative movable lids shown in their deployed position at the insertion end of a heating cavity;

Figure 8A is a schematical sectional view of an aerosol-generating system according to a second embodiment of the present invention, with the movable lid of the aerosol-generating device in its retracted position and an aerosol-generating article inserted in the heating cavity;

Figure 8B is a top view of the movable lid of figure 8A;

Figure 9A is a schematical sectional view of an aerosol-generating system according to a third embodiment of the present invention, with the movable lid in its retracted position;

Figure 9B is a top view of the movable lid of figure 9A;

Figure 10 is schematical sectional view of an aerosol-generating system according to a fourth embodiment

of the present invention, with the movable lid including a magnetic element and the aerosol-generating article comprising a ferromagnetic heating portion;

Figures 11A and 11B illustrate an aerosol-generating device according to a fifth embodiment of the present invention, with the movable lid respectively in its retracted and in its deployed position;

Figures 12A and 12B illustrate an aerosol-generating device according to a sixth embodiment of the present invention, with the movable lid respectively in its retracted and in its deployed position;

Figure 13 schematically illustrates an example of an actuator which may be implemented in an aerosol-generating device according to the invention;

Figure 14 is a partial perspective view of the actuator of figure 13.

Detailed description of the invention

[0072] The present invention will be described with respect to particular embodiments and with reference to the appended drawings, but the invention is not limited thereto. In the drawings, which are only schematic, the size of some of the elements may be exaggerated and not drawn on scale for illustrative purposes. The dimensions and the relative dimensions do not correspond to actual reductions to practice of the invention.

[0073] In the different figures, elements that are functionally identical are designated by similar references with increments of 100.

[0074] Figure 1A illustrates an aerosol-generating system 1000 comprising an aerosol-generating device 100 according to a first embodiment of the present invention and an aerosol-generating article 1.

[0075] The device 100 comprises an outer body 110 of any adapted shape, housing a longitudinal heating cavity 120 (hereafter also named cavity) extending along a center axis Z1 defining a longitudinal direction Z, and provided with an opening 122 at one insertion or upper end 120a. The heating cavity 120 is adapted to receive at least part of the aerosol-generating article 1 inserted through its opening 122, as shown in figure 1A.

[0076] The device 100 further includes a heating system 130 powered by an electrical power source 132 and configured to heat the aerosol-generating article 1 received in the heating cavity 120.

[0077] As illustrated, the heating system 130 may be an external heater including a heater body 134 in the form of a longitudinal metal sleeve surrounding the heating cavity 120, and a heating element 136, such as a thick or thin film comprising a layer of electrically insulating material and a layer of electrically conductive material

outside or within the heater body 134.

[0078] When an aerosol-generating article 1 is inserted in the heating cavity 120 and the device 100 is actuated by the user, an electrical current is supplied to the heating element 136 by the electrical power source 132. The heating element 136 is heated, and the heat is transmitted by thermal conduction to the heater body 134 and consequently to the article 1 surrounded by said heater body 134.

[0079] Upon heating, the aerosol-forming substance contained in the tobacco substrate of the article 1 vaporises and creates a vapour that extracts nicotine and flavour components from said tobacco substrate.

[0080] According to the invention, the aerosol-generating device 100 comprises a lid 150 provided inside the heating cavity 120 and movable in the longitudinal direction Z between a retracted position where it forms a bottom surface of the heating cavity 120, and a deployed position where it fully closes the heating cavity 120 to avoid entry of external material between use.

[0081] The movable lid 150 is illustrated in its retracted position in figure 1A and in its deployed position in figure 1B.

[0082] In this example, the heating cavity 120 is delimited laterally by a lateral wall 123 and has a tubular shape with a constant, here circular, section (considered in a plane X-Y transversal to the longitudinal direction Z).

[0083] At its insertion end 120a, the cavity 120 is further delimited with an end wall 124 in which is formed the opening 122, also of circular section, through which the aerosol-generating article 1 can be inserted.

[0084] The movable lid 150 may have any adapted shape that allows its longitudinal movement inside the heating cavity 120 and at the same time is adapted to obturate the heating cavity 120, at its insertion end 120a, in the deployed position.

[0085] In the illustrated configuration of figure 1C, the movable lid 150 has a top portion 151 arranged to cooperate with edges of the opening 122 in the deployed position. It is further provided with a base portion 152 of larger diameter, adapted to contact the end wall 124 - eventually serving as an abutting wall for the movable lid 150 - in the deployed position.

[0086] Advantageously, the movable lid 150 is formed of a flexible material and dimensioned so as to be at least partially compressed in the deployed position, to provide a better sealing.

[0087] In the illustrated example of figure 1A for example, the movable lid 150 is entirely formed of a flexible material. The top portion 151 of the lid 150 is advantageously compressed laterally when engaged in the opening 122 and/or the base portion 152 is advantageously compressed longitudinally against the end wall 124.

[0088] This example, however, is not limiting. Figures 2 to 7 illustrate alternative solutions for the movable lid and/or its cooperation with the heating cavity or the opening for closing said cavity.

[0089] In the example of figure 2, the movable lid 150A

is formed of a flexible material and dimensioned so as to be at least partially compressed in the deployed position, to provide a better sealing.

[0090] In this particular example, the movable lid 150 is entirely formed of a flexible material, and the top portion 151 of the lid 150 is advantageously compressed laterally when engaged in the opening 122 and/or the base portion 152 is advantageously compressed longitudinally against the end wall 124.

[0091] When the movable lid 150A is displaced up and down between the retracted and deployed positions, the flexible lid 150A slides and is guided along the wall 123 of the cavity 120.

[0092] The movable lid 150B of figure 3 differs from that of figure 2 in that it is only partially made of flexible material. The movable lid 150B here has a peripheral gasket 153 extending around the entire circumference thereof and a core portion 154 made of rigid material.

[0093] In the example of figure 4, the movable lid 150C is provided with a flexible skirt 155 extending downwardly: the outer surface of the skirt forms a longer guiding surface which avoids lid flipping.

[0094] The movable lid may also be arranged to not cooperate with the edges of the opening. The movable lid 150D of figure 5 is similar to that of figure 4 but without the top portion 151. This may eventually avoid that the movable lid stay stuck in the opening in the deployed position. Obturation of the heating cavity may then occur by longitudinal contact between the lid 150D and the end wall 124 or, if the upper part of the lateral wall 123 of the cavity 120 is adapted, by lateral contact between the lid 150D and said lateral wall 123.

[0095] The movable lid 150E of figure 6 is very similar to that of figure 5, except that it has a disk-shape of constant diameter, without a skirt 155 extending downwardly.

[0096] In the example of figure 7, the movable lid 150F has a disk-shape with a section complementary to that of opening 122.

[0097] According to the first embodiment illustrated in figures 1A and 1B, the movement of the movable lid 150 (insertion and/or rejection) inside the heating cavity is actuated by means of a mechanical linear actuator 160 of the screw-nut type.

[0098] In this embodiment, the actuator 160 comprises a rotatable nut 161 fixed in the longitudinal direction and a screw 164 translatable in the longitudinal direction upon rotation of the nut 161. The example of figures 1A and 1B is that of a non-captive linear actuator, in which the nut 161 driving the screw 164 is put into motion by a motor 162 linked to an actuation button 163 accessible to the user.

[0099] The lid 150 is solidary with the screw 164.

[0100] For example, as illustrated in figure 1A or 1B, the screw 164 extends along a longitudinal axis Z2, coaxially with the heating cavity 120.

[0101] The movable lid 150 is fixed to the top end 164a of the screw 164. The lid 150 so rotates together with the screw 164 while vertically moving up and down in the

heating cavity 120.

[0102] A clearance is required under the heating cavity 120, to receive the screw 164 in the retracted position.

[0103] In addition, and as shown particularly in figure 1B, the device 100 may advantageously comprise a controlling unit 190 including a heat controlling system 191 configured to measure at least one parameter relating to the heating system 130 and disable deployment of the lid 150 until said parameter has reached a predetermined threshold. The parameter may be a temperature and the heat controlling system 191 may comprise at least one temperature sensor 193, for example contacting the heating cavity 120. The parameter may be a period of time after the heating system 130 has been shut off and the heat controlling system 191 may include a timer.

[0104] The controlling unit 190 may further comprise a position controlling system 192 configured to assess a position of the movable lid and control actuation of the heating system 130 based on said position. This shall ensure that the article is completely inserted before the heating system is actuated.

[0105] The movable lid may for example be configured to close an electrical or optical or impedance circuit 194 in its retracted position. The position controlling system 192 may then be configured to monitor a parameter of said circuit.

[0106] According to another example, the position controlling system 192 may be configured to monitor a parameter of the movement of the movable lid 150. For example, the motor 162 actuating the movement could be configured to sense a resistance to the motion or measure the motion from the deployed position, e.g., by mean of an encoder of counting steps of a step motor.

[0107] An actuator 160 according to a preferred example, which may be implemented in a device as described hereabove, is now described in more detail with reference to figures 13 and 14.

[0108] In this particular example, the heater body 134 is received within a holder 165, typically made of high-temperature resistant plastic such as PEEK, having a base 1651 orthogonal to the longitudinal direction Z of the heating cavity 120 and holding means 1652 such as longitudinal tongues upwardly protruding from the base 1651, configured to hold the heater body 134 for example by clamping and maintain it in longitudinal alignment with the lead screw 164.

[0109] Advantageously, the holding means 1652 are configured to hold the heater body 134 at a distance from the base 1651. The interstice between the heater body 134 and the base 1651 is intended to receive parts of the actuator 160 as will be described hereafter.

[0110] The heater body 134 here has a cup shape, with a lateral tubular wall 1341 and a bottom wall 1342.

[0111] The actuator 160 comprises a screw 164 translatable in the longitudinal direction Z by actuation of a motor 162 linked to an actuation button accessible to the user 163. The screw 164 goes through an opening 1343

formed in the bottom wall 1342 of the heater body 134 and is long enough to move the lid 150 up and down along the length of the heating cavity 120. The edges 1344 of the bottom wall 1342 around the screw opening 1343 may advantageously be turned upwardly to prevent dirt to fall into the device. An additional silicone seal 1345 may further be placed around said opening 1343, on a lower side of bottom wall 1342, to prevent the dirt from falling out.

[0112] In this particular embodiment, the actuator comprises a reduction gearing between the motor 162 and the screw 164, for transferring rotational movement to the screw 164. The reduction gearing comprises meshing cogwheels, here two cogwheels 1611, 1612, having together an overall transmission ratio less than 1 for decreasing the rotation speed and increasing the torque transmitted to the screw 164.

[0113] In the embodiment of figures 13 and 14, the motor 162 is attached to the holder 165, in particular to a bottom side of base 1651, and its axis 169, which goes through said base 1651, is solidary with the first cogwheel 1611 of smaller diameter. Hence the motor 162 is placed further from the heater body 134 and protected from possible overheating. The motor 162 is further connected to a printed circuit board delivering electric power, and to the battery of the device (not shown).

[0114] The first cogwheel 1611 is secured at a top side of the base 1651 with a cotter pin 166 to prevent getting loose. The first cogwheel 1611 meshes with the second cogwheel 1612 of larger diameter, hence transferring rotational movement of the motor axis 169 to said second cogwheel 1612.

[0115] The second cogwheel 1612 has a gearing portion 1612a located at a top side of the base 1651 and meshing with the first cogwheel 1611, and a central axis 1612b provided with a threaded hole configured to receive the screw 164 in threaded engagement. The second cogwheel 1612 so forms a nut of the mechanical actuator 160.

[0116] With such arrangement, a rotational movement of the second cogwheel 1612 induces a longitudinal movement of the screw 164, and so of the movable lid 150 which is solidary with the screw 164.

[0117] In the particular illustrated example, the central axis 1612b of the second cogwheel 1612 is mounted in a through hole 1653 of the base 1651.

[0118] According to a non-illustrated embodiment, a bearing could further be over-moulded to said through hole 1653 of the holder 165 to reduce the friction between the axis of cogwheel 1612 and the base 1651.

[0119] A small latch 167 may be placed below the second cogwheel 1612 and the holder 165 to fix the cogwheel 1612 in longitudinal position, as shown in figures 13 and 14.

[0120] According to a non-illustrated embodiment, the rigidity of the screw 164 may further be enhanced by providing an additional holder at the bottom thereof.

[0121] The reduction gears such as cogwheels 1611,

1612 may be manufactured from temp-resistant plastic, such as PolyEtherEtherKetone (PEEK) or from metals. The screw 164 and movable lid 150 may be made from metals, preferably stainless steel.

[0122] Once the user presses the actuation button, the motor 162 starts moving the screw 164 up. As the screw 164 rotates and goes up, the movable lid 150 is being pushed up. At its bottom end, the screw 164 is advantageously provided with a hard stop 168 preventing it from falling out in case the motor 162 doesn't stop in time.

[0123] Figures 8A illustrates an aerosol-generating system 2000 comprising an aerosol-generating device 200 according to a second embodiment, and an aerosol-generating article 1. The aerosol-generating device 200 here implements a linear actuator 260 of the external type, where the screw 264 is rotatable around its longitudinal axis Z2 but fixed in the longitudinal direction Z. The lid 250 is provided with a threaded hole 257 and so forms a nut threadedly mounted on the screw 264. Blocking means are provided to block the lid 250 against any rotation around screw axis Z2. Hence, a rotation of the screw 264 results in a translation of the lid 250 in the longitudinal direction. This system is more compact than that of the first embodiment, as no clearance is needed for the screw outside the heating cavity.

[0124] A reduction gearing such as illustrated in figures 13 and 14, and more generally an actuator of the type described in said figures, could be implemented similarly in combination with said embodiment.

[0125] As shown in figure 8B, blocking means may for example comprise a lateral protuberance 256 of the movable lid 250, in shape-fitting cooperation with a peripheral recess 226 (schematically shown by a dotted line in figure 8B) of the heating cavity extending continuously in the longitudinal direction, the walls of the peripheral recess forming abutments for the lateral protuberance 256.

[0126] In the particular illustrated embodiment and as shown in more detail in figure 8B, the screw 264 - laterally offset with respect to a center axis Z1 of the heating cavity 220 - is housed in said recess 226, and the threaded hole 257 of the movable lid 250 is formed in the lateral protuberance 256 thereof. The screw 264 being laterally offset with respect to the insertion opening 222, it does not interfere with the obturation of said opening by the movable lid 250 when in the deployed position.

[0127] Figures 9A illustrates an aerosol-generating system 3000 comprising an aerosol-generating device 300 according to a third embodiment, and an aerosol-generating article 1. The aerosol-generating device 300 here implements a linear actuator 360 of the external type where a threaded hole 357 for cooperating with the screw 364 is formed at a center of the movable lid 350. In a manner similar to the second embodiment, the screw 364 is rotatable around its longitudinal axis Z2 (here aligned with the axis Z1 of the cavity 320) but fixed in the longitudinal direction Z. Blocking means, such as a form fitting arrangement between the lid 350 and a recess 326 of the heating cavity 320, are provided to block the lid

350 against any rotation around screw axis Z2. Hence, a rotation of the screw 364 results in a translation of the lid 350 in the longitudinal direction Z.

[0128] In the particular embodiment of figure 9A, the screw has a sharp tip at its top end 364a, capable of piercing a bottom end of the aerosol-generating article 1.

[0129] Although not illustrated and according to a particular alternative example, the screw 364 may further be arranged to act as an internal heater, in place of the external heater 330.

[0130] Also, a reduction gearing such as illustrated in figures 13 and 14, and more generally an actuator of the type described in said figures, could be implemented similarly in combination with said embodiment.

[0131] Although lead-screw type actuators are particularly convenient for the considered application, other types of mechanical actuators may be envisaged. According to a non-illustrated example, the actuator may comprise one or more connection rods (advantageously one or more pairs of connecting rods arranged in series) connected to the lid and pivotable (around axes perpendicular to the longitudinal direction) so that the lid be moved longitudinally upon rotation of the connecting rod. In such arrangement, a rack and pinion gear system may for example be provided for actuating rotation of said at least one connecting rod.

[0132] Figure 10 illustrates an aerosol-generating system 4000 comprising a device 400 according to a fourth embodiment, and an aerosol-generating article 1.

[0133] The movable lid 450 here includes a magnetic element such as a permanent magnet 458.

[0134] Also, the aerosol-generating article 1 contains a heating portion 2 of ferromagnetic material, for example iron. To heat the article 1 once inserted in the heating cavity 420, the aerosol-generating device 400 is provided with an induction heating system 430 including an induction coil 431.

[0135] The magnetic lid 450 does not perturbate the induction heating system 430 as the inductive heating is alternating, e.g., at 100kHz, while the permanent magnet 458 is steady and not generating any Eddy currents. Moreover, the magnetic permeability of the magnet, e.g. a neodymium magnet, is typically very similar to air.

[0136] With such arrangement, the motion of the lid may be actuated manually, by pushing the article 1 manually inside the cavity (to retract the lid) and pulling the article out of the cavity (to deploy the lid again after use). In particular, the magnetic force between the heating portion 2 of the aerosol-generating article 1 and the magnetic element 458 of the movable lid 450 may be designed so that a movement of the aerosol-generating article out of the heating cavity 420 pulls the movable lid 450 in its deployed position. The magnetic force should in particular be stronger than the force of gravity exerted on the lid 450.

[0137] According to another embodiment, the movable lid 450 may be lifted with the magnetic field generated by induction coil 431.

[0138] According to still another example, the aerosol-generating system may comprise a dedicated magnetic actuator for moving the lid from its deployed towards its retracted position and vice versa.

[0139] It is understood that a magnetic lid 450 may also be implemented with conventional articles 1 having no heating portion 2, when combined with any adapted magnetic actuation system (including a coil of the heating system or any other adapted magnetic actuation means).

[0140] Figures 11A illustrates an aerosol-generating system 5000 comprising an aerosol-generating device 500 according to a fifth embodiment, and an aerosol-generating article 1. The aerosol-generating device 500 here includes a spring-loaded ejection system 570 adapted to return the movable lid 550 from its retracted position towards its deployed position.

[0141] In this example, the movable lid 550 is solidary with a longitudinal rod 572 extending downwards.

[0142] The rod 572 is arranged to penetrate in a dedicated clearance under the heating cavity 520 when the lid 550 is moved towards its retracted position, and to enter the heating cavity 520 when the lid 550 is moved towards its deployed position.

[0143] As shown in figure 11B, the rod 572 is longer than the heating cavity 520 so that a rod portion protrudes downstream of the cavity 520 in the deployed position of the lid 550.

[0144] A spring 576 is mounted around said rod 572, outside of the cavity 520.

[0145] The lower end 576b of the spring 576 is solidary with the rod 572. As shown in figure 11A, it may abut on a flange formed at the bottom end 572b of the rod 572, or may be otherwise fixed in position in the vicinity of said bottom end 572b.

[0146] The opposite upper end 576a of the spring 576 is fixed in the longitudinal direction Z. In the non-limitative illustrated example, it abuts on a flange 524 located in the vicinity of the bottom end 520b of the cavity.

[0147] The longitudinal movement of the lid 550 inside the cavity 520 changes the distance between both ends of the spring 576 and so changes the compression state of said spring 576.

[0148] To start his smoking experience, the user presses an aerosol-generating article 1 on the lid 550 and towards inside the heating cavity 520. The movable lid 550 is simply pushed down by the user's force applied on the article 1, and towards the retracted position.

[0149] The spring 576 is stretched upon moving the lid 550 towards its retracted position.

[0150] A non-illustrated locking mechanism shall be provided to keep the movable lid 550 in its retracted position.

[0151] Once the vaping session is finished, the locking mechanism may be unlocked, for example by clicking on the article 1, to allow the lid 550 to recover its deployed position and the spring 576 to be released again (as shown in figure 11B).

[0152] Figures 12A illustrates an aerosol-generating

system 6000 comprising an aerosol-generating device 600 according to a sixth embodiment, also including a spring loaded ejection mechanism 670 for the movable lid 650, and an aerosol-generating article 1.

[0153] In this embodiment, two fixed rods 672, 672' are provided along the heating cavity 620 with a spring respectively 676, 676' mounted around each rod 672, 672'. Provision of two rods 672, 672', advantageously arranged symmetrically around the center axis Z1 of the cavity 620, maintains a symmetry of the forces and allows a better guidance of the movable lid 650. In alternative embodiments however, one rod or more than two rods may be implemented in a similar arrangement.

[0154] Each spring 676, 676' has one end 676a, 676a' fixed in the longitudinal direction Z, notably fixed at the upper end 672a, 672a' of the rod to which it is associated, and its lower end 676b, 676b' fixed to the movable lid 650.

[0155] Each spring is in a released configuration when the movable lid 650 is in its retracted position as shown in figure 12A, and in a compressed configuration when the lid 650 is in its deployed configuration, as shown in figure 12B.

[0156] Although not explicitly mentioned, all second to sixth embodiments may integrate a heating system and/or a controlling unit as described in detail with reference to the first embodiment.

[0157] Also, an actuator of the type illustrated in figures 13 and 14 may be implemented in any other embodiment, when technically applicable.

[0158] Alternative configurations for the movable lid or the insertion end of the heating cavity, such as that illustrated in figures 2 to 7, may also be envisaged in combination with the second to sixth embodiments.

Claims

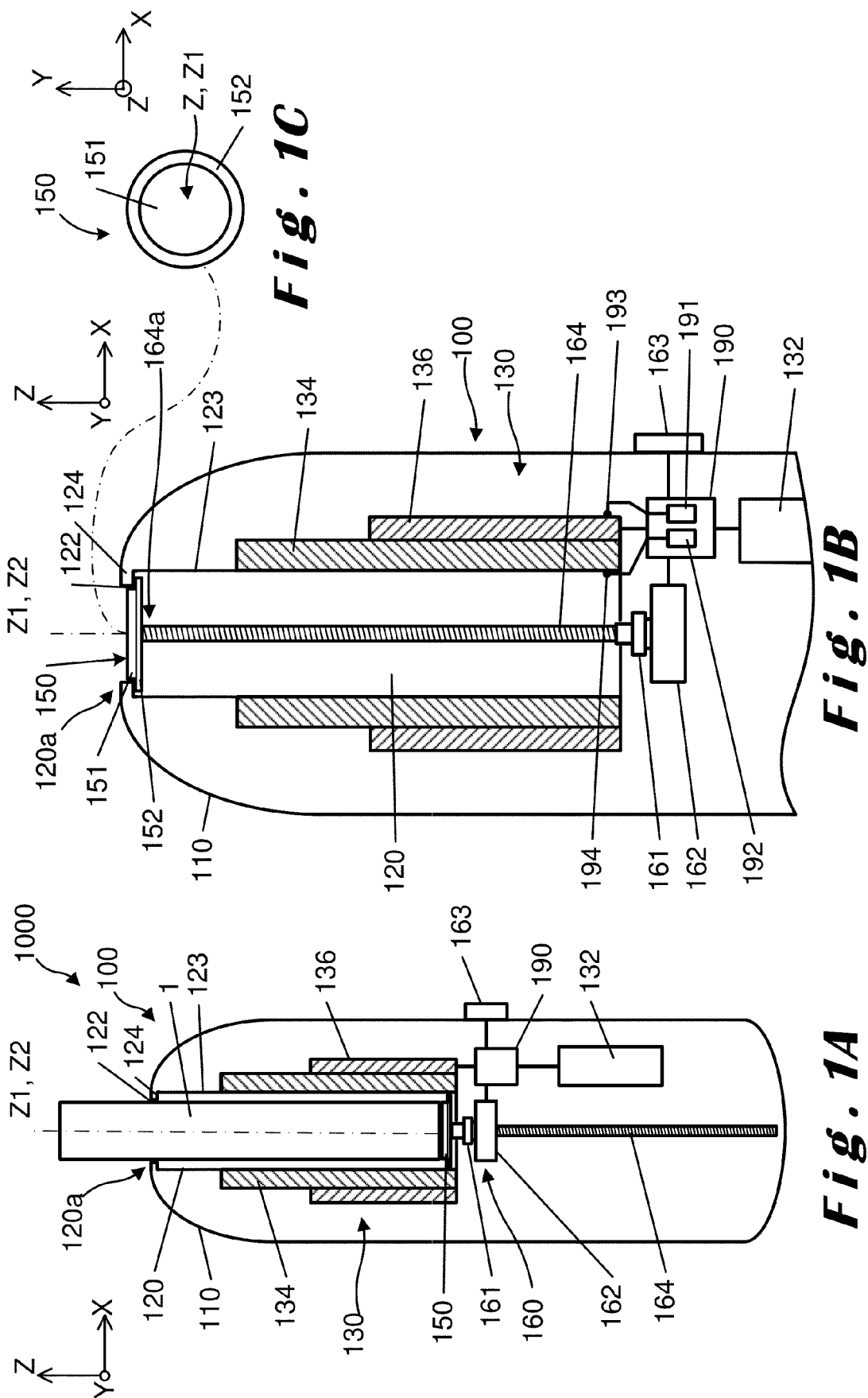
1. An aerosol-generating device (100, ..., 600), comprising
 - a longitudinal heating cavity (120) provided with an opening (122) at one insertion end (120a) and adapted to receive at least part of an aerosol-generating article (1) inserted through said insertion opening (122), and
 - a heating system (130) for heating an aerosol-generating article (1) received in said heating cavity (120),
 the aerosol-generating device (100, ..., 600) being **characterized in that** it further comprises a movable lid (150) longitudinally movable within the heating cavity (120) between a retracted position and a deployed position in which it obturates said heating cavity (120) at its insertion end (120a).
2. The aerosol-generating device (100, ..., 600) according to claim 1, wherein the movable lid (150) is

provided at least at its periphery with a flexible part (153).

3. The aerosol-generating device (500, 600) according to claim 1 or 2, further comprising a spring-loaded ejection system (570, 670) for ejecting the movable lid (550, 650) from its retracted position towards its deployed position. 5
4. The aerosol-generating device (100, 200, 300) according to claim 1 or 2, further comprising a mechanical linear actuator (160, 260, 360) for moving the lid (150, 250, 350) between its retracted position and deployed position. 10
5. The aerosol-generating device (100, ..., 600) according to claim 4, wherein the mechanical linear actuator (160, 260, 360) is a lead-screw actuator comprising a screw (164, 264, 364) extending in the longitudinal direction (Z) and a nut (161, 250, 350) threadedly engaging said screw (164, 264, 364). 15
6. The aerosol-generating device (200, 300) according to claim 5, wherein the actuator (160) comprises a motor (162) for driving the screw (164) and a reduction gearing between said motor and the screw. 20
7. The aerosol-generating device (200, 300) according to claim 6, wherein the reduction gearing comprises a first cogwheel (1611) solidary with the motor axis (169) and a second cogwheel (1612) solidary with or engaging with the screw (164). 25
8. The aerosol-generating device (100) according to any one of claims 5 to 7, wherein the nut (161) is fixed in the longitudinal direction (Z) of the heating cavity (120), the screw (164) is translatable in said longitudinal direction (Z) upon rotation of the nut (161), and the lid (150) is solidary with the screw (164). 30
9. The aerosol-generating device (100, ..., 600) according to any one of claims 1 to 8, wherein the movable lid (40) includes a magnetic element. 35
10. The aerosol-generating device (100, ..., 600) according to claim 9, further comprising a magnetic actuator (80) for moving the lid from its deployed towards its retracted position and vice versa. 40
11. The aerosol-generating device (100, ..., 600) according to any one of claims 1 to 10, further comprising a heat controlling system (191) configured to measure at least one parameter relating to the heating system (130), notably a period of time after the heating system (130) has been shut off or a temperature, and disable deployment of the lid (150) until said parameter has reached a predetermined 45

threshold.

12. The aerosol-generating device (100, ..., 600) according to any one of claims 1 to 11, further comprising a position controlling system (192) configured to assess a position of the movable lid (150) and control actuation of the heating system (130) based on said position. 50
13. An aerosol-generating system (1000, ..., 6000) comprising an aerosol-generating device (100, ..., 600) according to any one of claims 1 to 12, and an aerosol-generating article (1) configured to be inserted at least partially in the heating cavity (120, ..., 620) of said aerosol-generating device (100, ..., 600). 55
14. The aerosol-generating system (4000) according to claim 13, wherein the movable lid (450) includes a magnetic element (458), and the aerosol-generating article (1) includes a heating portion (2) made of ferromagnetic material.
15. The aerosol-generating system according to claim 14, wherein the heating portion (2) of the aerosol-generating article (1) and the magnetic element (458) of the movable lid (450) are designed so that a movement of the aerosol-generating article (1) out of the heating cavity pulls the movable lid (450) in its deployed position due to the magnetic force therebetween.



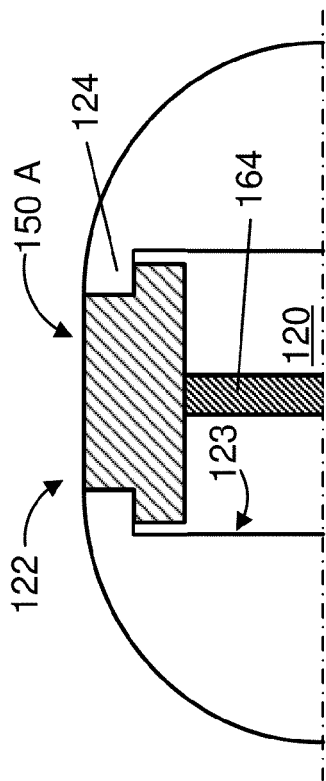


Fig. 2

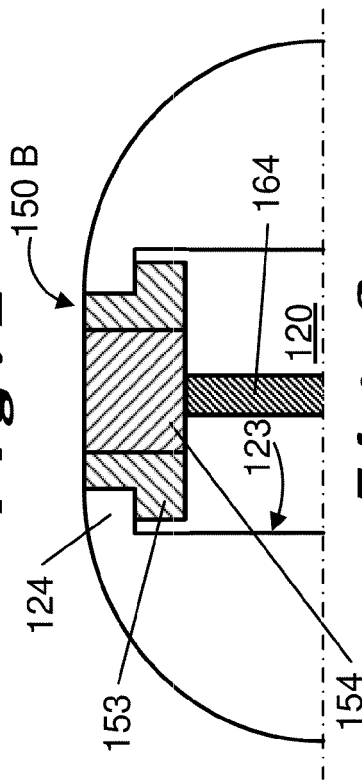


Fig. 3

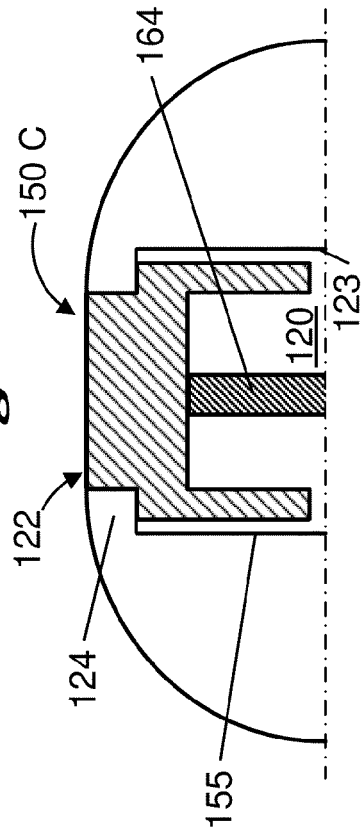


Fig. 4

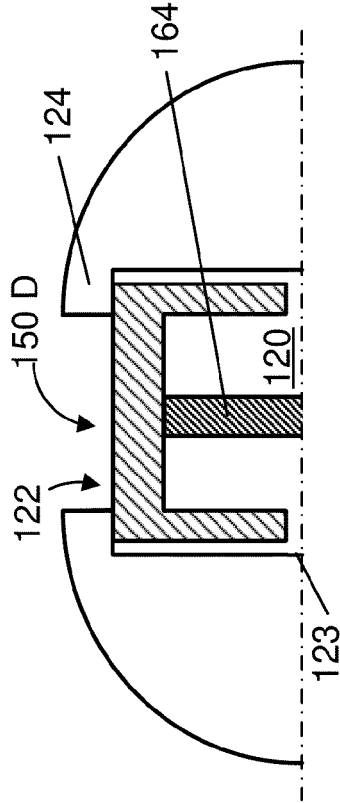


Fig. 5

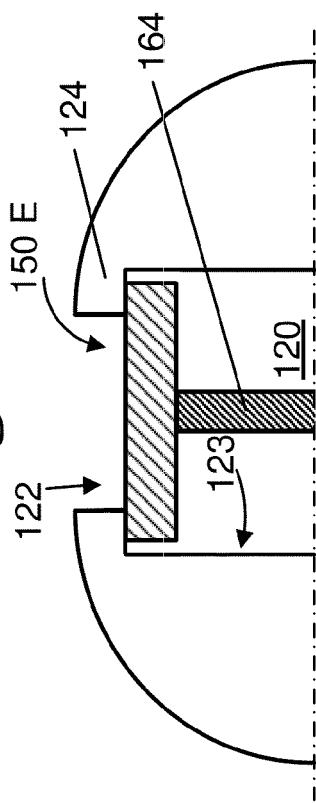


Fig. 6

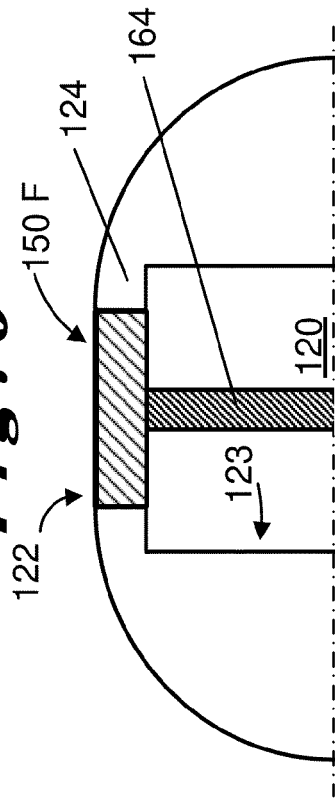
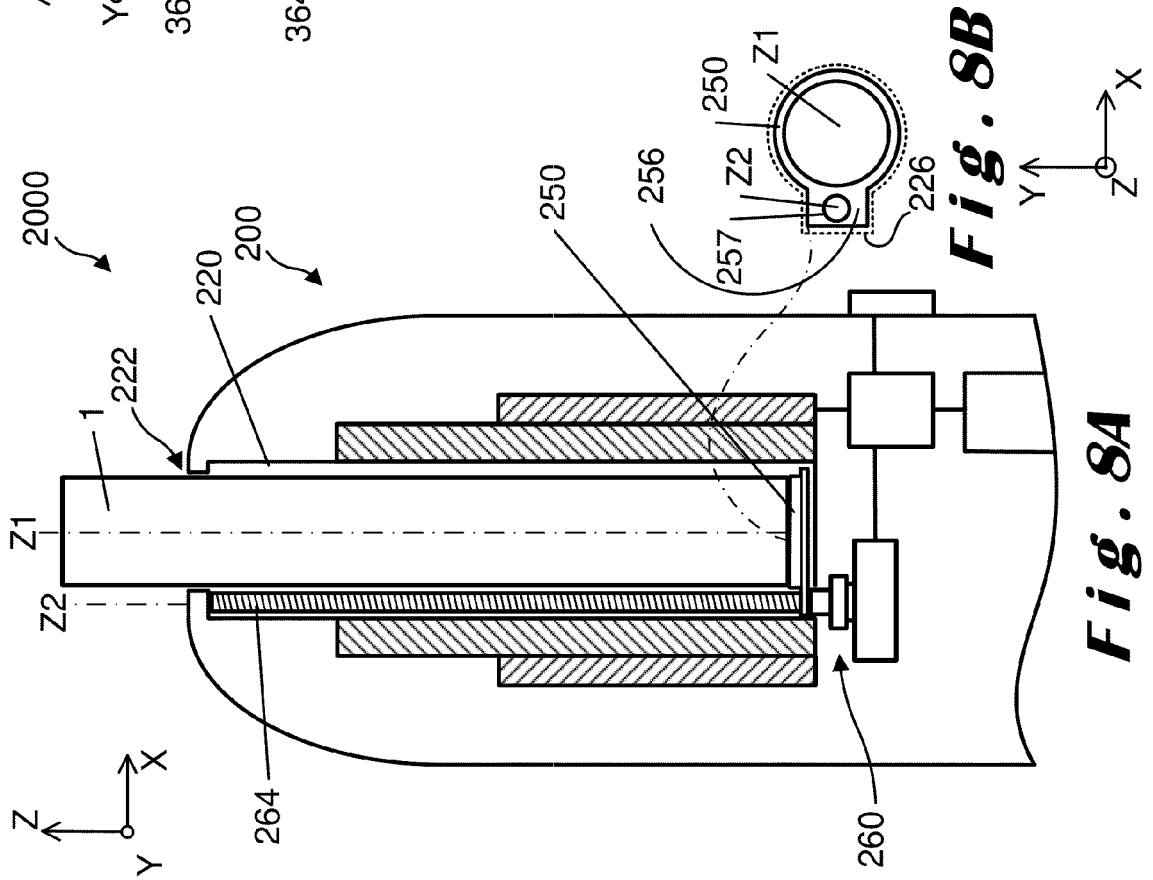
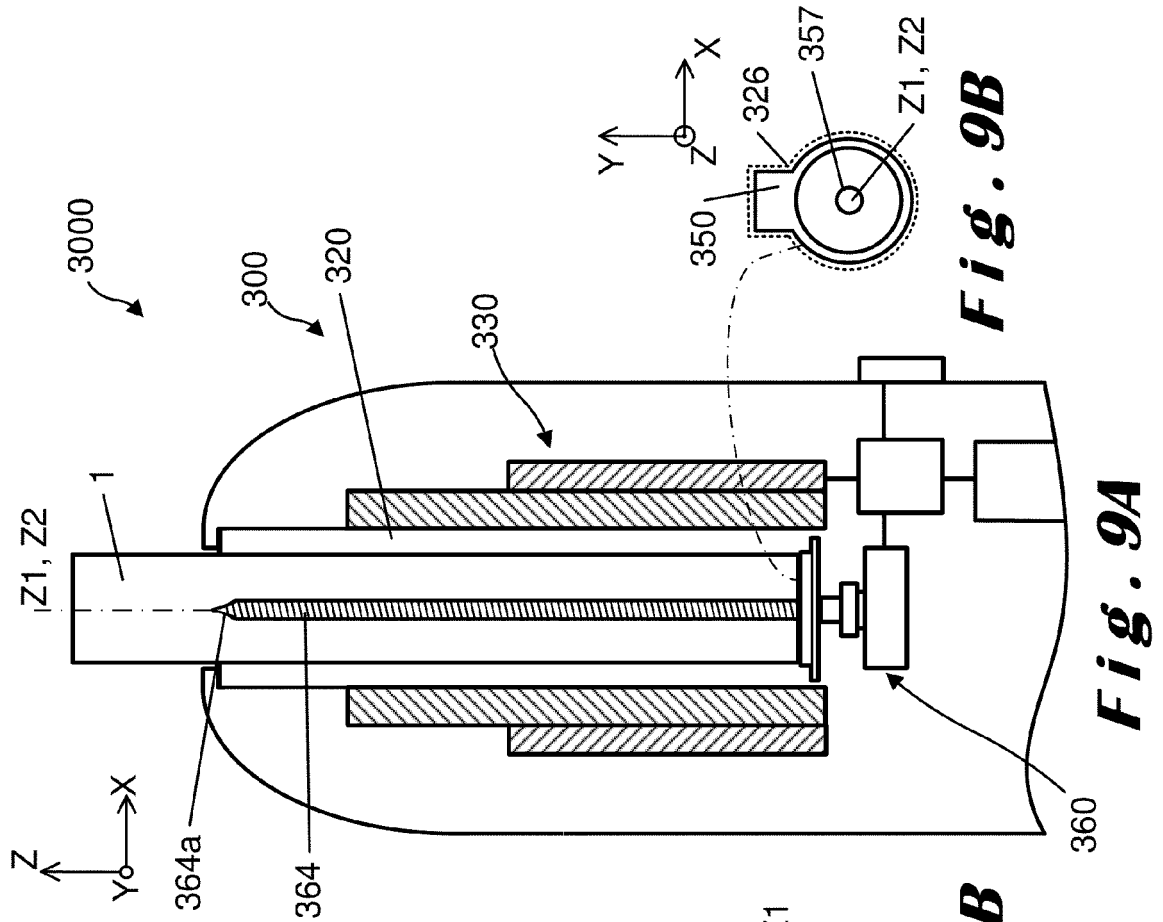


Fig. 7



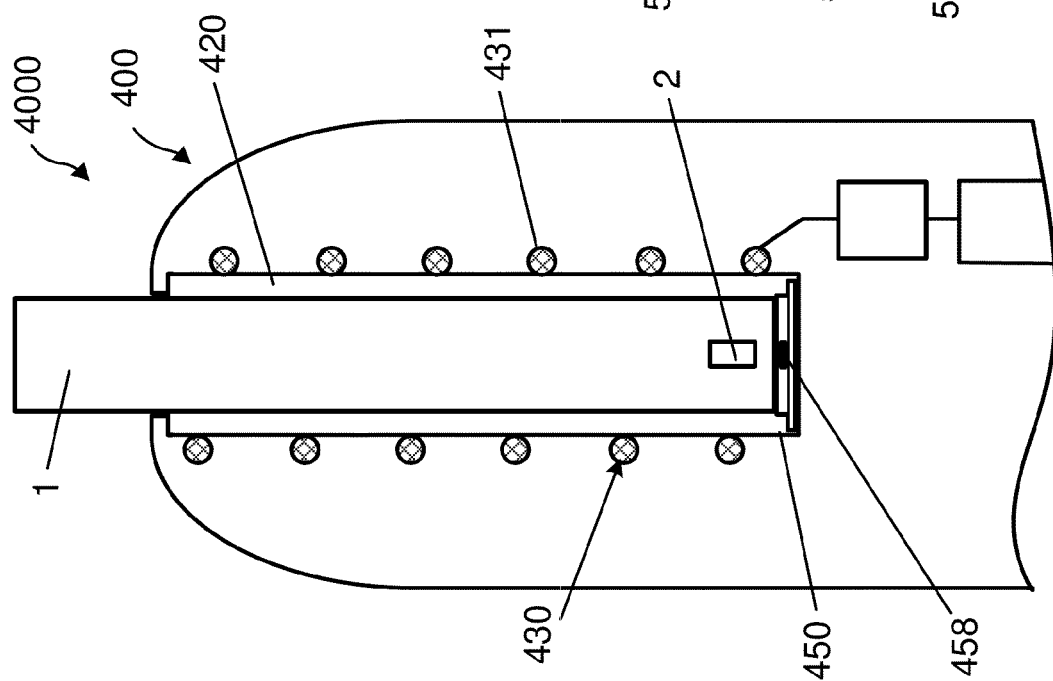


Fig. 10

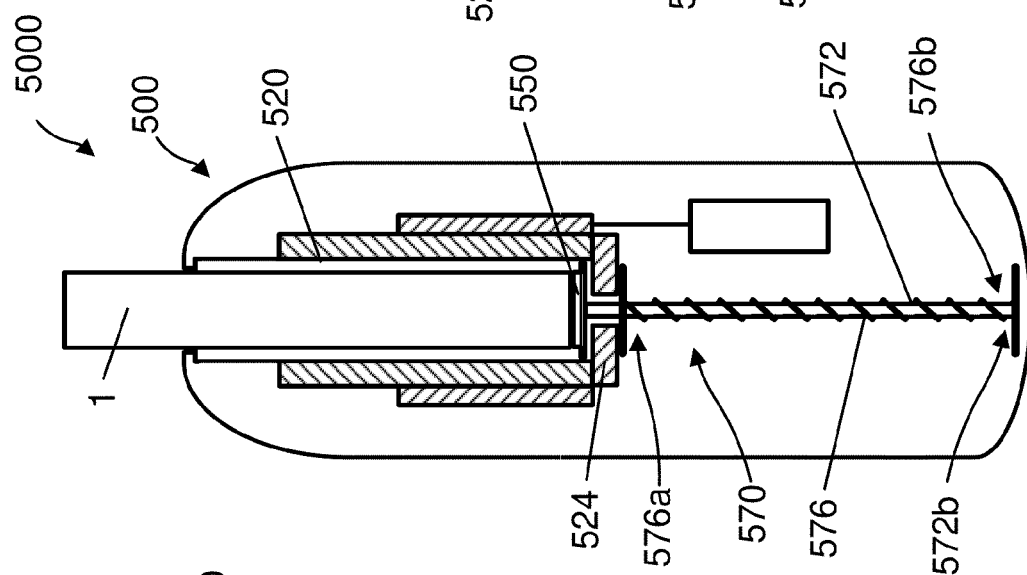


Fig. 11A

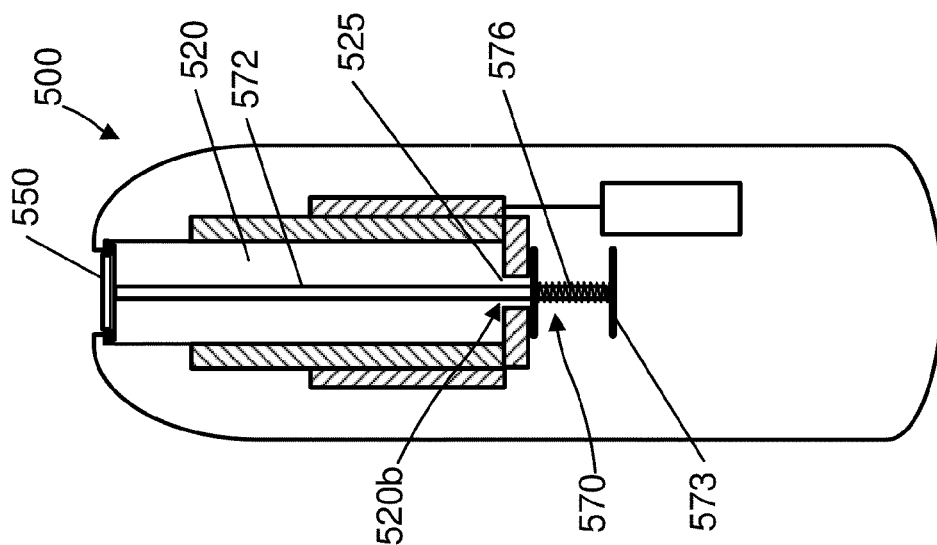


Fig. 11B

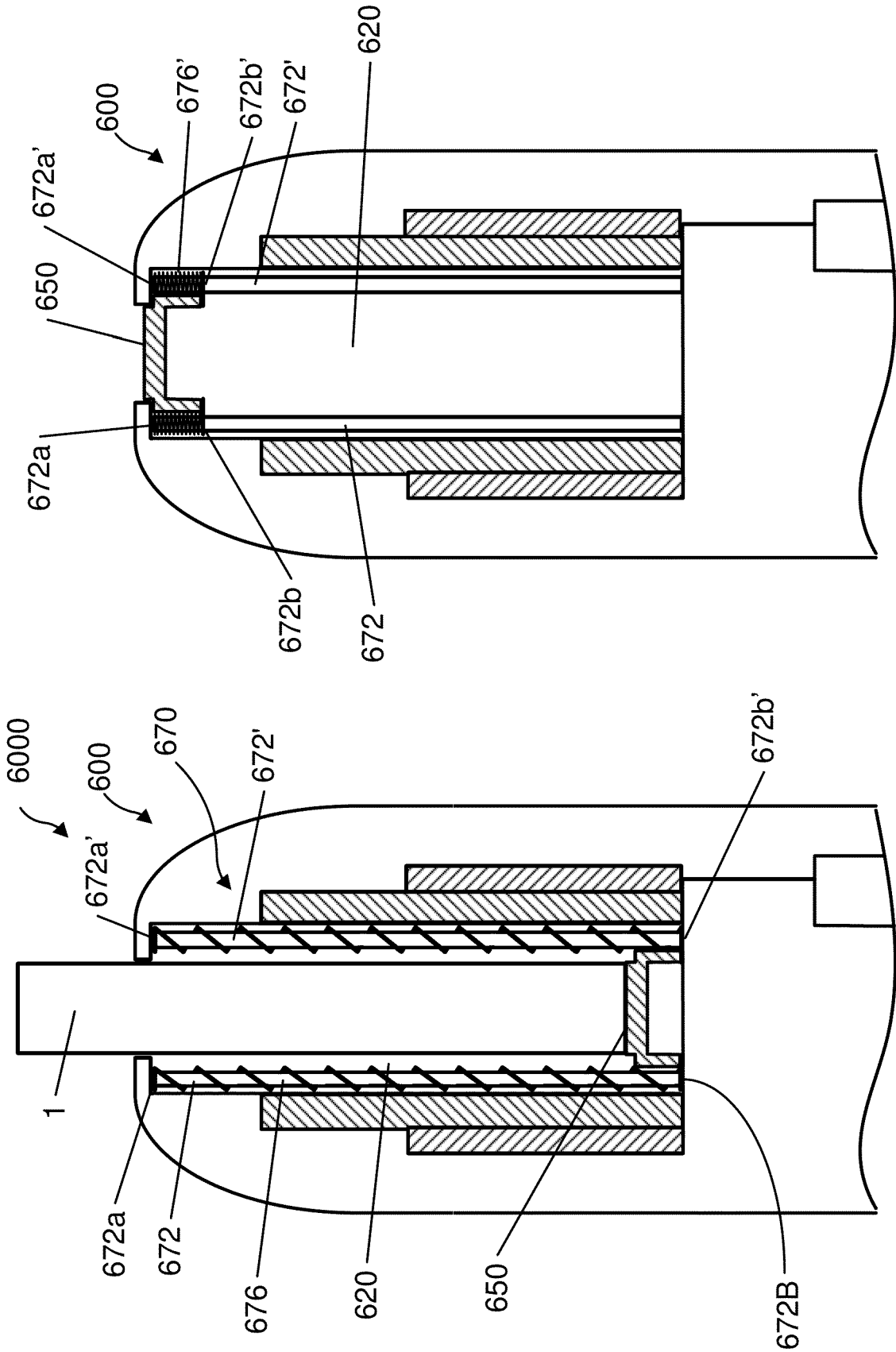
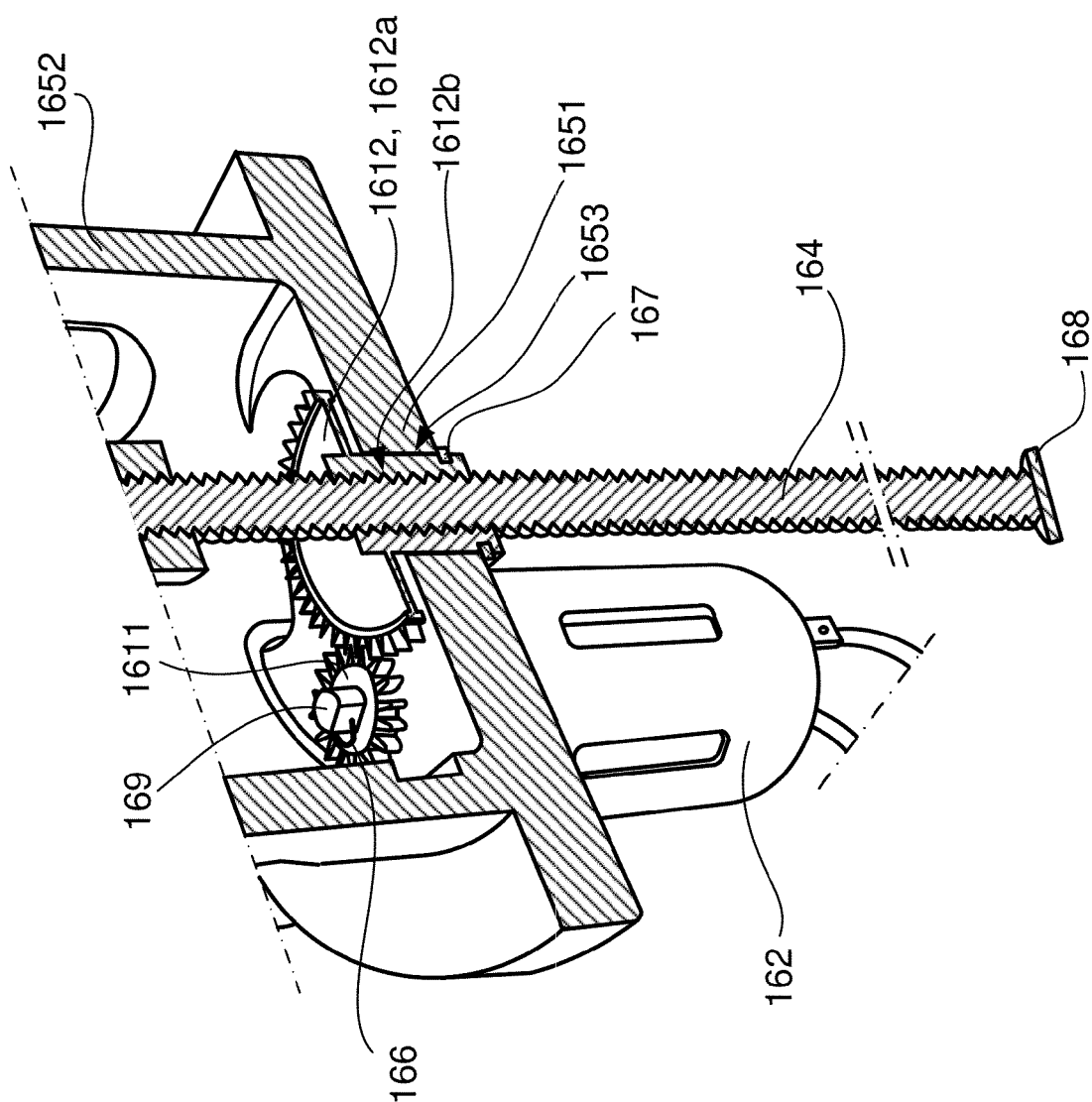
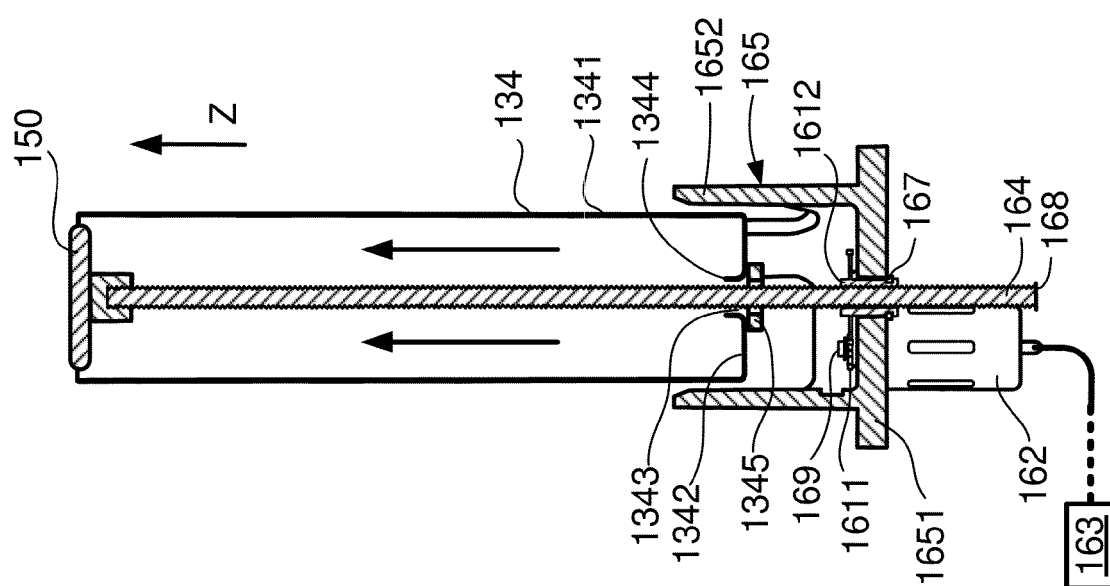


Fig. 12B

Fig. 12A





EUROPEAN SEARCH REPORT

Application Number

EP 22 20 6052

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2020/148334 A1 (PHILIP MORRIS PRODUCTS SA [CH]) 23 July 2020 (2020-07-23)	1-3, 11-13	INV. A24F40/40
A	* page 18, line 22 - page 19, line 11; figures * * page 9, line 16 - page 10, line 2 * * page 21, line 3 - line 20; claims *	4-10, 14, 15	ADD. A24F40/20
X	CN 112 754 085 A (CHINA TOBACCO HENAN IND CO LTD) 7 May 2021 (2021-05-07) * paragraph [0023] - paragraph [0024]; claims; figures *	1, 3, 13	
A	CN 114 680 394 A (LTD RESPONSIBILITY COMPANY OF TOBACCO INDUSTRY IN HUBEI) 1 July 2022 (2022-07-01) * paragraph [0058] - paragraph [0061]; claims 4-6; figures *	4-10	
A	WO 2022/231343 A1 (KT & G CORP [KR]) 3 November 2022 (2022-11-03) * paragraph [0050] - paragraph [0056]; claims; figures *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			A24F
The present search report has been drawn up for all claims			

2

EPO FORM 1503 03:82 (P04C01)

Place of search

Munich

Date of completion of the search

26 April 2023

Examiner

Marzano Monterosso

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 22 20 6052

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-04-2023

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2020148334 A1	23-07-2020	CN 113194764 A	30-07-2021
		EP 3911188 A1	24-11-2021
		JP 7183426 B2	05-12-2022
		JP 2022515449 A	18-02-2022
		KR 20210099626 A	12-08-2021
		RU 2764095 C1	13-01-2022
		US 2022125109 A1	28-04-2022
		WO 2020148334 A1	23-07-2020
CN 112754085 A	07-05-2021	NONE	
CN 114680394 A	01-07-2022	NONE	
WO 2022231343 A1	03-11-2022	KR 20220148603 A	07-11-2022
		WO 2022231343 A1	03-11-2022