



(51) International Patent Classification:

A24F 40/485 (2020.01) A24F 40/10 (2020.01)

(21) International Application Number:

PCT/EP2022/084389

(22) International Filing Date:

05 December 2022 (05.12.2022)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

21213533.9 09 December 2021 (09.12.2021) EP

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(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE,

KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU,
LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG,
NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS,
RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH,
TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS,
ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, CV,
GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI,
SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN,
GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: AN AEROSOL GENERATING DEVICE

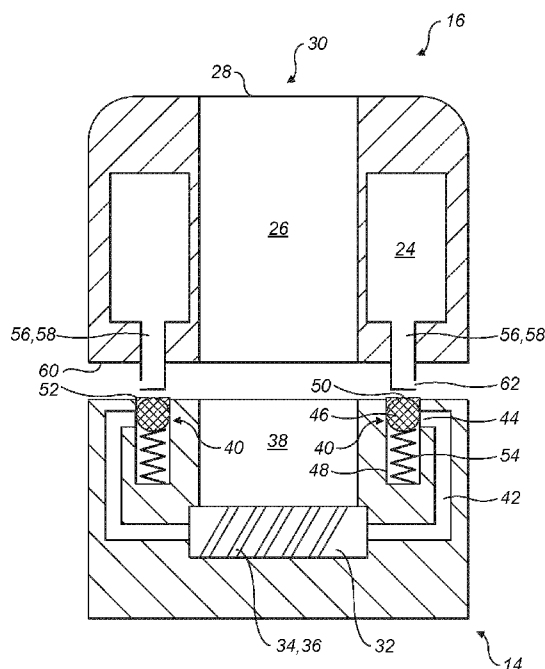


FIG. 2

(57) Abstract: An aerosol generating device (10) comprises a vaporizer unit (14) including a heater (34) for heating and vaporizing an aerosol generating liquid and a cartridge (16) including a liquid store (24) for containing an aerosol generating liquid. The cartridge (16) is removably coupleable to the vaporizer unit (14). The vaporizer unit (14) includes a resilient valve (40) for selectively blocking the flow of aerosol generating liquid from the liquid store (24) to the heater (34) and the resilient valve (40) is configured to move from a closed position towards an open position as the cartridge (16) is coupled to the vaporizer unit (14).

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AN AEROSOL GENERATING DEVICE

Technical Field

The present disclosure relates generally to an aerosol generating device, for example an
5 electronic cigarette, for heating an aerosol generating liquid to generate a vapour which
may cool and condense to form an aerosol for inhalation by a user of the device.

Technical Background

Aerosol generating devices, such as electronic cigarettes or “e-cigarettes” as they are
10 commonly known, have gained in popularity over recent years as an alternative to
traditional smoking articles, like cigarettes, cigars, and cigarillos. Aerosol generating
devices work by heating an aerosol generating liquid to generate a vapour that cools
and condenses to form an aerosol which is then inhaled by the user. The aerosol
generating liquid usually contains one or more of nicotine, propylene glycol, glycerine
15 and flavourings.

Conventional aerosol generating devices usually include a vaporizer unit to heat and
vaporize the aerosol generating liquid. Conventional vaporizer units typically employ
a wicking element, e.g., a cotton or ceramic wick, to transfer aerosol generating liquid
20 by capillary action from a liquid store to a heating element which is often in the form
of a heating coil wrapped around the wicking element or a resistive heating track coated
onto the wicking element. When a user operates the aerosol generating device, aerosol
generating liquid that has soaked into the wicking element is heated by the heating
element and volatilized to form a vapour which may then be entrained in an airflow
25 through the device and which may cool and condense to form an aerosol that is inhaled
by a user.

To facilitate the ease of use of aerosol generating devices, cartridges are often used.
These cartridges are often configured as “cartomizers”, which means an integrated
30 component comprising a liquid store, a liquid transfer element (e.g., a wicking element)
and a heater. Electrical connectors may also be provided to establish an electrical
connection between the heater and a power source. However, the complexity and

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numerous components of such cartridges are associated with drawbacks, such as complex and costly manufacturing and/or assembly processes. The disposal and/or recyclability of such cartridges also presents a challenge because they comprise numerous plastic and metallic components.

5

In view of the above, it would be desirable to provide an aerosol generating device which allows the use of cartridges having a simplified structure such that the manufacturability and/or assembly and/or recyclability of the cartridges can be improved and such that the cost of the exchangeable part of the device can be significantly reduced.

10

Summary of the Disclosure

According to a first aspect of the present disclosure, there is provided an aerosol generating device comprising:

15

a vaporizer unit including a heater for heating and vaporizing an aerosol generating liquid;

a cartridge including a liquid store for containing an aerosol generating liquid, the cartridge being removably couplable to the vaporizer unit;

20

wherein the vaporizer unit includes a resilient valve for selectively blocking the flow of aerosol generating liquid from the liquid store to the heater and the resilient valve is configured to move from a closed position towards an open position as the cartridge is coupled to the vaporizer unit.

25

The vaporizer unit, and in particular the heater, is configured to heat the aerosol generating liquid to volatilise at least one component of the aerosol generating liquid and thereby generate a vapour which may cool and condense to form an aerosol for inhalation by a user of the aerosol generating device. The present disclosure is particularly applicable to a portable (hand-held) aerosol generating device.

30

In general terms, a vapour is a substance in the gas phase at a temperature lower than its critical temperature, which means that the vapour can be condensed to a liquid by increasing its pressure without reducing the temperature, whereas an aerosol is a

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suspension of fine solid particles or liquid droplets, in air or another gas. It should, however, be noted that the terms 'aerosol' and 'vapour' may be used interchangeably in this specification, particularly with regard to the form of the inhalable medium that is generated for inhalation by a user.

5

By integrating the vaporizer unit into the aerosol generating device, the number of components within the cartridge is reduced and, thus, the structure of the cartridge can be simplified and the cost reduced. The recyclability of the cartridge can also be improved. Furthermore, the vaporizer unit can be re-used with multiple cartridges, avoiding the need to discard and replace components within the vaporizer unit each time a depleted cartridge is replaced. The resilient valve may also help to prevent leakage of the aerosol generating liquid during coupling of the cartridge to the vaporizer unit, in particular if the cartridge is inverted as it is coupled to the vaporizer unit.

15 Optional features will now be set out. These are applicable singly or in any combination with any aspect of the present disclosure.

The cartridge and vaporizer unit may comprise a releasable connection, e.g., a dedicated coupling element complementarily fitting with a dedicated coupling element of the vaporizer unit. The coupling elements may be one of: a threaded connection, a bayonet-type connection, a magnetic connection, a snap-fit connection, an actuatable latch and combinations thereof.

25 The cartridge may include a pressing element. The pressing element may be configured to cooperate with the resilient valve and thereby move the resilient valve from the closed position towards the open position during coupling of the cartridge to the vaporizer unit. A simple and reliable mechanism is thereby provided for opening the resilient valve.

30 The pressing element may comprise a projecting element. A reliable opening of the resilient valve is assured by the projecting element.

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The projecting element may be hollow and may be arranged to convey aerosol generating liquid from the liquid store to the heater when the resilient valve is in the open position. The projecting element thus serves a dual purpose, namely to open the resilient valve and to convey aerosol generating liquid to the heater. The structure of the cartridge is thereby further simplified.

The projecting element may be part of a liquid conduit of the cartridge. In mode the projecting element forms circumferential walls of the conduit such that liquid can flow in a substantially tubular flow path demarcated by the circumferential walls. In particular, the projecting element comprises a terminal wall with a pressing surface for pressing on the valve and at least one liquid outlet positioned upstream of the terminal wall, e.g. on a circumferential wall of the liquid conduit. In another possible mode the projecting element is centrally arranged in the conduit and demarcates with circumferential walls of the conduit, a substantially annular flow path for the liquid.

The resilient valve may comprise a ball or plunger movable from the closed position towards the open position and may comprise a biasing member, e.g., a compression spring, configured to bias the ball or plunger to the closed position. The biasing member ensures that the resilient valve is biased to, and retained in, the closed position when the cartridge is not coupled to the vaporizer unit.

The vaporizer unit may include a conduit having a liquid inlet and a chamber for receiving at least part of the resilient valve. With this arrangement, the resilient valve can be recessed from an end face of the vaporizer unit within the chamber, thus reducing the risk of the valve being accidentally moved from the closed position to the open position and ensuring that such movement occurs only during coupling of the cartridge to the vaporizer unit.

The ball or plunger may be positioned in the chamber and may be arranged to block the liquid inlet when biased to the closed position by the biasing member. The liquid inlet is reliably blocked by the ball or plunger prior to coupling of the cartridge to the vaporizer unit.

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The liquid inlet is preferably located downstream of the chamber such that no liquid is able to flow in the conduit of the vaporizing unit until the ball or plunger is biased to the open position.

5

In a possible mode, the plunger and the biasing member can be formed of a single piece. For example, the single piece can be made of a rubber-elastic material. It can for instance comprise two functional parts; one blocking part and a one biasing part.

10 The heater may comprise a capillary element and heating element in contact with each other. For example, the heater may be a coil-and-wick heater. For example, the vaporizer unit may include a liquid transfer element, such as a wick, and the heater may comprise a heating coil which extends around the liquid transfer element. The liquid transfer element facilitates the transfer of aerosol generating liquid from the liquid store
15 to the heating element where it is heated to form a vapour.

The vaporizer unit may further comprise, in addition to or as part of the resilient valve, a sealing member which may be configured to seal the coupling between the cartridge and the vaporizer unit. The seal helps to prevent the leakage of aerosol generating liquid
20 when the cartridge is coupled to the vaporizing unit. The seal may, for instance, be a rubber-elastic O-ring or lip seal.

The ball or plunger may be configured to applying a sealing pressure against the sealing member when the ball or plunger is biased to the closed position by the biasing member.
25

25

In a possible mode, the sealing member is part of the cartridge and is biased against the ball or plunger when the ball or plunger is biased to the closed position by the biasing member. For example, the sealing member may be positioned at the outlet of the cartridge such as an O-ring or lip seal located at the periphery of the outlet conduit.

30

The vaporizer unit may comprise a vaporization chamber and the heater may be positioned in or adjacent to the vaporization chamber. The vaporizer unit may include

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an air inlet communicating with the vaporization chamber, for example with an inlet of the vaporization chamber. The cartridge may include a vapour outlet channel in communication with an outlet of the vaporization chamber. The vapour generated in the vaporization chamber may cool and condense to form an aerosol as it flows along the vapour outlet channel, from the vaporization chamber towards an end of the vapour outlet channel. The end of the vapour outlet channel may comprise a mouthpiece.

The aerosol generating liquid may comprise polyhydric alcohols and mixtures thereof such as glycerine and/or propylene glycol. The aerosol generating liquid may contain nicotine or nicotine salts. The aerosol generating liquid may contain one or more additives, such as a flavouring. The flavouring may include Ethylvanillin (vanilla), menthol, cherry, Isoamyl acetate (banana oil) or similar, for instance.

The aerosol generating liquid may be vaporised by heating the aerosol generating liquid up to its boiling point by the heater, such as a temperature up to 400°C, preferably up to 350°C.

Brief Description of the Drawings

Figure 1 is a diagrammatic view of an aerosol generating device;
Figure 2 is a diagrammatic cross-sectional view of a vaporizer unit and cartridge prior to coupling of the cartridge to the vaporizer unit; and
Figure 3 is a diagrammatic cross-sectional view of the vaporizer unit of Figure 2 with the cartridge coupled to the vaporizer unit.

Detailed Description of Embodiments

Embodiments of the present disclosure will now be described by way of example only and with reference to the accompanying drawings.

As described hereinafter, example implementations of the present disclosure relate to an aerosol generating device, in particular a portable hand-held smoking device such as an electronic cigarette. Aerosol generating devices according to the present disclosure use electrical energy to heat and volatise an aerosol generating liquid, without

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combusting the aerosol generating liquid and/or without significant chemical alteration of the aerosol generating liquid, to form an inhalable aerosol or vapour; and components of such device have the form of articles that most preferably are sufficiently compact to be considered hand-held devices. The use of the aerosol generating device does not
5 result in the production of smoke in the sense that the vapour or aerosol does not result from by-products of combustion or pyrolysis of tobacco, but rather, the use of the aerosol generating device results in the production of a vapour or aerosol due to volatilization or vaporization of certain components incorporated in the aerosol generating liquid.

10

In some example implementations, the aerosol generating device may be characterized as an electronic cigarette in which the aerosol generating liquid may comprise propylene glycol or glycerine or a combination thereof. Aerosol generating devices within the meaning of the present disclosure may transport the volatilized components
15 of the aerosol generating liquid in an airflow through the aerosol generating device to a user of the device, the user of the device being able to activate or deactivate the generation of aerosol and to control the duration, velocity and volume of the airflow by means of a puffing or inhaling action.

20 Referring to Figure 1, there is shown diagrammatically an example of an aerosol generating device 10 comprising a power supply portion 12, a vaporizer unit 14 and a cartridge 16. The aerosol generating device 10 typically has an elongate and possibly substantially cylindrical shape. Other shapes are, however, entirely within the scope of the present disclosure.

25

The power supply portion 12, which can also be referred to as a main body or control body, of the aerosol generating device 10, is advantageously configured as a re-usable unit. The power supply portion 12 comprises a power source 18 (e.g., a battery) and a controller 20 (e.g., a printed circuit board (PCB), an integrated circuit, a memory
30 component, a microprocessor, individually or as part of a micro-controller, and the like) to control the operation of the aerosol generating device 10, and more particularly the operation of the vaporizer unit 14.

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The vaporizer unit 14 is configured to heat and vaporize an aerosol generating liquid. The vaporizer unit 14 can form an integral part of the power supply portion 12 or can be a separate unit that is releasably connected to the power supply portion 12 via a
5 releasable connection 22, for example to allow removal and replacement of the vaporizer unit 14. The releasable connection 22 (where present) can be, for example, a snap-fit connection, a threaded connection, a bayonet connection or a magnetic connection.

10 The cartridge 16 includes a liquid store 24 for containing an aerosol generating liquid. As noted above, the aerosol generating liquid may comprise an aerosol-forming substance such as propylene glycol and/or glycerol and may contain other substances such as nicotine, nicotine salts and acids. The aerosol generating liquid may also
15 comprise flavourings such as, e.g., tobacco, menthol or fruit flavour. As best seen in Figures 2 and 3, the liquid store 24 may surround, and coextend with, a vapour outlet channel 26. The vapour outlet channel 26 has an outlet 28 at a mouth end 30 of the aerosol generating device 10 through which an inhalable aerosol is delivered to a user.

The vaporizer unit 14 includes a wicking element 32 and a heater 34 in the form of a
20 resistive heating coil 36 that is wound helically around the outside of the wicking element 32. Together, the wicking element 32 and the resistive heating coil 36 form a coil-and-wick heater 34 that is located in a vaporization chamber 38 of the vaporizer unit 14. The wicking element 32 is configured to convey aerosol generating liquid from the liquid store 24 to the heating coil 36 so that the conveyed aerosol generating liquid
25 can be heated and vaporized when an electric current from the power source 18 is passed through the resistive heating coil 36. The coil-and-wick may also be replaced by another type of heater such as a ceramic heater, for example, as described in EP 3516972 A1.

30 The vaporizer unit 14 includes at least one conduit 42 having a liquid inlet 44 which is aligned with at least one corresponding liquid outlet 62 of the cartridge 16 when the cartridge 16 is coupled to the vaporizer unit 14. The liquid outlet 62 may be closed by

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a sealing foil or other suitable closure in some embodiments, the sealing foil or closure being removable by a user before the cartridge 16 is coupled to the vaporizer unit 14.

The vaporizer unit 14 includes a pair of resilient valves 40 for controlling the supply of aerosol generating liquid from the liquid store 24 to the heater 34. In some
5 embodiments, a single resilient valve 40 can be used although a pair of valves 40 advantageously allows the supply of aerosol generating liquid to be controlled to opposite ends of the wicking element 32 and, hence, to the heater 34. Each resilient valve 40 is configured to control the supply of aerosol generating liquid from the liquid
10 store 24 to the heater 34 by selectively blocking the flow of aerosol generating liquid from the liquid store 24 to the heater 34. As will be explained in further detail below, each resilient valve 40 is configured to move from a closed position shown in Figure 2 towards an open position shown in Figure 3 as the cartridge 16 is coupled (i.e., connected) to the vaporizer unit 14.

15 Each resilient valve 40 includes a ball 46 (or plunger) positioned in a chamber 48 formed in the vaporizer unit 14. The ball 46 is biased to a closed position shown in Figure 2 by a biasing member 54 such as a compression spring. The chamber 48 is suitably shaped, or a stop member can be provided, to prevent the ball 46 from being
20 ejected from an opening 50 of the chamber 48 by the biasing member 54. The stop member may be, for instance, a reduced section of the entry of the chamber 48. When the ball 46 is biased to the closed position, it blocks the liquid inlet 44 of the conduit 42. In some examples, the vaporizer unit 14 can include a sealing member 52, possibly positioned at the opening 50 of the chamber 48 or at the inlet of a short conduit leading
25 to the chamber, which is configured to seal the coupling between the cartridge 16 and the vaporizer unit 14. When the ball 46 is biased to the closed position shown in Figure 2 by the biasing member 54, the ball 46 contacts the sealing member 52 and applies a sealing pressure against it. This ensures tightness of the closure of the vaporizer unit 14 in absence of the cartridge 16 and so prevents ingress of dirt as well as leakage of
30 condensate from the unit.

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The cartridge 16 includes a pair of pressing elements 56 which are configured to cooperate with the resilient valves 40 during coupling of the cartridge 16 to the vaporizer unit 14 to move the resilient valves 40 from the closed position shown in Figure 2 towards the open position shown in Figure 3. Each pressing element 56
5 comprises a, preferably hollow, projecting element 58 that projects from an end face 60 of the cartridge 16 and urges the ball 46 from the closed position shown in Figure 2 towards the open position shown in Figure 3, thereby compressing the biasing member 54. Each projecting element 58 includes a liquid outlet 62 that is configured to convey aerosol generating liquid from the liquid store 16 to the heater 34. As noted above, the
10 liquid outlet 62 of each projecting element 58 is aligned with a corresponding liquid inlet 44 of the conduit 42 when the cartridge 16 is coupled to the vaporizer unit 14 to allow aerosol generating liquid to flow to the heater 34 via the conduit 42 and wicking element 32. As can be seen in Figure 3, when the ball 46 is moved to the open position by the corresponding projecting element 58, the liquid communication between the
15 opening 50 of the chamber 48 and the liquid inlet 44 of the conduit 42 is established and the flow of aerosol generating liquid is unobstructed by either the ball 46 or the biasing member 54, ensuring that aerosol generating liquid can flow reliably to the heater 34.

20 When the cartridge 16 is uncoupled from the vaporizer unit 14, the force applied by the projecting element 58 to the corresponding ball 46 is removed, thereby allowing each ball 46 to be urged by the corresponding biasing member 54 to the closed position shown in Figure 2 until a replacement cartridge 16 is coupled to the vaporizer unit 14.

25 The coupling of the cartridge 16 with the vaporizer unit 14 may be provided by a coupling element of the cartridge 16 complementarily fitting with a coupling element of the vaporizer unit 14. The coupling elements may be one of: a threaded connection, a bayonet connection, a magnetic connection, a snap-fit connection, an actuatable latch and combinations thereof. As a result of the coupling operation of the coupling
30 elements, the cartridge 16 becomes positioned in a fixed position relative to the vaporizer unit 14 in which the resilient valve 40 is positioned in the open position.

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Although exemplary embodiments have been described in the preceding paragraphs, it should be understood that various modifications may be made to those embodiments without departing from the scope of the appended claims. Thus, the breadth and scope of the claims should not be limited to the above-described exemplary embodiments.

5

Any combination of the above-described features in all possible variations thereof is encompassed by the present disclosure unless otherwise indicated herein or otherwise clearly contradicted by context.

10 Unless the context clearly requires otherwise, throughout the description and the claims, the words “comprise”, “comprising”, and the like, are to be construed in an inclusive as opposed to an exclusive or exhaustive sense; that is to say, in the sense of “including, but not limited to”.

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Claims

1. An aerosol generating device (10) comprising:
a vaporizer unit (14) including a heater (34) for heating and vaporizing an aerosol generating liquid;
5 a cartridge (16) including a liquid store (24) for containing an aerosol generating liquid, the cartridge (16) being removably couplable to the vaporizer unit (14);
wherein the vaporizer unit (14) includes a resilient valve (40) for selectively blocking the flow of aerosol generating liquid from the liquid store (24) to the heater (34) and the resilient valve (40) is configured to move from a closed position towards
10 an open position as the cartridge (16) is coupled to the vaporizer unit (14).
2. An aerosol generating device according to claim 1, wherein the cartridge (16) includes a pressing element (56) configured to cooperate with the resilient valve (40) and thereby move the resilient valve (40) from the closed position towards the open
15 position.
3. An aerosol generating device according to claim 2, wherein the pressing element (56) comprises a projecting element (58).
- 20 4. An aerosol generating device according to claim 3, wherein the projecting element (58) is hollow and arranged to convey aerosol generating liquid from the liquid store (24) to the heater (34) when the resilient valve (40) is in the open position.
5. An aerosol generating device according to any preceding claim, wherein the
25 resilient valve (40) comprises a ball (46) or plunger movable from the closed position towards the open position and a biasing member (54) configured to bias the ball (46) or plunger to the closed position, preferably wherein the biasing member (54) is a compression spring.
- 30 6. An aerosol generating device according to any preceding claim, wherein the vaporizer unit (14) includes a conduit (42) having a liquid inlet (44) and a chamber (48) for receiving at least part of the resilient valve (40).

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7. An aerosol generating device according to claims 5 and 6, wherein the ball (46) or plunger is positioned in the chamber (48) and arranged to block the liquid inlet (44) when biased to the closed position by the biasing member (54).

5

8. An aerosol generating device according to any preceding claim, wherein the heater (34) comprises a coil-and-wick heater or a ceramic heater.

9. An aerosol generating device according to any preceding claim, wherein the vaporizer unit (14) further comprises, in addition to the resilient valve (40), a sealing member (52) configured to seal the coupling between the cartridge (16) and the vaporizer unit (14).

10. An aerosol generating device according to claim 9 when dependent on claim 5, wherein the ball (46) or plunger is configured to applying a sealing pressure against the sealing member (52) when the ball (46) or plunger is biased to the closed position by the biasing member (54).

11. An aerosol generating device according to any preceding claim, wherein the cartridge (16) comprises a dedicated coupling element complementarily fitting with a dedicated coupling element of the vaporizer unit (14).

12. An aerosol generating device according to claim 11, wherein the coupling elements comprise one of: a threaded connection, a bayonet-type connection, a magnetic connection, a snap-fit connection, an actuatable latch and combinations thereof.

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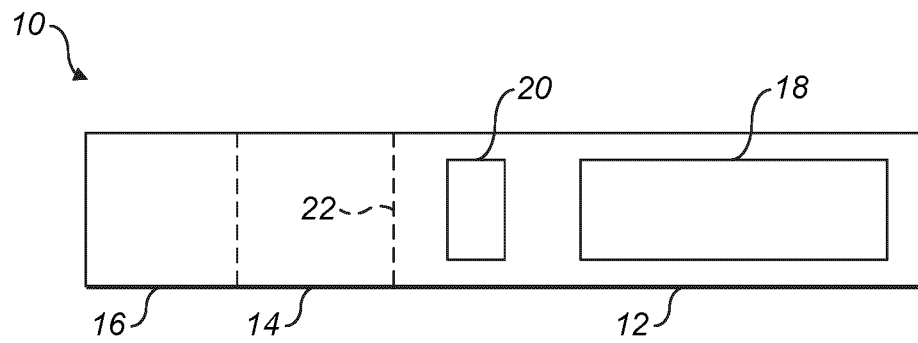


FIG. 1

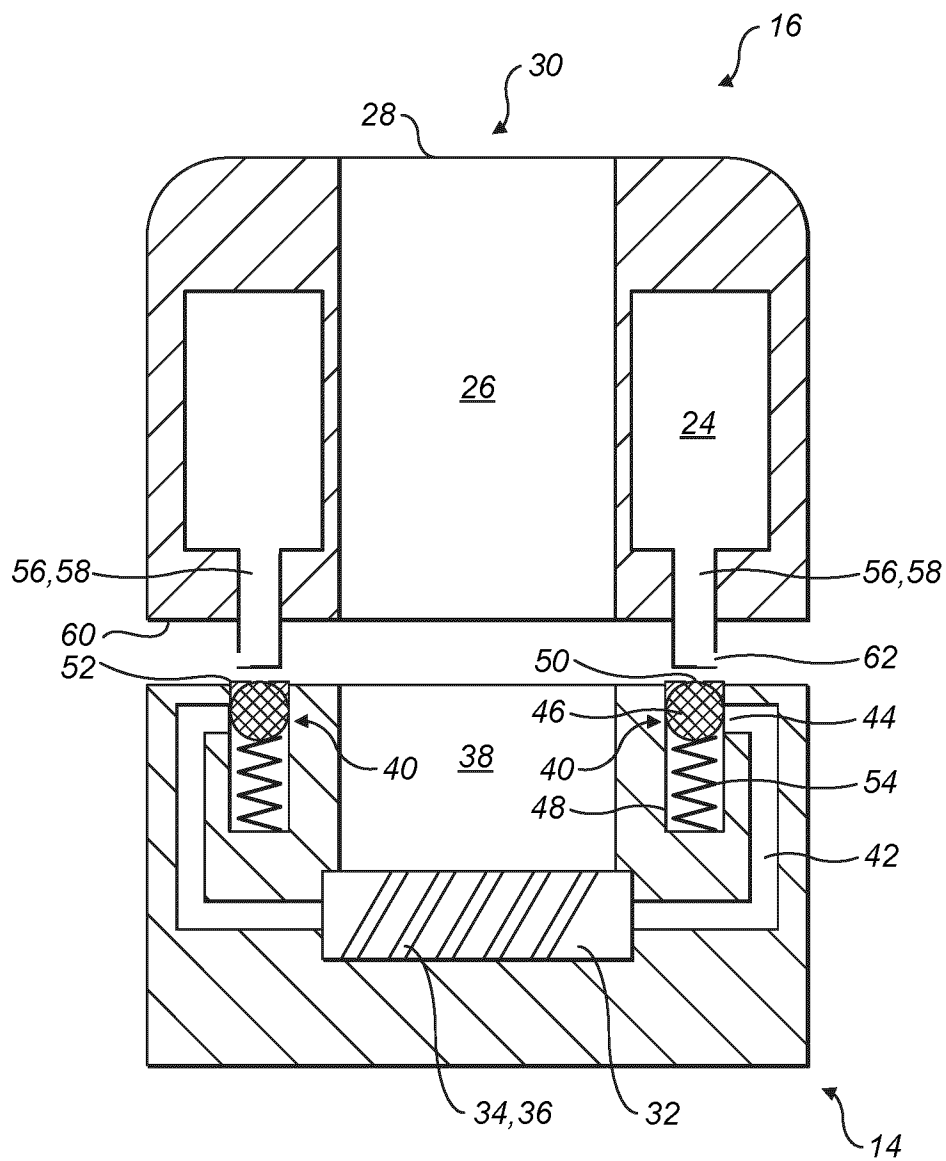


FIG. 2

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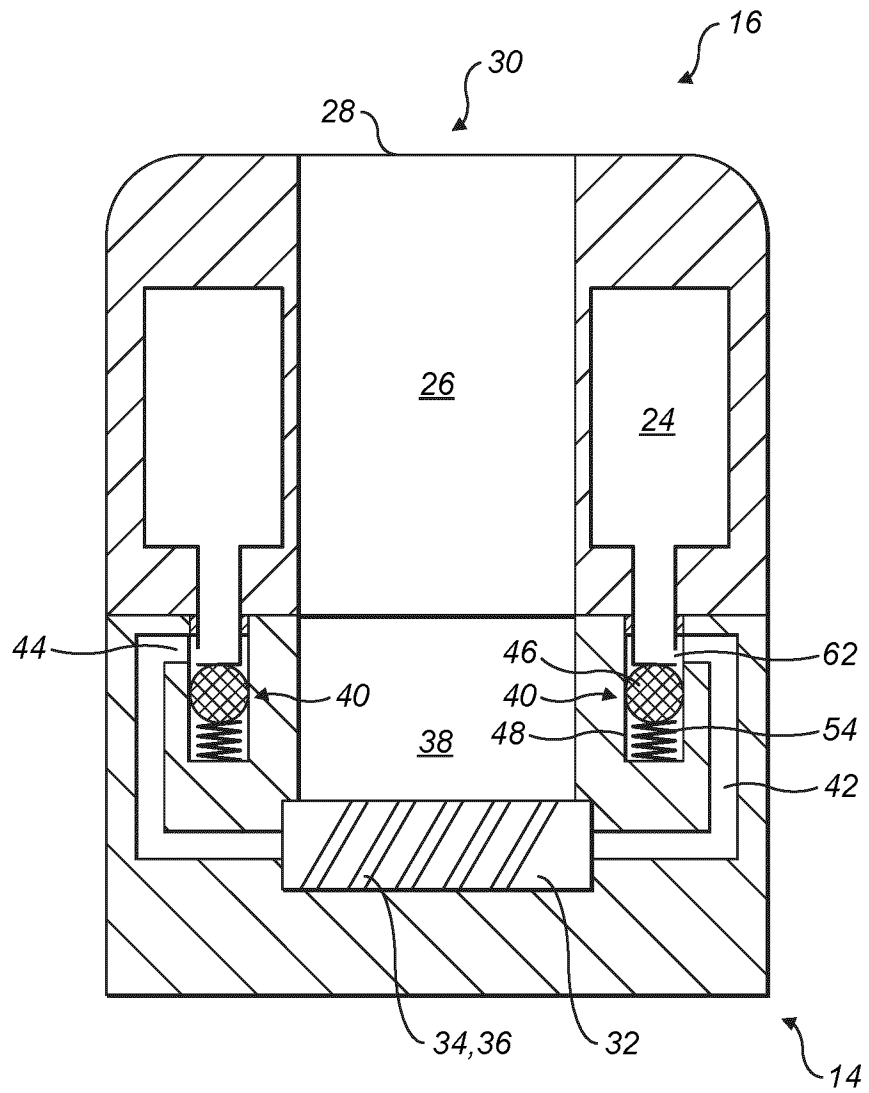


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2022/084389

A. CLASSIFICATION OF SUBJECT MATTER

INV. A24F40/485

ADD. A24F40/10

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)

A24F A61M

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2021/093017 A1 (HAREL YIGAL COHEN [DE]) 1 April 2021 (2021-04-01)	1-3, 5-9, 11, 12
A	paragraph [0018] - paragraph [0019]; figure 2	4, 10

X	US 2021/352964 A1 (KOKADIR SUCIPTO [ID]) 18 November 2021 (2021-11-18)	1-3, 5, 8, 9, 11, 12
A	paragraph [0060] - paragraph [0117]; figures 1, 22, 23	4, 6, 7, 10

A	EP 3 247 232 A1 (OLD NAVIGATORS LTD [CN]) 29 November 2017 (2017-11-29)	1-12
	paragraph [0019] - paragraph [0055]; figure 7	



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

13 March 2023

Date of mailing of the international search report

21/03/2023

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2022/084389

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