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(54) Title: ASSEMBLY OF CARTRIDGE AND FLAT HEAT ELEMENT FOR MICROVAPORIZER

(57) Abstract: A microvaporizer (10) including a cartridge (14), a flat plate heater (16) and a base (12). The cartridge (14) includes a mouth piece (40) configured to deliver an aerosol to the user's airways. The cartridge (14) also includes a hollow main body (42) with a recessed wall (60) to receive the flat plate heater (16).

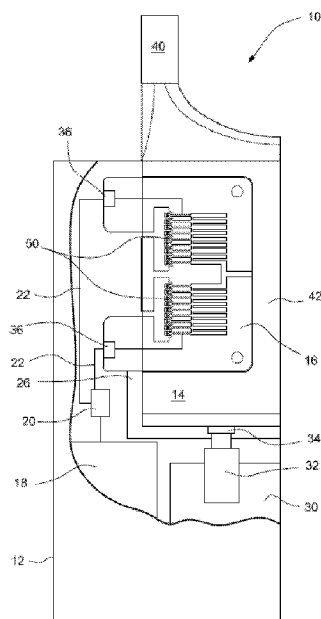


FIG.1



assembly of cartridge and flat heat element for microvaporizer

Technical Field

[0001] The invention relates to microvaporizers, e.g., vaping devices, and particularly relates to fluid containers and heaters for microvaporizers.

Background Art

[0002] Microvaporizers (also referred to as vaping devices) are often used to dispense one or more active substances using the vaporized material. In atmospheric dispensers the substances may include materials such as deodorizing fragrance, medicine, nicotine, and insect repellent. In the case of personal vaporizers the active substances typically include a flavor and/or nicotine. The flavor and nicotine strength can be dialed up or down so as to mimic a traditional smoking experience. In general the vaporized material is the sole source of active substances in the microvaporizer.

[0003] Heaters in microvaporizers typically include a coiled heating wire wrapped around a wick or other fluid conduit that draws a liquid infused with chemicals (such as nicotine) from a reservoir. The coiled heating wire heats the liquid in the wick or received from the conduit. The liquid is vaporized by the heating. The vapor flows from the heating wire through a mouthpiece and to the user.

Summary of Invention

Technical Problem

[0004] The heating wire, devices to hold the wick, fluid passages from the reservoir and to the wick are typically complex in a conventional microvaporizer. The connections between the heating wire, wick and reservoir tend to require complex fittings and other connection related devices. These fittings and devices are often complex and costly to manufacture, and may be difficult to use.

[0005] There is a long felt need for a simple and easy to assemble heater, wick or related fluid conduit, and fluid reservoir.

Solution to Problem

Technical Solution

[0006] The inventors conceived of an assembly including a flat heater and cartridge which may be assembled together and then mounted in a base unit, which may be a handheld device. The cartridge may include a pathway for aerosol to reach the user, with an interface to connect to a device or mouthpiece. The cartridge may also include an internal fluid reservoir and a flat sided mount to receive the flat heater.

[0007] The mount may be a recess in the side of the cartridge having a flat bottom and

configured to receive and hold the flat heater. An inlet port on the flat bottom may allow liquid from the internal reservoir in the cartridge to flow into fluid passages in the flat heater. A pump in the internal reservoir may pump liquid from the reservoir into the flat heater and towards heating elements in the heater.

- [0008] An outer flat surface of the flat heater may be flush, e.g., in the same plane as, the side of the cartridge with the recess. The outer flat surface of the heater has an outlet, adjacent the heating elements, to allow vapor, e.g., an aerosol, generated by heating liquid flowing through the heater to flow from the cartridge and heater into a mouthpiece of the microvaporizer.
- [0009] The cartridge and flat heater may be simple structures which may be manufactured at a low cost as compared to conventional liquid delivery systems in microvaporizers.
- [0010] The cartridge may include a mouth piece configured to deliver an aerosol to the user's airways and a hollow main body with a recessed wall. The cartridge may also include a flat heater mounted to the recessed wall of the hollow main body.
- [0011] The recessed wall may include two openings configured to fluidly connect to the fluid passages in the heater. At least one of the two openings may include a seal, and the seal may be an O-ring. One of the openings may be configured to fluidly connect to an inlet of the heater, and the other one of the openings may be configured to fluidly connect to an outlet of the heater.
- [0012] The recessed wall may further include a mounting structure configured to engage the heater to align the heater within a recess in the hollow main body. The mounting structure may include a pair of protrusions configured to engage a respective pair of openings in the heater.
- [0013] Another aspect of the technology may include a microvaporizer device configured to deliver an aerosol to a user's airways. The microvaporizer device may include a power supply and the cartridge described above.
- [0014] Yet another aspect of the technology may include a cartridge configured to be mounted to a microvaporizer device. The cartridge may include a mouth piece configured to deliver an aerosol to the user's airways. The cartridge may also include a hollow main body with a recess and a storage tank configured to retain a chemically infused liquid. The storage tank may be contained inside the hollow main body. The cartridge may also include a flat heater removably mounted to a recessed wall in the recess of the hollow main body. The flat heater may be a unitary component configured so that positioning the heater in the recess fluidly connects the heater to the storage tank and the mouth piece.
- [0015] The flat heater may be configured so that an outer surface of the heater is flush with an outer surface of the cartridge when the heater is positioned in the recess.
- [0016] The heater may be configured to be retained in the recess by friction.

- [0017] The cartridge may further include a pump configured to pump liquid in and out of the storage tank. In addition, the pump may be configured to pump liquid in and out of the heater.
- [0018] The cartridge may further comprising a screw valve. In addition, the screw valve may include opposing gears.
- [0019] Yet another aspect of the technology may include a microvaporizer device configured to deliver an aerosol to a user's airways. The microvaporizer device may include a power supply and the cartridge described above.
- [0020] Yet another aspect of the technology may include a cartridge configured to be mounted to a microvaporizer device. The cartridge may include a mouth piece configured to deliver an aerosol to the user's airways and a hollow main body with a recessed planar wall that comprises a supply port and a discharge port. The cartridge may also include a flat heater removably mounted to the recessed wall. The flat heater may be configured so that an inlet of the flat heater aligns with the supply port and an outlet of the flat heater aligns with the discharge port when the flat heater is secured against the recessed planar wall.
- [0021] The flat heater may be configured to be secured against the recessed planar wall by snapping the heater in place
- [0022] The cartridge may further include a storage tank configured to retain a chemically infused liquid. The storage tank may be contained inside the hollow main body and being fluidly connected to the supply port.
- [0023] Yet another aspect of the technology may include a microvaporizer device configured to deliver an aerosol to a user's airways. The microvaporizer device may include a power supply and the cartridge described above.

Advantageous Effects of Invention

Brief Description of Drawings

Description of Drawings

- [0024] Fig. 1 shows an exemplary microvaporizer including a base, cartridge and heater, with a portion of a sidewall of the base removed to show the cartridge and heater.
- [0025] Fig. 2 is a perspective view of the cartridge and heater shown in Fig. 1.
- [0026] Fig. 3 is another perspective view of the cartridge and heater shown in Fig. 1.
- [0027] Fig. 4 is an exploded view of the cartridge and heater shown in Fig. 1.
- [0028] Fig. 5 is a perspective view of the hollow main body of the cartridge.
- [0029] Fig. 6 is another perspective view of the hollow main body of the cartridge.
- [0030] Fig. 7 is another perspective view of the hollow main body of the cartridge.
- [0031] Fig. 8 is a schematic diagram of the cartridge of Fig. 1.
- [0032] Fig. 9 is a schematic diagram of an alternate cartridge.

Mode for the Invention

Mode for Invention

- [0033] Fig. 1 shows microvaporizer 10 for generating an aerosol for inhalation by a user. The microvaporizer 10 may be configured as a vaping device for delivery of a nicotine vapor to the mouth of a user. The microvaporizer 10 may also be configured to deliver a medicinal vapor, such as an aerosol infused with asthma drugs, to the mouth of a user. Moreover, the microvaporizer may be configured for use to deliver other types of vapor (aerosols) to a user.
- [0034] The microvaporizer 10 may include a base 12, a cartridge 14 and a flat panel heater 16. The base 12 may be a hollow handheld device. The outer surfaces of the base 12 may be shaped to be easily held in one hand and carried in a user's pocket or purse.
- [0035] The base 12 may house a battery 18, electronic circuits 20 and electrical conductors 22 connecting the battery 18, electronic circuits 20 and the flat panel heater 16. The electronic circuits 20 may control delivery of electrical power from the battery 18 to resistive heating elements 24, e.g, conductive loops, in the flat panel heater 16.
- [0036] The base 12 may also house a secondary reservoir 26 which may provide fluid to the cartridge 14. The secondary reservoir 26 may be internal to the base 12 and may be behind a mount (not shown) for the cartridge 14. The secondary reservoir 26 may be optional. It is contemplated that the secondary reservoir 26 may be in addition to a primary reservoir 28 in the cartridge 14 if the primary reservoir 28, e.g, fluid conduit, is too small to store enough fluid to generate vapor for an extended period, such as several days. It is further contemplated that the primary reservoir 28 may be omitted and the secondary reservoir 26 in the base 12 may be the only reservoir in the microvaporizer 10.
- [0037] The base 12 may also include a motor 30 to drive a drive shaft 32 of a pump 34 in the cartridge 14. The pump 34 may pump fluid from the cartridge 14 into and through the flat panel heater 16 and/or pump fluid from the secondary reservoir 26 into the primary reservoir 28. It is contemplated that the pump 34 may pump fluid from the secondary reservoir 26 into the primary reservoir 28 once a certain period of time, e.g., 20 to 120 seconds, has elapsed since the last inhaling action by the user. It is contemplated that the pump 34 may pump unused fluid from the flat panel heater 16 into the primary reservoir 28 and/or the secondary reservoir 26.
- [0038] The cartridge 14 may be mounted in or on the base 12. The base 12 may have a slot to receive the cartridge 14 or may have a sidewall with a recess to receive and hold the cartridge 14. The cartridge 14 may be permanently attached to the base 12 or may be removable from the base 12.
- [0039] Electrical connectors 36 that receive tabs 38 on the flat panel heater 16 may be

internal to the housing of the base 12. The electrical connectors 36 may provide a conductive coupling between the electrical conductors 36 internal to the base 12 and the resistive heating elements 24 of the flat panel heater 16.

[0040] As illustrated in Figs. 1 to 4, the cartridge 14 may include a user interface (e.g., a mouthpiece) 40 for delivering the aerosol directly to the user's airways. The user interface 40 may be permanently attached to the cartridge 14 or may be removable from the cartridge 14. The cartridge 14 may also have a universal connection so that more than one size or type of user interface 40 may be attached to the cartridge 14.

[0041] The cartridge 14 may also include a hollow main body 42 which houses the primary reservoir 28, at least a part of the pump 34 and a mounting structure 44 to receive the flat panel heater 16. The primary reservoir 28 may have liquid capacity of in a range of one to thirty milliliter capacity, such as, for example, a two milliliter capacity.

[0042] The dimensions of the cartridge 14 may be sufficiently small to fit in the handheld base 12. For example, the cartridge 14 may have a generally rectangular shape, not including the connection to the user interface 40 or the drive shaft 32 of the pump 34. The rectangular shape may have a length in a range of 1 to 2 inches (2.5cm to 5cm), a width of 0.5 to 1 inch (1.3 to 1cm) and a thickness of 0.25 to 0.5 inch (0.6 to 1.3cm).

[0043] The flat panel heater 16 may be a flat panel assembly of a metallic layer (the resistive heating elements 24) that is sandwiched between non-conductive substrate plates 46, 48. As shown in Figure 1, 3 and 4, the substrate plates 46, 48 may be transparent to show the resistive heating elements 24. The transparency of the substrate plates 46, 48 may facilitate a visual inspection of the operation of the flat panel heater 16. The substrates 46, 48 may be flat panels formed of plastic or other material which may be non-conductive or a dielectric. The resistance heating elements 24 may be made of a thin layer of electrically conducting material, while the substrates 46, 48 may be made of electrically insulating material. Narrow gaps in the metallic layer may form channels 52 with the substrates 46, 48. The electrically conducting material surrounding the gaps may heat, vaporize and transform the chemically infused fluid into an aerosol. The metallic layer may include the tabs 38 and heating elements 50 that are part of a conductive circuit formed by the metallic layer 24. Current may flow through the tabs 38 and the heating elements 50, e.g., loops, to heat the heating elements 50 and thereby vaporize the fluid contained within in the loops or otherwise at the heating elements 50. In addition, the metallic layer 24 may include the channels 52 through which the fluid may flow to the heating elements 50. The metallic layer 24 need not be entirely metallic and may be non-conductive with conductive paths between the tabs 38 and heating elements 50.

[0044] Further, the channels 52 may be etched into a side surface of one or both of the substrate plates 46, 48 and the conductive paths from the tabs 38 to and including the

heating elements 50 may be embedded in the side surface of the substrate plate(s) 46, 48. In this configuration, a metallic layer may not be needed.

[0045] An opening (not shown) in one of the substrates 46, 48 may align with a fluid port 54 in the mounting structure 44 in the cartridge 14. The fluid port 54 may allow fluid to flow from the primary reservoir 26 in the cartridge 14, through the fluid port 54 and into the channels 52 of the flat panel heater 16.

[0046] The mounting structure 44 for the flat panel heater 16 may include a recess 56 in a side wall of the hollow main body 42 of the cartridge 14. The recess 56 may be deep enough so that the outermost substrate plate 48 of the flat panel heater 16 may be flush with an outer surface 58 of the hollow main body 42. The shape of the perimeter of the recess 56 may be complimentary to the shape of the perimeter of the flat panel heater 16 to facilitate a tight fit between the flat panel heater 16 and the hollow main body 42. The perimeter may be defined by a ledge between the recess 56 and the outer surface 58. The recess 56 may be open on one side to receive the flat panel heater 16. A recessed planar wall 60 against which the flat panel heater 16 may be mounted against may be located opposite the recess opening. The recessed planar wall 60 may include the fluid port 54 and a discharge port 62.

[0047] The fluid port 54 may be fluidly connected to the primary reservoir 28 either directly or by way of a fluid passage 64 internal to the cartridge 14. In addition, the fluid port 54 may sealingly connect to an inlet of the flat panel heater 16 when the flat panel heater 16 is mounted in the recess 56. A seal, e.g., an O-ring, 66 may be fixed to the fluid port 54 to ensure a sealed connection with the inlet of the flat panel heater 16. Alternatively, the seal 66 may be fixed to the inlet of the flat panel heater 16.

[0048] As shown in Figs. 5-7, the pump 34 may include a screw valve (e.g., opposing gears). As shown schematically in Fig. 8, the pump 34 may pump the liquid from the primary reservoir 28 into and out of the flat panel heater 16 by creating a pressure difference across the channels 52 in the flat panel heater 16. Alternatively or in addition to, a secondary pump (not shown) may also be used to pump fluid into and out of the primary reservoir 28 in the cartridge 14 from the secondary reservoir 26 in the base 12. It is contemplated that other types of pumps may be used (e.g., piston pumps, gear pumps, diaphragm pumps, etc.).

[0049] The discharge port 62 may be fluidly connected to the user interface 40 or a connection to the user interface 40 by way of a vapor passage 68 between an outlet of the flat panel heater 16 and the user interface 40. The heating elements 50 of the flat panel heater 16 may convert the fluid to vapor. The vapor may flow from the heating elements 50 through vapor openings 70, e.g., slots, in one of the substrates 46, 48 that faces the recessed planar wall 60 of the recess 56 in the cartridge 14. The recessed planar wall 60 may have a vapor inlet 72, e.g., a slot, that is aligned with the vapor

opening(s) 70 of the flat panel heater 16. Vapor formed at the heating elements 50 may flow through the vapor opening(s) 70, into the vapor inlet 72 in the recess 56 of the cartridge 14 and through the vapor passage 68 in the cartridge 14 to the user interface 40.

- [0050] It is contemplated that the primary reservoir 28, the fluid passage 64, the fluid port 54, the flat panel heater 16 and the vapor passage 68 may together form a fluid flow path 75. Accordingly, mounting the flat panel heater 16 in the recess 56 of the cartridge 14 may complete or fill a gap in the fluid flow path 75 and may fluidly connect the fluid port 54 to the discharge port 62. Conversely, removing the flat panel heater 16 from the recess may leave a gap in the fluid flow path 75. It is contemplated that one or more of the secondary reservoir 26, the user interface 40, and the pump 34 may optionally be part of the fluid flow path 75.
- [0051] To mount the flat panel heater 16 in the recess 56 of the cartridge 14, a flat outer side of one of the substrates 46, 48 may be pressed or slid into the recess 56. Holes 74 in the flat panel heater may receive protrusions (e.g., posts) 76, extending out from the recessed planar wall 60. The holes 74 may be positioned outside of the fluid flow path 76. An interference fit between the holes 74 in the flat panel heater and the posts 76 of the cartridge 14 may secure the flat panel heater 16 to the cartridge 14. It is contemplated that the protrusions 76 may extend from the flat panel heater 16 and that the recessed planar wall 60 may include the holes 74. Alternatively or in addition, the flat panel heater 16 may be secured to the cartridge 14 with a clip, snap-fit or other fastening system.
- [0052] It is contemplated that the cartridge 14 may be capable of vaporizing two different flows of fluid simultaneously. In this configuration, the hollow main body 42 may include the fluid passage 64 and a second fluid passage 78 between the pump 34 and the fluid port 54. This configuration may also include a second pump 34 that operates in parallel with the first pump 34. For example, the first pump 34 may pump a first fluid through the fluid passage 64, while at the same time, the second pump 34 may pump a second fluid through the second fluid passage 78. It is contemplated that the primary reservoir 28 may contain the first fluid, while the secondary reservoir 26 may contain the second fluid. Alternatively, both fluids may be stored within the hollow main body 42. Also, it is further contemplated that only the second fluid passage 78 may be omitted and both fluids may be combined upstream of the flat panel heater 16. It is also contemplated that both fluids may be stored in the same reservoir. It should be understood that in the configuration including the second pump 34 and the second fluid passage 78, both the second pump 34 and the second fluid passage 78 may be part of the fluid flow path 75.
- [0053] While at least one exemplary embodiment of the present invention(s) is disclosed

herein, it should be understood that modifications, substitutions and alternatives may be apparent to one of ordinary skill in the art and can be made without departing from the scope of this disclosure. This disclosure is intended to cover any adaptations or variations of the exemplary embodiment(s). In addition, in this disclosure, the terms "comprise" or "comprising" do not exclude other elements or steps, the terms "a" or "one" do not exclude a plural number, and the term "or" means either or both. Furthermore, characteristics or steps which have been described may also be used in combination with other characteristics or steps and in any order unless the disclosure or context suggests otherwise.

Claims

- [Claim 1] A cartridge (14) configured to be mounted to a microvaporizer device (10), the cartridge (14) comprising:
a vapor passage (68) configured to deliver aerosol to a user interface (40);
a hollow main body (42) with a recessed wall (60); and
a flat panel heater(16) mounted to the recessed wall (60) of the hollow main body (42).
- [Claim 2] The cartridge (14) of claim 1, wherein the recessed wall (60) comprises two fluid openings (54, 62) configured to fluidly connect to fluid passages (52) in the flat panel heater (16).
- [Claim 3] The cartridge (14) of claim 2, wherein one of the fluid openings (54, 62) is configured to fluidly connect to an inlet of the flat panel heater (16), and the other one of the fluid openings (54, 62) is configured to fluidly connect to an outlet of the flat panel heater (16).
- [Claim 4] The cartridge (14) of any one of claims 2 to 3, wherein at least one of the two fluid openings (54, 62) comprises a seal (66).
- [Claim 5] The cartridge (14) of claim 4, wherein the seal (66) is an O-ring.
- [Claim 6] The cartridge (14) of any one of claims 1 to 5, wherein the recessed wall (60). further comprises a mounting structure (44) configured to engage the flat panel heater (16) to align the flat panel heater (16) within a recess (56) in the hollow main body (42).
- [Claim 7] The cartridge (14) of claim 6, wherein the mounting structure (44) comprises a pair of protrusions (76) configured to engage a respective pair of alignment openings (74) in the flat panel heater (16).
- [Claim 8] The cartridge (14) of any one of claims 1 to 7, further comprising the user interface.
- [Claim 9] The cartridge (14) of any one of claims 1 to 8, wherein the user interface is a mouthpiece.
- [Claim 10] The cartridge (14) of any one of claims 1 to 9, wherein the hollow main body (42) comprises a universal connection adapted to connect to more than one type of user interface (40).
- [Claim 11] A microvaporizer device (10) configured to deliver an aerosol to a user's airways, the microvaporizer device (10) comprising:
a power supply (18); and
the cartridge (14) of any one of claims 1 to 10.
- [Claim 12] The microvaporizer device(10) of claim 11, further comprising a base

- 12 containing the power supply (18) and electronic circuits (20) configured to control the flat panel heater (16).
- [Claim 13] The microvaporizer device (10) of claim 12, wherein the cartridge (14) is removably connected to the base 12.
- [Claim 14] The microvaporizer device (10) of any one of claims 12 to 13, wherein the base 12 further contains a secondary reservoir (26) configured to supply liquid to the cartridge (14).
- [Claim 15] A cartridge (14) configured to be mounted to a microvaporizer device (10), the cartridge (14) comprising:
a vapor passage (68) configured to deliver aerosol to a user interface (40);
a hollow main body (42) with a recess (56);
a storage tank (28) configured to retain a chemically infused liquid, the storage tank (28) being contained inside the hollow main body (42);
and
a flat panel heater (16) removably mounted to a recessed wall (60) in the recess (56) of the hollow main body (42), the flat panel heater (16) being a unitary component configured so that positioning the flat panel heater (16) in the recess (56) fluidly connects the flat panel heater (16) to the storage tank (28) and the user interface (40).
- [Claim 16] The cartridge (14) of claim 15, wherein the flat panel heater (16) is configured so that an outer surface of the flat panel heater (16) is flush with an outer surface (58) of the cartridge (14) when the flat panel heater (16) is positioned in the recess (56).
- [Claim 17] The cartridge (14) of any one of claims 15 to 16, wherein the flat panel heater (16) is configured to be retained in the recess (56) by friction.
- [Claim 18] The cartridge (14) of any one of claims 15 to 17, further comprising a pump (34) configured to pump liquid in and out of the storage tank (28).
- [Claim 19] The cartridge (14) of claim 18, wherein the pump (34) is configured to pump the liquid in and out of the flat panel heater (16).
- [Claim 20] The cartridge (14) of any one of claims 18 to 19, wherein the pump (34) is configured to be actuated at predetermined intervals of time.
- [Claim 21] The cartridge (14) of any one of claims 18 to 20, wherein the pump (34) comprises a screw valve.
- [Claim 22] The cartridge (14) of claim 21, wherein the screw valve comprises opposing gears.
- [Claim 23] A microvaporizer device (10) configured to deliver an aerosol to a

user's airways, the microvaporizer device (10) comprising:

a power supply (18); and

the cartridge (14) of any one of claims 15 to 22.

[Claim 24]

A cartridge (14) configured to be mounted to a microvaporizer device (10), the cartridge (14) comprising:

a vapor passage (68) configured to deliver aerosol to a user interface (40);

a hollow main body (42) with a recessed planar wall (60) that comprises a supply port (54) and a discharge port (62); and

a flat panel heater (16) removably mounted to the recessed planar wall (60), the flat panel heater (16) being configured so that an inlet of the flat panel heater (16) aligns with the supply port (54) and an outlet of the flat panel heater (16) aligns with the discharge port (62) when the flat panel heater (16) is secured against the recessed planar wall (60).

[Claim 25]

The cartridge (14) of claim 24, wherein the flat panel heater (16) is configured to be secured against the recessed planar wall (60) by snapping or clipping the flat panel heater (16) in place against the recessed planar wall (60).

[Claim 26]

The cartridge (14) of claim 24, wherein the flat panel heater (16) is configured to be secured against the recessed planar wall (60) by sliding the flat panel heater (16) in place against the recessed planar wall (60).

[Claim 27]

The cartridge (14) of any one of claims 24 to 26, further comprising a storage tank (28) configured to retain a chemically infused liquid, the storage tank (28) being contained inside the hollow main body (42) and being fluidly connected to the supply port (54).

[Claim 28]

The cartridge (14) of any one of claims 24 to 27, wherein the flat panel heater (16) has a rectangular shape.

[Claim 29]

The cartridge (14) of any one of claims 24 to 28, wherein the recess (56) has a rectangular shape.

[Claim 30]

A microvaporizer device (10) configured to deliver an aerosol to a user's airways, the microvaporizer device comprising:

a power supply (18); and

the cartridge (14) of any one of claims 24 to 29.

[Claim 31]

A cartridge (14) configured to be mounted to a microvaporizer device (10), the cartridge (14) comprising:

a hollow main body (42) containing a liquid storage tank (28), a liquid passage (64), and a vapor passage, the liquid passage (64) and the

vapor passage (68) being separated by a recess (56) in an outer surface (58) of the hollow main body (42); and

a flat panel heater (16) removably mounted within the recess (56), the flat panel heater (16) being configured so that upon being mounted within the recess (56), the flat panel heater (16) completes a fluid flow path (75) from the liquid storage tank (28) to the vapor passage (68), wherein the vapor passage (68) is configured to deliver aerosol from the recess (56) to a user interface (40), and

wherein the liquid passage (64) is configured to deliver fluid from the storage tank (28) to the recess (56).

[Claim 32]

The cartridge (14) of claim 31, wherein the flat panel heater (16) is configured so that removing the flat panel heater (16) from the recess (56) leaves a gap in the fluid flow path (75).

[Claim 33]

The cartridge (14) of any one of claims 31 to 32, further comprising a pump configured to pump fluid through the fluid flow path (75).

[Claim 34]

The cartridge (14) of any one of claims 31 to 33, wherein the hollow main body (42) is configured to vaporize two separate flows of fluid at the same time.

[Claim 35]

The cartridge (14) of claim 34, wherein the hollow main body comprises a second liquid passage (78), the liquid passage (64) being configured to deliver one of the two separate flows of fluid to the recess (56), the second liquid passage (78) being configured to deliver the other of the two separate flows of fluid to the recess (56).

[Claim 36]

The cartridge (14) of any one of claims 34, wherein the two separate flows of fluid are stored in two separate reservoirs.

[Claim 37]

The cartridge (14) of claim 36, wherein the storage tank (28) is one of the two separate reservoirs.

[Claim 38]

A microvaporizer device (10) configured to deliver an aerosol to a user's airways, the microvaporizer device comprising:

a power supply (18); and

the cartridge (14) of any one of claims 31 to 37.

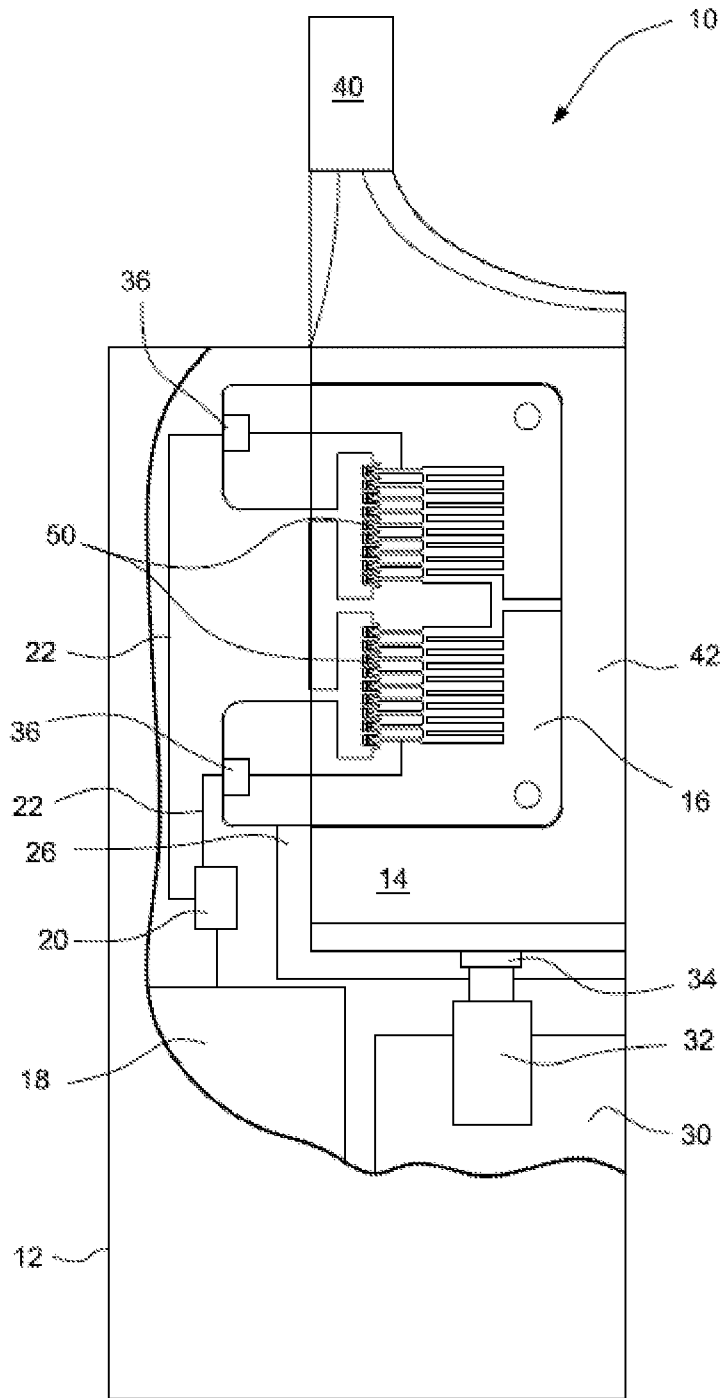


FIG.1

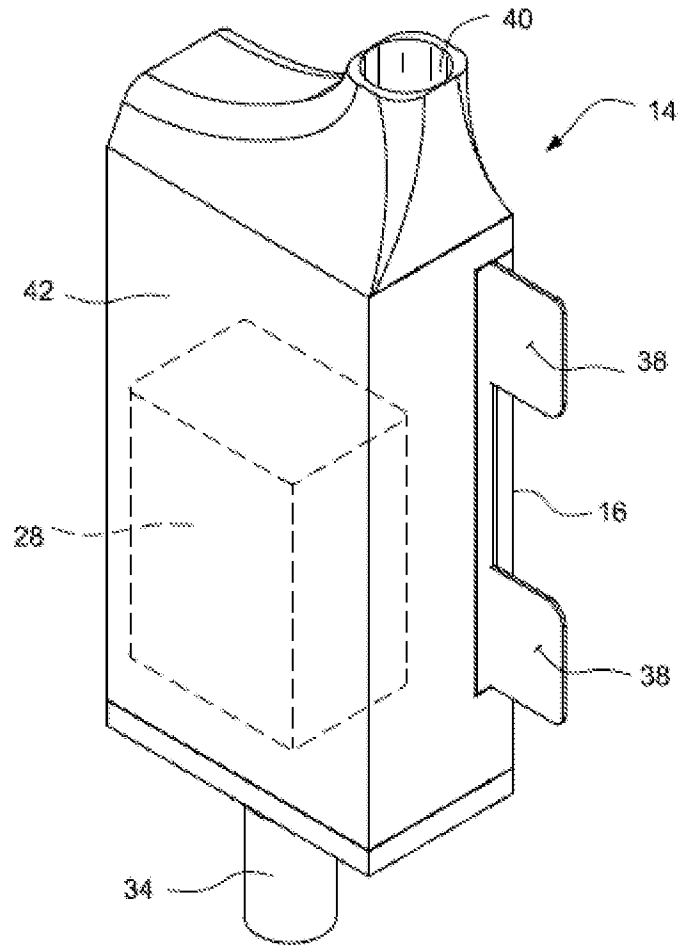


FIG.2

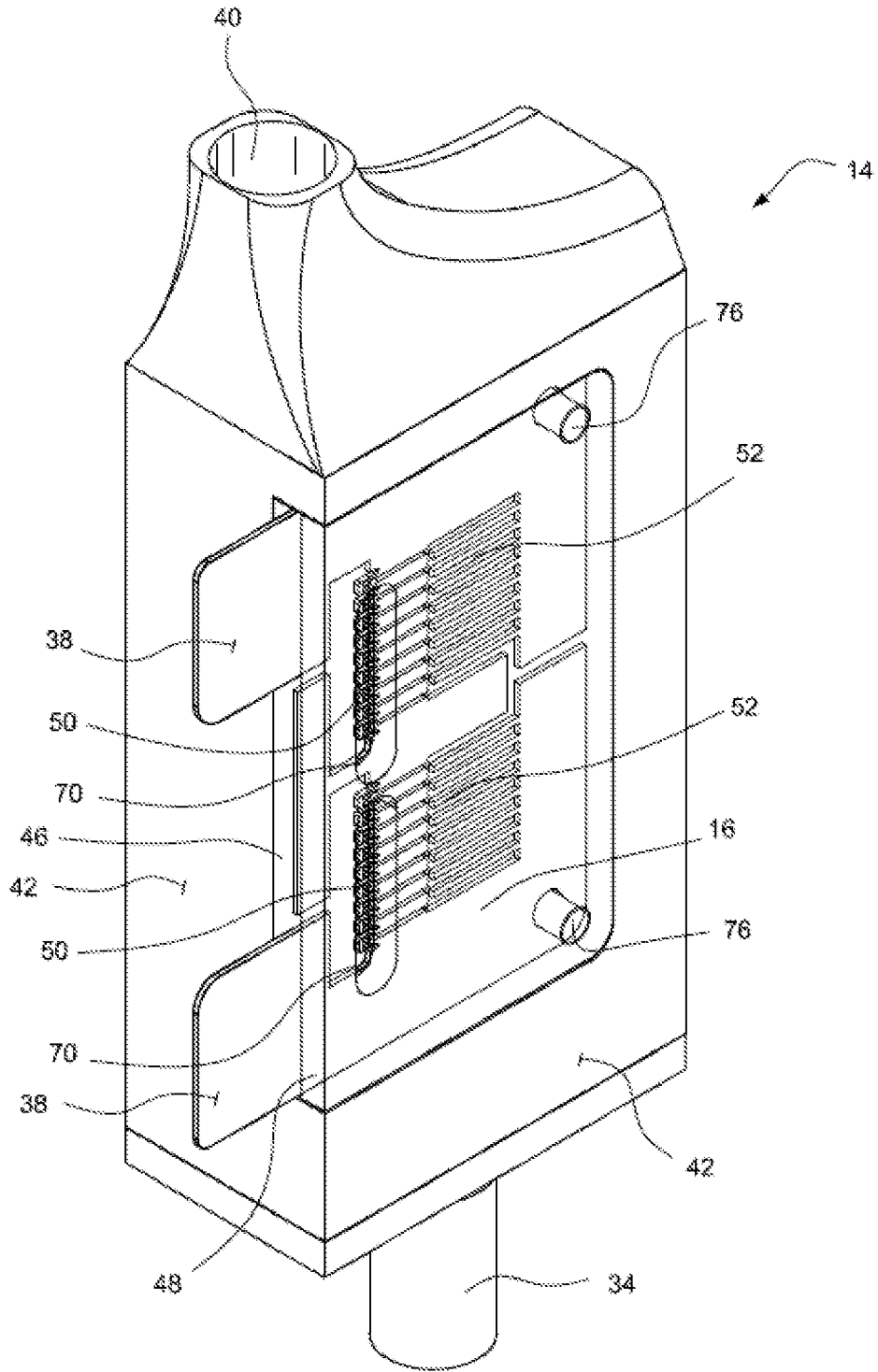
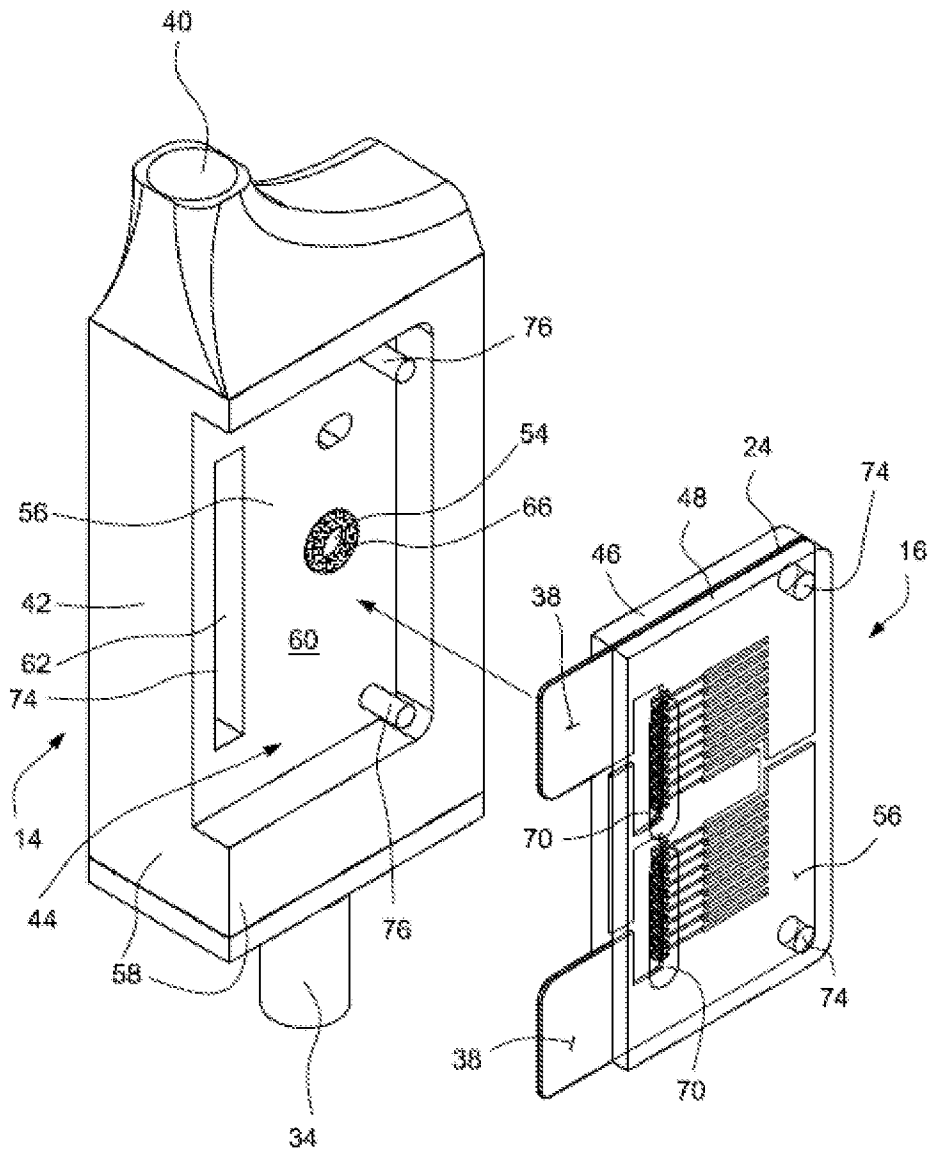


FIG.3



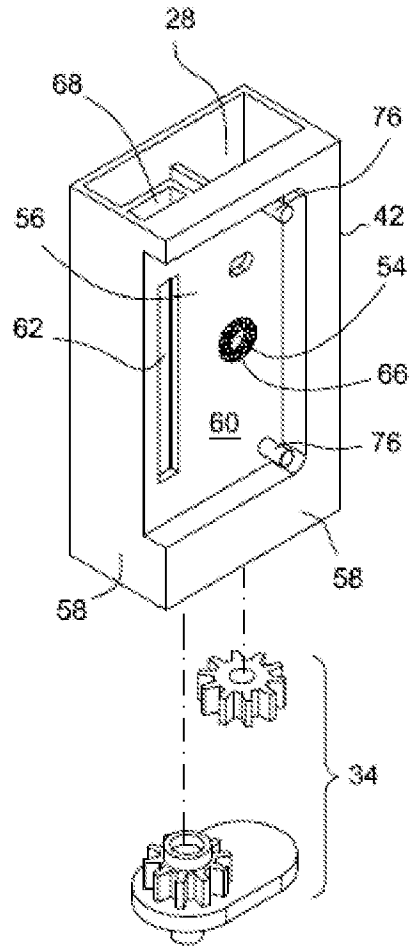


FIG.5

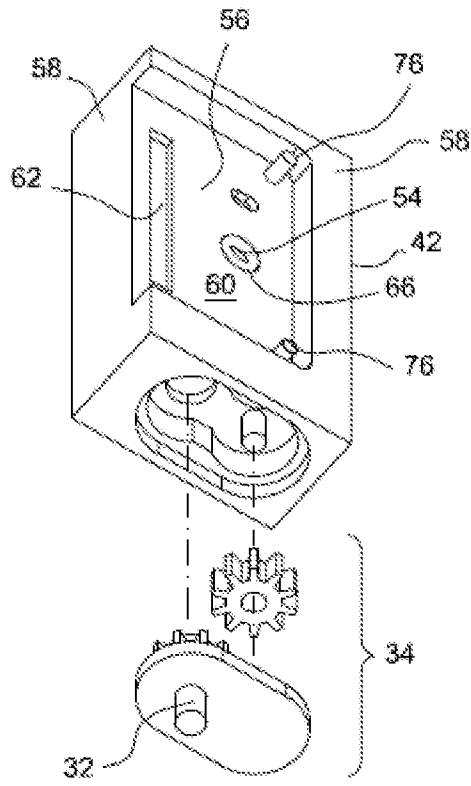


FIG. 6

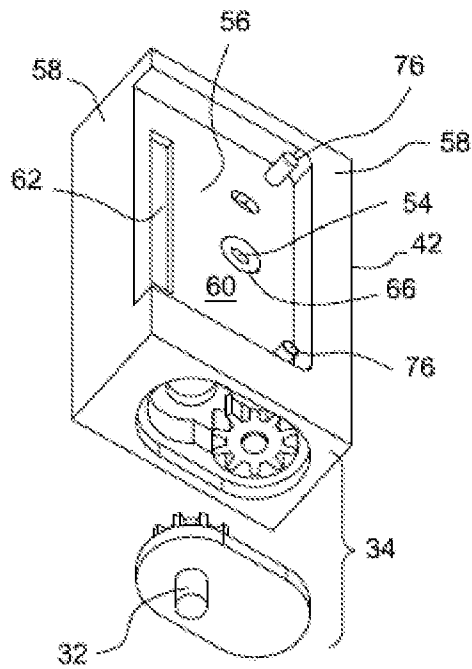


FIG. 7

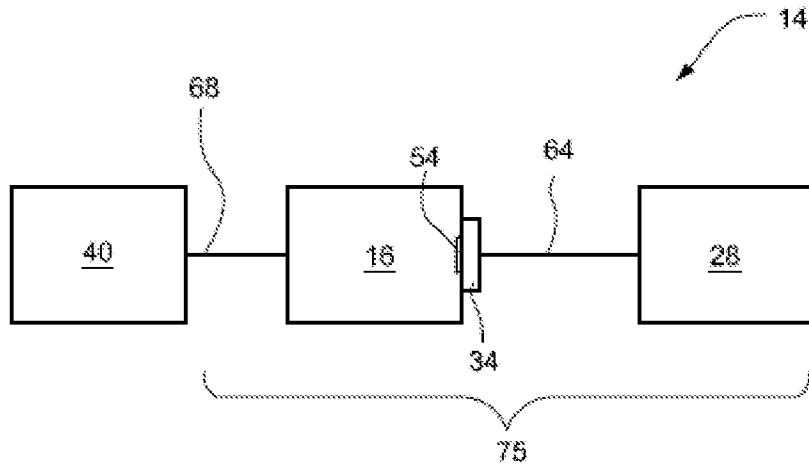


FIG. 8

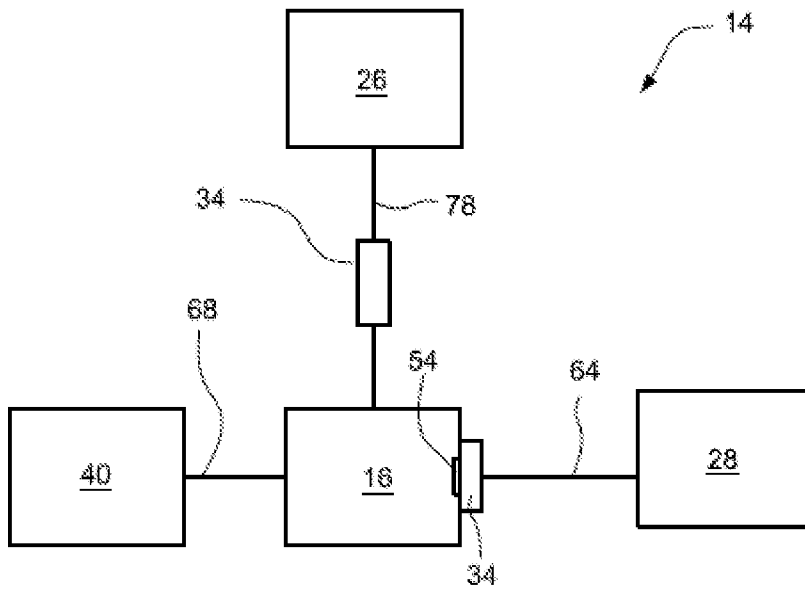


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/085706

A. CLASSIFICATION OF SUBJECT MATTER A24F 40/46(2020.01)i; A61M 15/06(2006.01)i 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 40; A61M 15; A24F 47 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) CNKI&CNABS&CNTXT&VEN&EPODOC&ETXT: electric cigartte, atomizer, vaporizer, heater		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 206079043 U (CHINA TOBACCO HUNAN IND CO LTD) 12 April 2017 (2017-04-12) abstract, pages 3, 4 of description and figures 1-7	1-17, 23-32, 34-38
Y	CN 206079043 U (CHINA TOBACCO HUNAN IND CO LTD) 12 April 2017 (2017-04-12) abstract, pages 3, 4 of description and figures 1-7	18-22, 33
Y	CN 1541577 A (HAN, Li) 03 November 2004 (2004-11-03) figure 1 and the example 1 of description	18-22, 33
A	CN 108514158 A (WUHAN INST TECHNOLOGY) 11 September 2018 (2018-09-11) the whole document	1-38
A	CN 107713026 A (BEIHAI HUAYUAN ELECTRONIC CO LTD) 23 February 2018 (2018-02-23) the whole document	1-38
A	US 2017006916 A1 (KIMREE HI-TECH INC) 12 January 2017 (2017-01-12) the whole document	1-38
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 05 February 2020		Date of mailing of the international search report 19 February 2020
Name and mailing address of the ISA/CN National Intellectual Property Administration, PRC 6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088 China Facsimile No. (86-10)62019451		Authorized officer SHI,Jianping Telephone No. 86-(010)-62085675

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Information on patent family members

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