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(54) **A VAPOR GENERATING DEVICE AND A METHOD FOR GENERATING VAPOR**

(57) The invention relates to a vapor generating device (10) for generating a vapor from a liquid, wherein said liquid comprises nicotine or a salt thereof, a method for generating vapor and an electronic delivery system for providing nicotine to a user. Vapor generating device (10) comprises a base plate (11) supporting an electric heater (20), said electric heater (20) having an interior space arranged to receive a liquid conveying elongated wick (24), and a plurality of apertures (28) extending from interior space to an exterior surface, said apertures (28) transmitting liquid released from wick (24) to electric heater (20). The invention also relates to a method to use the vapor generating device (10) to inhale nicotine aerosol.

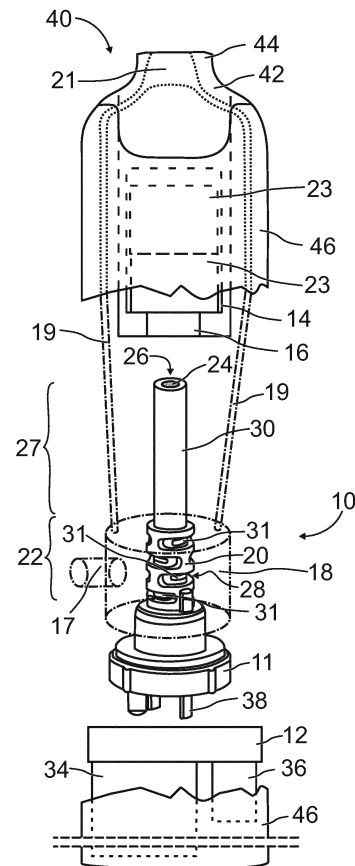


Fig. 2

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Description

FIELD OF INVENTION

[0001] The invention relates to a vapor generating device for generating a vapor from a liquid, wherein said liquid comprises nicotine or a salt thereof, and a method of generating vapor from a liquid. The invention further relates to an electronic delivery system for providing nicotine to a user.

BACKGROUND OF INVENTION

[0002] Electronic nicotine delivery systems (ENDS) emerged in 2003 and have grown to become widely available globally. These systems replace conventional smoking articles that involve the combustion of tobacco or other smokable material. The ENDS generally involve the vaporization and/or aerosolization of nicotine, often by heating a nicotine-containing liquid to mimic conventional smoking without combustion and generating tar and some of the more dangerous byproducts of conventional smoking articles.

[0003] Some inexpensive products, known as e-cigarettes, on the market deliver the nicotine-containing liquid to the heater via a fabric saturated with the liquid and other devices provide a disposable cartridge for the liquid. In some of the products, the liquid saturates a sponge material that helps to transport it to the heater. Other systems incorporate an inexpensive glass fiber bundle wick to transport the liquid from the heater. The wick itself is often integrated with an electric heater. Thus, the liquid, wick and heater are all elements of the disposable cartridge. Although, many e-cigarettes formulations contain nicotine, their use as a means to quit smoking can be inadequate for various reasons, such as: (i) the nicotine concentration in the formulation can be too low, (ii) a considerable amount of nicotine can be lost by not being captured by the body, and (iii) given the visible aerosol they often generate, their use is not discreet and mimics the habit that the user desires to quit.

[0004] Thus, there is a need to develop liquid formulations containing nicotine whose generated aerosol is less visible and is better retained in the oral and respiratory tracts. However, so far there has not been any vapor generating device introduced into the market that aids the smoking addicts to quit smoking that provide specific and controlled doses of nicotine that simulated the delivery from a cigarette.

SUMMARY OF THE INVENTION

[0005] The invention relates to the development of new improved vapor generating device for generating a vapor from a liquid. The vapor generating device is used in an electronic delivery system for generating a vapor from a liquid such as a nicotine solution, wherein said system secures that there will be no leakage of any liquid or vapor

as well as a controlled delivery of the vapor in terms of dosage, which enables the possibility to provide specific and defined doses to a human in need to quit smoking. The system shows a consistency in relation to providing the same dosages over time up to at least 400 dosages.

[0006] In accordance with the invention liquid received in a wick or similar liquid carrying device is vaporized by an electric heater enclosing at least a heater section of said wick. The wick can be self-contained or supported by a tube-like element. In the delivery system, the vapor generating device is arranged in the vicinity of a cartridge supporting a liquid container, so as to allow the wick or similar liquid carrying device to transport liquid from the container to the heater section of the wick. The heater is connected to an energy or power source and a control unit that will activate the heater at certain conditions. In various embodiments, the heater is mounted on or supported by a base plate. Any required electric wirings extend from the heater through base plate to control unit and power supply.

[0007] The electric heater is provided with a plurality of apertures or through holes through which liquid may pass from the wick and be vaporized when the heater is activated. An open volume at the heater forms a vaporizing chamber. In various embodiments, the wick is elongated and has an extension section extending outside the heater. Vapor generating device is enclosed in a housing together with a power supply and a control unit.

[0008] In the delivery system, there is also a mouth piece and at least one channel or outlet conduit extending from the mouth piece to the vaporizing chamber. When a user inhales through the mouth piece vaporized liquid present in the vaporizing chamber will be drawn through the at least one duct or outlet conduit to the mouth piece and to the user. The mouth piece is inserted into the housing. The housing is provided with at least one air inlet connecting vaporizing chamber with the exterior of housing.

[0009] Finally, the invention relates to a method of using the system or method as defined above or below for the treatment of a human being a smoking addict, i.e., aid in quitting smoking.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Figure 1: is a schematic perspective view showing one embodiment of an electronic delivery system comprising a vapor generating device in accordance with the invention.

Figure 2: is a schematic perspective view showing a first embodiment of a vapor generating device in accordance with the invention schematically shown in a system between a mouth piece and a bottom section of a housing.

Figure 3: is a schematic perspective view showing a second embodiment of a vapor generating device

in accordance with the invention.

Figure 4: is a schematic perspective view showing a third embodiment of a vapor generating device in accordance with the invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0011] It is to be so noted, however, that the appended drawings illustrate only typical embodiments of the invention and, therefore, are not to be considered limiting of its scope, for the invention may admit to other equally effective embodiments. The embodiment of an electronic delivery system 40 shown in Figure 1 comprises a vapor generating device 10 in accordance with the invention. Vapor generating device 10 is enclosed in a housing 46. A disposable cartridge 42 with a mouthpiece 44 is attached to and partly inserted into housing 46. Vapor generating device 10 is completely enclosed within housing 46 and is shown schematically only. At least one air inlet 17 is provided and extends into an interior space within housing 46. In a first aspect, as shown in Figure 2 to Figure 4, the invention relates to a vapor generating device 10 for generating a vapor from a liquid, wherein said liquid comprises nicotine or a salt thereof. The liquid is contained in a reservoir 14 supported inside said disposable cartridge 42. The embodiments of a vapor generating device 10 shown in Figure 2 and Figure 3 comprise a base plate 11 and an elongated wick or similar liquid carrying element extending from base plate 11 inside a tube 30. Tube 30 is hollow with an interior void formed as a central bore 26 in which a wick 24 is received.

[0012] An electric heater 20 encloses a heater section 22 of the wick 24 and the tube 30. Electric heater 20 and housing 46 cooperate to form a vaporization chamber 18 schematically shown in Figure 2. When cartridge 42 with mouthpiece 44 is attached to and inserted in housing 46 an airflow from said at least one air inlet 17 through vaporization chamber 18, outlet conduits 19 and an outlet 21 of mouthpiece 44 is provided to permit a user to inhale nicotine aerosol formed therein. Electric heater 20 is formed with an interior opening arranged to receive tube 30. A plurality of apertures 28 extends radially from the interior opening to the exterior of the electric heater 20. In various embodiments tube 30 is rigid. Tube 30 is elongated and will enter reservoir 14 through a port 16 when cartridge 42 is inserted into housing 46. Port 16 ensures that there is no leaking of fluid from reservoir 14. At least one sponge 23 is provided inside reservoir 14. Sponge 23 is soaked with liquid. In various embodiments, electric heater 20 comprises an electrically resistive material embedded within a heat diffusing material. Rigid tube 20 comprises a material that allows to be heated by electric heater 20 to above 120 °C. In various embodiments material of heater 20 withstands temperatures in interval 120 °C to 200 °C. Specifically, material of heater 20 withstands temperatures such as at least 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240 or 250 °C. There-

by the rigid tube becomes heated and the liquid present within the openings of the rigid tube 20 becomes heated and vaporize. The vapor moves away towards the mouth piece and into the human being. A suitable plastic material can be used for the rigid tube. Examples of different plastics suitable for the tube are selected from the group consisting of polyether ether ketone (PEEK), polyphenylene sulfide (PPS), polysulphone (PSU) and polyetherimide (PEI). Base plate 11 isolates electric heater 20 from other thermally sensitive components of electronic delivery system 40. Base plate 11 forms a part of a wall section 12 separating electric heater 20 from other components enclosed within housing 46.

[0013] Rigid tube 20 is formed with at least one opening 31, extending from central bore 26 to the exterior of rigid tube 20. Normally, a plurality of spaced apart openings 31, 32 is provided. In various embodiments, elongated openings 31 are provided and in other embodiments circular openings 32, as shown in Figure 3, are provided. Other shapes of openings can be used. It is also possible to combine differently shaped openings in rigid tube 20.

[0014] In the embodiment of vapor generating device 10 shown in Figure 4, no tube 24 is used. Instead, an elongated self-contained wick 25 intimately contacts electric heater 20. Elongated self-contained wick 25 is sufficiently rigid and robust to resist damage and significant distortion while moving axially with respect to port 16 of disposable cartridge 42. Electric heater 20 is formed with an interior opening arranged to receive elongated self-contained wick 25, and a plurality of apertures 28 extending from interior space to an exterior surface. Spaced apart openings 31, 32 are facing or opening into apertures 28. Liquid received from reservoir 14 in wick 24, 25 will be transmitted through apertures 28 and will be heated by electric heater 20 and be vaporized.

[0015] Wick 24 and elongated self-contained wick 25 comprise an extension section 27. Extension section 27 has a length sufficient to penetrate through port 16 into reservoir 14 when cartridge 42 is attached to housing 46 to transport liquid to heater section 22. In various embodiments wick 24 and elongated self-contained wick 25 are fixedly mounted within interior opening of electric heater 20. In a second aspect the invention relates to a method of generating a vapor from a liquid. Liquid is transported through wick 24, 25 to heater section 22 where liquid exits through apertures 28. Electric heater 20 is activated by control unit 36 and heated by power from power supply 34 to a temperature over boiling point of the liquid used to start vaporization of liquid in vaporization chamber 18. When the user inhales from outlet 21 nicotine aerosol formed in vaporization chamber 18 will flow from vaporization chamber 18 and through outlet conduits 19 to outlet 21. After a suitable predetermined period of time control unit 36 stops power supply from providing energy to electric heater and the vaporization stops. However, the system is calibrated to give a predetermined dose of the active ingredient, such as nicotine or a salt thereof every time the power source is activated.

In various embodiments said predetermined period of time starts when a pressure transducer senses a change of pressure caused by inhalation in mouthpiece by a user. Said pressure transducer can be arranged in the vicinity of air inlet 17.

[0016] The liquid in the cartridge may be a liquid such as those disclosed in the PCT application WO 2015/177177, comprising Propylene glycol, water and nicotine or a salt thereof. Such a liquid having suitable properties, which makes the liquid vaporizes when the electric heater become active and heats up the liquid, suitable to be used in the second system as disclosed herein.

[0017] In a further embodiment the invention relates to a system for generating a vapor from a liquid, wherein said liquid comprises nicotine or a salt thereof. The method comprises the steps of

[0018] Providing a system (10) comprising at least a power supply (34), an electric heater (20), energy source (20), a plastic tube (30) with openings (31 or 32) and a wick (24) being placed within the plastic tube (30). The system has at least one air inlet and provides a receptacle for a disposable cartridge (42) proximate the electric heater (20), the wick (24) and the plastic tube (30).

[0019] Attaching cartridge (42) comprising liquid reservoir (14) containing a liquid comprising nicotine or a salt thereof and having a mouth piece (44) located in one end, the cartridge (42) being attached to the system so that the wick (24) extends from the system into liquid reservoir (14) of the cartridge to enable transfer of liquid from the cartridge into the system.

[0020] Allowing the liquid to be transferred from the cartridge via the wick to the openings (31 or 32) present on the elongated plastic tube (30),

[0021] Activating the electric heater (20) that heats the elongated plastic tube (30) and the liquid present within the openings (31 and/or 32) arranged in the plastic tube (30) vapor away from the openings towards the mouth piece present on the cartridge.

[0022] The following numbered embodiments form part of the description:

1. A vapor generating device (10) for generating a vapor from a liquid, wherein said liquid comprises nicotine or a salt thereof, comprising
 - a base plate (11) supporting an electric heater (20), said electric heater (20) having an interior space arranged to receive a liquid conveying elongated wick (24; 25), and a plurality of apertures (28) extending from interior space to an exterior surface, said apertures (28) transmitting liquid released from wick (24) to electric heater (20).
 2. A vapor generating device (10) in accordance with embodiment 1, also comprising a power supply (34) operatively connected to electric heater (20) and to a control unit (36).
 3. A vapor generating device (10) in accordance with embodiment 1, wherein electric heater (20) compris-

es an electrically resistive material contained within a heat diffusing material.

4. A vapor generating device (10) in accordance with embodiment 1, wherein said liquid conveying elongated wick (24) is enclosed in a plastic tube (30), said plastic tube (30) being received in the interior space of electric heater (20) and having at least one opening (31; 32) facing one of said apertures (28),

5. A vapor generating device (10) in accordance with embodiment 1, wherein wick (24; 25) is porous.

6. A vapor generating device (10) in accordance with embodiment 4, wherein said at least one opening (31) is circular with a diameter of 1 mm.

7. A vapor generating device (10) in accordance with embodiment 4, wherein said at least one opening (31; 32) has an area between 0.7 mm² and 1 mm².

8. A vapor generating device (10) in accordance with embodiment 1, wherein wick (24; 25) is self-contained.

9. A vapor generating device (10) in accordance with embodiment 8, wherein wick (24; 25) is porous.

10. A vapor generating device (10) in accordance with embodiment 1, wherein at least one electric connector (38) engaging electric heater (20) extend through base plate (11).

11. A vapor generating device (10) in accordance with embodiment 2, wherein control unit (36) is arranged to activate electric heater (20) during a predetermined time period.

12. A method of generating vapor from a liquid comprising nicotine or a salt thereof comprising:

- obtaining liquid through a wick (24; 25),
- transmitting liquid to an electric heater (20) enclosing a heater section (22) of said wick (24; 25),
- vaporizing liquid in a vaporizing chamber (18) by heating electric heater (20) to a temperature of over 150 °C during a predetermined time period,
- supplying air to said vaporizing chamber (18), and
- directing a nicotine aerosol formed in said vaporizing chamber (18) to a mouthpiece (44) for inhalation by a user.

13. An electronic delivery system (40) for providing nicotine to a user, comprising

- a cartridge (42) with a mouthpiece (44) and a liquid reservoir (14) containing a liquid comprising nicotine or a salt thereof,
- a housing (46) enclosing a power supply (34) and a control unit (36) and being arranged to receive said cartridge (42) with mouthpiece (44),
- an electric heater (20) electrically connected to power supply (34),
- an elongated wick (24; 25) received in electric heater (20) and having an extension section (27) extending

from electric heater (20) into liquid reservoir (14) when cartridge (42) with a is received in housing (46), a vaporization chamber (18) formed by a space between electric heater (20) and housing (46), at least one air inlet (17) to said vaporization chamber (18), and at least one outlet conduit (19) extending from vaporization chamber (18) to an outlet (21) of mouthpiece (44), wherein control unit (36) is arranged to activate electric heater (20) during a predetermined time period for vaporizing liquid being in contact with electric heater (20).

Claims

1. A vapor generating device (10) for generating a vapor from a liquid, wherein said liquid comprises nicotine or a salt thereof, comprising a base plate (11) supporting an electric heater (20), said electric heater (20) having an interior space arranged to receive a liquid conveying elongated wick (24; 25), and a plurality of apertures (28) extending from interior space to an exterior surface, said apertures (28) transmitting liquid released from wick (24) to electric heater (20).
2. A vapor generating device (10) in accordance with claim 1, also comprising a power supply (34) operatively connected to electric heater (20) and to a control unit (36).
3. A vapor generating device (10) in accordance with claim 1, wherein electric heater (20) comprises an electrically resistive material contained within a heat diffusing material.
4. A vapor generating device (10) in accordance with claim 1, wherein said liquid conveying elongated wick (24) is enclosed in a plastic tube (30), said plastic tube (30) being received in the interior space of electric heater (20) and having at least one opening (31; 32) facing one of said apertures (28),
5. A vapor generating device (10) in accordance with claim 1, wherein wick (24; 25) is porous.
6. A vapor generating device (10) in accordance with claim 4, wherein said at least one opening (31) is circular with a diameter of 1 mm.
7. A vapor generating device (10) in accordance with claim 4, wherein said at least one opening (31; 32) has an area between 0.7 mm² and 1 mm².
8. A vapor generating device (10) in accordance with claim 1, wherein wick (24; 25) is self-contained.
9. A vapor generating device (10) in accordance with claim 8, wherein wick (24; 25) is porous.
10. A vapor generating device (10) in accordance with claim 1, wherein at least one electric connector (38) engaging electric heater (20) extend through base plate (11).
11. A vapor generating device (10) in accordance with claim 2, wherein control unit (36) is arranged to activate electric heater (20) during a predetermined time period.
12. A method of generating vapor from a liquid comprising nicotine or a salt thereof comprising:
 - obtaining liquid through a wick (24; 25), transmitting liquid to an electric heater (20) enclosing a heater section (22) of said wick (24; 25), vaporizing liquid in a vaporizing chamber (18) by heating electric heater (20) to a temperature of over 150 °C during a predetermined time period, supplying air to said vaporizing chamber (18), and directing a nicotine aerosol formed in said vaporizing chamber (18) to a mouthpiece (44) for inhalation by a user.
13. An electronic delivery system (40) for providing nicotine to a user, comprising a cartridge (42) with a mouthpiece (44) and a liquid reservoir (14) containing a liquid comprising nicotine or a salt thereof, a housing (46) enclosing a power supply (34) and a control unit (36) and being arranged to receive said cartridge (42) with mouthpiece (44), an electric heater (20) electrically connected to power supply (34), an elongated wick (24; 25) received in electric heater (20) and having an extension section (27) extending from electric heater (20) into liquid reservoir (14) when cartridge (42) with a is received in housing (46), a vaporization chamber (18) formed by a space between electric heater (20) and housing (46), at least one air inlet (17) to said vaporization chamber (18), and at least one outlet conduit (19) extending from vaporization chamber (18) to an outlet (21) of mouthpiece (44), wherein control unit (36) is arranged to activate electric heater (20) during a predetermined time period for vaporizing liquid being in contact with electric heater (20).

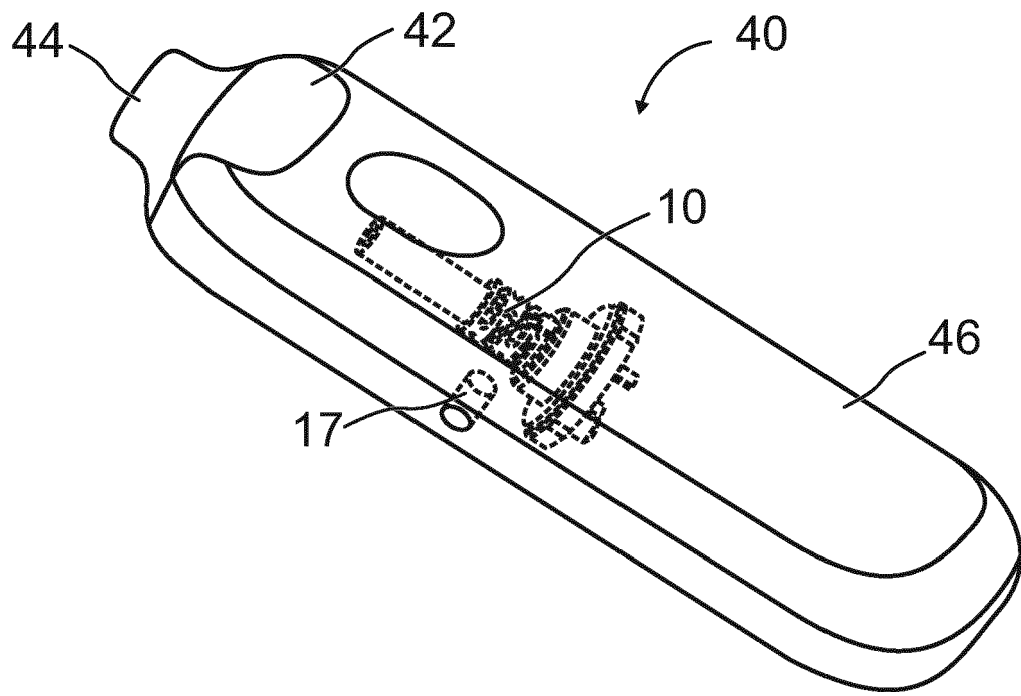


Fig. 1

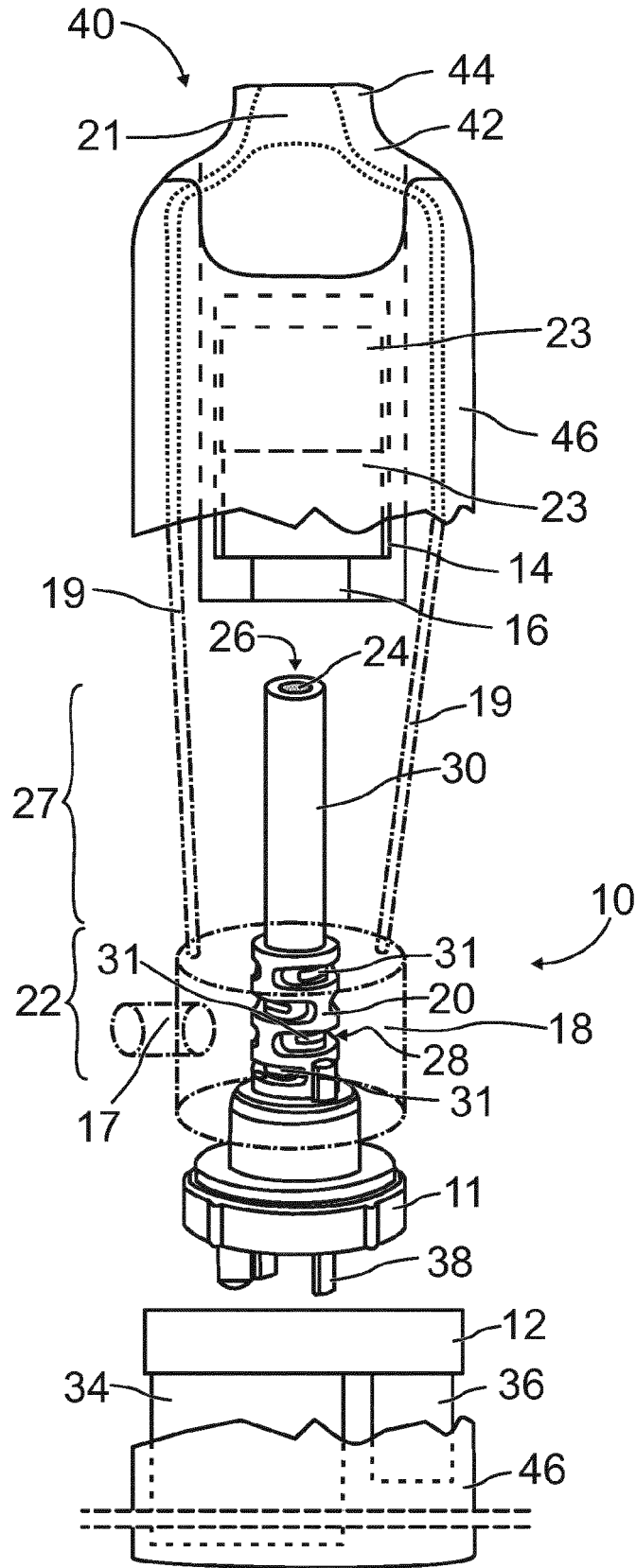


Fig. 2

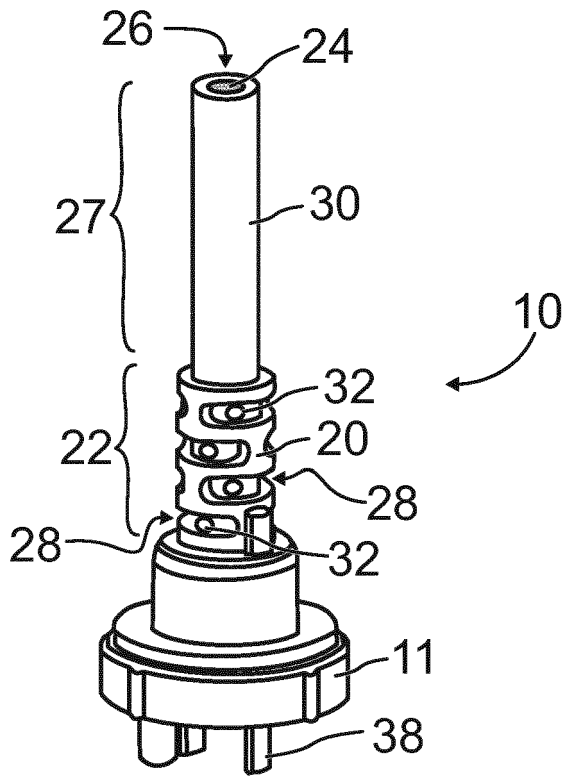


Fig. 3

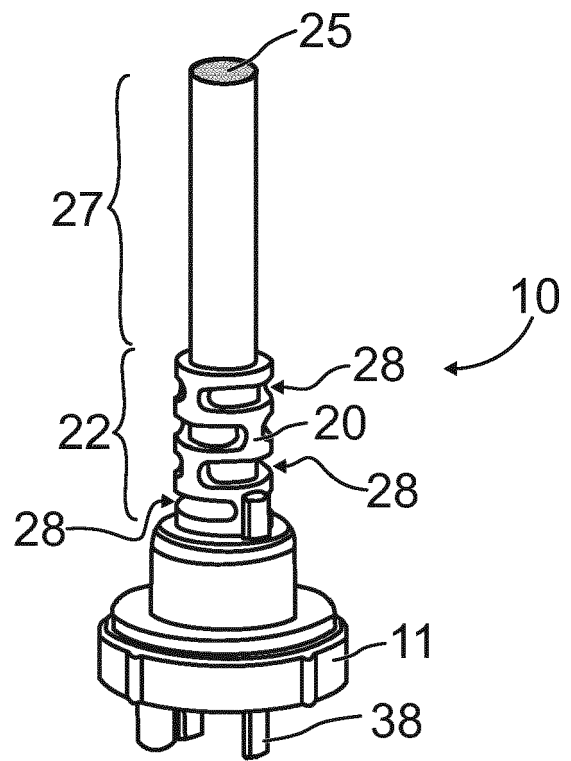


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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