US 20240277055A1

(19) **United States**
(12) **Patent Application Publication**
Atkins et al.
(10) **Pub. No.: US 2024/0277055 A1**
(43) **Pub. Date: Aug. 22, 2024**

(54) **HEAT NOT BURN VAPORIZER DEVICES**

(71) Applicant: **JUUL Labs, Inc.**, Washington, DC (US)

(72) Inventors: **Ariel Atkins**, San Francisco, CA (US); **Brandon Cheung**, San Francisco, CA (US); **Steven Christensen**, Burlingame, CA (US); **Jason King**, San Francisco, CA (US); **Joshua A. Kurzman**, San Francisco, CA (US); **Esteban Leon Duque**, Berkeley, CA (US); **Kevin Lomeli**, San Francisco, CA (US); **Matthew Rios**, San Francisco, CA (US)

(21) Appl. No.: **18/649,161**

(22) Filed: **Apr. 29, 2024**

Related U.S. Application Data

(63) Continuation of application No. PCT/US2022/048341, filed on Oct. 31, 2022.

(60) Provisional application No. 63/410,693, filed on Sep. 28, 2022, provisional application No. 63/274,922, filed on Nov. 2, 2021.

Publication Classification

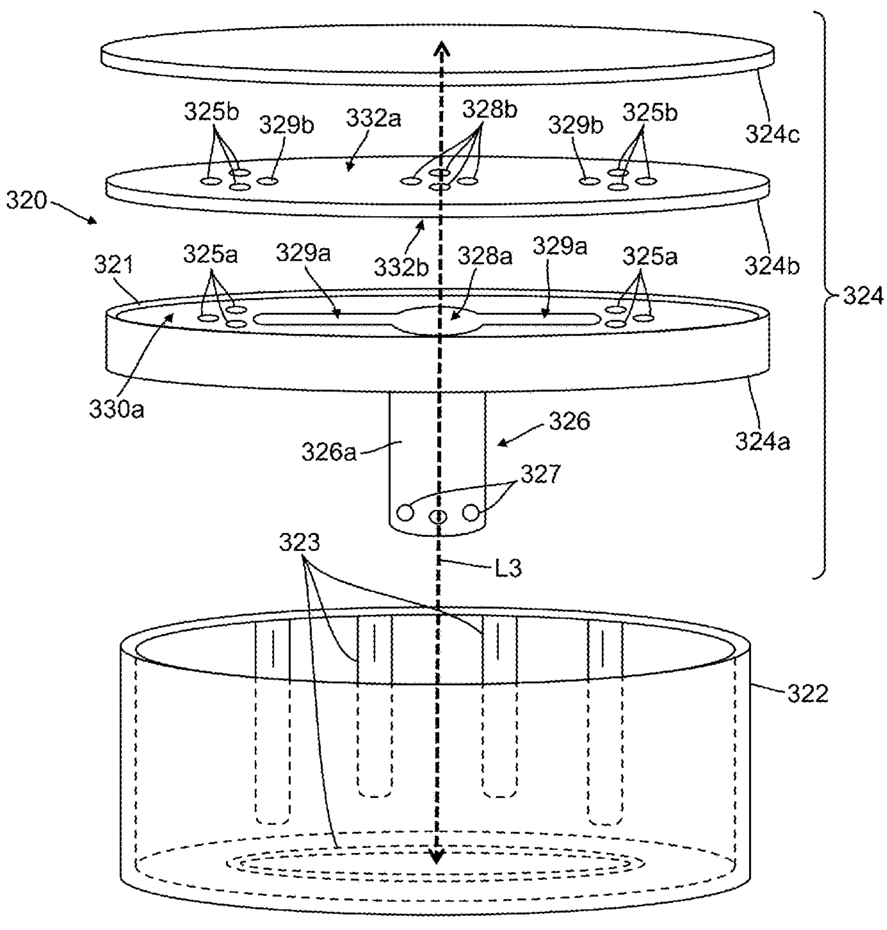
(51) **Int. Cl.**

A24F 40/46	(2006.01)
A24D 3/04	(2006.01)
A24D 3/17	(2006.01)
A24F 7/00	(2006.01)
A24F 40/42	(2006.01)
A24F 40/485	(2006.01)
H05B 3/06	(2006.01)

(52) **U.S. Cl.**
CPC ***A24F 40/46*** (2020.01); ***A24D 3/043*** (2013.01); ***A24D 3/17*** (2020.01); ***A24F 7/00*** (2013.01); ***A24F 40/42*** (2020.01); ***A24F 40/485*** (2020.01); ***H05B 3/06*** (2013.01); *H05B 2203/007* (2013.01)

(57) **ABSTRACT**

Vaporizer devices for generating an inhalable aerosol are provided. In one exemplary embodiment, a vaporizer device can include a receptacle, one or more heating elements positioned to heat the receptacle, and a cartridge configured to be inserted into the receptacle. The cartridge can include a container configured to heat vaporizable material when the heating element heats the receptacle, a lid with a plurality of first air inlets configured to direct air into the container, and a structure within the container, in which the structure is configured to direct the air through the vaporizable material to form a vaporized material.



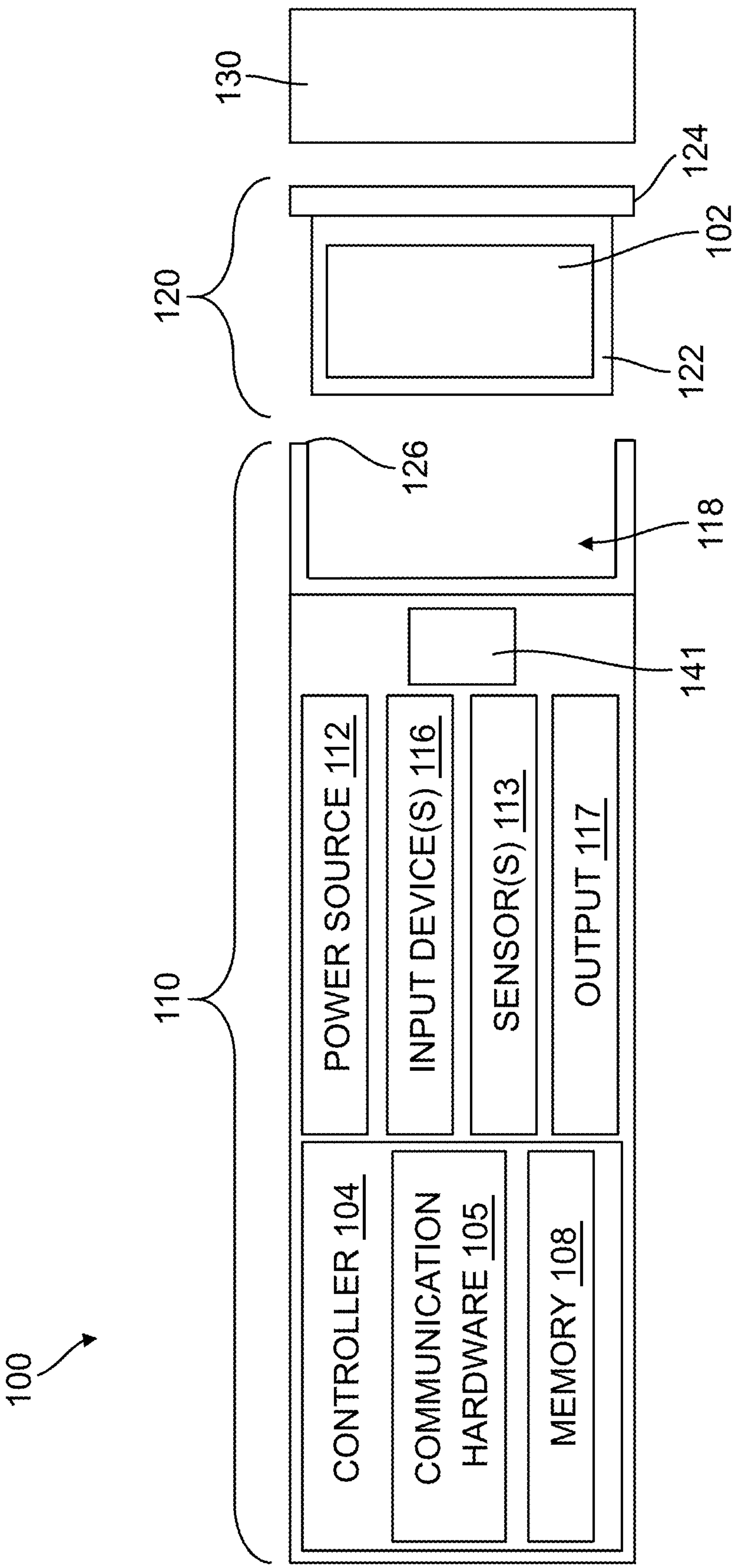

130
124
120
102
122
126
118
110
141
POWER SOURCE 112
INPUT DEVICE(S) 116
SENSOR(S) 113
OUTPUT 117
CONTROLLER 104
COMMUNICATION HARDWARE 105
MEMORY 108
100

FIG. 1

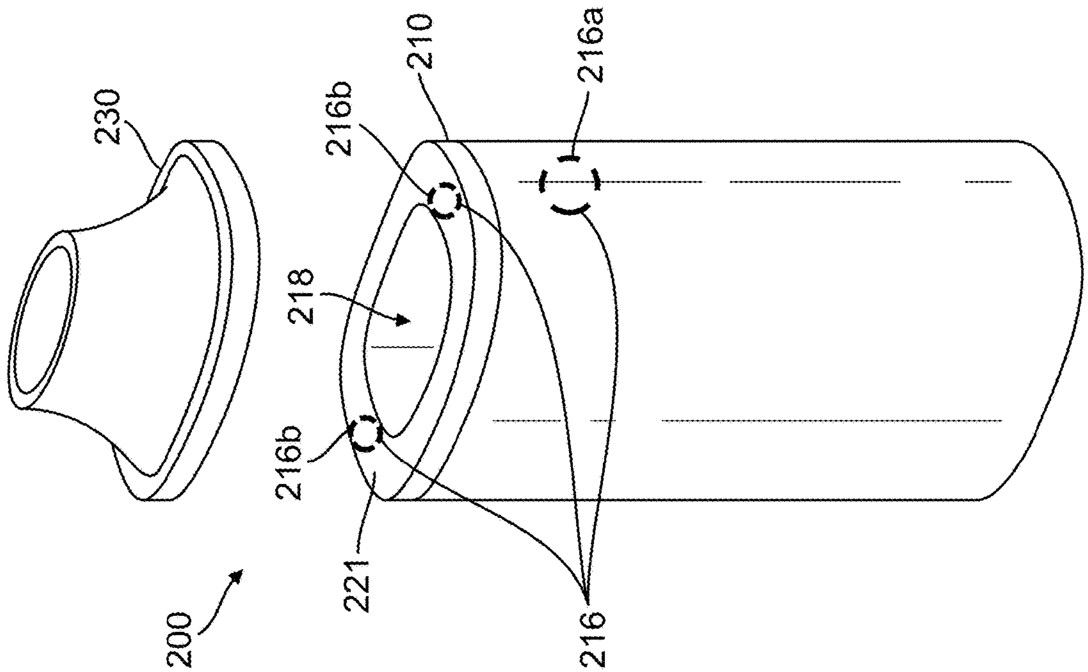


FIG. 2B

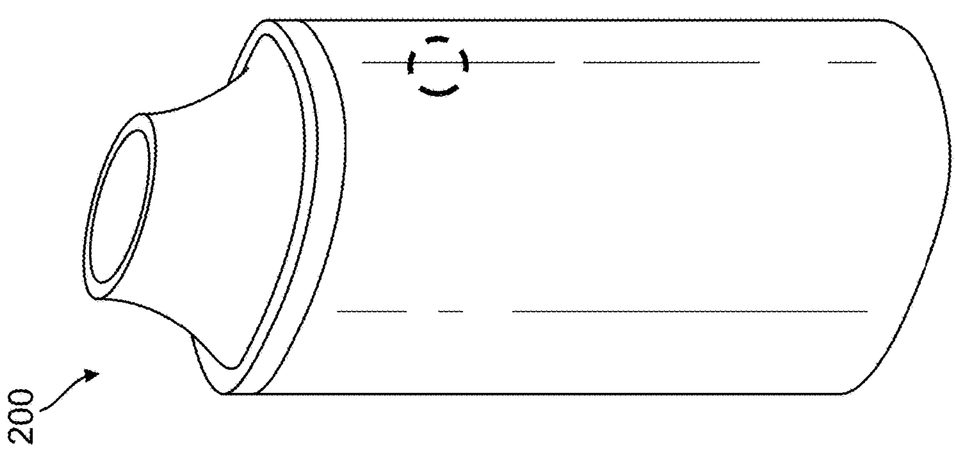


FIG. 2A

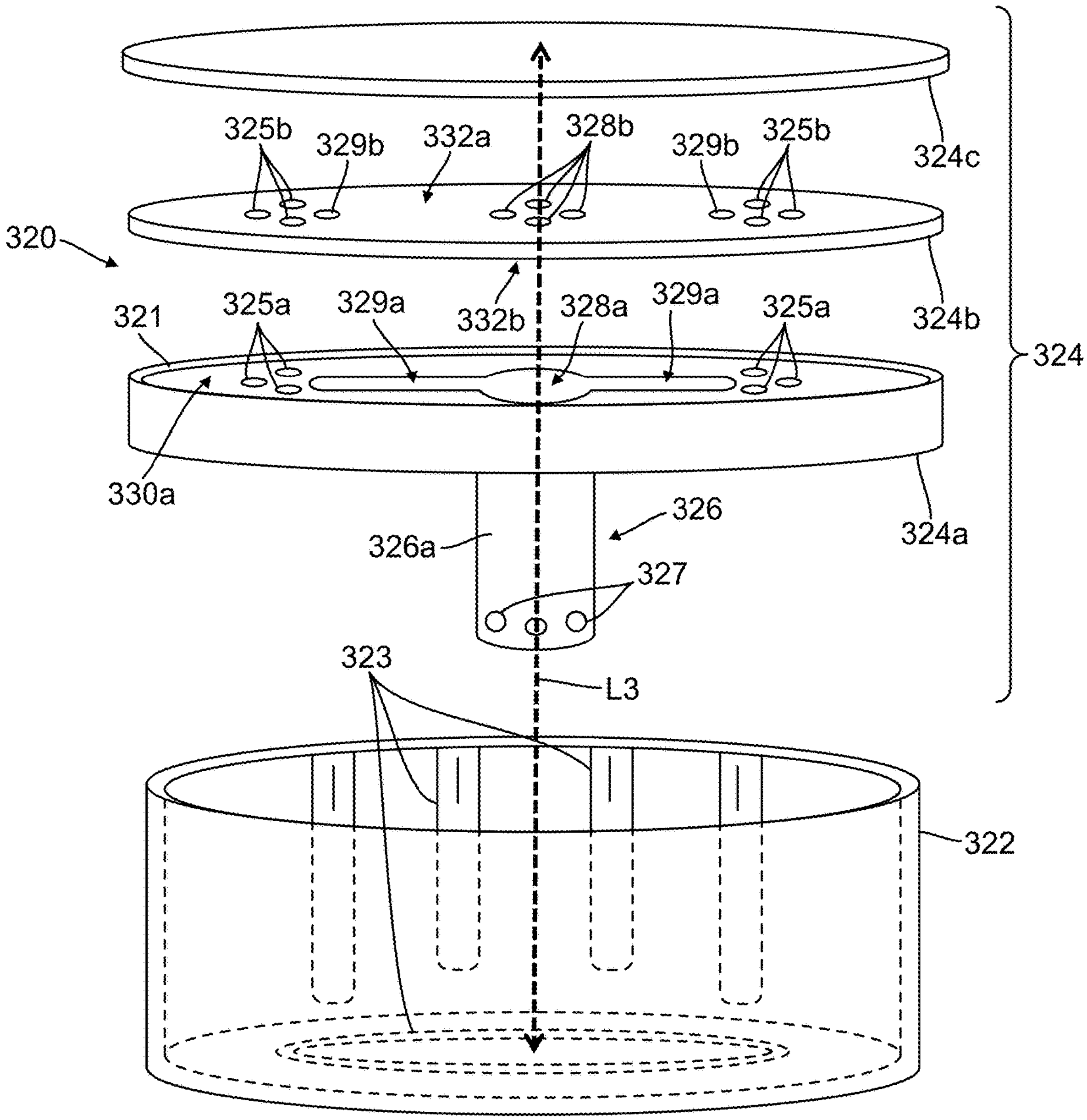
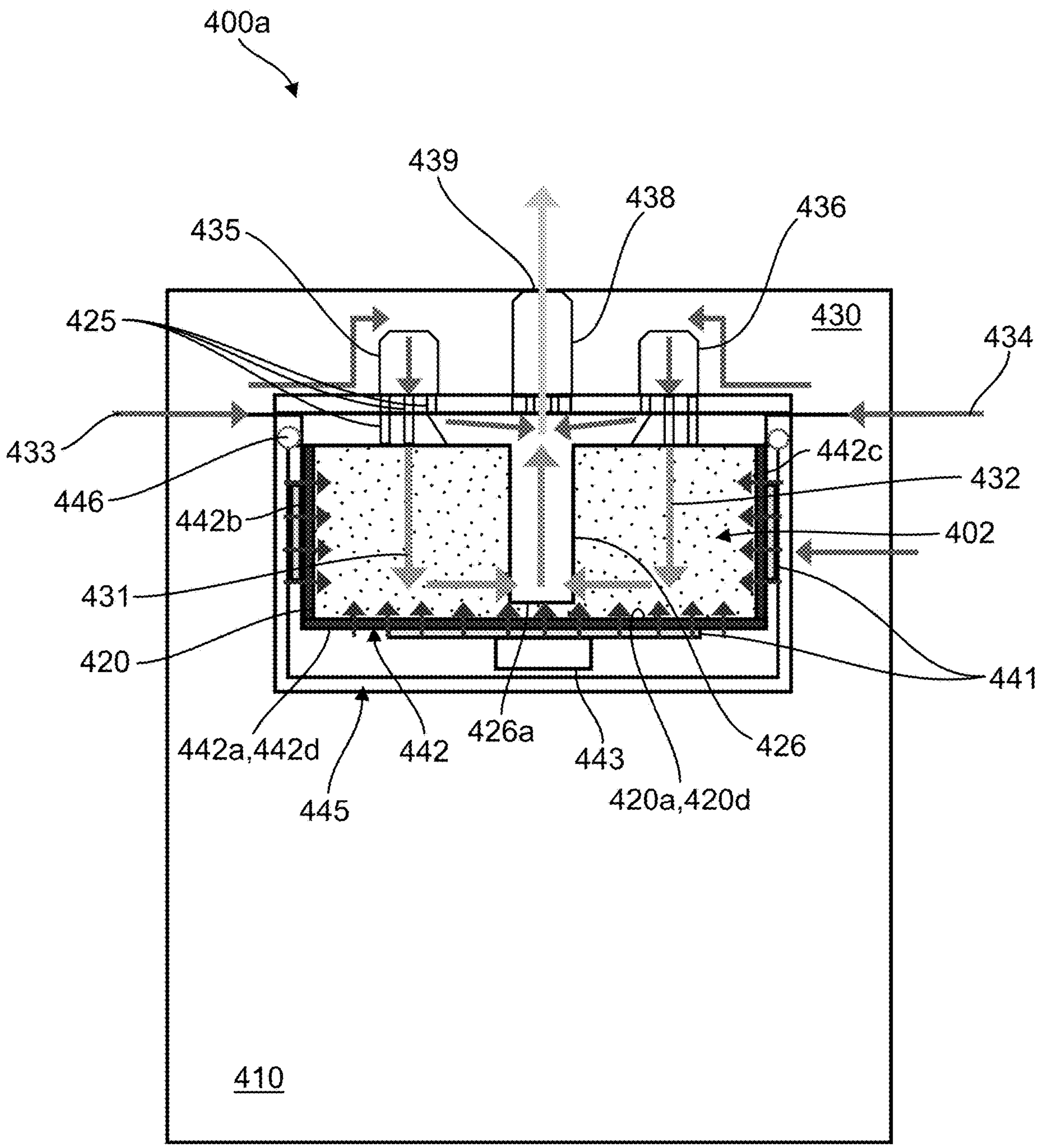

325b
329b
332a
328b
329b
325b
324c
320
325a
329a
329a
325a
321
332b
328a
324b
324
330a
326
324a
326a
327
323
L3
322

FIG. 3



400a
439
438
436
435
425
430
434
433
442c
432
446
442b
402
431
420
441
442a,442d
442
426a
443
426
420a,420d
445
410

FIG. 4A

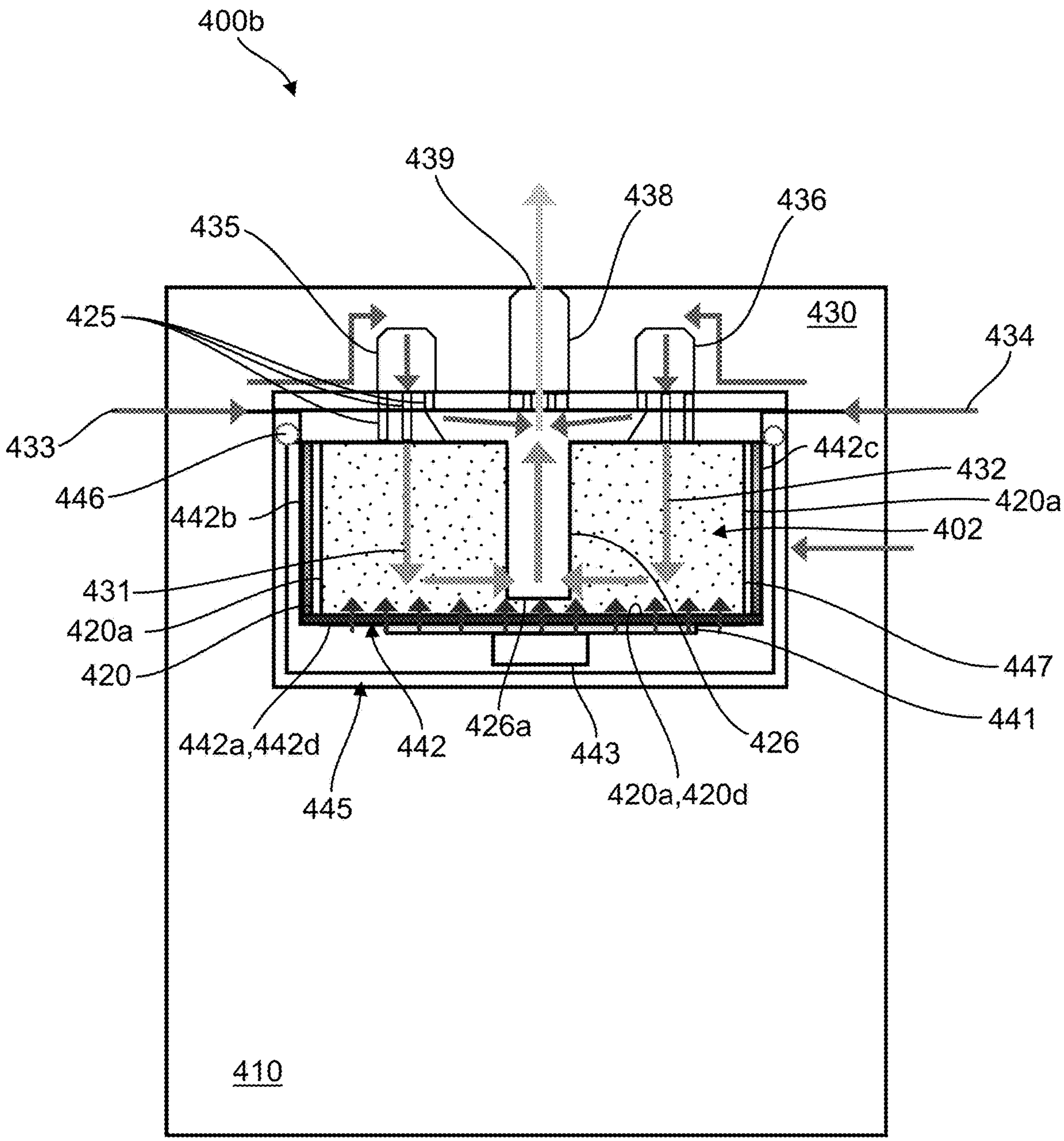

400b
439
438
436
435
425
430
434
433
446
442c
432
420a
442b
402
431
420a
447
420
441
442a,442d
442
426a
443
426
420a,420d
445
410

FIG. 4B

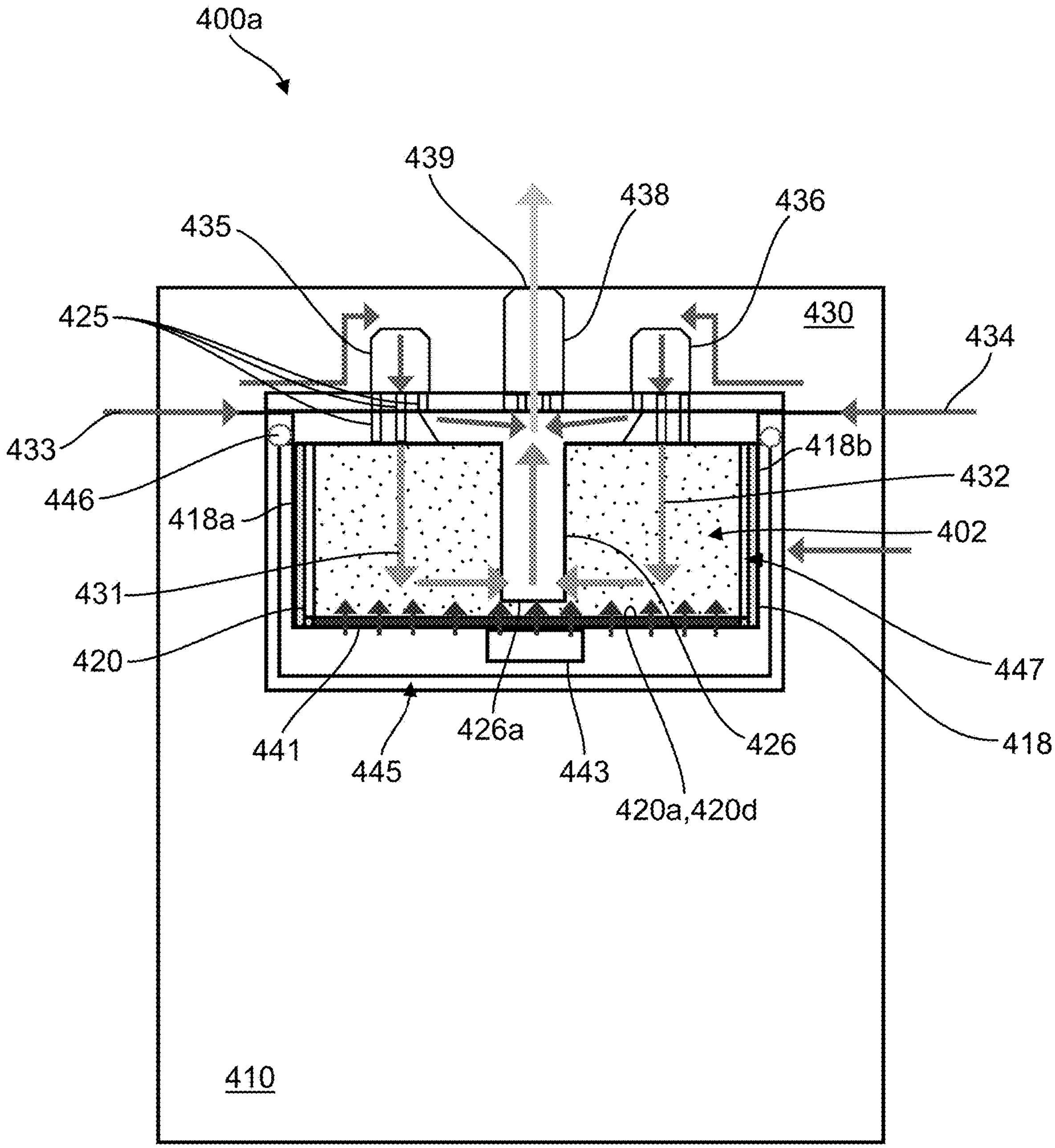

400a
439
438
436
435
430
425
434
433
418b
432
446
418a
402
431
447
420
441
426a
426
418
445
443
420a,420d
410

FIG. 4C

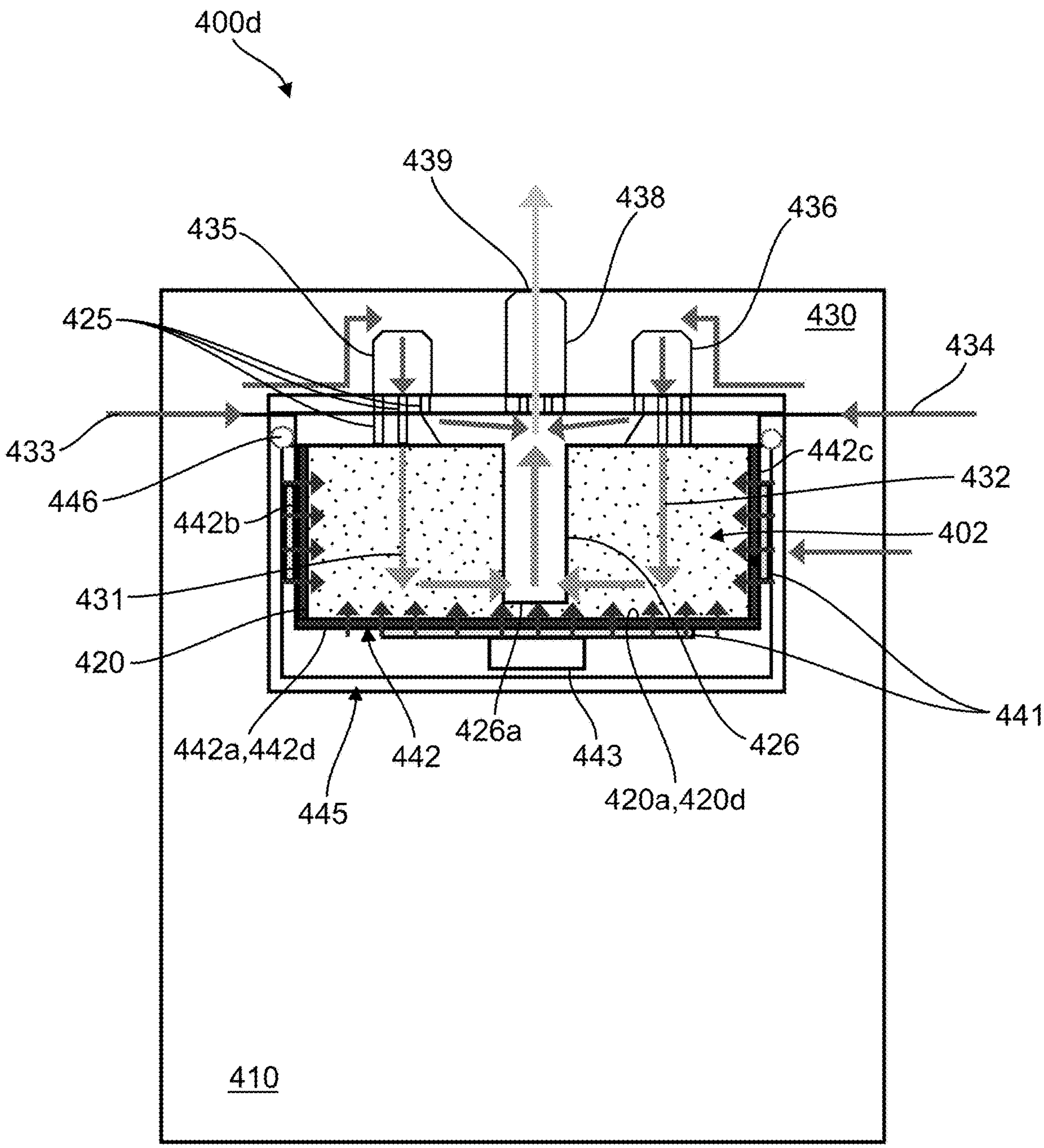

400d
439
438
436
435
430
425
434
433
442c
432
446
402
442b
431
420
441
442a,442d
442
426a
443
426
420a,420d
445
410

FIG. 4D

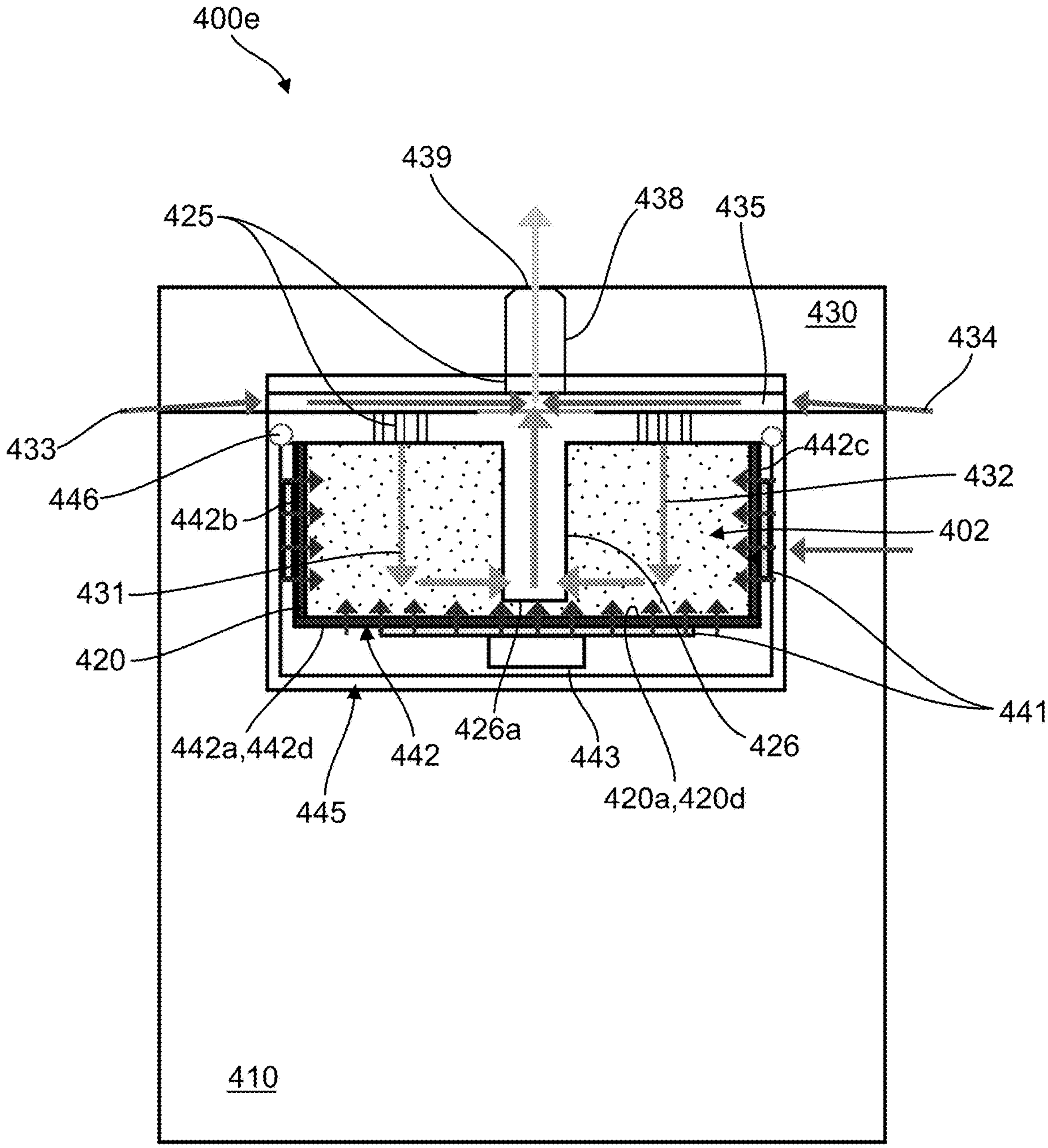

400e
439
438
435
425
430
434
433
446
442c
432
442b
402
431
420
441
442a,442d
442
426a
443
426
420a,420d
445
410

FIG. 4E

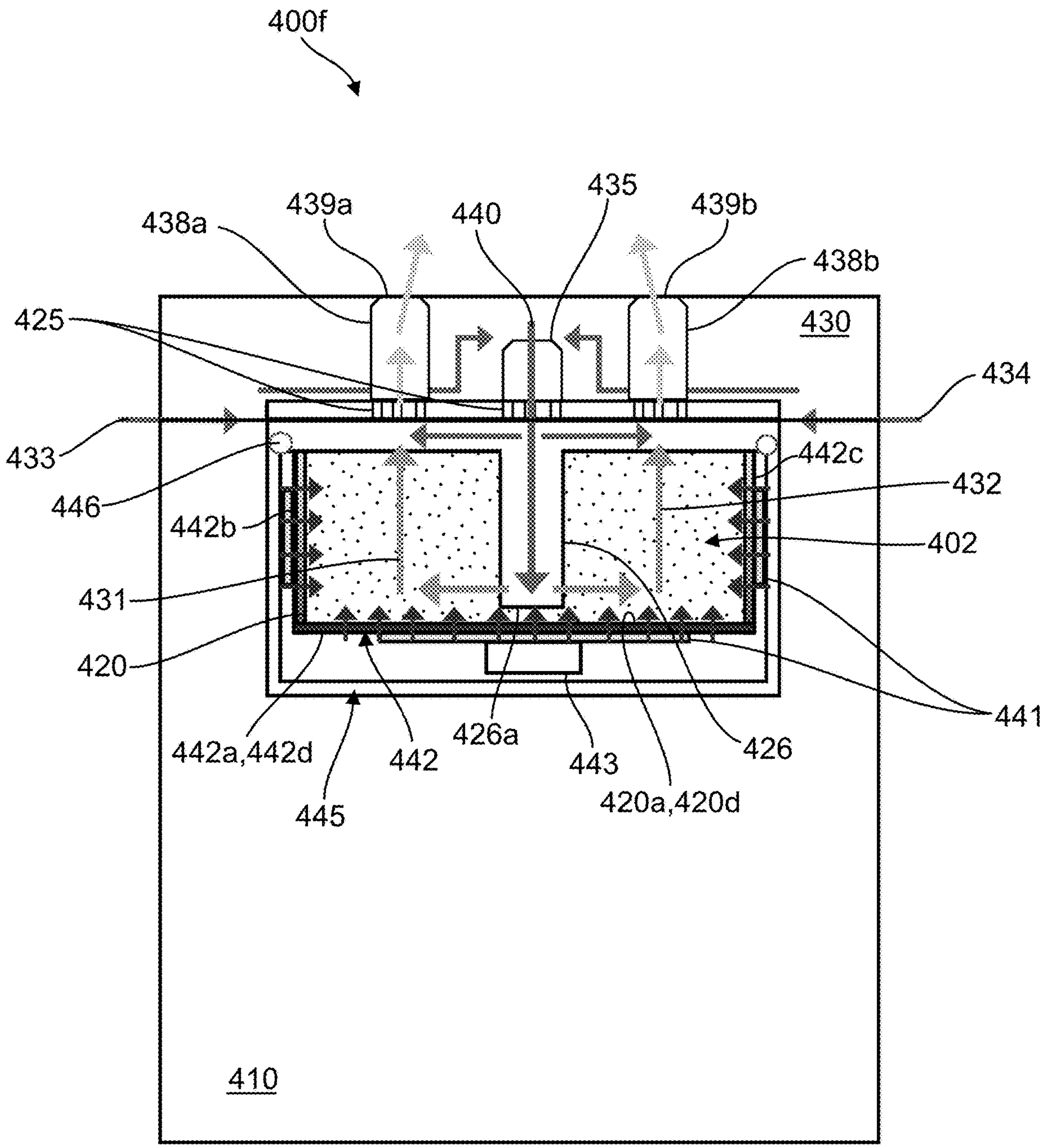

400f
438a
439a
440
435
439b
438b
430
425
434
433
446
442c
432
442b
402
431
420
441
442a,442d
442
426a
443
426
420a,420d
445
410

FIG. 4F

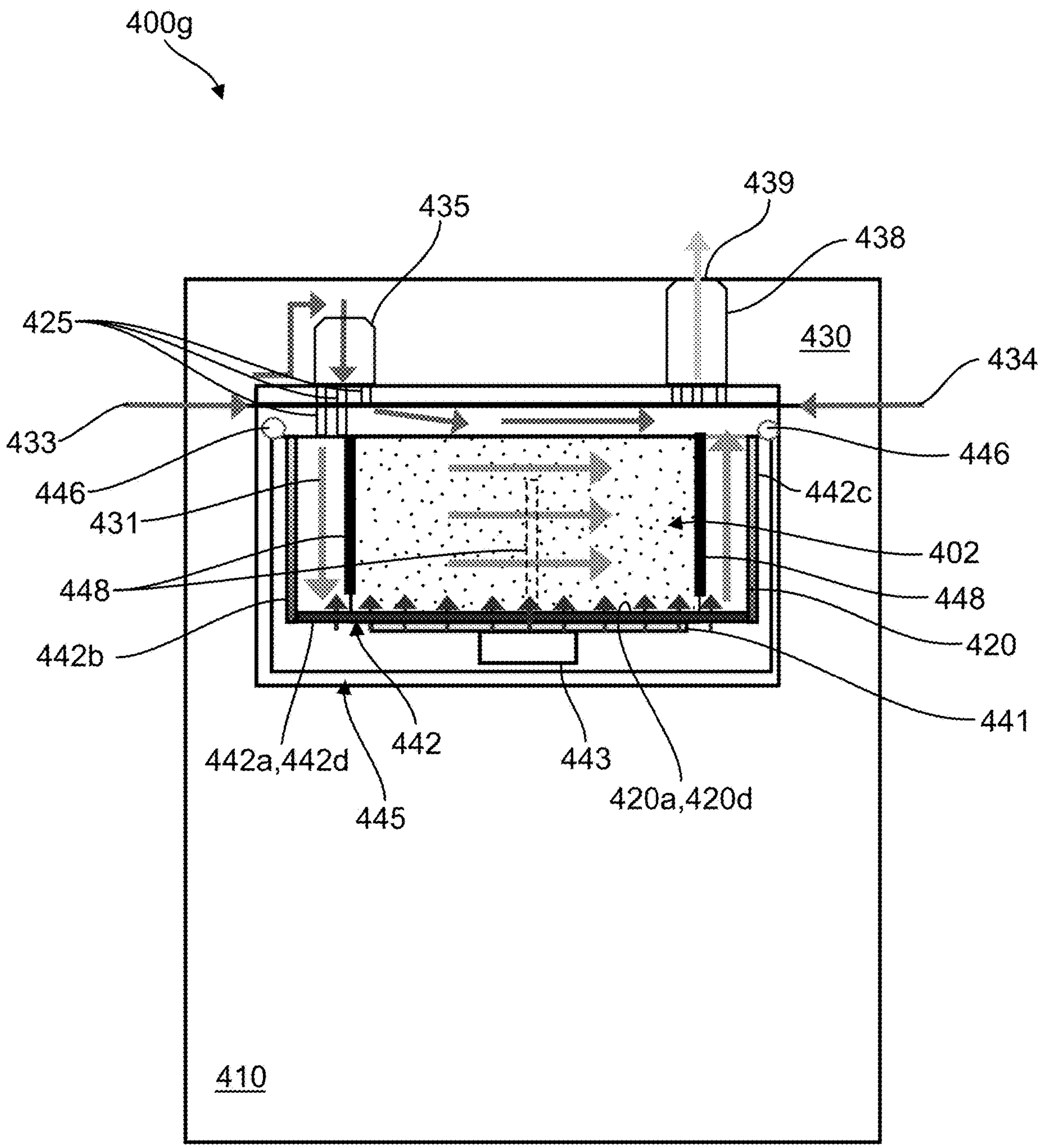

400g
435
439
438
425
430
434
433
446
446
442c
431
402
448
448
420
442b
441
442a,442d
442
443
420a,420d
445
410

FIG. 4G

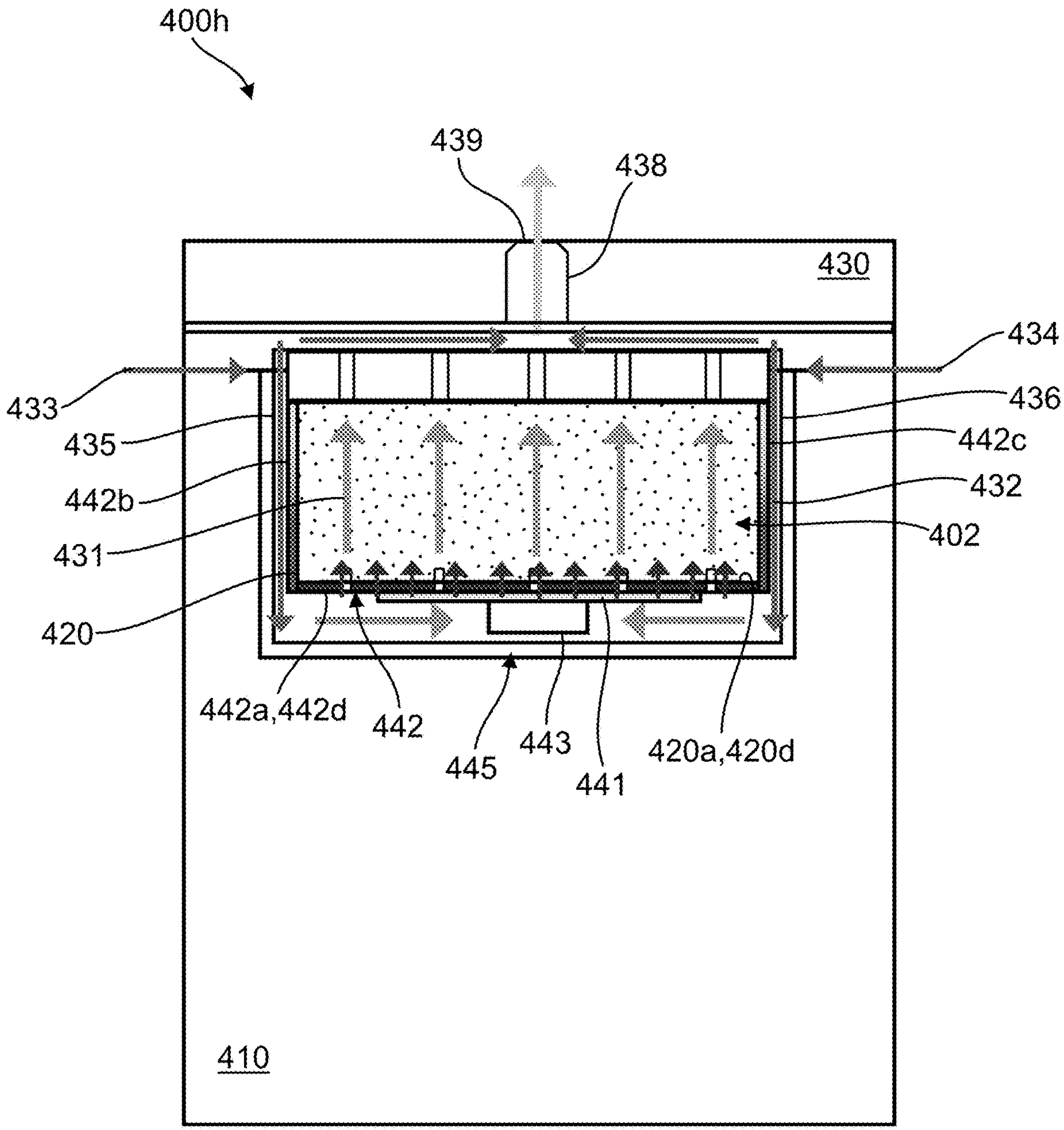

400h
439
438
430
434
433
436
435
442c
442b
432
431
402
420
442a,442d
442
445
443
441
420a,420d
410

FIG. 4H

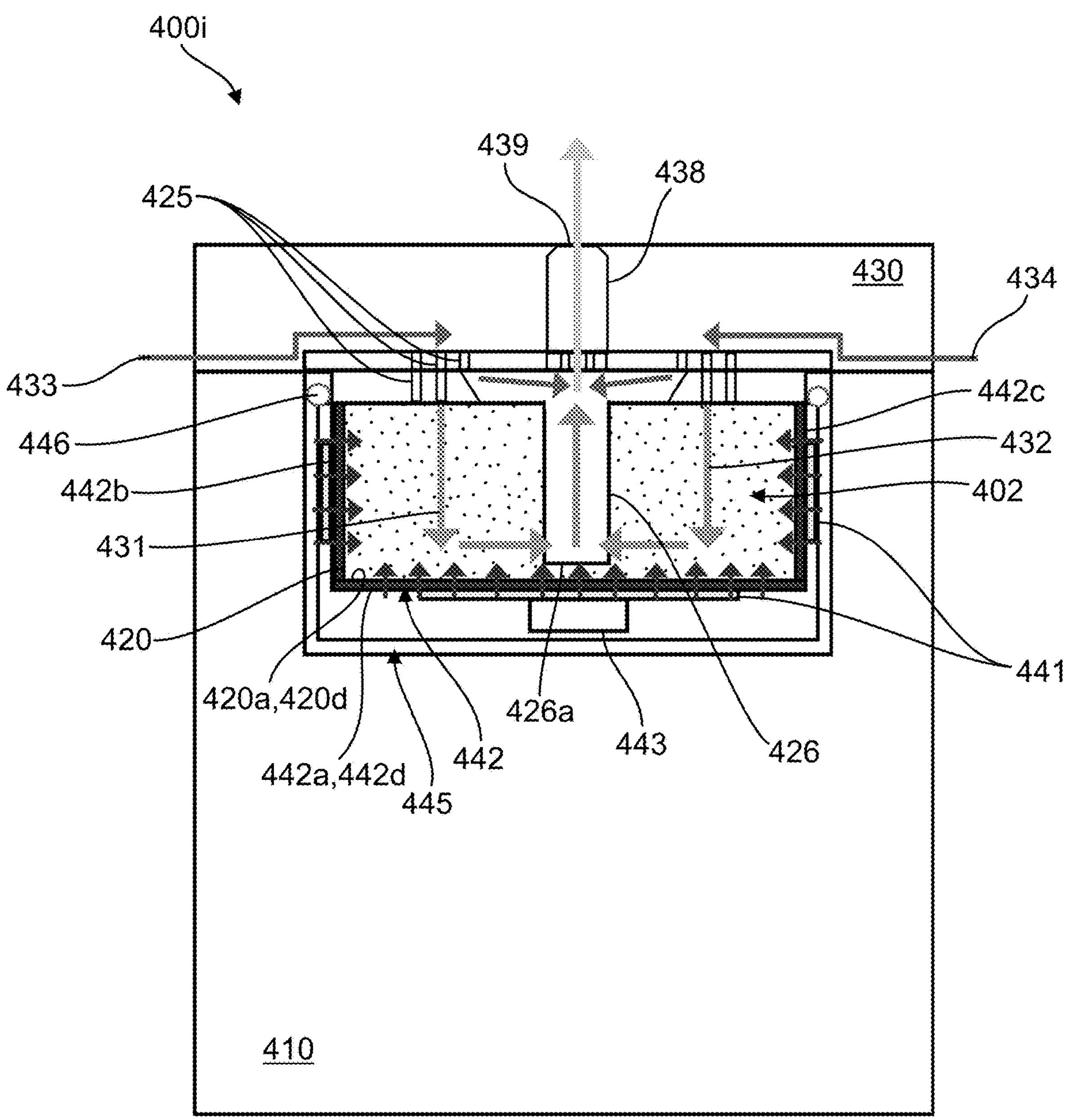

400i
439
438
425
430
434
433
442c
446
432
442b
402
431
420
441
420a,420d
426a
443
426
442a,442d
442
445
410

FIG. 4I

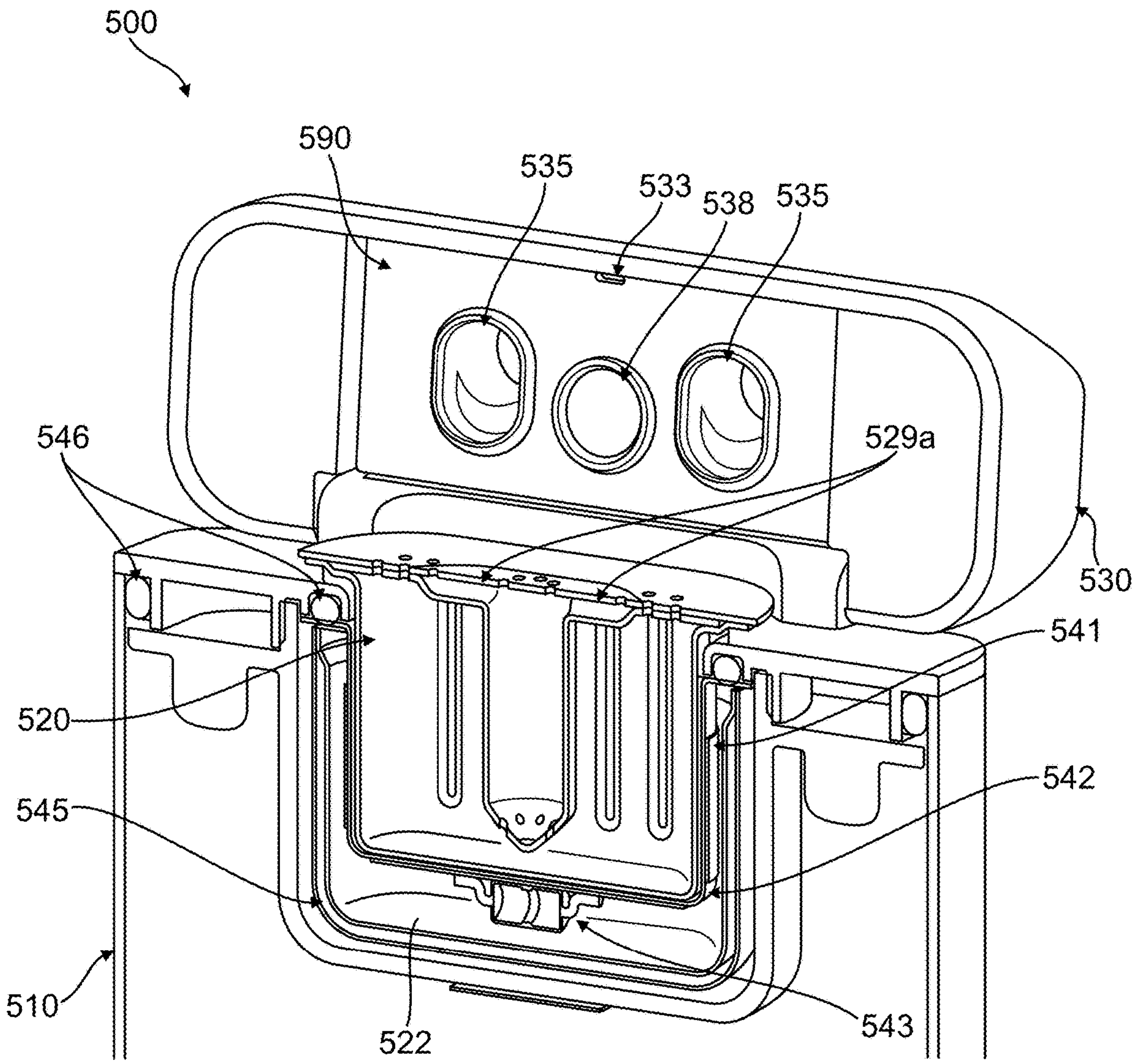


FIG. 5A

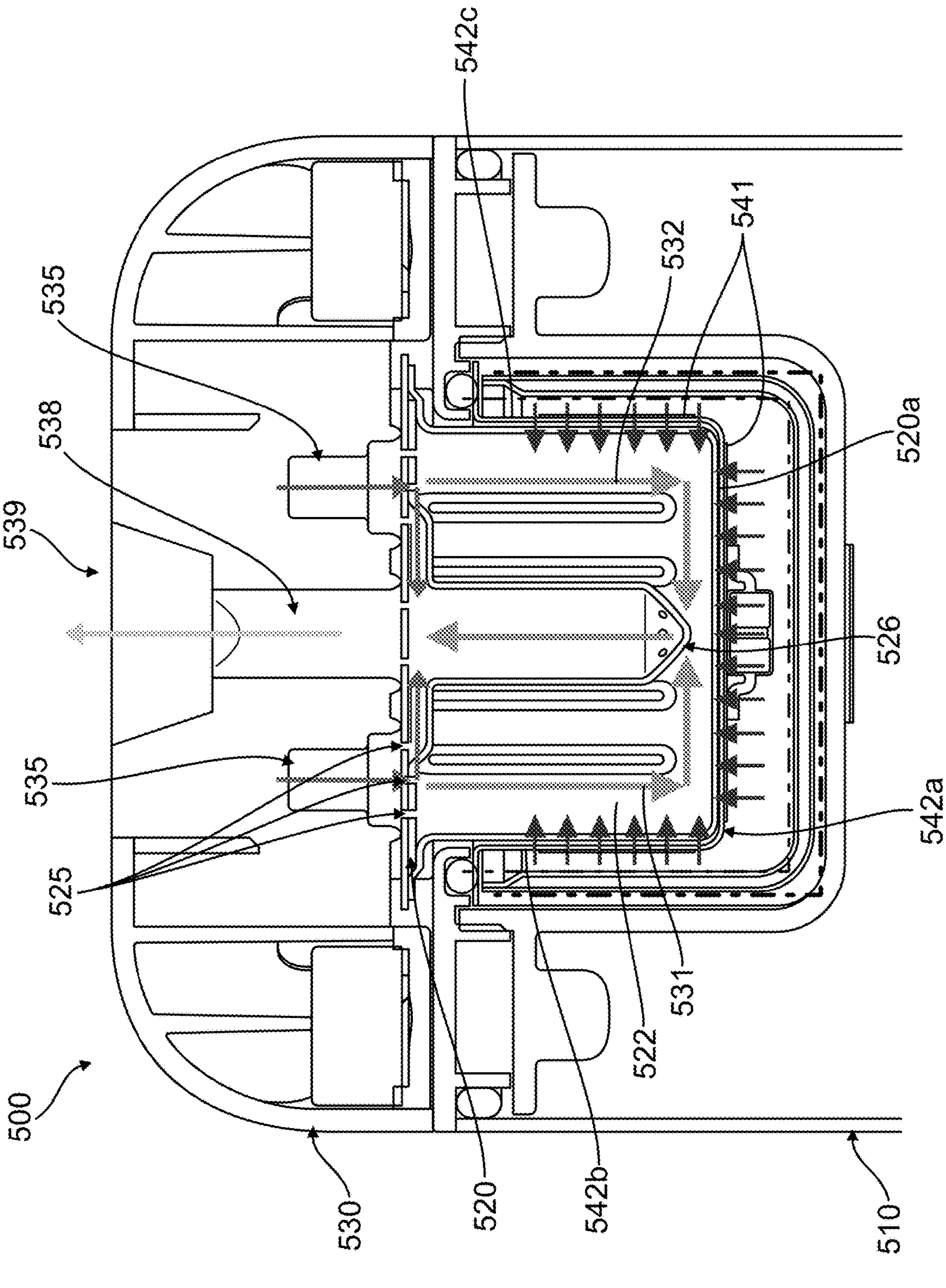

500
530
520
542b
522
531
510
525
535
539
538
535
532
541
542c
520a
526
542a

FIG. 5B

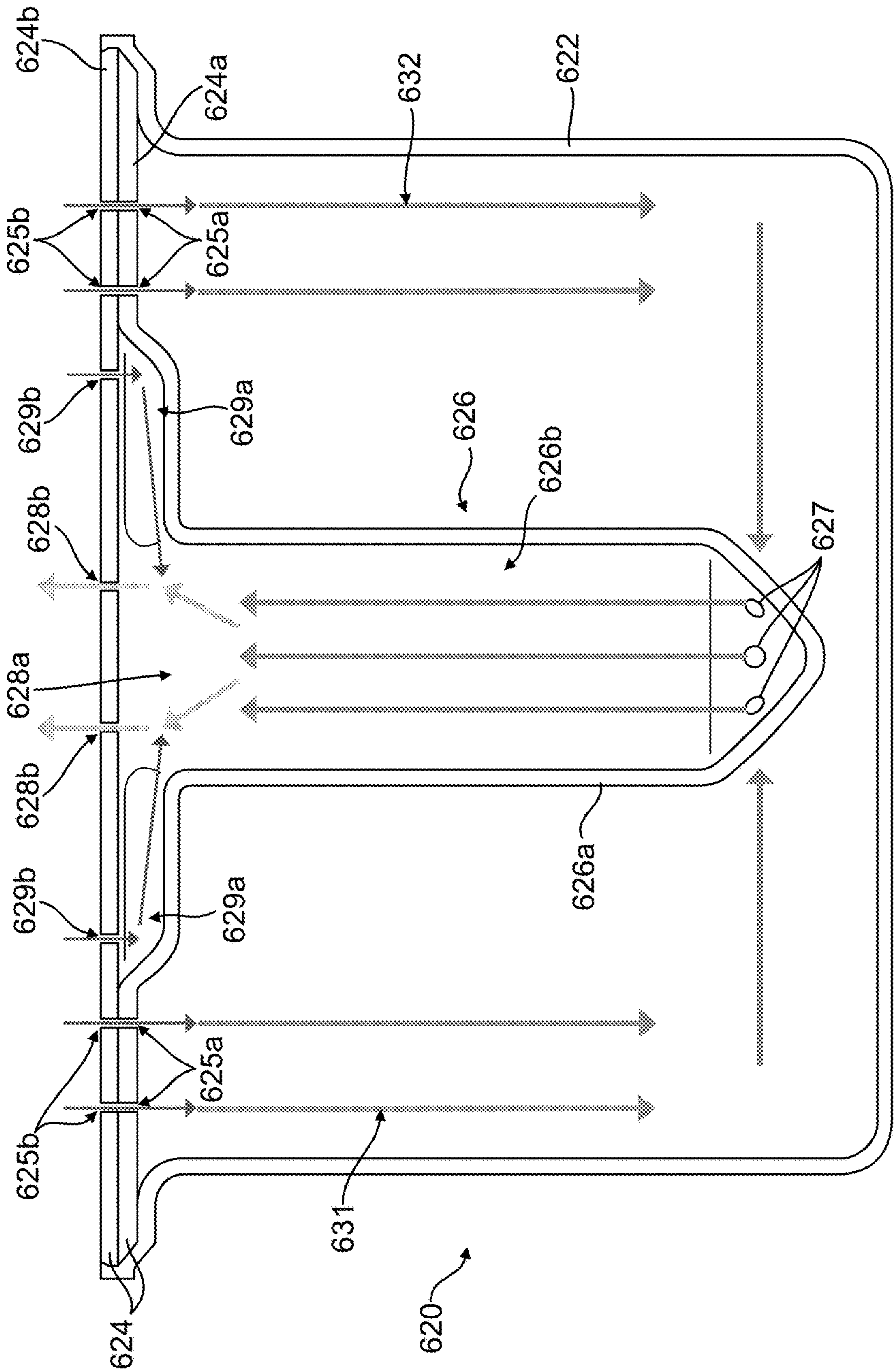

624b
624a
632
622
625b
625a
629b
629a
626
626b
628b
627
628a
628b
629b
629a
626a
625a
625b
631
624
620

FIG. 6

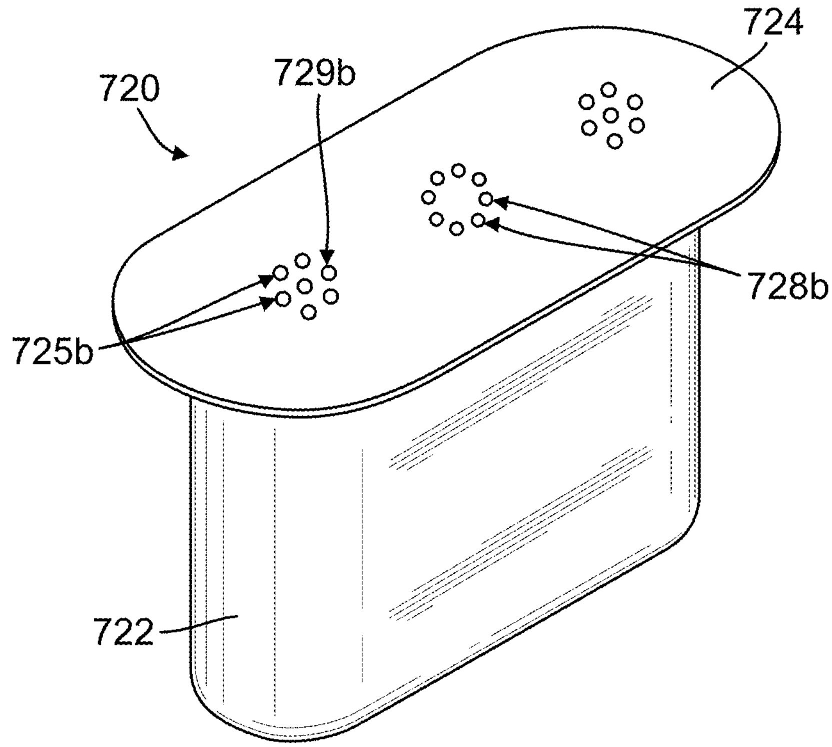


FIG. 7A

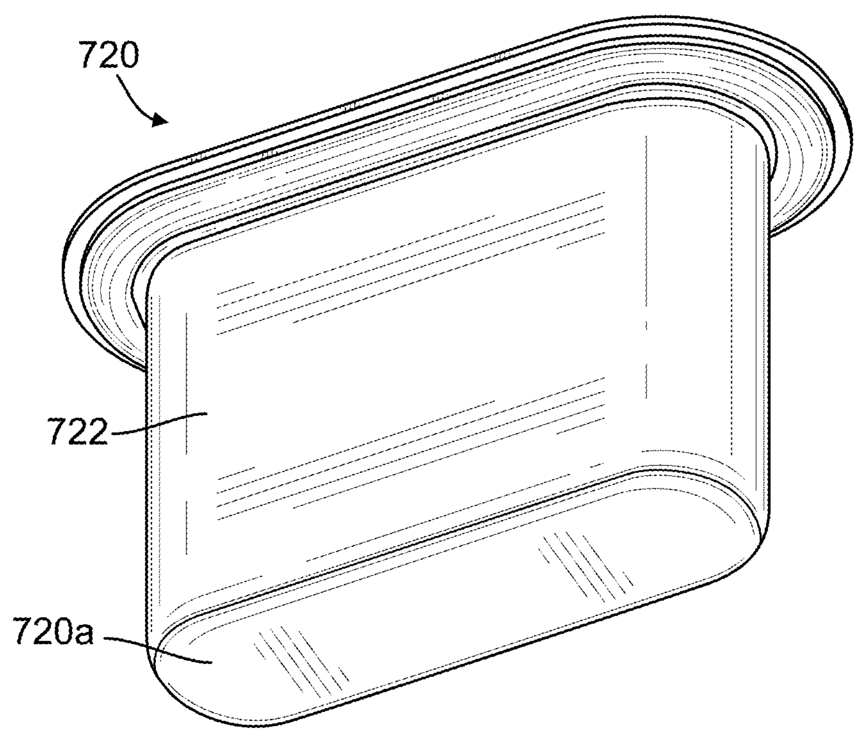


FIG. 7B

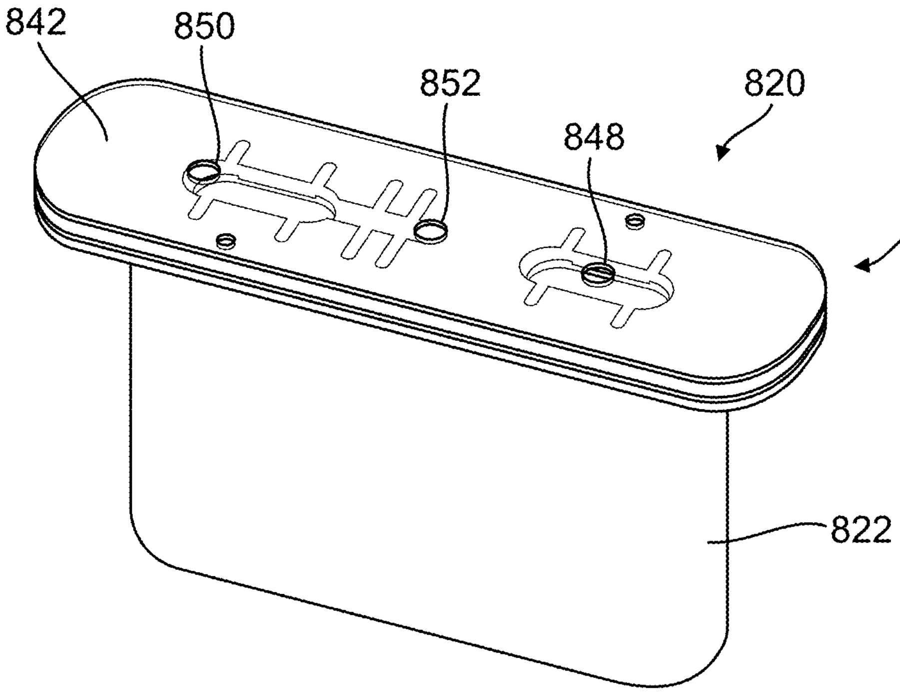

842
850
852
820
848
824
822

FIG. 8A

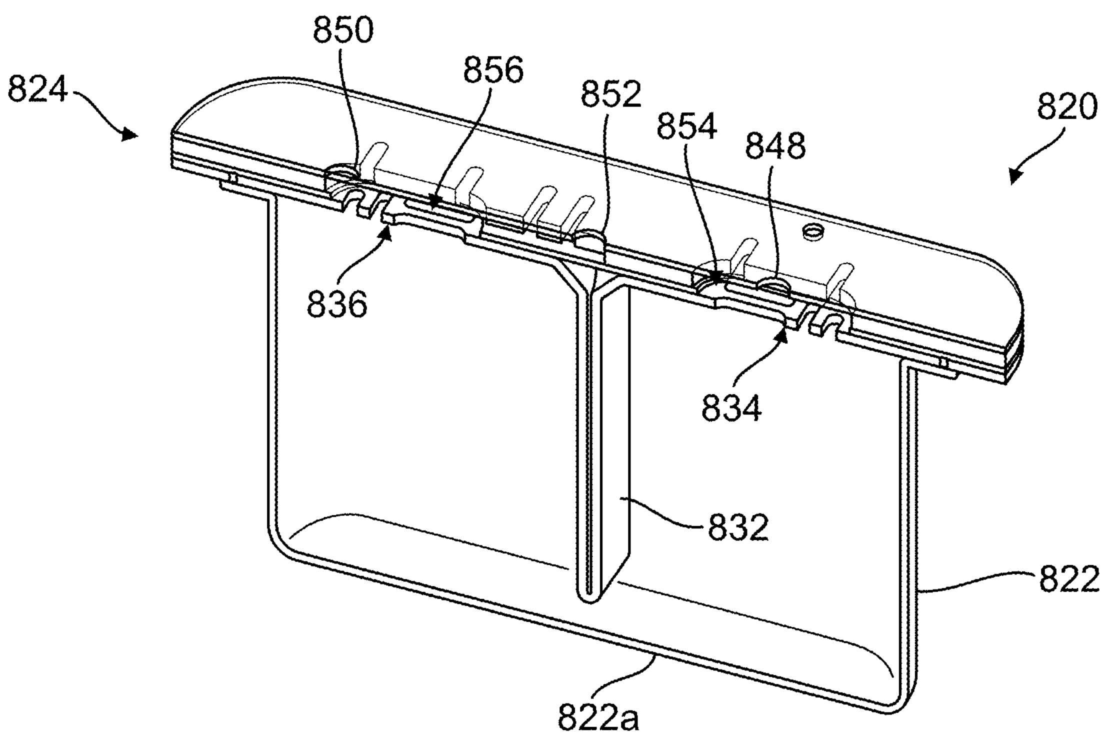

850
856
824
852
820
854
848
836
834
832
822
822a

FIG. 8B

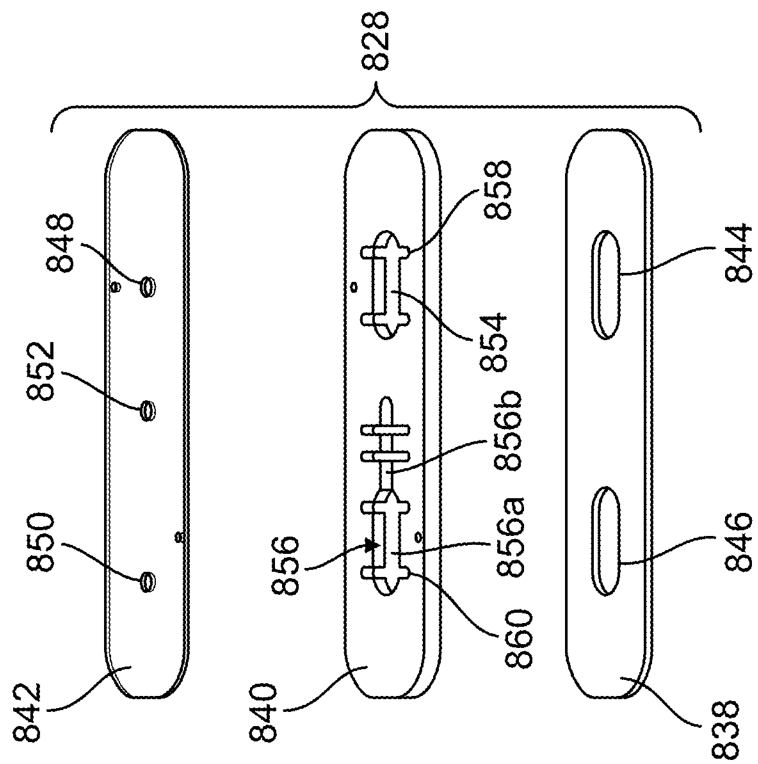

828
848
852
850
842
858
854
856b
856
856a
860
840
844
846
838

FIG. 10

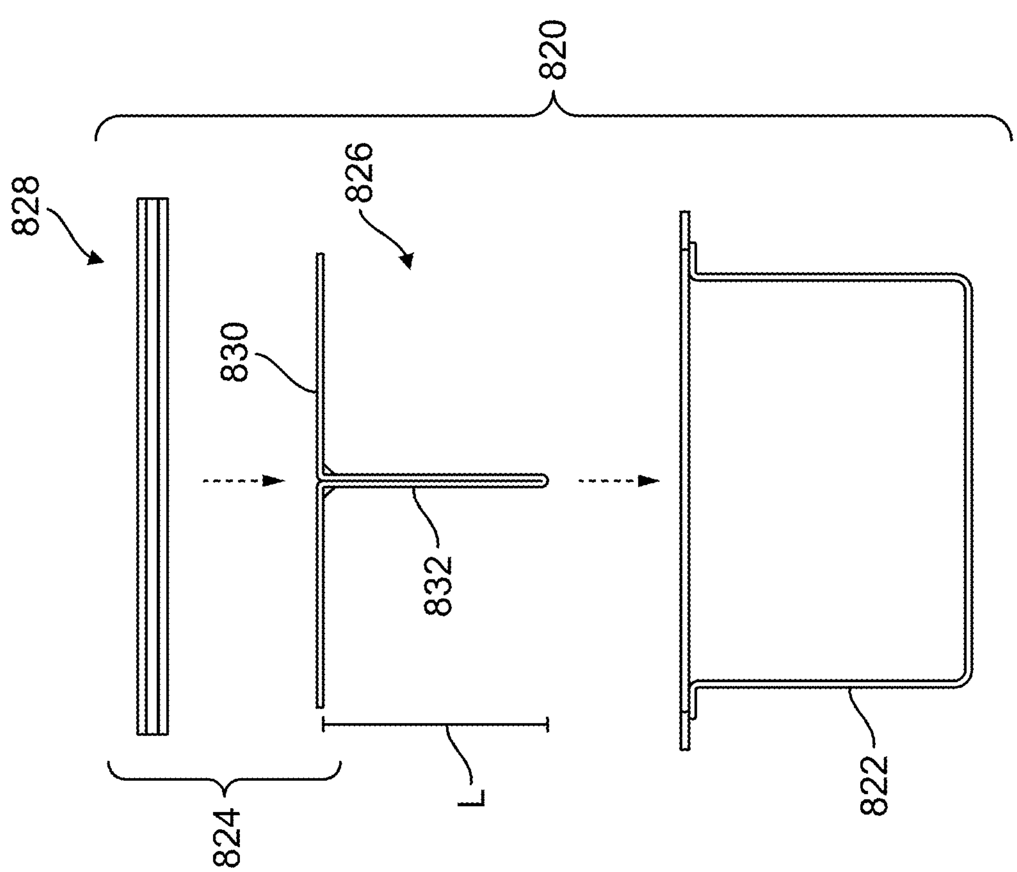

820
828
826
830
832
L
824
822

FIG. 9

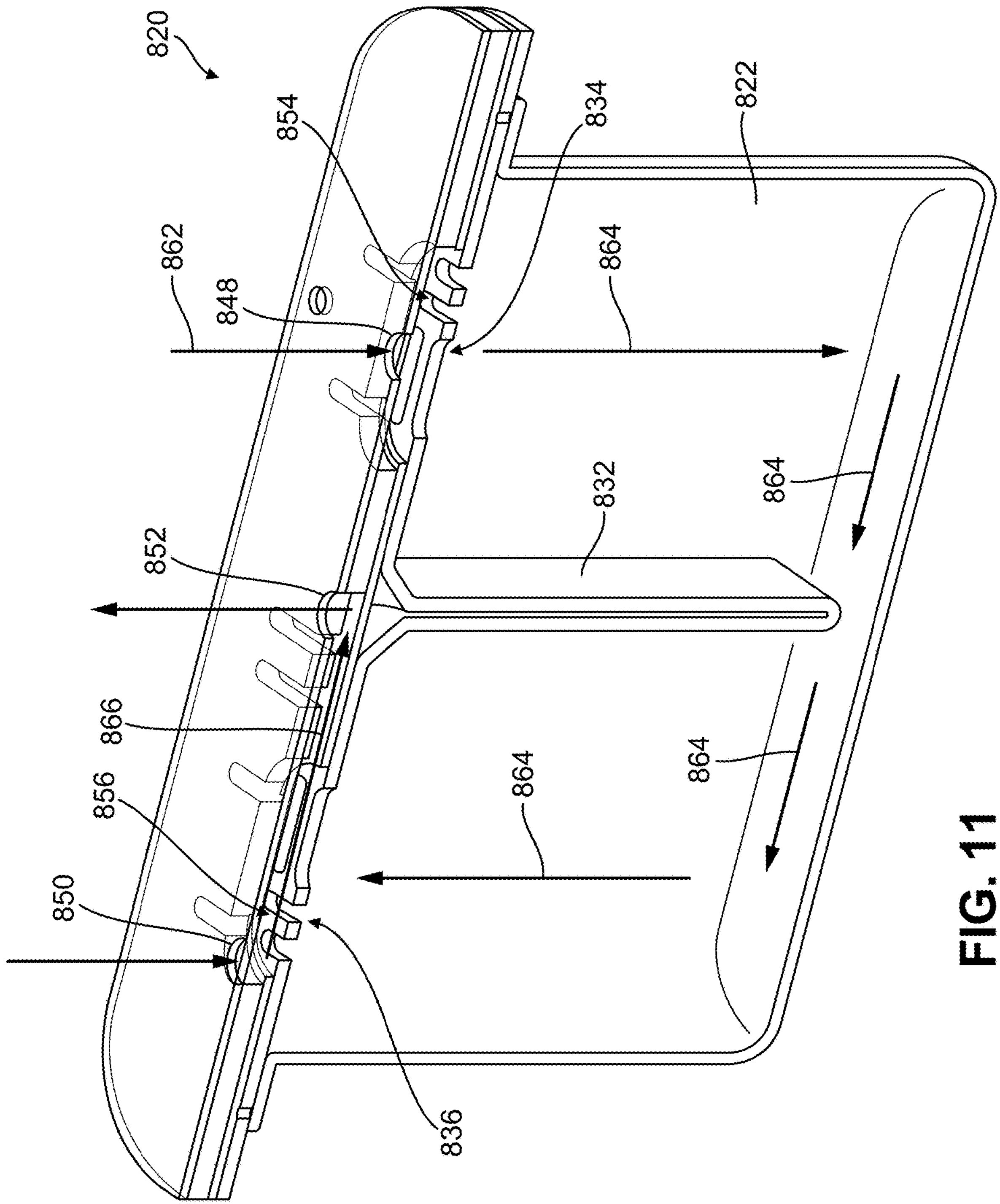


FIG. 11

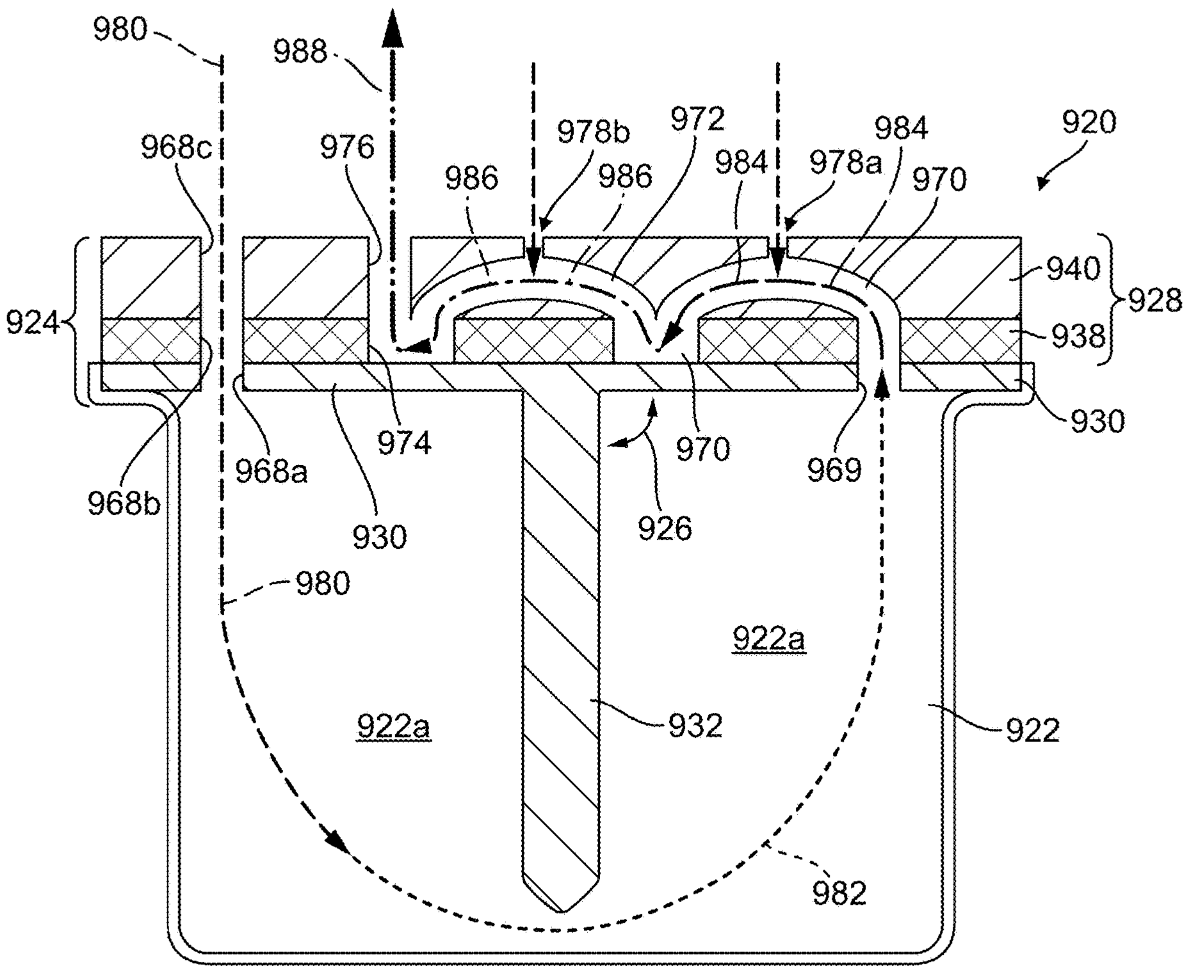

980
988
968c
976
978b
972
984
978a
920
986
986
984
970
940
928
924
938
930
968a
974
970
969
968b
930
926
980
922a
922a
932
922
982

FIG. 12

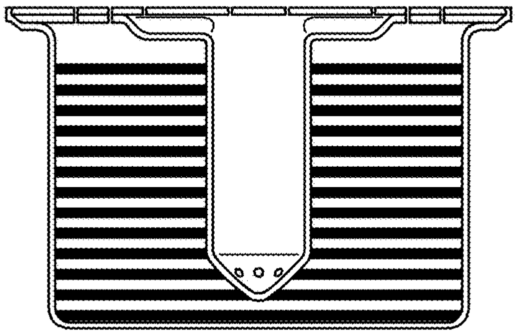


FIG. 13A

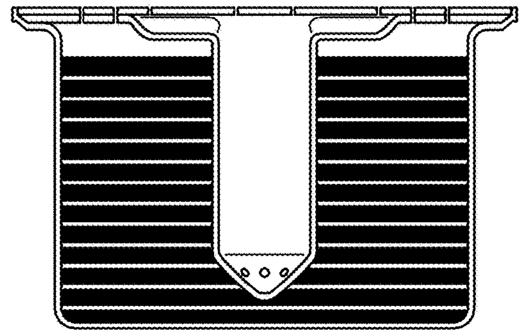


FIG. 13B

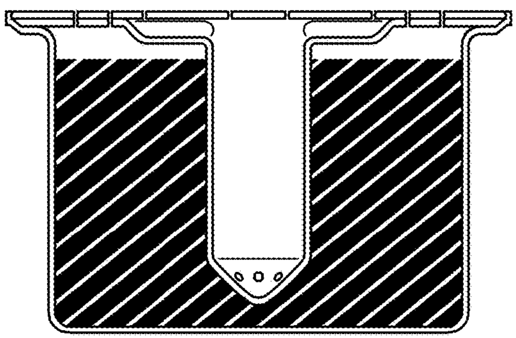


FIG. 13C

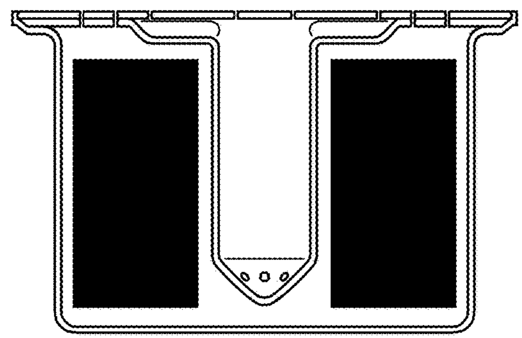


FIG. 13D

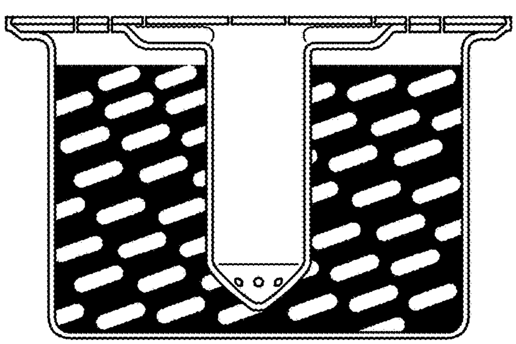


FIG. 13E

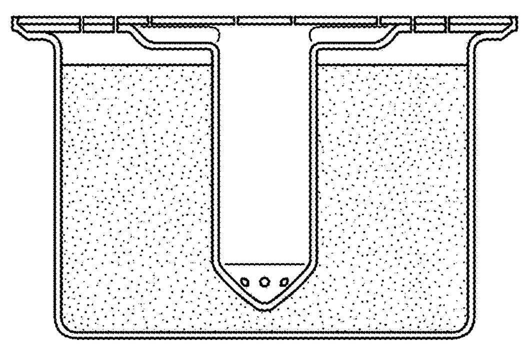


FIG. 13F

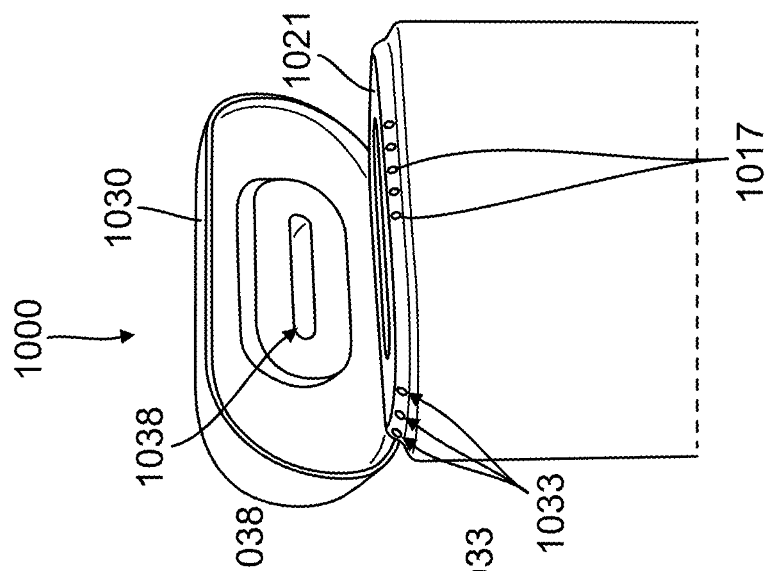


FIG. 14C

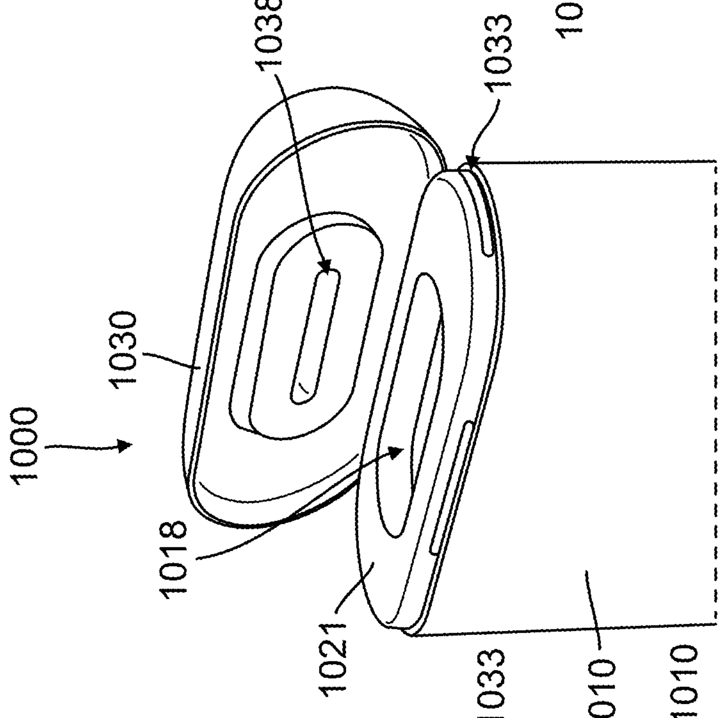


FIG. 14B

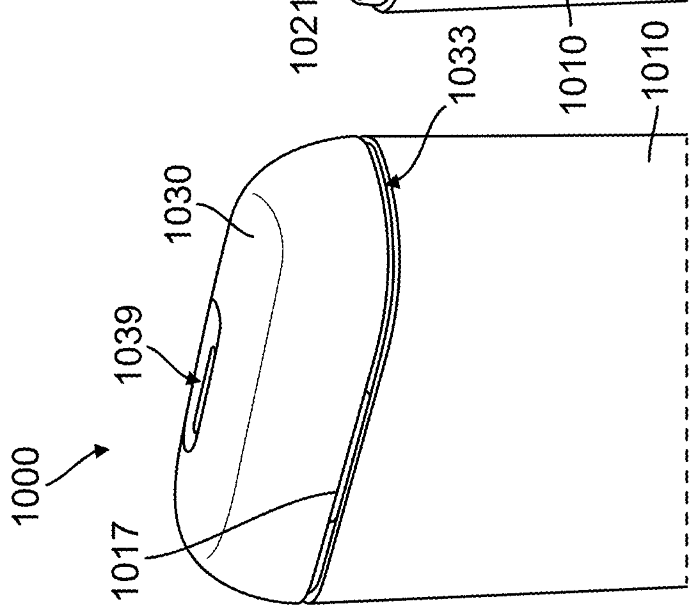


FIG. 14A

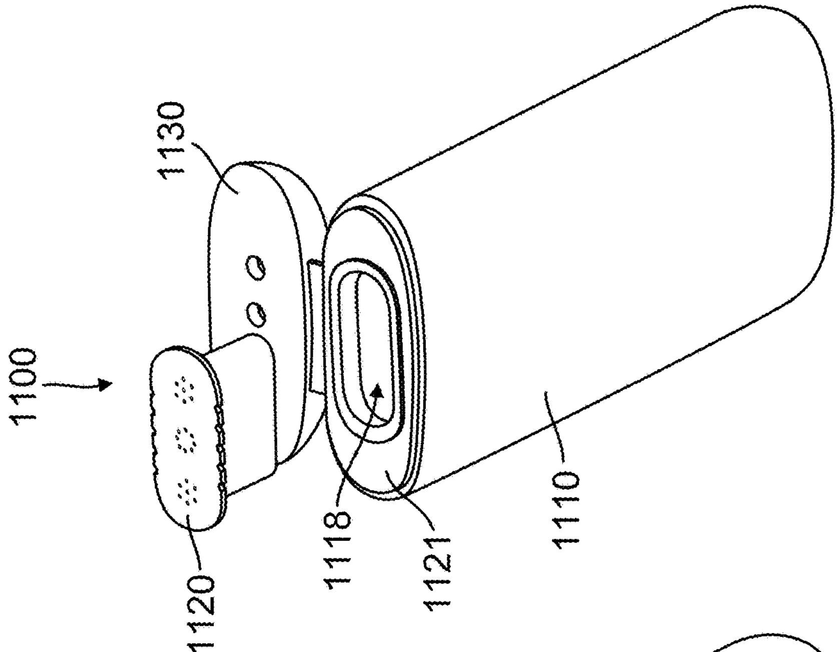


FIG. 15C

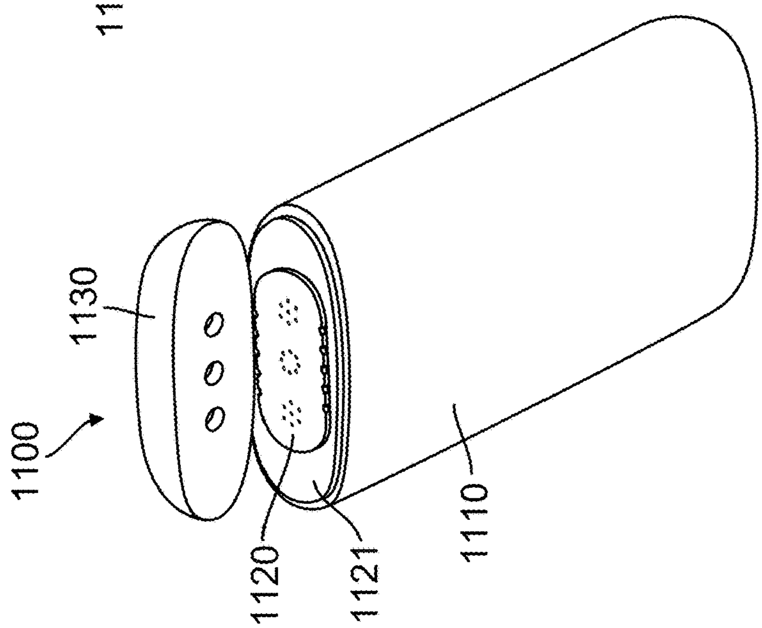


FIG. 15B

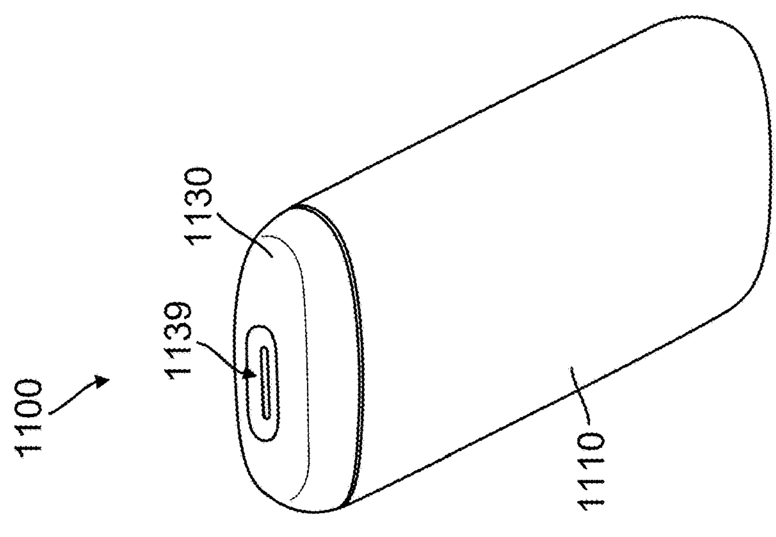


FIG. 15A

FIG. 16A

FIG. 16B

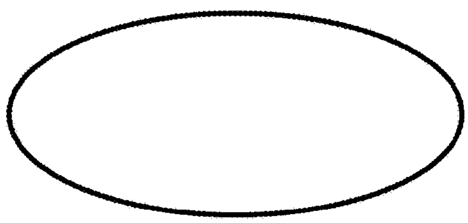


FIG. 16C

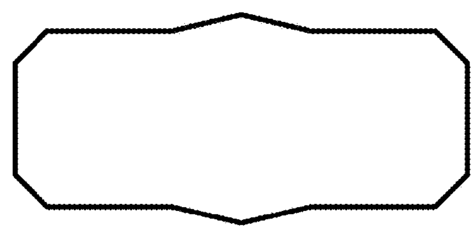


FIG. 16D

FIG. 16E

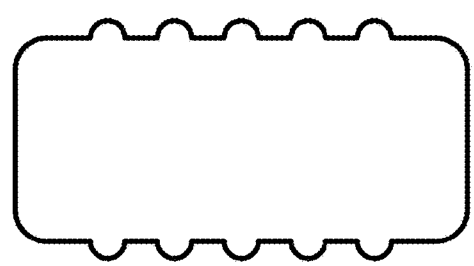


FIG. 16F

HEAT NOT BURN VAPORIZER DEVICES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Patent Application Nos. 63/274,922 and 63/410,693, filed on Nov. 2, 2021 and Sep. 28, 2022, respectively, and entitled "Heat Not Burn Vaporizer Devices" the disclosures of which are incorporated herein by reference in their entirety.

TECHNICAL FIELD

[0002] The subject matter described herein relates to vaporizer devices, including vaporizer devices comprising a vaporizer body configured to heat a cartridge of vaporizable material.

BACKGROUND

[0003] Vaporizer devices, which can also be referred to as vaporizers, electronic vaporizer devices, or e-vaporizer devices, can be used for delivery of an aerosol (for example, a gas-phase and/or a condensed-phase material suspended in a stationary or moving mass of air or some other gas carrier) containing one or more active ingredients by inhalation of the aerosol by a user of the vaporizer device. For example, electronic nicotine delivery systems (ENDS) include a class of vaporizer devices that are battery powered and that can be used to simulate the experience of smoking, but without burning of tobacco or other substances. Vaporizer devices are gaining increasing popularity both for prescriptive medical use, in delivering medicaments, and for consumption of tobacco, nicotine, and other plant-based materials. Vaporizer devices can be portable, self-contained, and/or convenient for use.

[0004] In use of a vaporizer device, the user inhales an aerosol, colloquially referred to as "vapor," which can be generated by a heating element that vaporizes (e.g., causes a liquid or solid to at least partially transition to the gas phase) a vaporizable material, which can be liquid, a solution, a solid, a paste, a wax, and/or any other form compatible for use with a specific vaporizer device. The vaporizable material used with a vaporizer device can be provided within a cartridge (e.g., a separable part of the vaporizer device that contains vaporizable material) that includes an outlet (e.g., a mouthpiece or an outlet in fluid communication with a mouthpiece) for inhalation of the aerosol by a user.

[0005] To receive an inhalable aerosol generated by a vaporizer device, a user may, in certain examples, activate the vaporizer device by taking a puff, by pressing a button, and/or by some other approach. A puff as used herein can refer to inhalation by the user in a manner that causes a volume of air to be drawn into the vaporizer device such that the inhalable aerosol is generated by a combination of vaporized material (e.g., gas-phase material) with the volume of air.

[0006] An approach by which a vaporizer device generates an inhalable aerosol from a vaporizable material involves heating the vaporizable material (e.g., within a cartridge, an insert, a vaporization chamber, a heater chamber, an oven, and/or a compartment associated with a heating element) to cause at least a portion of the vaporizable material to be converted to vaporized material (e.g., gas-phase material). A vaporization chamber, heater chamber, oven, or the like can refer to an area or volume in the vaporizer device within which a heat source (for example, a conductive, convective, and/or radiative heat source) causes heating of a vaporizable material to produce a vaporized material and allow the vaporized material to mix with air to form an aerosol for inhalation by a user of the vaporizer device.

[0007] Vaporizer devices can be controlled by one or more controllers, electronic circuits (for example, sensors, heating elements, buttons, switches), and/or the like on or in the vaporizer device. Vaporizer devices can also wirelessly communicate with an external controller (e.g., a computing device such as a personal computer or smartphone).

[0008] In some implementations, vaporizer cartridges that contain solid vaporizable material (e.g., comprising plant material such as tobacco leaves and/or parts of tobacco leaves) must be heated to undesirably high temperatures in order to cause inner regions of the vaporizable material to be heated to a minimum temperature required for vaporization. As a result, portions of the solid vaporizable material contained within a vaporizer cartridge can burn or char at these high temperatures and produce combustion or partial combustion byproducts (e.g., chemical elements or chemical compounds) that may have undesirable characteristics, such as unpleasant smells or tastes, negative health impacts, etc. Furthermore, uniform heating of the vaporizable material in current conduction-based vaporizers may be difficult to achieve due to the low thermal conductivity of certain vaporizable materials (e.g., plant materials, such as tobacco). Accordingly, controlled and even distribution of heat is desirable in such devices.

[0009] Conduction-based vaporizer devices may be configured to convert to the gas phase one or more compounds present in vaporizable material that includes a liquid component (e.g., solid material soaked in a liquid solution, at least partially saturated with a liquid solution, dipped in a liquid solution, treated with a liquid solution, and/or the like), using a heating element that contacts the vaporizable material. As such, the liquid component can contaminate the heating element. This contamination can ultimately compromise performance of the vaporizer device. Some vaporizers may incorporate the heating element into the disposable part of the vaporizer device (e.g., the cartridge), such that the heating element may be replaced with each new cartridge and thereby limit, but not eliminate, heating element contamination. However, this can increase manufacturing labor and costs associated with the disposable part.

[0010] Some issues with current vaporizer devices include the inability to efficiently and effectively heat the vaporizable material without wasting a significant amount of energy. For example, some vaporizer devices include a heater body wrapped around an external surface of a tobacco material and placed directly in an airstream. Such a configuration may cause one or more heater surfaces to be exposed to the airstream, thereby losing at least a portion of thermal energy produced by the heater that could have been used to heat the tobacco material. As such, energy may be wasted as the generated heat is not effectively utilized.

[0011] Vaporizer devices configured to embed some or part of a heater apparatus inside of the tobacco material may include airflow passing through the tobacco material thereby prohibiting tight tobacco compaction around the heater, thus diminishing heat transfer from the heater to the tobacco material. Furthermore, vaporizer devices with a heater element embedded within or at least partially surrounded by the tobacco may also experience cleaning and hygiene issues.

For example, as the heater pierces the tobacco, residue may be left on the heater element after use, thereby requiring the user to clean the heater element before continued use.

SUMMARY

[0012] Aspects of the current subject matter relate to vaporizer devices including various implementation of a vaporizer body and/or cartridge of vaporizable material configured to generate an inhalable aerosol. For purposes of summarizing, certain aspects, advantages, and novel features have been described herein. It is to be understood that not all such advantages may be achieved in accordance with any one particular implementation. Thus, the disclosed subject matter may be implemented, embodied, or carried out in a manner that achieves or optimizes one advantage or group of advantages without achieving all advantages as may be taught or suggested herein. The various features and items described herein may be incorporated together or separable, except as would not be feasible based on the current disclosure and what a skilled artisan would understand from it.

[0013] In various implementations, a vaporizer device (e.g., for generating an inhalable aerosol) includes a receptacle, one or more heating elements positioned to heat the receptacle, a cartridge configured to be inserted into the receptacle, and a mouthpiece. The cartridge includes a container comprising vaporizable material and the container is configured to, at least in part, heat the vaporizable material when the heating element heats the receptacle. The cartridge can additionally include a lid having a plurality of first air inlets configured to direct air into the container and/or at least one air outlet. The cartridge further includes a structure within the container, the structure configured to direct the air through the vaporizable material to form a vaporized material and/or direct the vaporized material towards the at least one air outlet. The cartridge further includes at least one condensation chamber configured to condense the vaporized material into an inhalable aerosol, where the at least one condensation chamber is in fluid communication with the at least one air outlet. The mouthpiece can include a mouthpiece outlet configured to deliver an inhalable aerosol to a user, and/or the mouthpiece outlet can be in fluid communication with the at least one condensation chamber.

[0014] In interrelated implementations, which may be included in a vaporizer device of any of the implementations described, the receptacle comprises an oven. Optionally, the one or more heating elements are positioned at, against, near, and/or along one or more walls of the receptacle. The one or more walls of the receptacle can include a bottom receptacle wall that is distal to the mouthpiece and/or one or more side walls extending in a longitudinal dimension that is perpendicular to the bottom receptacle wall.

[0015] In optional variants of the implementations described, a heating element of the one or more heating elements extends along at least a portion of the one or more side walls of the receptacle and/or a heating element of the one or more heating elements is wrapped around at least a portion of an exterior of the receptacle. In optional variants of the implementations described, a heating element of the one or more heating elements extends along at least a portion of the bottom receptacle wall. Any of the heating element(s) may be the same heating element or separate heating elements. Optionally the heating element(s) may be flexible heating circuit(s) and/or ceramic heater(s). The heating element(s) may be in direct contact with the cartridge or indirect contact with the cartridge (e.g., in thermal contact with but not physically touching the cartridge). For example, one or more flexible heating circuit(s) can be in contact with and/or wrapped around at least a portion (e.g., majority or minority) of the surfaces of the side walls and/or bottom wall of the receptacle or oven. In another example, a ceramic heater may additionally or alternatively be positioned at (or at least partially form) the bottom wall of the receptacle or oven.

[0016] In optional variants of the implementations described, the cartridge includes one or more side walls extending between a proximal end and a distal end of the cartridge (e.g., opposite ends) and/or a bottom container wall at or near (e.g., proximate) the distal end of the cartridge. Optionally, the lid includes a top barrier at or near (e.g., proximate) the proximal end of the cartridge. The lid can include a base component that includes a shaft having one or more shaft through-holes.

[0017] In optional variants of the implementations described, the container, lid (e.g., top barrier, perforated lid, and/or base component), and/or other components of the cartridge can be formed of or otherwise include non-vapor permeable material, such as metal, metal alloy, paper material such as cardstock, corrugated material such as cardboard, tobacco paper, temperature-resistant plastic, and/or the like. If a metal or metal alloy is used, it can include aluminum and/or stainless steel. In optional variants of the implementations described, at least a portion of the lid (e.g., a top barrier, perforated lid, and/or base component) can include paper material and the container and other portions of the lid (perforated lid and/or base component) can include aluminum or stainless steel.

[0018] In interrelated implementations, which may be included in a vaporizer device of any of the implementations described, the vaporizer device includes at least one airflow path configured to deliver the inhalable aerosol to the user. In optional variants of the implementations described, the structure (of the cartridge) includes a baffle or a shaft having a plurality of shaft through-holes. In other optional variants of the implementations described, the airflow path includes the plurality of air inlets, the plurality of through-holes, the at least one condensation chamber, the at least one air outlet, the mouthpiece outlet, and/or the plurality of shaft through-holes. In optional variants of the implementations described, the shaft includes (one or more of) the at least one condensation chamber, and (one or more of) the at least one condensation chamber is in fluid communication with (one or more of) the plurality of air inlets, which are configured to direct air into (one or more of) the at least one condensation chamber to promote nucleation of the vaporized material into an inhalable aerosol.

[0019] In optional variants of the implementations described, the mouthpiece includes (one or more of) the at least one condensation chamber and includes or forms at least a portion of at least one air inlet in fluid communication with (one or more of) the at least one condensation chamber. The at least one air inlet is configured to direct air into (one or more of) the at least one condensation chamber to promote nucleation of the vaporized material into the inhalable aerosol.

[0020] In optional variants of the implementations described, the mouthpiece includes or forms at least a portion an air inlet configured to direct air into the vaporizer device. In optional variants of the implementations described, the lid includes at least one second air inlet configured to direct air toward a combined airflow path of the vaporized material to thereby promote nucleation of the vaporized material into the inhalable aerosol. In some aspects of implementations described, the directed air mixes with the combined airflow path within at least a portion of the cartridge, outside of the cartridge, or both.

[0021] In optional variants of the implementations described, the structure (of the cartridge) includes at least one first hole and at least one second hole, with the at least one first hole being configured to direct the air passing through the plurality of air inlets of the lid into the container and the at least one second hole being configured to direct the vaporized material toward the at least one air outlet of the lid. The combination of the at least one first hole and the at least second hole allows air ingress and air egress into and out of the cartridge through the lid. Optionally, air ingress through the at least first hole passes through the lid in a first direction and air egress through the at least one second holes passes through the lid in a second direction that is different than the first direction (e.g., opposite directions relative to each other).

[0022] In interrelated implementations, which may be included in a vaporizer device of any of the implementations described, the vaporizable material can include solid plant-based material, such as tobacco. In optional variants of the implementations described, the vaporizable material includes both a tobacco substance and a non-tobacco substance. Optionally, the tobacco substance includes tobacco leaves and the non-tobacco substance includes a substance with similar characteristics to the tobacco substance. The similar characteristics can include a heat transfer profile of the tobacco substance, an air transfer profile of the tobacco substance, a capillary pressure profile of the tobacco substance, a porosity profile of the tobacco substance, and/or the like. For example, the substance can include puffed-up tobacco stems, hemp, cotton, wood, porous glass beads, a porous ceramic, and/or the like. Optionally, the tobacco leaves include dried or dehydrated tobacco leaves.

[0023] In optional variants of the implementations described, the tobacco substance and the non-tobacco substance are formed and/or layered in sheets and/or strands. Optionally, the non-tobacco substance is formed into pellets, boluses, and/or beads interspersed within the tobacco substance. Also optionally, the tobacco substance and the non-tobacco substance are mixed together into a homogenous or non-homogenous mixture. In interrelated implementations, which may be included in a vaporizer device of any of the implementations described, the structure includes a filter upstream of the at least one air outlet.

[0024] In optional variants of the implementations described, the structure is further configured to direct the vaporized material towards the at least one air outlet.

[0025] In optional variants of the implementations described, the at least one condensation chamber is positioned within the cartridge.

[0026] In optional variants of the implementations described, the lid includes a filter assembly. Optionally, the filter assembly includes a first layer and an absorbent layer, in which the at least one condensation chamber is defined within the absorbent layer. Also optionally, the filter assembly further includes a second layer, in which the absorbent layer is positioned between the first layer and the second layer. Also optionally, each of the first layer, second layer, and absorbent layer has at least one through-hole extending therethrough. Optionally, the absorbent layer includes at least one aeration hole, in which the at least one aeration hole is in fluid communication with the condensation chamber.

[0027] The details of one or more variations of the subject matter described herein are set forth in the accompanying drawings and the description below. Other features and advantages of the subject matter described herein will be apparent from the description and drawings, and from the claims. The claims that follow this disclosure are intended to define the scope of the protected subject matter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The accompanying drawings, which are incorporated in and constitute a part of this specification, show certain aspects of the subject matter disclosed herein and, together with the description, help explain some of the principles associated with the disclosed implementations. The patent or application file contains at least one drawing executed in color. Copies of this patent or patent application with color drawing(s) will be provided by the Office upon request and payment of the necessary fee. In the drawings:

[0029] FIG. **1** illustrates a block diagram of a vaporizer device, consistent with implementations of the current subject matter;

[0030] FIG. **2**A illustrates a perspective view of an implementation of a vaporizer device, consistent with implementations of the current subject matter;

[0031] FIG. **2**B illustrates another perspective view of the vaporizer device of FIG. **2**A, in which the mouthpiece is removed;

[0032] FIG. **3** illustrates a front view of an implementation of a cartridge, consistent with implementations of the current subject matter;

[0033] FIG. **4**A illustrates a front cross-sectional view of a vaporizer device, consistent with implementations of the current subject matter;

[0034] FIG. **4**B illustrates a front cross-sectional view of a vaporizer device, consistent with implementations of the current subject matter;

[0035] FIG. **4**C illustrates a front cross-sectional view of a vaporizer device, consistent with implementations of the current subject matter;

[0036] FIG. **4**D illustrates a front cross-sectional view of a vaporizer device, consistent with implementations of the current subject matter;

[0037] FIG. **4**E illustrates a front cross-sectional view of a vaporizer device, consistent with implementations of the current subject matter;

[0038] FIG. **4**F illustrates a front cross-sectional view of a vaporizer device, consistent with implementations of the current subject matter;

[0039] FIG. **4**G illustrates a front cross-sectional view of a vaporizer device, consistent with implementations of the current subject matter;

[0040] FIG. **4**H illustrates a front cross-sectional view of a vaporizer device, consistent with implementations of the current subject matter;

[0041] FIG. **4**I illustrates a front cross-sectional view of a vaporizer device, consistent with implementations of the current subject matter;

[0042] FIG. **5**A illustrates a perspective cross-sectional view of a vaporizer device, consistent with implementations of the current subject matter;

[0043] FIG. **5**B illustrates a front cross-sectional view of a vaporizer device, consistent with implementations of the current subject matter;

[0044] FIG. **6** illustrates a front cross-sectional view of a vaporizer cartridge, consistent with implementations of the current subject matter;

[0045] FIG. **7**A illustrates a top perspective view of a vaporizer cartridge, consistent with implementations of the current subject matter;

[0046] FIG. **7**B illustrates a bottom perspective view of a vaporizer cartridge, consistent with implementations of the current subject matter;

[0047] FIG. **8**A illustrates a top perspective view of a vaporizer cartridge, consistent with implementations of the current subject matter;

[0048] FIG. **8**B illustrates a cross-sectional view of the vaporizer cartridge of FIG. **8**A;

[0049] FIG. **9** illustrates a partially exploded view of the vaporizer cartridge of FIG. **8**A;

[0050] FIG. **10** illustrates a top perspective cross-sectional view of a filter assembly of the vaporizer cartridge of FIG. **8**A;

[0051] FIG. **11** illustrates a magnified view of the vaporizer cartridge of FIG. **8**B;

[0052] FIG. **12** illustrates a front cross-sectional view of a vaporizer cartridge, consistent with implementations of the current subject matter;

[0053] FIG. **13**A illustrates a front cross-sectional view of a vaporizer cartridge, consistent with implementations of the current subject matter;

[0054] FIG. **13**B illustrates a front cross-sectional view of a vaporizer cartridge, consistent with implementations of the current subject matter;

[0055] FIG. **13**C illustrates a front cross-sectional view of a vaporizer cartridge, consistent with implementations of the current subject matter;

[0056] FIG. **13**D illustrates a front cross-sectional view of a vaporizer cartridge, consistent with implementations of the current subject matter;

[0057] FIG. **13**E illustrates a front cross-sectional view of a vaporizer cartridge, consistent with implementations of the current subject matter;

[0058] FIG. **13**F illustrates a front cross-sectional view of a vaporizer cartridge, consistent with implementations of the current subject matter;

[0059] FIG. **14**A illustrates a top perspective view of a vaporizer device, consistent with implementations of the current subject matter;

[0060] FIG. **14**B illustrates a top perspective view of a vaporizer device, consistent with implementations of the current subject matter;

[0061] FIG. **14**C illustrates a top perspective view of a vaporizer device, consistent with implementations of the current subject matter;

[0062] FIG. **15**A illustrates a top perspective view of a vaporizer device, consistent with implementations of the current subject matter;

[0063] FIG. **15**B illustrates a top perspective view of a vaporizer device, consistent with implementations of the current subject matter;

[0064] FIG. **15**C illustrates a top perspective view of a vaporizer device, consistent with implementations of the current subject matter;

[0065] FIG. **16**A illustrates an exemplary cross-section of a cartridge and/or receptacle of a vaporizer device, consistent with implementations of the current subject matter;

[0066] FIG. **16**B illustrates an exemplary cross-section of a cartridge and/or receptacle of a vaporizer device, consistent with implementations of the current subject matter;

[0067] FIG. **16**C illustrates an exemplary cross-section of a cartridge and/or receptacle of a vaporizer device, consistent with implementations of the current subject matter;

[0068] FIG. **16**D illustrates an exemplary cross-section of a cartridge and/or receptacle of a vaporizer device, consistent with implementations of the current subject matter;

[0069] FIG. **16**E illustrates an exemplary cross-section of a cartridge and/or receptacle of a vaporizer device, consistent with implementations of the current subject matter; and

[0070] FIG. **16**F illustrates an exemplary cross-section of a cartridge and/or receptacle of a vaporizer device, consistent with implementations of the current subject matter.

[0071] When practical, similar reference numbers denote similar structures, features, or elements.

DETAILED DESCRIPTION

[0072] Implementations of the current subject matter include methods, apparatuses, articles of manufacture, and systems relating to vaporization of one or more materials for inhalation by a user. For example, various implementations of vaporizer devices are described herein that provide a number of benefits, including improving contact between a heating element and/or heated surface of a heating system and a cartridge containing vaporizable material to ensure efficient and effective thermal transfer between the heating element and vaporizable material. For example, by maintaining intimate contact between the cartridge and the heating element and/or heated surface, thermal losses (e.g., to a surrounding housing of the vaporizer device) may be reduced, and heating efficiency (e.g., per amount of power consumption) may be increased. An additional benefit that may be provided by various implementations of vaporizer devices described herein is increased user satisfaction. For example, in some implementations, the proper mixing of relatively cool air (e.g., ambient temperature air) and heated air containing vaporized material can improve the formation of sub-micron sized aerosol particles, thereby reducing condensation of one or more compounds released during heating of the vaporized material onto internal surfaces (e.g., inhalation tubes and/or mouthpiece components) of the vaporizer. Such condensates may ultimately be drawn into the mouth of a user in liquid form, thereby leading to unpleasant taste sensations, and are not available for inhalation, thereby reducing an amount of available inhalable product. Accordingly, by ensuring proper mixing and aerosol generation, implementations of the current subject matter can increase user satisfaction.

[0073] In some implementations, the vaporizable material can be placed within a cartridge that is in direct contact with and/or in close proximity to a heating element of a heating system to allow for efficient and effective heat transfer from the heating element to the cartridge, and thereby to the vaporizable material. In some implementations, a cartridge comprising the vaporizable material, e.g., vaporizable material contained within an appropriately configured structure, can be placed within a vaporization chamber, heater chamber, oven, or the like, in which case the area or volume in the vaporizer device within which a heating element causes heating of at least a portion of a vaporizable material includes an internal area or volume of the cartridge. Characteristics of an appropriately configured structure may include one or more of being formed at least partially of metal or some other material that is durable under heating and that has a sufficient thermal conductivity, having one or more openings through which air may enter and/or exit the cartridge to aid in convective heating of the vaporizable material and/or conveyance of inhalable components generated by heating the vaporizable material out of the cartridge, and the like. In other implementations, the vaporizable material can be placed in direct contact with and/or in close proximity to a heating element of a heating system to allow for efficient and effective heat transfer from the heating element to the vaporizable material. As such, the vaporizer devices, heating systems, cartridges, and vaporizable material described herein can provide more efficient heating of vaporizable material and formation of inhalable aerosol compared to some currently available vaporizer devices. Other benefits are described herein and are within the scope of this disclosure.

[0074] The term "vaporizer device" as used in the following description and claims refers to any of a self-contained apparatus, an apparatus that includes two or more separable parts (e.g., a vaporizer body that includes a battery and other hardware, a cartridge and/or insert that includes a vaporizable material, and/or a mouthpiece configured to deliver an inhalable aerosol to a user), and/or the like. A "vaporizer system," as used herein, can include one or more components, such as a vaporizer device, a charger for charging the vaporizer device, a wired or wireless communication device in communication with the vaporizer device, a remote server in communication with the communication device, and/or the like. Examples of vaporizer devices consistent with implementations of the current subject matter include electronic vaporizers, electronic nicotine delivery systems (ENDS), and/or the like. Such vaporizer devices can be hand-held devices that heat (such as by convection, conduction, radiation, and/or some combination thereof) a vaporizable material to provide an inhalable dose of the material to a user.

[0075] The vaporizable material used with a vaporizer device may optionally be provided within a cartridge (e.g., an insertable and removable part of the vaporizer device that contains the vaporizable material) which can be refillable when empty, or disposable such that a new cartridge containing additional vaporizable material of a same or different type can be used. A vaporizer device can be a cartridge-using vaporizer device, a cartridge-less vaporizer device, or a multi-use vaporizer device capable of use with or without a cartridge. Some cartridge implementations can include a vaporizable material, which can be packed to an appropriate density, as described herein. In some implementations, a vaporizer device can include a heating chamber or compartment (e.g., a receptacle) configured to receive a cartridge directly therein and heat the vaporizable material for forming an inhalable aerosol.

[0076] In some implementations, a vaporizer device can be configured for use with a liquid vaporizable material (for example, a carrier solution in which an active and/or inactive ingredient(s) are suspended or held in solution, or a liquid form of the vaporizable material itself) and/or a non-liquid vaporizable material (e.g., a paste, a wax, a gel, a solid, a plant material, and/or the like). A non-liquid vaporizable material can include a plant material that emits some part of the plant material as the vaporizable material (for example, some part of the plant material remains as waste after the material is vaporized for inhalation by a user) or optionally can be a solid form of the vaporizable material itself, such that all of the solid material can eventually be vaporized for inhalation. A liquid vaporizable material can likewise be capable of being completely vaporized, or can include some portion of the liquid material that remains after all of the material suitable for inhalation has been vaporized.

[0077] Implementations of vaporizable material can be at least partly made of a non-liquid vaporizable material, such as tobacco (e.g., leaves) and/or other plant substances. In some aspects, vaporizable material can also include a humectant or other aerosol forming material or carrier, such as propylene glycol, vegetable glycerin, and/or the like. As such, some implementations of the vaporizer device can be configured to use a vaporizable material that is at least partly made of one or more vaporizable materials (e.g., that includes one or more compounds that can be converted to the gas phase when the vaporizable material is heated to a sufficient temperature) for heating and forming an inhalable aerosol, as will be described in greater detail below.

[0078] FIG. **1** depicts a block diagram illustrating an example of a vaporizer device **100** consistent with implementations of the current subject matter. Referring to FIG. **1**, the vaporizer device **100** can include a power source **112** (for example, a battery, which can be a rechargeable battery), and a controller **104** (for example, a processor, circuitry, etc. capable of executing logic) for controlling delivery of heat from a heating element **141** to cause at least a portion of the vaporizable material **102** (such as a solid, a liquid, a solution, a suspension, a part of an at least partially unprocessed plant material, etc.) of a cartridge **120** to be converted to the gas-phase. The controller **104** can be part of one or more printed circuit boards (PCBs) consistent with certain implementations of the current subject matter.

[0079] After conversion of some amount of one or more compounds present in the vaporizable material **102** to the gas phase, at least some of those gas-phase compounds can condense to form particulate matter in at least a partial local equilibrium with the gas phase as part of an aerosol, which can form some or all of an inhalable dose provided by the vaporizer device **100** during a user's puff or draw on the vaporizer device **100**. It should be appreciated that the interplay between gas and condensed phases in an aerosol generated by a vaporizer device **100** can be complex and dynamic, due to factors such as temperature (e.g., ambient or local at various points within the vaporizer device and/or cartridge, relative humidity, chemistry, vapor pressure of one or more vaporizable compounds, flow conditions in airflow paths (both inside the vaporizer device **100** and in the airways of a human or other animal), and/or mixing of the one or more compounds in the gas phase or in the aerosol phase with other air streams, which can affect one or more physical parameters of an aerosol. In some vaporizer devices, and particularly for vaporizer devices configured for delivery of very volatile compounds, the inhalable dose can exist predominantly in the gas phase (for example, formation of condensed phase particles can be very limited).

[0080] The heating element **141** can include one or more of a conductive heater, a radiative heater, and/or a convective heater. One type of heating element is a resistive heating element, which can include a material (such as a metal or alloy, for example a nickel-chromium alloy, or a non-metallic resistor) configured to dissipate electrical power in the form of heat when electrical current is passed through one or more resistive segments of the heating element. In some implementations of the current subject matter, the heating element **141** (e.g., a resistive heating element and/or the like) is configured to generate heat for converting to the gas phase one or more compounds present in the vaporizable material **102** to generate an inhalable dose of the one or more compounds present in the vaporizable material **102**. As noted, the vaporizable material **102** may be a liquid or non-liquid (or combination of both liquid and non-liquid). For example, the heating element **141** may be wrapped around, pressed into thermal contact with, or otherwise arranged to deliver heat to the vaporizable material **102** to cause release of one or more compounds into the gas phase for subsequent inhalation by a user in a gas-phase and/or a condensed (for example, aerosol particles or droplets) phase. In some implementations, the heating element **141** may be wrapped around, pressed into thermal contact with, or otherwise arranged to deliver heat to the cartridge **120** containing the vaporizable material **102** to convert the one or more compounds from the vaporizable material to the gas phase.

[0081] In some implementations, the vaporizable material **102** may be a non-liquid vaporizable material including, for example, a solid-phase material (such as a gel, a wax, or the like) or plant material (e.g., tobacco leaves and/or parts of tobacco leaves). Where the vaporizable material **102** is a non-liquid vaporizable material, the heating element **141** can be part of, or otherwise incorporated into or in thermal contact with, the walls of a heating chamber or compartment (e.g., receptacle **118**) into which the cartridge **120** and/or the vaporizable material **102** is placed. Additionally or alternatively, the heating element **141** can be used to heat air passing through or past the cartridge **120**, to cause convective heating of the vaporizable material **102** (e.g., within the cartridge **120**). In still other examples, the heating element **141** can be disposed in intimate contact with the vaporizable material **102** such that direct conductive heating of the vaporizable material **102** of the cartridge **120** occurs from within a mass of the vaporizable material **102**, as opposed to only by conduction inward from walls of the heating chamber (e.g., an oven and/or the like). Convective heating of air passing through or past the cartridge may also occur in such configurations. In some implementations, the heating element **141** can be a part of the vaporizer body **110** (e.g., part of the durable or reusable part of the vaporizer **100**), as shown in FIG. **1**.

[0082] In some implementations, the heating element **141** can be a part of the cartridge **120** (e.g., part of the disposable part of the vaporizer **100**). For example, the cartridge **120** can include one or more cartridge contacts that mate with one or more vaporizer body contacts (e.g., positioned along the receptacle **118**) for providing an electrically conductive pathway between the power source **112** of the vaporizer body **110** and the heating element **141** of the cartridge **120**.

[0083] In some implementations, the heating element **141** can provide heat to convert to the gas phase one or more compounds present in the vaporizable material **102** in association with a user puffing (e.g., drawing, inhaling, etc.) on a mouthpiece **130** and/or end of the vaporizer device **100** to cause air to flow from an air inlet, along an airflow path for assisting with forming an aerosol that can be delivered out through an air outlet in the mouthpiece **130** and inhaled by a user. Incoming air moving along the airflow path moves past (e.g., around, past, over, etc.) or through the cartridge **120** and/or vaporizable material **102** where compounds released from the vaporizable material **102** into the gas-phase are entrained into the air. The heating element **141** can be activated via the controller **104**, which can optionally be a part of the vaporizer body **110** as discussed herein, causing current to pass from the power source **112** through a circuit including the heating element **141**, which can be part of the vaporizer body **110**. As noted herein, at least some of the entrained one or more gas-phase compounds can condense while passing through the remainder of the airflow path such that an inhalable dose of the one or more compounds in an aerosol form can be delivered from the air outlet (e.g., via the mouthpiece **130**) for inhalation by a user.

[0084] In some implementations, the heating element **141** can be activated in association with a user interacting with the vaporizer device **100**. For example, activation of the heating element **141** can be caused by automatic detection of a puff or other user interaction based on one or more signals generated by one or more sensors **113**. The one or more sensors **113** and/or the signals generated by the one or more sensors **113** can include one or more of: a pressure sensor or sensors disposed to detect pressure along the airflow path of the vaporizer device **100** relative to ambient pressure or optionally to measure changes in absolute pressure; a temperature sensor or sensors, such as a thermistor, a thermocouple, or the like disposed to measure the temperature of the receptacle **118** or some other component of the vaporizer device or the cartridge itself; one or more circuits configured to determine a temperature of the heating element **141**, for example by measuring or determining a resistance of the heating element **141**; a motion sensor or sensors, such as an accelerometer, a gyroscope, or the like, configured to detect movement, vibration, orientation, position, acceleration, etc. of the vaporizer device **100**; a flow sensor or sensors configured to detect a flow rate of air, gas, or liquid within the vaporizer device **100**; a capacitive sensor configured to detect touch, such as of a user's finger(s), palm(s), lip(s)), etc. on some part of the vaporizer device **100**; detection of interaction with the vaporizer device **100** via one or more input devices **116**, such as buttons, other tactile control devices, or the like of the vaporizer device **100**; receipt of signals from a computing device in communication with the vaporizer device **100**; and/or via other approaches for determining that a puff is occurring or imminent.

[0085] In some implementations, the vaporizer device **100** can be configured to start a heating cycle that can include a period of heating the heating element **141**, receptacle **118**, cartridge **120**, and/or vaporizable material **102** to an operating (e.g., pre-determined) temperature or temperature range (e.g., a temperature or range sufficient to convert to the gas phase one or more compounds present in the vaporizable material **102**). Once the heating element **141**, receptacle **118**, cartridge **120**, and/or vaporizable material **102** reach the operating temperature or temperature range, the vaporizer device **100** can be configured to maintain or otherwise regulate the application of heat such that the vaporizable material **102** can be vaporized without burning. In some implementations, additional heat can be provided via the heating element **141** upon detection of an event, such as a user placing their lips on the vaporizer device **100**, the user taking a puff on the vaporizer device **100**, and/or any of the signals (e.g., generated by the one or more sensors **113**) described herein. The heating cycle can terminate upon detection of an additional interaction with the vaporizer device **100** via the one or more input devices **116**, upon determining that a certain amount of time has elapsed since the start of the heating cycle, upon determining that a certain amount of time has elapsed since the last detection of a user puff, upon determining that a cartridge **120** is not present within the receptacle **118**, as a result of other events, actions, detected durations of the same, etc. consistent with implementations described herein.

[0086] As discussed herein, the vaporizer device **100** consistent with implementations of the current subject matter can be configured to connect (e.g., wirelessly or via a wired connection) to a computing device (or optionally two or more devices) in communication with the vaporizer device **100**. To this end, the controller **104** can include communication hardware **105**. The controller **104** can also include a memory **108**. The communication hardware **105** can include firmware and/or can be controlled by software for executing one or more protocols for the communication.

[0087] A computing device can be a component of a vaporizer system that also includes the vaporizer device **100**, and can include its own hardware for communication, which can establish a wireless communication channel with the communication hardware **105** of the vaporizer device **100**. For example, a computing device used as part of a vaporizer system can include a general-purpose computing device (such as a smartphone, a tablet, a personal computer, some other portable device such as a smartwatch, or the like) that executes software to produce a user interface for enabling a user to interact with the vaporizer device **100**. In other implementations of the current subject matter, such a device used as part of a vaporizer system can be a dedicated piece of hardware such as a remote control or other wireless or wired device having one or more physical or soft (e.g., configurable on a screen or other display device and selectable via user interaction with a touch-sensitive screen or some other input device **116** like a mouse, pointer, trackball, cursor buttons, or the like) interface controls. The vaporizer device **100** can also include one or more outputs **117** or devices for providing information to the user. For example, the outputs **117** can include one or more light emitting diodes (LEDs) configured to provide feedback to a user based on a status and/or mode of operation of the vaporizer device **100**. The one or more LEDs can be single-color LEDs and/or multicolored LEDs (e.g., both may be separately used).

[0088] In the example in which a computing device provides signals related to activation of the heating element **141**, or in other examples of coupling of a computing device with the vaporizer device **100** for implementation of various control or other functions, the computing device executes one or more computer instruction sets to provide a user interface and underlying data handling. In one example, detection by the computing device of user interaction with one or more user interface elements can cause the computing device to signal the vaporizer device **100** to activate the heating element to reach an operating temperature for creation of an inhalable dose of aerosol. Other functions of the vaporizer device **100** can be controlled by interaction of a user with a user interface on a computing device in communication with the vaporizer device **100**.

[0089] The temperature of the heating element **141** of the vaporizer device **100** can depend on a number of factors, including an amount of electrical power delivered to the heating element **141** and/or a duty cycle at which the electrical power is delivered, conductive and/or radiative heat transfer to other parts of the vaporizer device **100** and/or to the environment, latent heat losses due to vaporization of the vaporizable material **102**, and/or convective heat losses due to airflow (e.g., air moving across the heating element **141** and/or an area heated by the heating element **141** when a user puffs on the vaporizer device **100**). As noted herein, to reliably activate the heating element **141** and/or heat the heating element **141** to a desired temperature, the vaporizer device **100** may, in some implementations of the current subject matter, make use of signals from the one or more sensors **113** (for example, a pressure sensor) to determine when a user is inhaling. The one or more sensors **113** can optionally be positioned in the airflow path and/or can be connected (for example, by a passageway or other path) to an airflow path containing an inlet for air to enter the vaporizer device **100** and an outlet via which the user inhales the resulting aerosol such that the one or more sensors **113** experiences changes (for example, pressure changes) concurrently with air passing through the vaporizer device **100** from the air inlet to the air outlet. In some implementations of the current subject matter, the heating element **141** can be activated in association with a user's puff, for example by automatic detection of the puff, or by the one or more sensors **113** detecting a change (such as a pressure change) in the airflow path.

[0090] The one or more sensors **113** can be positioned on or coupled to (e.g., electrically or electronically connected, physically or via a wireless connection) the controller **104** (for example, a printed circuit board assembly or other type of circuit board). To take measurements accurately and maintain durability of the vaporizer device **100**, it can be beneficial to provide a seal resilient enough to separate an airflow path from other parts of the vaporizer device **100**. The seal, which can be a gasket, can be configured to at least partially surround the one or more sensors **113** such that connections of the one or more sensors **113** to the internal circuitry of the vaporizer device **100** are separated from a part of the one or more sensors **113** exposed to the airflow path. Such arrangements of the seal in the vaporizer device **100** can be helpful in mitigating against potentially disruptive impacts on vaporizer components resulting from interactions with environmental factors such as water in the vapor or liquid phases and/or to reduce the escape of air from the designated airflow path in the vaporizer device **100**. Passage of air, liquid, or other fluid passing and/or contacting circuitry of the vaporizer device **100** can cause various unwanted effects, such as altered pressure readings, and/or can result in the buildup of material, such as moisture or residue, errant portions of the vaporizable material **102**, etc., in parts of the vaporizer device **100** where they can result in poor pressure signal, degradation of the one or more sensors **113** or other components, and/or a shorter life of the vaporizer device **100**. Leaks in the seal can also result in a user inhaling air that has passed over parts of the vaporizer device **100** containing, or constructed of, materials that may not be desirable to be inhaled.

[0091] In vaporizer devices in which the power source **112** is part of a vaporizer body **110** and the heating element **141** is disposed in the cartridge **120** configured to couple with the vaporizer body **110**, the cartridge **120** and vaporizer **100** may include electrical connection features (e.g., electrical contacts) for completing a circuit that includes the controller **104** (e.g., a printed circuit board, a microcontroller, or the like), the power source **112**, and the heating element **141**. The circuit completed by these electrical connections can allow delivery of electrical current to the heating element **141** (e.g., resistive heating element) and may further be used for additional functions, such as measuring a resistance of the resistive heating element for use in determining and/or controlling a temperature of the resistive heating element based on a thermal coefficient of resistivity of the resistive heating element.

[0092] In some implementations, the receptacle **118** can include all or part of the heating element **141** (e.g., a heating coil, resistive heating element, etc.) that is configured to heat the cartridge **120** received in the receptacle **118**, such as for forming an aerosol to be inhaled by a user of the vaporizer device **100**. For example, the receptacle **118** can include various implementations of the heating element **141** that are configured to receive and/or be placed in contact with the cartridge **120**. Various implementations of the heating element **141**, the receptacle **118**, and the cartridge **120** are described herein for integration within and/or use with a variety of vaporizer bodies **110** for forming inhalable aerosol.

[0093] In some implementations, the cartridge **120** can be configured for insertion in the receptacle **118**, such as for forming contact between an outer surface of the cartridge **120** and one or more inner walls of the receptacle **118**. In some implementations, the cartridge **120** can have a same or a similar shape as the receptacle **118**. In some implementations, the cartridge **120** can include a square or rectangular shape. In some implementations, the cartridge **120** can include a circular cross-section and/or a cylindrical shape. In some implementations, the cartridge **120** can have a non-circular cross section transverse to the axis along which the cartridge **120** is inserted into the receptacle **118**. The non-circular cross section(s) of the cartridge **120** and/or receptacle **118** can include two sets of parallel or approximately parallel opposing sides (e.g., having a parallelogram-like shape), or other shapes, including curved shapes, having rotational symmetry of at least order two. For example, FIGS. **11**A-**11**F illustrate example cross-sections of the cartridge **120** and/or receptacle **118**, including a rectangular shape (FIG. **11**A), a rounded rectangular shape (FIG. **11**B), an elliptical or oval shape (FIG. **11**C), or other shapes that include corners, bends, edges, protrusions, recesses, and/or the like (FIGS. **11**D-**11**F). In this context, approximate shape indicates that a basic likeness to the described shape is apparent, but that sides of the shape in question need not be completely linear and vertices need not be completely sharp. Rounding of both or either of the edges or the vertices of the cross-sectional shape is contemplated in the description of any non-circular cross section referred to herein.

[0094] In some implementations, at least one of the one or more inner walls forming the receptacle **118** can include the heating element **141** and/or include thermally conductive material. For example, cartridge **120** configurations in which the cartridge **120** forms a sliding fit and/or forms close contact with the receptacle **118** can allow for efficient heat transfer between the heating element **141**, the receptacle **118**, and the cartridge **120**, thereby causing efficient and effective heating of the vaporizable material **102** of the cartridge **120**.

[0095] Furthermore, the cartridge **120** can include compressed and/or higher density configurations of non-liquid vaporizable material **102**, which can further contribute to efficient and effective heating and converting to the gas phase one or more compounds present in the vaporizable material **102**. For example, vaporizable material **102** in a compressed and/or high-density configuration can include a minimal amount of air or pockets of air in the vaporizable material **102** thereby increasing the efficiency and effectiveness of transferring heat within the vaporizable material **102**. Such a configuration can allow for reduced power consumption at least because less heating power is needed to effectively heat the vaporizable material **102** to a temperature sufficient to cause release of inhalable substances. Additionally, lower temperatures (e.g., at a contact surface of an oven or heating element) can be used to heat the vaporizable material **102** at least because of the improved heating efficiency of the vaporizable material **102**, which can also reduce power consumption and formation of hazardous byproducts resulting from heating the vaporizable material at higher temperatures. Various implementations of the cartridge **120** are described herein that include the vaporizable material formed in compressed and/or high-density configurations for achieving at least some of the benefits described above.

[0096] In some implementations, the vaporizer device **100** can include a heating system configured to receive and heat the vaporizable material **102** for generating an inhalable aerosol. For example, implementations of the heating system can include one or more heating elements **141** positioned at, against, near, within, outside, and/or along the walls of the receptacle **118** (e.g., extending along at least a portion of the wall(s) at the distal end (e.g., bottom) of the receptacle **118**, extending along at least a portion of each of the distal wall(s) and/or side wall(s) of the receptacle **118**, etc.). In some implementations, the one or more heating elements **141** can be configured to heat one or more of the walls of the receptacle **118** from the outside to the interior of the receptacle **118** (e.g., with the vaporizable material **102** being in the interior of the receptacle **118**). The heating system can also include at least one airflow pathway, which can be configured to move heated air through the vaporizable material **102**. As will be described in greater detail below, the heating system can be configured to receive the cartridge **120** and heat the cartridge **120** from the outside-in (e.g., from an outer surface to an interior of the cartridge **120** (e.g., the interior being where vaporizable material **102** is housed)) using at least one heating element **141** to provide an inhalable aerosol via one or more airflow pathways for inhalation by a user.

[0097] Various implementations of such heating systems of vaporizer devices **100** are described herein that provide a number of benefits, including evenly distributing heat through the vaporizable material **102** of the cartridge **120**. This can result in improved inhalable aerosol generation, less energy and/or lower average temperatures required to form inhalable aerosol, and increased user satisfaction with the device use and consumption of the vaporizable material **102**.

[0098] In some implementations, the heating system of the vaporizer device **100** is configured to heat a non-liquid vaporizable material, such as a tobacco-based material. For example, the vaporizer body **110** can include one or more compartments or receptacles **118** that each accept at least one cartridge **120** configured to be heated by one or more heating elements **141** thereby generating an inhalable aerosol. In some implementations, the vaporizer device **100** may include one or more airflow pathways that extend through the cartridge **120** positioned within a respective receptacle **118**, and out through a mouthpiece **130** to a user.

[0099] In some implementations, the cartridge **120** may include a non-vapor permeable barrier (e.g., metal, metal alloy, paper material such as cardstock, corrugated material such as cardboard, tobacco paper, temperature-resistant plastic, and/or the like) configured to contain vaporizable material **102**. In some implementations, use of a metal such as aluminum may be advantageous where efficient heat transfer (e.g., requiring less energy to spread across a larger region) is required, which can be the case where a singular heat source is provided. In other implementations, a metal such as stainless steel may be advantageous where efficient heat transfer is of less concern, such as where multiple heat sources are provided to heat different regions of the cartridge **120**. Containing the vaporizable material **102** within a non-vapor permeable barrier can protect the heating element **141**, receptacle **118**, mouthpiece **130** and/or other portions of the vaporizer device **100** from vapor deposits and/or remains of the vaporizable material, such that cleaning of the heating element **141** and/or other portions of the vaporizer device **100** after use may not be required.

[0100] As illustrated, the cartridge **120** can include a container **122** and a lid **124**. In some aspects, the container **122** can be configured to hold the vaporizable material **102** and/or the lid **124** can be configured to close the top (e.g., proximal end) of the container **122** such that the vaporizable material **102** remains within the container **122**. In some implementations, the lid **124** and/or a proximal end of the container **122** can extend beyond the general width of the container **122** (e.g., the width at the distal end of the container **122** and/or the width of the container **122** at a midpoint of the container **122** between the proximal and distal ends), such that a portion of the cartridge **120** rests outside of the receptacle **118**. Stated another way, the width of the cartridge **120** can taper in from the lid **124** and/or proximal end of the cartridge **120** such that a portion of the cartridge **120** rests on a ledge **126** outside of the receptacle **118** and another portion of the cartridge **120** (e.g., the more than half of the container **122** and/or more than half of the vaporizable material **102**) rests within the receptacle **118**. Various implementations of a heating system and cartridge **120** are described in greater detail below.

[0101] FIGS. **2**A-B illustrate perspective views of an implementation of a vaporizer device **200**, consistent with implementations of the current subject matter. The vaporizer device **200** can be an implementation of one or more components of the vaporizer device **100** of FIG. **1**. For example, as illustrated, the vaporizer device **200** can include a vaporizer body **210** and a mouthpiece **230**. When the mouthpiece **230** is removed from the vaporizer body **210**, a receptacle **218** is exposed. Outside of the receptacle **218**, the vaporizer body includes a ledge **221**. As described herein, a cartridge containing vaporizable material can be inserted into the receptacle **218**, and at least a portion of the cartridge can remain outside of the receptacle **218**, such as by resting on the ledge **221**. The mouthpiece **230** can be attached to the vaporizer body **210** in a closed position, in which case the cartridge can be enclosed within the vaporizer device **200** and/or at least partially enclosed within the receptacle **218**.

[0102] In some implementations, the mouthpiece **230** can be completely removable and attachable to the vaporizer body **210** by one or more coupling mechanisms, such as snap fit, magnetic force, and/or the like. In some implementations, the mouthpiece **230** can be attached to the vaporizer body **210** by a hinge, ball-and-socket, clasp, and/or the like.

[0103] As illustrated, the vaporizer device **200** can include one or more input devices **216***a*, **216***b* (collectively referred to as input devices **216**), such as a pair of input devices **216***a* on opposing sides of the vaporizer body **210** and/or one or more input devices **216***b* on the ledge **221**, such that the one or more input devices **216***b* are accessible to a user only when the mouthpiece **230** is opened and/or removed to expose the receptacle **218**. In some implementations, the one or more input devices **216***a*, **216***b* can include a button (e.g., plastic, metal, elastomeric), a capacitive sensor, and/or the like. A controller **104** (not illustrated) of the vaporizer device **200** can be configured to detect actuation (e.g., touch or force) of the one or more input devices **216***a*, **216***b* based on signals or data provided by the one or more input devices **216***a*, **216***b*. In implementations where multiple input devices **216***a* are present, a controller **104** of the vaporizer device **200** can be configured to activate the device only in response to detecting actuation of all of the input devices **216***a*. It can be beneficial to provide multiple input devices **216***a* in different locations that are less likely to each be activated accidentally (e.g., in locations most likely to be touched all at the same time only during active use of the vaporizer device **200**).

[0104] In some implementations, the controller **104** can be configured to select predetermined operating temperatures and/or heating profiles from among N temperatures or profiles. In accordance with these implementations, the controller **104** can be configured (and thereby a user can be allowed) to select a temperature or profile based on detecting actuation of the one or more input devices **216***b*. In some implementations, two or more input devices **216***b* can be used to increase and decrease the currently selected operating temperature and/or profile between a range of zero (0) through N temperatures and/or profiles, where zero means the vaporizer device **200** is in an "off" state (e.g., not actively heating the receptacle **218** but otherwise configured to detect interactions with one or more components of the vaporizer device **200**). Accordingly, one of the two or more input devices **216***b* can be actuated to increase the currently selected operating temperature and/or profile and another of the two or more input devices **216***b* can actuated to decrease the currently selected operating temperature and/or profile. The two or more input devices **216***b* can be actuated to provide for switching between the "off" state and an "on" state (e.g., where the "on" state starts at the lowest preconfigured temperature and/or profile) when both of the two or more input devices **216***b* or a dedicated one of the two or more input devices **216***b* are/is actuated (e.g., held down or pressed) for a predetermined time. In other implementations, one input device **216***b* can be actuated to increase the temperature and/or profile through a range of zero (0) through N temperatures and/or profiles, and/or the one input device **216***b* can be held down to switch between the "off" state and the "on" state.

[0105] In some implementations, the controller **104** can be configured to detect when the mouthpiece **230** is being pushed with sufficient force against the vaporizer body **210** (e.g., against the ledge **221**) and/or for a sufficient duration of time. In response to determining that the mouthpiece **230** is being pushed with sufficient force and/or for a sufficient duration of time, the controller **104** can switch the vaporizer device **200** between the "off" state and the "on" state (e.g., when the mouthpiece is held down for a predetermined time), increase the temperature and/or profile through a range of zero (0) through N temperatures and/or profiles, and/or the like.

[0106] In some implementations, the controller **104** can be configured to determine whether a cartridge **120** is spent and/or should be changed. This can occur when all, most, or an estimated threshold amount of one or more compound present in the vaporizable material **102** contained within the cartridge **120** has been converted to the gas phase, when an insufficient amount or quality of the vaporizable material **102** is present to provide an inhalable aerosol that would be satisfying to a user, and/or the like. For example, based on the length of time the cartridge **120** is heated, the temperatures at which the cartridge **120** is heated across the length of time, and/or the like, the controller **104** can be configured to determine that the cartridge is spent and/or should be changed. Based on determining that the cartridge is spent and/or should be changed, the controller **104** can be figured to provide an indication that the cartridge is spent and/or should be changed, switch the vaporizer device **200** into the "off" state, and/or the like. During operation of the vaporizer device **200**, the controller **104** can be configured to provide indications of an estimated amount of vaporizable material **102** left in the cartridge and/or an estimated amount of time remaining in a vaporizing session during which the vaporizable material **102** may be used (e.g., a period of time starting when the vaporizer device **200** is heated or when the receptacle **218** reaches a predetermined operating temperature and ending when the cartridge **120** is spent and/or should be changed).

[0107] The vaporizer device **200** can include one or more LEDs and can be configured to illuminate the LEDs in response to detecting actuation of one or more of the input devices **216***a*, **216***b*, in response to detecting the mouthpiece **230** being pushed with sufficient force against the vaporizer body **210**, to indicate the currently selected operating temperature and/or temperature profile, to indicate the current temperature of the receptacle **218**, to indicate the current temperature of the receptacle **218** relative to the currently selected operating temperature and/or temperature profile, to indicate the current temperature of the receptacle **218** has reached the currently selected operating temperature, an estimated amount of useable vaporizable material **102** remaining in a cartridge **120**, an estimated amount of time remaining in a vaporizing session, an indication that the cartridge **120** is spent and/or should be changed, and/or the like. In some implementations, the one or more input devices **216***a*, **216***b* can include the LEDs, be at least partially surrounded by the LEDs, and/or be positioned relative to the LEDs such that a perimeter (e.g., halo) of light at least partially surrounds a perimeter of the one or more input devices **216***a*, **216***b*.

[0108] The controller **104** can be configured to illuminate the LEDs in one or more colors and/or according to one or more patterns. For example, the controller **104** can be configured to illuminate the LEDs according to different colors to indicate a current temperature of the receptacle **218** (e.g., oven), blink one or more times to indicate the current temperature of the receptacle **218** has reached the currently selected operating temperature, and/or the like. Additionally or alternatively, the controller **104** can be configured to provide haptic feedback (e.g., via one or more outputs **117**, such as a motor, a linear resonant actuator, and/or the like) to indicate the one or more input devices **216***a*, **216***b* have been pressed, whether the vaporizer device **200** has switched between the "off" state and the "on" state (e.g., that the receptacle **218** is heating up), a current temperature of the receptacle **218** (e.g., in a periodic pattern with increasing frequency), whether the current temperature of the receptacle **218** has reached the currently selected operating temperature, when threshold amounts of the estimated amount of useable vaporizable material **102** remaining in a cartridge **120** are reached, when threshold amounts of estimated amounts of time remaining in the vaporizing session are reached, that the cartridge **120** is spent and/or should be changed, and/or the like.

[0109] FIG. **3** illustrates an exploded front view of an implementation of a cartridge **320**, consistent with implementations of the current subject matter. The cartridge **320** can be an implementation of one or more components of the cartridge **120** of FIG. **1**, configured to hold a vaporizable material **102**, and/or configured for use within a vaporizer device such as the vaporizer device **100** of FIG. **1** and/or the vaporizer device **200** of FIGS. **2**A-B. As illustrated, the cartridge **320** can contain two or more components, such as a container **322** and a lid **324**. The lid **324** can include one or more different components, such as a base component **324***a*, perforated lid **324***b*, and top barrier **324***c*.

[0110] As illustrated, the base component **324***a* can include a shaft **326**, a plurality of through-holes **325***a*, one or more channels **329***a*, and/or a central opening **328***a*. The plurality of through-holes **325***a* can be in fluid communication with the container **322**. As such, the plurality of through-holes **325***a* can be configured to deliver air to or towards the container **322** and/or withdraw air from the container **322**. The one or more channels **329***a* can be in fluid communication with the central opening **328***a*. As such, the one or more channels **329***a* can be configured to deliver air to or towards the central opening **328***a* and/or withdraw air from the central opening **328***a*. The central opening **328***a* can be in fluid communication with the shaft **326**. As such, the central opening **328***a* can be configured to deliver air to or towards the shaft **326** and/or withdraw air from the shaft **326**. Although the central opening **328***a* is illustrated and described as being central to the base component **324***a*, in some implementations, the central opening **328***a* can be off-center (e.g., simply and "opening" that provides the same or similar functionality). Although only one central opening **328***a* is illustrated and described, in some implementations, more than one central opening **328***a* may be present, which may be "centralized" across one, two, three, or even no dimensions of the base component **324***a*.

[0111] While the shaft **326** can have a variety of configurations, as shown, the shaft **326** can have a generally cylindrical configuration and can include one or more shaft through-holes **327** extending through the wall(s) **326***a* of the shaft **326**. The one or more shaft through-holes **327** can be in fluid communication with an interior channel (obstructed in FIG. **3**) of shaft **326**. As such, the one or more shaft through-holes **327** can be configured to deliver air to and/or withdraw air from the interior channel of shaft **326**. Additionally or alternatively, the one or more shaft through-holes **327** can be in fluid communication with the container **322**. As such, the one or more shaft through-holes **327** can be configured to deliver air to and/or withdraw air from the container **322**.

[0112] Although illustrated as being positioned towards the distal end of the shaft **326**, the one or more shaft through-holes **327** can be provided in a different location of the shaft **326**, such as closer to the proximal end of the cartridge **320**. Although three one or more shaft through-holes **327** are illustrated, one, two, or greater than three one or more shaft through-holes **327** may be present, positioned in a location that is closer to the proximal end of the cartridge **320**, or both. In some implementations, at least one of the one or more shaft through-holes **327** can be present on the distal end of the shaft **326**, and/or the distal end of the shaft **326** can be closed. While the illustrated one or more shaft through-holes **327** extend in a lateral direction relative to the longitudinal axis L of the shaft **326**, in other implementations, the one or more shaft through-holes **327** may extend in a direction along or at an angle that is greater than or less than 90 degrees relative to the longitudinal axis L of the shaft. If the one or more shaft through-holes **327** extend along or at an angle that is greater than or less than 90 degrees relative to the longitudinal axis L of the shaft **326**, then they may be efficiently provided within the shaft **326** via a stamping operation during the manufacturing process. In some implementations, the base component **324*a*** can comprise metal, metal alloy, paper material such as cardstock, corrugated material such as cardboard, tobacco paper, temperature-resistant plastic, and/or the like.

[0113] As illustrated, the perforated lid **324*b*** can include a plurality of through-holes **325*b***, one or more entrance holes **329*b***, and/or one or more exit holes **328*b***. The plurality of through-holes **325*b*** of the perforated lid **324*b*** can be configured to align with one or more of the plurality of through-holes **325*a*** of the base component **324*a*** and/or be in fluid communication with the plurality of through-holes **325*a*** of the base component **324*a***. As such, the plurality of through-holes **325*b*** of the perforated lid **324*b*** can be configured to deliver air to or towards the plurality of through-holes **325*a*** of the base component **324*a*** and/or withdraw air from the plurality of through-holes **325*a*** of the base component **324*a***.

[0114] The one or more entrance holes **329*b*** can be configured to align with one or more of the one or more channels **329*a*** of the base component **324*a*** and/or be in fluid communication with the one or more channels **329*a*** of the base component **324*a***. As such, the one or more entrance holes **329*b*** of the perforated lid **324*b*** can be configured to deliver air to or towards the one or more channels **329*a*** of the base component **324*a*** and/or withdraw air from the one or more channels **329*a*** of the base component **324*a***. The one or more exit holes **328*b*** can be configured to align with the central opening **328*a*** of the base component **324*a*** and/or be in fluid communication with the central opening **328*a*** of the base component **324*a***. As such, the one or more exit holes **328*b*** of the perforated lid **324*b*** can be configured to deliver air to or towards the central opening **328*a*** of the base component **324*a*** and/or withdraw air from the central opening **328*a*** of the base component **324*a***. Although the one or more entrance holes **329*b*** and one or more exit holes **328*b*** are described with respect to one direction of airflow, in some implementations, the one or more entrance holes **329*b*** may be configured to allow air to exit (e.g., the one or more channels **329*a***) and/or the one or more exit holes **328*b*** may be configured to allow air to enter (e.g., the central opening **328*a***).

[0115] In some implementations, the base component **324*a*** and the perforated lid **324*b*** can be coupled together. For example, the base component **324*a*** can include a lip **321** that is configured to secure and press the distal side **332*b*** of the perforated lid **324*b*** against the proximal side **330*a*** of the base component **324*a***. In some implementations, the lip **321** can be configured to rest above the perforated lid **324*b*** (e.g., by bending and/or folding) to secure the perforated lid **324*b*** against the proximal side **330*a*** of the base component **324*a***.

[0116] In some implementations, the top barrier **324*c*** may simply be removable and/or disposable. However, in some implementations, the top barrier **324*c*** may remain secured to at least a portion of the proximal side **332*a*** of the perforated lid **324*b*** during use, in which case it can be configured and/or disposed to direct air towards the through-holes **325*a***, **325*b***, central opening **328*a***, one or more channels **329*a***, entrance holes **329*b***, and/or exit holes **328*b***. In accordance with these implementations, the top barrier **324*c*** may include at least one hole such that inhalable aerosol exiting the cartridge **320** can be delivered to a user. In some implementations, the top barrier **324*c*** and perforated lid can define a compartment therebetween. In such instances, during use, one or more compounds converted to the gas phase by heating of the vaporizable material and air present within the compartment can mix to form an inhalable aerosol to be inhaled by a user.

[0117] The container **322** can include a plurality of channels **323**. The plurality of channels **323** can protrude from and/or extend into the interior of the container **322**. In some implementations, the plurality of channels **323** can help to form the bulk shape of the vaporizable material **102** (not illustrated) within the container **322**, which can affect the temperature at which the vaporizable material **102** is heated and/or the rate at which one or more compounds present in the vaporizable material **102** are converted to the gas phase and/or otherwise released from the vaporizable material **102**. That is, when the vaporizable material is inserted into the container the bulk shape can be similar to the shape of the container, based at least in part on the vaporizable material filling the voids defined in the container. For example, if the plurality of channels **323** extend outward from the interior of the container **322**, then the channels **323** may be in contact (e.g., physical and/or thermal) with one or more heated walls of the vaporizer device **100** (e.g., oven) and/or other regions of the exterior of the container **322** may not be contact with the one or more heated walls. In some aspects, reducing the total surface area of the container **322** that is intended to be in contact with one or more heated walls can reduce the effects, on aerosol generation, of heating variability (e.g., rapid increases or decreases in temperature of the heating element **141**), degradation (e.g., warping or bowing), and/or cleanliness (e.g., foreign objects or residue) associated with the one or more heated walls over time. For example, implementing channels **323** that form controlled regions of thermal contact between the container **322** and the receptacle **118** reduces the total surface contact area of the container **322**, and therefore may improve the predictability of heat transfer and reduce temperature variations between different cartridges **120** and/or different vaporizer devices **100** having slightly different dimensions. Accordingly, the plurality of channels **323** can provide controlled regions of close thermal contact between the container **322** and a heat source (e.g., the walls of an oven). In some implementations, the channels **323** may be configured to compress when the cartridge **322** is inserted into a heat source, which can increase the surface area of the container **322** in contact with heat from the heat source, at least in regions proximate to the channels **323**. In some implementations, the plurality of channels **323** may not be filled by vaporizable material **102** (e.g., hollow or vacant), in which case the plurality of channels **323** can be configured to increase the circulation of (heated) air within the container **322**. In some implementations, the plurality of channels **323** can provide the container **322** (and thereby the cartridge **320**) with additional rigidity, such that the cartridge **320** is more resistant to a force that may otherwise crush the cartridge **320**. Further, the plurality of channels **323** can minimize toggling between the cartridge **322** and the vaporizer body (not shown).

[0118] Although illustrated as generally cylindrical, a cross-section of the base component **324***a*, perforated lid **324***b*, and/or top barrier **324***c* can be a different shape. For example, in some implementations, a cross-section of the base component **324***a*, perforated lid **324***b*, and/or top barrier **324***c* can be similar to one or more of the cross-sections of FIGS. **11**A-**11**F. The cross-section may be anywhere between the respective distal and proximal ends of each of the base component **324***a*, perforated lid **324***b*, and/or top barrier **324***c*.

[0119] Although the flow of "air" is described, depending on the location within or even outside of the cartridge **320**, the "air" can contain other matter, such as gas-phase and/or condensed-phase material suspended in a stationary or moving mass of air or some other gas carrier (e.g., an aerosol), a liquid or solid at least partially transitioned to the gas phase (e.g., a vaporizable material), and/or the like.

[0120] FIGS. **4**A-**4**I illustrate cross-sectional schematics of various implementations of a vaporizer device **400***a-i* consistent with implementations of the current subject matter. For purposes of simplicity only, certain components of the vaporizer devices **400***a-i* are not illustrated. Further, these vaporizer devices **400***a-i* can be implementations of one or more components of the vaporizer device **100** of FIG. **1**, the vaporizer device **200** of FIGS. **2**A-**2**B, and/or the cartridge **320** of FIG. **3**.

[0121] As illustrated in FIG. **4**A, the vaporizer device **400**, **400***a* can include a vaporizer body **410**, a mouthpiece **430**, and/or a cartridge **420** containing a vaporizable material **402**. The vaporizer body **410** can include an oven **442** configured to be heated by one or more heating elements **441**. The oven **442** can include a region, configured to be heated (e.g., via convective heat), defined at least in part by a bottom wall **442***a* (distal end **442***d*) and two opposing side walls **442***b*, **442***c*, each extending from the bottom wall **442***a*. The heat provided by the oven **442** and/or one or more heating elements **441** can heat the vaporizable material **402** to generate an inhalable aerosol, as described herein. In some implementations, the oven **442** can provide an implementation of a receptacle **118** for insertably receiving the cartridge **420**.

[0122] In some implementations, at least one of the one or more heating elements **441** can be a different type of heater. For example, a first of the one or more heating elements **441** can include a flex heater wrapped (e.g., substantially, a majority, or partially) around the oven **442**. Additionally or alternatively, a second of the one or more heating elements **441** can include a surface heater, such a ceramic heater, in thermal contact with the oven **442** (e.g., the bottom wall **442***a* of the oven **442**) (see FIGS. **4**A-**4**B, **4**D-**4**F) or directly (e.g., substantially, a majority, or partially touching) with the cartridge **420** (see FIG. **4**C). In some implementations, only one heating element **441** may be present, which can reduce the cost and simplify manufacturability of the vaporizer device **400**, **400***a*. The one or more heating elements **441** can take other forms, such as conductive heater, a radiative heater, and/or a convective heater, as described herein (e.g., by converting one or more compound present in the vaporizable material **402** to the gas phase from which recondensation to an inhalable aerosol can occur). In some implementations, one or more of the heating elements **441** can be built into one or more of the walls **442***a*, **442***b*, **442***c* of the oven **442**.

[0123] Potentially dependent upon the location and/or type of heaters used, the walls of the cartridge **420** can be configured to physically contact the internal surface of the walls **442***a*, **442***b*, **442***c* of the oven **442** only in certain areas. As described herein, to provide controlled regions of close thermal contact between the cartridge **420** and the walls **442***a*, **442***b*, **442***c* of the oven **442**, a container **322** of the cartridge **420** can include a plurality of channels **323** that protrude from and/or extend into the interior of the container **322** of the cartridge **420**.

[0124] In implementations where only one heating element **441** is provided, such as at or near the distal end of the oven **442** as illustrated in the vaporizer device **400***b* of FIG. **4**B, it can be advantageous to increase the physical contact between the cartridge **420** at or near the distal end of the oven **442** and/or minimize the physical contact between the cartridge **420** and other areas of the oven **442** that are not actively heated, such as the side walls **442***b*, **442***c* of the oven **442**. The term "side walls" as used herein can refer to walls between the distal and proximal ends of an object, such as the oven **442**, the cartridge **420**, and/or the like. Accordingly, in addition to or alternatively from using a plurality of channels **323** to space portions (e.g., a majority) of the external surface area (e.g., side walls) of the cartridge **420** away from the side walls of the oven **442**, the cartridge **420** can be dimensioned to fit within the oven **442** in a location where side walls **420***a*, **420***b* of the cartridge **420** are spaced away from the side walls of the oven **442**. The space between the side walls **420***a*, **420***b* of the cartridge **420** and the side walls **442***b*, **442***c* of the oven **442** is illustrated as air gap **447**. It will be appreciated that if the side walls **420***a*, **420***b* of the cartridge **420** are in contact with side walls **442***b*, **442***c* of the oven **442** that are not actively heated, heat loss can result via heat transfer from the side walls **420***a*, **420***b* of the cartridge **420** to the side walls **442***b*, **442***c* of the oven **442**, resulting in reduced performance. The vaporizer device **400**, **400***b* can include the same components of, and otherwise operate in the same manner as, the vaporizer device **400***a* of FIG. **4**A, except as noted.

[0125] In implementations where only one heating element **441** is provided, such as at or near the distal end of the oven **442** as illustrated in the vaporizer device **400***c* of FIG.

4C, it can be advantageous to place the cartridge **420** in direct contact with the single heating element **441**. In such implementations, an oven **442** might not be present, but similar to the vaporizer device **400***b* of FIG. 4B, in addition to or alternatively from using a plurality of channels **323** to space the majority of the external surface area (e.g., side walls) of the cartridge **420** away from the side walls **418***a*, **418***b* of the receptacle **418**, the cartridge **420** can be dimensioned to fit within the receptacle **418** in a location where side walls **420***a*, **420***b* of the cartridge **420** are spaced away from the side walls **418***a*, **418***b* of the receptacle **418**. The space between the side walls **420***a*, **420***b* of the cartridge **420** and the side walls **418***a*, **418***b* of the receptacle is illustrated as air gap **447**. The vaporizer device **400**, **400***c* can include the same components of, and otherwise operate in the same manner as, the vaporizer device **400***a* of FIG. 4A, except as noted.

[0126] The vaporizer body **410** can include a thermistor **443** disposed to take resistance and/or temperature measurements based on a temperature of the oven **442** and/or a temperature of the one or more heating elements **441**. While the thermistor **443** is illustrated as being in direct contact with the heating element **441**, in other implementations, the thermistor **443** can be in direct contact with a wall of the oven **442** (e.g., one or more walls **442***a*, **442***b*, **442***c* (see FIG. 4A)). Alternatively or in addition, in some implementations, the thermistor **443** can be positioned within the vaporizer body **410** (e.g., on at least a portion of an internal surface of one or more walls **442***a*, **442***b*, **442***c* of the oven **442**) such that the thermistor directly contacts at least a portion of the cartridge **420** when the cartridge **420** is inserted into the vaporizer body **410**.

[0127] In order to operate the vaporizer device **400**, **400***a-c*, the controller **104** can execute instructions stored in the memory **108** to perform operations that result in heating the oven **442** and/or one or more heating elements **441** to a target temperature sufficient to release one or more vaporizable compounds from the vaporizable material **402** (e.g., operating temperature). Based on data from the thermistor **443** and/or one or more sensors **113**, the operations can monitor the temperature of the oven **442** and/or one or more heating elements **441**, and increase or decrease the amount of power supplied to the one or more heating elements **441** such that the temperature of and/or in the oven **442** is within an acceptable range (e.g., operating temperature range). The operations for heating the oven **442** and/or one or more heating elements **441** can be invoked based on one or more parameters, such as whether or not a cartridge **420** is present within the oven **442**, whether a signal or pattern of signals is received from an input device **116**, **216** (e.g., in response to a user pressing and/or holding a button one or more times within a specified period of time, for a specified period of time, according to a predetermined pattern and/or the like), whether there is sufficient power remaining in the power source **112**, and/or the like. In some implementations, the operations can include stopping the flow of power to the one or more heating elements **441** based on one or more parameters, such as a cartridge **420** being removed, whether the one or more heating elements **441** have been active for more than a predefined period of time, based on data from one or more sensors **113** (e.g., a lack of motion for a predefined period of time, a lack of use of the device based on a lack of a detected drop in temperature from a thermistor for a predefined period of time), whether a signal or pattern of signals is received from an input device **116**, **216** (e.g., in response to a user pressing and/or holding a button one or more times within a specified period of time, for a specified period of time, according to a predetermined pattern and/or the like), whether there is sufficient power remaining in the power source **112**, and/or the like.

[0128] The vaporizer body **410** can include insulation **445** to insulate the rest of the vaporizer body **410** (e.g., controller **104**, power source **112**, external shell or casing, etc.) from the heat of the oven **442** and/or the one or more heating elements **441**. In some implementations, the insulation **445** can include a vacuum-insulated Dewar. Although a primary insulation **445** is illustrated, one or more secondary insulation regions and/or materials may be present within the vaporizer device **400**, **400***a-c*. The vaporizer body **410** can include one or more seals **446** to help seal the oven **442** from the rest of the vaporizer body **410**. In some implementations, the one or more seals **446** can include an o-ring seal.

[0129] A first airflow path **431** and a second airflow path **432** can be defined at least in part by the vaporizer body **410**, mouthpiece **430**, cartridge **420**, and/or vaporizable material **402**. The first airflow path **431** and the second airflow path **432** can be configured to direct the flow of air from outside of the vaporizer device **400**, **400***a-c*, into the vaporizer device **400**, **400***a-c*, within the vaporizer device **400**, **400***a-c*, and out of the vaporizer device **400**, **400***a-c*. Although two airflow paths **431**, **432** are illustrated and described, in some implementations, only one airflow path may be present or more than two airflow paths may be present.

[0130] As illustrated, the first airflow path **431** can include and/or be defined at least in part by one or more of a first airflow inlet **433**, a first airflow channel **435**, holes **425** (e.g., including a plurality of through-holes **325***a*, **325***b*, one or more channels **329***a* (illustrated as angled walls), a central opening **328***a*, one or more entrance holes **329***b*, one or more exit holes **328***b*), the cartridge **420** (e.g., including a base component **324***a*, a perforated lid **324***b*, and/or container **322**), the vaporizable material **402**, a shaft **426** (e.g., including one or more shaft through-holes **327**), an airflow outlet channel **438**, and/or an airflow outlet **439**. The second airflow path **432** can include and/or be defined at least in part by one or more of a second airflow inlet **434**, a second airflow channel **436**, holes **425** (e.g., including a plurality of through-holes **325***a*, **325***b*, one or more channels **329***a* (illustrated as angled walls), a central opening **328***a*, one or more entrance holes **329***b*, one or more exit holes **328***b*), the cartridge **420** (e.g., including a base component **324***a*, a perforated lid **324***b*, and/or container **322**), the vaporizable material **402**, a shaft **426** (e.g., including one or more shaft through-holes **327**), an airflow outlet channel **438**, and/or an airflow outlet **439**.

[0131] As illustrated, the mouthpiece **430** can include the first airflow inlet **433** in fluid communication with the first airflow channel **435**, and/or the second airflow inlet **434** in fluid communication with a second airflow channel **436**. Although first and second airflow inlets **433**, **434** are illustrated as being formed towards and/or by the intersection of the mouthpiece **430** and the vaporizer body **410**, the first and second airflow inlets **433**, **434** can be located in different locations. For example, first and second airflow inlets **433**, **434** can be formed elsewhere in the mouthpiece **430**, such as on the front or back side of the vaporizer device **400**, **400***a-c* (not shown), the proximal end of the mouthpiece **430**, and/or the like. In other implementations, the mouthpiece **430** can include one airflow inlet or more than two airflow inlets. In some implementations, the mouthpiece **430** can include one or more features configured to direct the flow of air between the first and second airflow inlets **433**, **434** and the first and second airflow channels **435**, **436**. For example, the mouthpiece **430** can include one or more regions that are configured to remain hollow when the mouthpiece **430** is closed against the vaporizer body **410**, such that air may flow between the first and second airflow inlets **433**, **434** and the first and second airflow channels **435**, **436**.

[0132] The mouthpiece **430** can include an airflow outlet channel **438** in fluid communication with an airflow outlet **439**. In some implementations, the distal ends (e.g., bottom surface) of one or both of the first and second airflow channels **435**, **436** and/or the airflow outlet channel **438** can be disposed to press against a proximal end (e.g., lid **324**) of the cartridge **420** to provide a better seal for the airflow paths **431**, **432**. In some implementations, the first and second airflow channels **435**, **436** and/or the airflow outlet channel **438** can include a rubber-like material (e.g., silicone) at their respective, distal ends to provide a better seal. In some implementations, the mouthpiece **430** and the vaporizer body **410** can be configured to remain closed even while force is being applied to open the mouthpiece **430** due to the first and second airflow channels **435**, **436** and/or the airflow outlet channel **438** being pressed against the cartridge **420**. In some implementations, the distal end of the cartridge **420** can include one or more crumple zones (e.g., one or more channels **323**, as described herein), which can be configured to compress when the mouthpiece **430** closes down on the vaporizer body **410**.

[0133] After air enters the first and second airflow channels **435**, **436**, it can be directed to move towards and through a plurality of holes **425** in the cartridge **420**. At least a portion of the air that enters the holes **425** can then pass through the vaporizable material **402** along the first airflow path **431** and the second airflow path **432**. As air passes through the container **422** and/or vaporizable material **402**, the air becomes heated via the oven **442** and/or one or more heating element **441**, as described herein. The air along the airflow paths **431**, **432** can thereby become sufficiently heated to cause conversion of some amount of one or more compounds present in the vaporizable material **402** to the gas phase. Air along the airflow paths **431**, **432** can mix with and carry vaporized material (e.g., the one or more gas-phase compounds) towards the airflow outlet channel (e.g., air outlet channel **438** in FIGS. **4**A-**4**E and **4**G-**4**H) or first and second airflow outlet channels **438***a*, **438***b* in FIG. **4**F).

[0134] The combination of the plurality of holes **435** and the airflow paths **431**, **432** allows for a more even distribution of airflow (e.g., substantially uniform or completely uniform airflow) through the bulk of the vaporizable material. This can effect a more uniform heating across the vaporizable material, and consequently, a more even depletion of the vaporizable material during use, which reduces waste (e.g., the amount of vaporizable material remaining in a disposed cartridge).

[0135] The porosity of the vaporizable material **402** can depend at least upon the packing density of the vaporizable material **402** (e.g., level of compression), granularity of the tobacco material (e.g., average size of tobacco pieces) within the vaporizable material **402**, and humectant loading (e.g., amount of carrier present, such as Vegetable Glycerin (VG) and/or Propylene Glycol (PG)) within the vaporizable material **402**. In turn, the rate of airflow through the vaporizable material **402** can be affected by the porosity of the vaporizable material **402**. Accordingly, in some implementations, packing density, granularity, and amount of carrier can vary to achieve a desired consistency and/or quality of inhalable aerosol, as described herein.

[0136] As illustrated, the first and second airflow paths **431**, **432** can combine in a central location of the cartridge **420**, such as within an internal shaft **426** of the cartridge **420**, as described herein. For example, the first and second airflow paths **431**, **432** can pass into the shaft **426** by way of one or more shaft through-holes **327**. The combined first and second airflow paths **431**, **432** can then deliver the vaporized material towards the airflow outlet **439** (where a vacuum is being applied (e.g., by suction of a user) and causing air to flow along the airflow paths **431**, **432**). The vaporized material passing through the shaft **426** can condense within the shaft **426**. Accordingly, the shaft **426** can be referred to as a condensation chamber or condensation region.

[0137] As illustrated, the distal end **426***a* of the shaft **426** can be spaced apart from the distal end **420***d* of the cartridge **420** and/or vaporizable material **402** may be present within the cartridge **420** between the distal end **426***a* of the shaft **426** and (the inside of) the distal end **420***d* of the cartridge **420**. In some aspects, spacing the shaft **426** away from the heated region of the cartridge **420** can help to keep the temperature relatively low within the shaft **426**, which can help to cool the vaporized material quicker. In related aspects, providing vaporizable material **402** at or near the heated region of the cartridge **420** can increase the overall efficiency of vaporization, as vaporization in this region will be relatively high over time.

[0138] However, in some implementations, it may be desirable to keep the shaft **426** relatively hot, to reduce the likelihood of condensation forming on the interior walls of the shaft **426**. Accordingly, the distal end **426***a* of the shaft **426** may be pressed against (the inside of) the distal end **420***d* of the cartridge **420** to heat the shaft **426**. Alternatively, in some implementations, the distal end **426***a* of the shaft **426** may be close to (the inside of) the distal end **420***d* of the cartridge **420**. For example, the distal end **426***a* of shaft **426** can be spaced from the distal end **420***d* of the cartridge **420** at a distance between 0 to 2 millimeters or between 0 to 1 millimeters. In some implementations, the distal end **426***a* of the shaft **426** can be shaped into a tip, which may be pointed or terminate at a flattened end (e.g., an end extending in a traverse direction relative to the longitudinal axis of the shaft **426**). In accordance with implementations in which the distal end shaft is shaped into a tip, the cartridge **420** can be filled with vaporizable material **402** and the shaft **426** can more efficiently push the vaporizable material **402** out of the way during the manufacturing process. Pushing the vaporizable material **402** out of the way rather than compressing the vaporizable material **402** can be advantageous, as described herein.

[0139] It will be appreciated that, as the one or more compounds converted to the gas phase by heating of the vaporizable material are cooled, condensation and formation of an inhalable aerosol will occur. Depending on how and where the cooling occurs, condensate may form and/or be deposited on the walls of the vaporizer body **410**, cartridge **420**, and/or mouthpiece **430**, especially where the air mass containing the one or more compounds is still relatively hot and comes in contact with a relatively cool wall. Accordingly, to mitigate formation and deposition of condensate, it can be beneficial to sufficiently mix cool air with the combined airflow paths **431**, **432**, which include vaporized material (e.g., the one or more compounds released to the gas phase via the heating of the vaporizable material **402**), as early as possible.

[0140] As illustrated, in some implementations, at least a portion of the (cool) air that enters the holes **425** in the cartridge **420** can be directed (e.g., via angled walls) towards a location where the (heated) combined first and second airflow paths **431**, **432** pass through the cartridge **420**. As such, the air from the holes **425** can mix with the combined first and second airflow paths **431**, **432**, to decrease the temperature of the vaporized material in the combined first and second airflow paths **431**, **432** and promote proper aerosol formation. The regions of the cartridge **420** where the relatively cool air stream from the holes **425** meets with the combined first and second airflow paths **431**, **432** (e.g., the shaft **426**, the central opening **328***a*, the holes **425** downstream from the central opening **328***a*) can be referred to as condensation chambers or condensation regions.

[0141] In some implementations, in order to promote the mixing of cool air and the vaporized material (e.g., to condense the one or more compounds of the vaporizable material in the gas phase into an aerosol), the cartridge **420** can include one or more features to create a vortex or otherwise direct airflow in a non-linear fashion, such as one or more obstructions in the first and second airflow paths **431**, **432**, holes of a particular geometry (e.g., shape, size, angle), holes in a particular location, number of holes, and/or the like.

[0142] After this mixing occurs, the resulting aerosol continues to travel along the combined first and second airflow paths **431**, **432**, through holes **425** in fluid communication with an airflow outlet channel **438**. Provided that the aerosol is sufficiently cool by the time it enters the airflow outlet channel **438**, the likelihood of condensation of the compounds released by heating of the vaporizable material onto internal surfaces (e.g., walls of the airflow outlet channel **438**) is reduced. The airflow outlet channel **438** can be in fluid communication with the airflow outlet **439** such that the inhalable aerosol may travel along the combined airflow paths **431**, **432** and out of the mouthpiece **430** (e.g., to a user). The vaporized material (e.g., the one or more compounds) passing through the airflow outlet channel **438** can condense within the airflow outlet channel **438**. Accordingly, the airflow outlet channel **438** can be referred to as a condensation chamber or condensation region.

[0143] Additionally or alternatively, as illustrated in the vaporizer device **400***d* of FIG. **4**D, the mixing of cool air with the combined first and second airflow paths **431**, **432**, which include vaporized material, can occur outside of the cartridge **420**. For example, in some implementations, in order to promote the mixing of cool air with the combined first and second airflow paths **431**, **432**, the airflow outlet channel **438** can include one or more pathways for cool air to enter (e.g., from the airflow inlets **433**, **434**) and mix with the combined first and second airflow paths **431**, **432**. The airflow outlet channel **438** can include one or more features to create a vortex or otherwise direct airflow in a non-linear fashion, such as one or more obstructions in or extending from the walls of the airflow outlet channel **438**, holes of a particular geometry (e.g., shape, size, angle), holes in a particular location, number of holes, and/or the like. Alone or in combination with any features of the airflow outlet channel **438** that are configured to direct airflow in a non-linear fashion, the cartridge **420** can include one or more features to direct airflow in a non-linear fashion, such as one or more obstructions in or extending from the walls of the airflow outlet channel **438**, holes of a particular geometry (e.g., shape, size, angle), holes in a particular location, number of holes, and/or the like. The vaporizer device **400**, **400***d* can include the same components of, and otherwise operate in the same manner as, any of the vaporizer devices **400**, **400***a-c* of FIG. **4**A-C, except as noted.

[0144] In some implementations, the first and second airflow channels **435**, **436** may not be present within the mouthpiece **430**. For example, as illustrated in the vaporizer device **400***c* of FIG. **4**E, the first and second airflow paths **431**, **432** can be defined at least in part by an airflow channel **435** in fluid communication with each of the first and second airflow inlets **433**, **434**. The airflow channel **435** can be defined in a lid of the cartridge **420** (e.g., lid **324**) such as between a base component and a top layer of the cartridge **420** (e.g., similar to the base component **324***a* and the top barrier **324***c*, respectively). In some implementations, the airflow channel **435** can be defined between a component that is the functional equivalent of a base component combined with a perforated top (e.g., one unitary piece or two combined pieces, similar to the base component **324***a* and perforated lid **324***b*) and a top layer of the cartridge **420** (e.g., similar to the top barrier **324***c*).

[0145] As illustrated, the airflow channel **435** includes a central region that is open, where (cool) air from the airflow inlets **433**, **434** can mix with the (heated) combined airflow paths **431**, **432**. One or more features to create a vortex or otherwise direct airflow in a non-linear fashion, as described herein, may be present at or near this central region. Although all of the holes **425** are illustrated as through-holes and the airflow channel **435** is depicted as including a central region that is open, one or more channels may be present within the cartridge **420** (e.g., similar to the angled walls in the cartridge **420** of the vaporizer device **400***a* of FIG. **4**A and/or the one or more channels **329***a* of FIG. **3**) and/or the central region of the airflow channel **435** may be closed (e.g., and instead include additional holes **425**). The vaporizer device **400**, **400***e* can include the same components of, and otherwise operate in the same manner as, any of the vaporizer devices **400***a-d* of FIGS. **4**A-D, except as noted.

[0146] In some implementations, as illustrated in the vaporizer device **400***f* of FIG. **4**F, the direction of airflow can be reversed (e.g., relative to the vaporizer devices **400***a-e* of FIGS. **4**A-E). In such implementations, the mouthpiece **430** can include an airflow inlet channel **435**, a first airflow outlet channel **438***a* in fluid communication with a first airflow outlet **439***a*, and/or a second airflow outlet channel **438***b* in fluid communication with a second airflow outlet **439***b*. Additionally or alternatively, the cartridge **420** can include a different configuration of holes **425**, such as by including a larger open area in the base component **324***a* and/or no (or less) through-holes **325***a* in the base component **324***a*.

[0147] As illustrated, an airflow path **440** can include and/or be defined at least in part by one or more of a first airflow inlet **433**, a second airflow inlet **434**, an airflow channel **435**, holes **425** (e.g., including one or more exit holes **328***b*, a central opening **328***a*, one or more channels **329***a*, one or more entrance holes **329***b*, and/or a plurality of through-holes **325***a*, **325***b*), a shaft **426** (e.g., including one or more shaft through-holes **327**), a first airflow path **431**, a second airflow path **432**, the cartridge **420** (e.g., including a base component **324***a*, a perforated lid **324***b*, and/or container **322**), the vaporizable material **402**, a first airflow outlet channel **438***a*, a second airflow outlet channel **438***b*, a first airflow outlet **439***a*, and/or a second airflow outlet **439***b*.

[0148] The airflow path **440** can be configured to provide ambient air to a hot region of the cartridge **420** (e.g., near the bottom wall **442***a* of the oven **442** at or near the one or more heating elements **441**, which is potentially the hottest region of the cartridge **420** prior to air flowing through the vaporizer device **400**, **400***f*), such that heated air is more evenly distributed across the vaporizable material **402** (e.g., relative to the vaporizer devices **400***a-c* of FIGS. **4**A-E). The vaporizer device **400**, **400***f* can include the same components of, and otherwise operate in the same manner as, any of the vaporizer devices **400***a-e* of FIGS. **4**A-E, except as noted.

[0149] In some implementations, as illustrated in the vaporizer device **400***g* of FIG. **4**G, the cartridge **420** can include one or more baffles **448**. In accordance with these implementations, only one airflow inlet **433** in fluid communication with one airflow inlet channel **435** and/or one airflow outlet **439** in fluid communication with one airflow outlet channel **438** may be present, to provide for a more unidirectional airflow path **431**. However, an additional airflow inlet **434** (not shown) may be present, such as to provide additional ambient air for mixing with the (heated) airflow path **431** and aid with aerosol generation.

[0150] As illustrated, the airflow path **431** may enter on one side of the cartridge **420** and exit on the opposite side of the cartridge **420**. A first baffle **448** near where the airflow path **431** enters the cartridge **420** may be configured to direct the airflow path **431** to the distal end of the cartridge (e.g., near the distal end of the oven **442**), and may terminate in a distal edge that provides a gap for the airflow path **431** to enter the vaporizable material **402**. In some implementations, the first baffle **448** can include one or more holes dimensioned to allow for the passage of air through the first baffle **448**. If a plurality of holes are present in the first baffle **448**, they may be of different diameters, such as increasing in diameter from the proximal edge to the distal edge of the first baffle **448**.

[0151] The airflow path **431** can pass through the vaporizable material **402** towards a second baffle **448**, potentially passing at different rates (e.g., speeds, volumes, etc.) at different levels of the vaporizable material **402** (e.g., more proximate to or distal from the distal end of the oven **442**). The second baffle **448** can be near where the airflow path **431** exits the cartridge, may be configured to direct the airflow path **431** to the distal end of the cartridge (e.g., near the distal end of the oven **442**), and/or may terminate in a distal edge that provides a gap for the airflow path **431** to exit the vaporizable material **402**. In some implementations, the second baffle **448** can include one or more holes dimensioned to allow for the passage of air through the second baffle **448**. If a plurality of holes are present in the first baffle **448**, they may be of different diameters, such as increasing or decreasing in diameter from the proximal edge to the distal edge of the first baffle **448**.

[0152] After the airflow path **431** exits the vaporizable material **402**, it may combine with a (cool) air stream, such as within the lid of the cartridge **420** and/or outside of the cartridge **420**. For example, at least a portion of the (cool) air that enters the holes **425** in the cartridge **420** can be directed towards a location where the (heated) airflow path **431** passes through the cartridge **420**. As such, the air from the holes **425** can mix with the airflow path **431** to decrease the temperature of the vaporized material in the airflow path **431** and promote proper aerosol formation. Because the vaporizable material **402** may not occupy the full width of the cartridge **420**, in some implementations, the cartridge **420** is only heated from the distal end **420***d* (e.g., via on heating element **441**).

[0153] In some implementations, more than one or two baffles **448** may be present. The presence of additional baffles may help to further guide the airflow path **431** to allow for a more even distribution of heat across the vaporizable material **402**. A plurality of baffles **448** can be used to form a C-shaped path, S-shaped path, snake-shaped path, and/or the like. Although one or more baffles **448** are generally discussed with respect to the vaporizer device **400***g* of FIG. **4**G, one or more baffles **448** may be included within any of the cartridges **420** of FIGS. **4**A-F. The vaporizer device **400**, **400***g* can include the same components of, and otherwise operate in the same manner as, any of the vaporizer devices **400***a-f* of FIGS. **4**A-F, except as noted.

[0154] In some implementations, as illustrated in the vaporizer device **400***h* of FIG. **4**H, the oven **442** and/or the cartridge **420** can include one or more holes in their respective distal ends **442***d*, **420***d*. In accordance with such implementations, the first and second airflow paths **431**, **432** can be configured to direct air from the first and second airflow inlets **433**, **434** down and around the side walls **442***b*, **442***c* of the oven **442** and/or side walls of the cartridge **420**. However, providing holes in the distal end **420***d* of the cartridge **420** or any region of the cartridge **420** that comes into contact with a heated surface can increase the likelihood that the vaporizable material **402** itself will come into contact with the heated surface, thereby increasing the likelihood that the vaporizer device **400**, **400***h* will experience performance issues over time (e.g., due to residue, buildup, burning, etc.). Accordingly, as described herein, the vaporizer devices **400***a-g* of FIGS. **4**A-G, where no vaporizable material **402** (before or after being vaporized) touches a heated surface, can provide advantages over the vaporizer device **400***h* of FIG. **4**H. The vaporizer device **400**, **400***h* can include the same components of, and otherwise operate in the same manner as, any of the vaporizer devices **400***a-g* of FIGS. **4**A-G, except as noted.

[0155] In some implementations, as illustrated in the vaporizer device **400***i* of FIG. **4**I, the first and second airflow inlets **433**, **434** can be configured to direct air to the holes **425** without the presence of the first and second airflow channels **435**, **436** in the mouthpiece **430** (similar to the vaporizer device **400***c*). In accordance with such implementations, the mouthpiece **430** can be configured to allow at least a portion of the first and second airflow inlets **433**, **434** to be exposed to ambient air, such that ambient air may enter the vaporizer device **400***i* and travel along the first and second airflow paths **433**, **434**. The vaporizer device **400**, **400***i* can include the same components of, and otherwise operate in the same manner as, any of the vaporizer devices **400***a-h* of FIGS. **4**A-H, except as noted.

[0156] FIGS. **5**A-**5**B illustrate cross-sectional views of implementations of a vaporizer device **500**, consistent with implementations of the current subject matter. For purposes of simplicity only, certain components of the vaporizer devices **500** are not illustrated. Further, these vaporizer devices **500** can be implementations of one or more components of the vaporizer device **100** of FIG. **1**, the vaporizer device **200** of FIGS. **2**A-**2**B, the cartridge **320** of FIG. **3**, and/or the vaporizer devices **400**, **400***a*-**400***i* of FIGS. **4**A-**4**I.

[0157] As illustrated in FIG. **5**A, the vaporizer device **500** can include a vaporizer body **510**, a mouthpiece **530**, and/or a cartridge **520** configured to contain a vaporizable material. The vaporizer body **510** can include an oven **542** configured to be heated by one or more heating elements **541**. The vaporizer device **500** can additionally include insulation **545** and/or seals **546** configured to reduce heat transfer to other portions of the vaporizer device **500** (e.g., electronic components within the vaporizer body **510**, the outer shell of the vaporizer device **500**, the mouthpiece **530**, and/or the like). As further illustrated, the vaporizer device **500** can include a thermistor **543**, which can be operable to assist in regulating the temperature of the oven **542**, as described herein.

[0158] As illustrated, the mouthpiece **530** can include at least one airflow inlet **533**, one or more airflow channels **535**, and/or an airflow outlet channel **538**. As described herein, the at least one airflow inlet **533** can be in fluid communication with the one or more airflow channels **535**, which in turn can be configured to provide air to the cartridge **520**. In some implementations, the one or more airflow channels **535** and/or the airflow outlet channel **538** can include a sealing ring configured to provide a seal between the respective channel and a corresponding section of the cartridge **520**. In some implementations, at least a portion of the one or more airflow channels **535** and/or the airflow outlet channel **538** can be part of a removable insert **590**, which may be configured to detach from the mouthpiece **530** (e.g., for cleaning).

[0159] The cartridge **520** can include channels **529***a*, beneath and defined at least in part by a perforated lid, configured to direct air into an airflow path through the cartridge **520**, as described in greater detail with respect to FIG. **5**B. Further, as shown in FIGS. **5**A-**5**B, the cartridge **520** can include a container **522** that can house vaporizable material (not shown).

[0160] As illustrated in FIG. **5**B, the oven **542** can include a region, defined at least in part by a bottom wall **542***a* (distal end) and two opposing side walls **542***b*, **542***c*, each extending from the bottom wall **542***a*. The one or more heating elements **541** can be configured to heat one or more of the walls **542***a*, **542***b*, **542***c* of the oven **542** via conductive and/or convective heat. For example, the one or more heating elements **541** can heat the walls **542***a*, **542***b*, **542***c* of the oven **542** via conductive heat in locations of the oven **542** where the walls **542***a*, **542***b*, **542***c* of the oven **542** are in physical contact with the one or more heating elements **541** and/or convective heat in locations of the oven **542** where the walls **542***a*, **542***b*, **542***c* of the oven **542** are in thermal contact but not physical contact with the one or more heating elements **541**. The heat provided by the oven **542** and/or one or more heating elements **541** can heat the cartridge **520** and thereby heat the vaporizable material contained therein to generate an inhalable aerosol, as described herein. For example, the oven **542** can heat the cartridge **520** via conductive heat in locations of the cartridge **520** where the cartridge **520** is in physical contact with the walls **542***a*, **542***b*, **542***c* of the oven **542** and/or convective heat in locations of the cartridge **520** where the cartridge **520** is in thermal contact but not physical contact with the walls **542***a*, **542***b*, **542***c* of the oven **542**. Additionally or alternatively, the one or more heating elements **541** can heat the cartridge **520** via conductive heat in locations of the cartridge **520** where the cartridge **520** is in physical contact with the one or more heating elements **541** and/or convective heat in locations of the cartridge **520** where the cartridge **520** is in thermal contact but not physical contact with the one or more heating elements **541**.

[0161] In some implementations, the oven **542** can provide an implementation of a receptacle **118** for insertably receiving the cartridge **520**. As illustrated, a side wall **520***a* (e.g., bottom) of the cartridge **520** can be configured to contact the bottom wall **542***a* of the oven **542** to provide heat transfer to the vaporizable material contained within the cartridge (not illustrated). As illustrated, the one or more heating elements **541** can include a flex heater wrapped (e.g., substantially, a majority, or partially) around the oven **542**. However, the one or more heating elements **541** can take other forms, as described herein.

[0162] As described herein, ambient air may enter the vaporizer device **500** from outside via an airflow inlet **533**. The air entering the airflow inlet **533** can be directed to the airflow channels **535**, and thereafter provided to a plurality of holes **525** in a lid of the cartridge **520**. At least a portion of the holes **525** can be configured to direct air into a container portion of the cartridge **520** while another portion of the holes **525** can be configured to direct air into the channels **529***a* within the cartridge **520**, physically separate from the container portion. The air that enters the container portion of the cartridge **520** can traverse first and second airflow paths **531**, **532**, which are heated by the at least one heating element **541** and/or the oven **542**. The heated air passing along the first and second airflow paths **531**, **532** can pass through vaporizable material contained within the container portion of the cartridge **520**, and the vaporized material generated as a result can be delivered to the shaft **526** in the middle and/or center of the cartridge **520**.

[0163] The combined first and second airflow paths **531**, **532** can then travel up the shaft **526** and mix with the air passing through the channels **529***a* of the cartridge **520** to be cooled to generate an inhalable aerosol. Thereafter, the combined and cooled first and second airflow paths **531**, **532** can deliver the generated aerosol to the airflow outlet channel **538**, where the aerosol is directed out of the airflow outlet **539** to a user.

[0164] The vaporizer device **500** can include the same components of, and otherwise operate in the same manner as, any of the vaporizer device **100** of FIG. **1**, vaporizer device **200** of FIGS. **2**A-**2**B, vaporizer devices **400***a-i* of FIGS. **4**A-**4**I, and/or any other vaporizer device described herein, except as noted.

[0165] FIG. **6** illustrates a cross-sectional view of an implementation of a cartridge **620** having a container **622** and a lid **624**, showing airflow paths (illustrated as arrows) into, through, and out of the cartridge **620**. The cartridge **620** is similar to the cartridge **420** in FIG. **4**A and therefore similar components are not described in detail herein. The lid **624** can include one or more different components, such as a base component **624***a* and a perforated lid **624***b*. The base component can include a shaft **626**, a plurality of through-holes **625***a*, one or more channels **629***a*, and/or a central opening **628***a*. The plurality of through-holes **625***a* can be in fluid communication with the container **622**. In this illustrated implementation, the plurality of through-holes **625***a* are configured to deliver air to or towards the container

622. The one or more channels **629***a* can be in fluid communication with the central opening **628***a*. As shown, the one or more channels **629***a* are configured to deliver air to or towards the central opening **628***a* to allow the air to mix with the vaporized material exiting the shaft **626**. Since the air is relatively cooler compared to the air mass containing the vaporized material, the mixing thereof promotes nucleation of the vaporized material into an inhalable aerosol, as described above. Although the central opening **628***a* is illustrated and described as being central to the base component **624***a*, in some implementations, the central opening **628***a* can be off-center (e.g., simply and "opening" that provides the same or similar functionality). Although only one central opening **628***a* is illustrated and described, in some implementations, more than one central opening **628***a* may be present, which may be "centralized" across one, two, three, or even no dimensions of the base component **624***a*.

[0166] As further shown, the shaft **626** may include one or more shaft through-holes **627** extending through the wall(s) **626***a* of the shaft **626**. The one or more shaft through-holes **627** can be in fluid communication with an interior channel **626***b* of shaft **626** and/or with the container **622**. In this illustrated implementation, the one or more shaft through-holes **627** are configured to deliver air and vaporized material from the container to the interior channel of shaft **626**.

[0167] As illustrated, the perforated lid **624***b* can include a plurality of through-holes **625***b*, one or more entrance holes **629***b*, and/or one or more exit holes **628***b*. The plurality of through-holes **625***b* of the perforated lid **624***b* are aligned with the plurality of through-holes **625***a* of the base component **624***a* and therefore in fluid communication therewith. As such, the plurality of through-holes **625***b* of the perforated lid **624***b* can be configured to deliver air to or towards the plurality of through-holes **625***a* of the base component **624***a*, as shown in FIG. **6** (e.g., when a vacuum is being applied (e.g., by suction of a user) while the cartridge **620** is inserted within a receptacle of a vaporizer device).

[0168] In this illustrated implementation, the one or more entrance holes **629***b* overlap with at least a portion of one or more of the one or more channels **629***a* of the base component **624***a* and therefore are in fluid communication with the one or more channels **629***a* of the base component **624***a*. As such, the one or more entrance holes **629***b* of the perforated lid **624***b* are configured to deliver air to or towards the one or more channels **629***a* of the base component **624***a*. The one or more exit holes **628***b* overlap with at least a portion of the central opening **628***a* of the base component **624***a* and therefore are in fluid communication with the central opening **628***a* of the base component **624***a*. As such, the one or more exit holes **628***b* of the perforated lid **624***b* are configured to withdraw air from the central opening **628***a* of the base component **624***a* (e.g., and towards an air outlet of a mouthpiece).

[0169] As further shown in FIG. **6**, a first airflow path **631** and a second airflow path **632** extend through the cartridge **620**. More specifically, the first airflow path **631** is defined at least in part by one or more the plurality of through-holes **625***a*, **625***b*, one or more channels **629***a*, a central opening **628***a*, one or more entrance holes **629***b*, one or more exit holes **628***b*. The second airflow path **632** is defined at least in part a plurality of through-holes **625***a*, **625***b*, one or more channels **629***a* (illustrated as angled walls), a central opening **628***a*, one or more entrance holes **629***b*, one or more shaft through-holes **627** and one or more exit holes **628***b*.

[0170] As illustrated, the first and second airflow paths **631**, **632** combine within interior channel **626***b* of shaft **326** of the cartridge **620**. The combined first and second airflow paths **631**, **632** can then deliver the vaporized material towards the central opening **628***a* of the shaft. Upon exiting the shaft **626** through the central opening **628***a*, the vaporized material mixes with the air being delivered into the cartridge **620** through the one or more entrance holes **629***b* of the perforated lid and the one or more channels **629***a* of the base component **624***a* mixes with the vaporized material. This mixing promotes the nucleation of the vaporized material into an inhalable aerosol (e.g., for subsequent inhalation by a user).

[0171] FIG. **7**A illustrates a top perspective view of a vaporizer cartridge **720** and FIG. **7**B illustrates a bottom perspective view of the vaporizer cartridge **720**, consistent with implementations of the current subject matter. As illustrated, the lid **724** of the vaporizer cartridge **720** can include two or more sets of a plurality of through holes. For example, the lid **724** can include two sets of through-holes **725***b* and entrance holes **729***b* at opposite sides of the lid **724**. Additionally or alternatively, the lid **724** can include a set of exit holes **728***b* at or near the center of the lid **724**. As illustrated, the container **722** of the cartridge **720** can include a bottom or side wall **720***a* that is substantially parallel to the lid **724**.

[0172] During use, air and vapor will mix within the mouthpiece to generate aerosol for inhalation by a user. As a result, this condensation can generate undesirable build up within the mouthpiece that adversely affects a user's experience with the vaporizer device. This condensation buildup would need to be removed from the mouthpiece throughout the device's use to allow the vaporizer device to work effectively and efficiently. As such, in some implementations, it would be desirable to minimize or avoid condensation forming within the mouthpiece of the vaporizer device. For example, as shown in FIGS. **8**A-**8**B, a vaporizer cartridge **820** can be designed such that condensation is encouraged within the cartridge as opposed to the mouthpiece of a vaporizer device. More specifically, the vaporizer cartridge is designed such that bypass air enters into the cartridge and mixes and cools the vapor within the cartridge into an aerosol for subsequent inhalation by the user (e.g., through a mouthpiece of a vaporizer device). Therefore, condensation that may be generated during the mixing and cooling of the vapor can be otherwise trapped within the vaporizer cartridge prior to exiting (e.g., through exit holes of the lid of the cartridge).

[0173] FIG. **8**A illustrates a top perspective view of a vaporizer cartridge **820** and FIG. **8**B is a cross-sectional view of the vaporizer cartridge **820** consistent with implementations of the current subject matter. The cartridge **820** can be an implementation of one or more components of the cartridge **120** of FIG. **1**, configured to hold a vaporizable material **102**, and/or configured for use within a vaporizer device such as the vaporizer device **100** of FIG. **1** and/or the vaporizer device **200** of FIGS. **2**A-B. While not shown, the cartridge **820** can be configured to be reversibly inserted into a receptacle of a vaporizer device.

[0174] As illustrated, the cartridge **820** can contain two or more components, such as a container **822** and a lid **824**. The lid **824** can include one or more different components, such as a base component **826**, which is shown in more detail in FIG. **9**, and a filter assembly **828**, which is shown in more detail in FIG. **10**. FIG. **9** is a partially exploded view of the cartridge **820**, and FIG. **10** is an exploded view top perspective view of the filter assembly **828**.

[0175] While the base component **826** can have a variety of configurations, as shown in FIGS. **8**B and **9**, the base component **826** has a base **830** and a baffle **832** extending therefrom and into the container **822**. Although the baffle **832** is illustrated as a single baffle and positioned central to the base **826**, in some implementations, the baffle **832** can include two or more baffles or the single baffle can be off-center. In use, the baffle **832** can be configured to direct air that enters the container **822** through the vaporizable material (not shown) within the container **822** to form a vaporized material. The baffle **832** can have a variety of configurations. For example, in some implementations, as shown in FIGS. **8**B and **9**, the baffle **832** can have an elongated and substantially planar configuration and can extend a length L into the container **822** (e.g., when the base component **826** is attached to the container **822** (see e.g., FIG. **8**B). The base component **826** can be attached to the container **822** in a variety of ways, such as for example, welding (e.g., laser welding), adhesion, snap-fit, magnetic attraction, and the like. Further, as shown in FIG. **8**B, the baffle **832** is spaced a distance from a bottom wall **822***a* of the container **822** so that air can travel through the container **822**, and consequently, through the vaporizable material housed therein.

[0176] Further, the base component **826** includes a plurality of through-holes extending through the base **830**. While the number and size of the plurality of through-holes can vary, in the illustrated implementation, there is a first plurality through-holes **834** and a second plurality of through-holes **836**. Both the first and second plurality of through-holes **834**, **836** can be in fluid communication with the container **822**. In use, the first plurality of through-holes **834** can be configured to deliver air to or towards the container **822**, and the second plurality of through-holes **836** can be configured to withdraw air from the container **822**.

[0177] As further shown in FIGS. **8**A and **8**B, the filter assembly **828** can be coupled to the base component **826**. The filter assembly **828**, as shown in more detail in FIG. **10**, can include two or more components, such as a first layer **838** (e.g., a bottom layer), an absorbent layer **840**, and a second layer **842** (e.g., a top layer). In other implementations, the filter assembly can include an absorbent layer and one or more layers, such as the first layer or the second layer. In yet other implementations, the filter assembly includes three or more layers.

[0178] While the first and second layers **838**, **842** can be formed of a variety of materials, in some implementations, the first layer **838**, the second layer **842**, or both can function as an adhesive layer. As such, the first layer **838**, the second layer **842**, or both can include one or more adhesive materials. Alternatively, or in addition, the first layer **838**, the second layer **842**, or both can include paper, plastic, ceramic, and/or the like. The absorbent layer **840** can include one or more materials, such as paper, plastic, cotton, cellulose acetate, ceramic, and/or the like, and can be configured to absorb condensation formed by the mixing of air (e.g., bypass air that is introduced into the cartridge **820**) and vaporized material (e.g., formed within the cartridge **820**) to form an inhalable aerosol that exits the cartridge **820** (e.g., towards a mouthpiece of a vaporizer device) for inhalation by a user. As a result, the absorbent layer **840** can help avoid condensation buildup that would otherwise occur within a mouthpiece that is in fluid communication with the cartridge **820**.

[0179] While the first layer **838** can have a variety of configurations, as illustrated in FIGS. **8**B, **9**, and **10**, the first layer **838** can be positioned adjacent to (e.g., directly adjacent to) the base component **826** and can include two through-holes **844**, **846**. The first through-hole **844** can be configured to align with at least a portion of the first plurality of through-holes **834** of the base component **826** and the second through-hole **846** can be configured to align with at least a portion of the second plurality of through-holes **836** of the base component **826** (see FIG. **8**B). As such, the first through-hole **844** can be in fluid communication with the first plurality of through-holes **834** and the second through-hole **846** can be in fluid communication with the second plurality of through-holes **836**. As a result, in use, the first through-hole **844** can be configured to deliver air to or towards the container **822**, and the second through-hole **846** can be configured to withdraw air and vaporized material from the container **822**.

[0180] The second layer **842** can have a variety of configurations. In some implementations, the second layer **842**, as illustrated in FIGS. **8**A, **8**B, and **10**, can include one or more through-holes. More specifically, in this illustrated implementation, the second layer **842** includes an air inlet hole **848** that can be configured to allow air to enter into the cartridge **820** and into the container **822**, a bypass inlet hole **850** that can be configured to allow air to enter the cartridge **820** and into the filter assembly **828**, thereby bypassing the container **822**, and an outlet hole **852** that can be configured to allow inhalable aerosol formed within the filter assembly **828** to exit the cartridge **820** for inhalation by a user. As further illustrated, the second layer **842** can be the top-most layer (e.g., outer-most layer of the filter assembly **828**, at an end of the cartridge).

[0181] As shown in FIGS. **8**B, **9**, and **10**, the absorbent layer **840** can be interposed between the first and second layers **838**, **842** and can include at least two through through-holes **854**, **856**. The first through-hole **854** can be configured to align with at least a portion of the first through-hole **844** of the first layer **838** and with the air inlet hole **848** of the second layer **842** (see FIG. **8**B). The second through-hole **856** can be configured to align with at least a portion of the second through-hole **846** of the first layer **838** and the bypass inlet hole **850** and the outlet hole **852** of the second layer **842**.

[0182] As discussed in more detail below, the second through-hole **856** of the absorbent layer **840** can be configured to serve as a condensation chamber of the cartridge **820**. More specifically, the second through-hole **856** has a first segment **856***a* that overlaps with the bypass inlet hole **850** and a second segment **856***b* that overlaps with the outlet hole **852** of the second layer **842**. The second segment **856***b* also overlaps with a portion of the first layer **838** that is substantial, or completely, flat, thereby defining a longer airflow path compared to a conventional cartridge in which there is only a straight airflow path up and out of the mouthpiece of a vaporizer device. In use, this configuration in combination with the second plurality of through-holes **836** of the base component **826** allows outside air to mix with the vaporized material such that an inhalable aerosol can be formed within the second through-hole **856** of the absorbent layer **840** prior to exiting the cartridge **820**, and ultimately passing through a mouthpiece of a device to a user for inhalation. Since the air entering the cartridge **820** through the bypass inlet hole **850** is relatively cooler compared to the air mass containing the vaporized material from the container, the mixing thereof promotes nucleation of the vaporized material into an inhalable aerosol, as described above. By generating aerosol within the cartridge **820** (e.g., within the condensation chamber of the cartridge), condensation buildup that would otherwise occur within the mouthpiece can be avoided.

[0183] Further, the absorbent layer **840** can include one or more channels **858**, **860** defined in the absorbent layer **840**. For example, as shown in FIG. **10**, the absorbent layer **840** can include one or more first channels **858** that are positioned such that they intersect the first through-hole **854** and can include one or more second channels **860** that are positioned such that they intersect the second through-hole **856**. The one or more first and second channels **858**, **860** can be configured to draw condensation formed within each respective first and second through-holes **854**, **856** of the absorbent layer **840** away from the through-holes **854**, **856** to help further avoid condensation buildup within the mouthpiece.

[0184] FIG. **11** is a magnified view of the cartridge **820** shown in FIG. **8**B and illustrates the airflow paths (illustrated by arrows) of the cartridge **820** during use. When a user puffs on a mouthpiece of a vaporizer device comprising the cartridge **820**, as illustrated, air enters through the cartridge **820** along a first airflow path **862** which is defined at least in part by the air inlet hole **848** of the second layer **842**, the first through-hole **854** of the absorbent layer **840**, the first through-hole **844** of the first layer **838**, and the first plurality of through-holes **834** of the base component **826**. That air enters the container **822** and travels along a second airflow path **864**, which is defined at least in part by the baffle **832** and extends along or proximate a bottom surface of the container **822**. While the air is passing through the container **822** it is heated by a heater of a vaporizer device (e.g., like heating element(s) **441** of device **400***a* of FIG. **4**A) and vaporizes at least a portion of the vaporizable material (not shown) that is housed within the container **822**. Thereafter, the air and vaporized material exit the container **822** through the second plurality of through-holes **836** of the base component **826** and travels along a third airflow path **866** that is defined in part by the second through-hole **856** in the absorbent layer **840**. While the air and vaporized material travel along the third airflow path **866**, they mix with air present within the second through-hole **856** that enters the third airflow path **866** by way of the bypass inlet hole **850** of the second layer **842**. This mixing promotes the nucleation of the vaporized material into an inhalable aerosol (e.g., for subsequent inhalation by a user). Further, the bypass ratio is dictated at least in part by the diameter of the bypass inlet hole **850** relative to the diameter of the air inlet hole **848**. As such, the restriction on the lid **824** can be controlled by the relative sizes of the bypass and air inlet holes **850**, **848**. Thus, the bypass ratio allows for the generation of desired aerosol droplet size to be controlled at least by the cartridge as opposed to, for example, a mouthpiece of the vaporizer device.

[0185] In some implementations, the bypass ratio can be greater than one (e.g., the size of the bypass inlet hole is larger than the size of the air inlet hole). In some implementations, the bypass ratio can be less than one (e.g., the size of the bypass inlet hole is smaller than the size of the air inlet hole). In implementations where the bypass ratio is greater than one, a greater amount of cooler air can be introduced into the third airflow path (e.g., third airflow path **866**) by way of the bypass inlet hole, and subsequently, can be mixed with the air and vaporized material that exit the container (e.g., air and vaporized material traveling along the third airflow path **866**). This can result in a lesser amount of nicotine within the cooler inhalable aerosol compared to when the bypass ratio is less than one.

[0186] In some implementations, the filter assembly can be designed with increased dead space within the condensation chamber, for example as shown in FIG. **12**. This increased dead space can help slow down the velocity of the vapor traveling through the absorbent layer and/or lengthen the airflow path, and as a result, promote nucleation of the vaporized material into an inhalable aerosol (e.g., for subsequent inhalation by a user).

[0187] FIG. **12** illustrates a cross-sectional view of an exemplary vaporizer cartridge with increased dead space (e.g., compared to the vaporizer cartridge **820**). Aside from the differences described below the vaporizer cartridge **920** is similar to the vaporizer cartridge **820** and therefore similar components are not discussed in detail herein. The vaporizer cartridge **920** in FIG. **12** includes a container **922** and a lid **924**.

[0188] The lid **924** includes a base component **926** having a base **930** and a baffle **932**, and a filter assembly **928** disposed on a surface of the base **930**. The filter assembly **928** includes an adhesive layer **938** and an absorbent layer **940**, where the adhesive layer **938** is positioned between the absorbent layer **940** and the base **930** of the base component **926**. The absorbent layer **940**, the adhesive layer **938**, and the base **930** each have a respective first through-hole **968***a*, **968***b*, **968***c*. The first through-holes **968***a*, **968***b*, **968***c* at least partially overlap and collectively form an air inlet that can allow outside air (e.g., relative to the cartridge **920**) to pass into the container **922**. Further, the base component **926** has a second through-hole **969** that is in fluid communication with the interior **922***a* of the container **922** and is in fluid communication with a first channel **970** defined within the filter assembly **928** (e.g., within the adhesive layer **938** and/or the absorbent layer **940**). The second through-hole **969** can allow air and vaporized material (not shown) within the container **822** to exit the container **822** and flow into the first channel **970** for nucleation.

[0189] As further illustrated, the first channel **970** is in fluid communication within a second channel **972** defined within the adhesive layer **938** and the absorbent layer **940**. As such, the second channel **972** is downstream of the first channel **970**. The second channel **972** is in fluid communication with a second through-hole **974** extending through the adhesive layer **938** and a second through-hole **976** extending through the absorbent layer **940**. The second through-holes **974**, **976** at least partially overlap and collectively form an air outlet that can allow inhalable aerosol to exit the cartridge for inhalation. The first and second channels **970**, **972** within the filter assembly **928** define the condensation chamber within the filter assembly **928**.

[0190] The first and second channels, **970**, **972** can have a variety of shapes and sizes. In some implementations, as illustrated in FIG. **12**, the first and second channels **970**, **972**

each have an arc-like shape. More specifically, the first and second channels **970**, **972** collectively are a series of arc-like shaped bends. In other implementations, the first channel **970** and/or the second channel **970**, **972** can have other types of sizes and shapes, e.g., rectangular, pill shaped, or any other suitable shape that can allow nucleation of the vaporized material. In certain implementations, the first channel **970** and the second channel **972** can have different shapes and/or sizes relative to each other.

[0191] Further, the absorbent layer **940** includes at least one aeration hole **978***a*, **978***b* that is defined therein and in fluid communication within the outside air (e.g., relative to the cartridge **920**). While the number of aeration holes can vary, in some implementations, as shown in FIG. **12**, the absorbent layer **940** includes a first aeration hole **978***a* and a second aeration hole **978***b* downstream of the first aeration hole **978***b*. The first aeration hole **978***a* is in fluid communication with the outside air and the first channel **970**, whereas the second aeration hole **978***b* is in fluid communication with the outside air and the second channel **972**.

[0192] In use, outside air enters through the first through-holes **968***a*, **968***b*, **968***c* (e.g., air inlet) and into the container **922** along a first airflow path (illustrated by arrow **980**). The air continues to travel along a second airflow path **982** that extends along or proximate a bottom surface of the container **922**. While the air is passing along or proximate a bottom surface of the container **922** it is heated by a heater of a vaporizer device (e.g., like heating element(s) **441** of device **400***a* of FIG. **4**A) and vaporizes at least a portion of the vaporizable material (not shown) that is housed within the container **922**. Thereafter, the heated air and vaporized material exit the container **822** through the second through-hole **969** of the base **930** and into the first channel **970** where it travels along a third airflow path **984** through the first channel **970**. While the air and vaporized material passes through the first channel **970** it comes into contact with a first amount of outside air present within the first channel **970** by way of the first aeration hole **978***a* and the nucleation of the vaporized material into an inhalable aerosol begins. This mixture then passes along a fourth airflow path **986** through the second channel **972** where it comes into contact with a second amount of outside air present within the second channel **972** by way of the second aeration hole **978***b* and the nucleation of at least a portion of the remaining vaporized material into an inhalable aerosol occurs. The inhalable aerosol then travels along a fifth airflow path **988** through the outlet of the cartridge **920** for inhalation by a user. In this implementation, the outlet is defined by the second-though holes **974**, **976** of the adhesive layer **938** and the absorbent layer **940**.

[0193] In some implementations, it may be desirable to control an amount of nicotine provided to a user over a given period of time (e.g., 2 milligrams of nicotine over 10-12 puffs). However, in some aspects, nicotine transfer can be efficiently and/or effectively delivered via the vaporizer devices described herein (e.g., one or more of the vaporizer devices **100**, **200**, **400**, **500**, **1000**, **1100**), which can result in quickly depleting all or substantially all of the nicotine available within a cartridge (e.g., cartridges **120**, **320**, **420**, **520**, **620**, **720**, **820**, **920**, **1020**, **1120**), such as when the cartridge contains an amount of tobacco and/or tobacco leaves similar to one combustible cigarette. Accordingly, a substance other than tobacco leaves can be included within the cartridge in order to control the amount of nicotine delivered over the course of use of a cartridge. It will be appreciated that "tobacco leaves" can refer to dried and/or dehydrated tobacco leaves.

[0194] In order to effectively control the amount of nicotine, a substance that has characteristics similar to at least some of the characteristics of tobacco leaves (e.g., characteristics other than the presence of nicotine) can be included within the cartridge along with tobacco leaves and a humectant or other aerosol forming material or carrier (e.g., PG, VG, and/or the like). In some aspects, the characteristics of tobacco leaves that may be desirable to match include heat transfer when saturated with a humectant and/or heat transfer when not saturated with a humectant (collectively referred to as a heat transfer profile), air transfer when saturated with a humectant and/or air transfer when not saturated with a humectant (collectively referred to as an air transfer profile), capillary pressure when saturated with a humectant and/or capillary pressure when not saturated with a humectant (collectively referred to as a capillary pressure profile), porosity when saturated with a humectant and/or porosity when not saturated with a humectant (collectively referred to as a porosity profile), and/or the like. Substances that have characteristics similar to at least some of the characteristics of tobacco leaves can include puffed-up tobacco stems, hemp, cotton, wood, porous glass beads, porous ceramic, and/or the like.

[0195] As illustrated in FIGS. **13**A-**13**F, in various implementations, tobacco leaves may be combined in the cartridge with substance(s) that have characteristics similar to at least some of the characteristics of tobacco leaves in different amounts and/or according to different procedures or mechanisms. For example, in some implementations, the tobacco leaves and the substance can be present in approximately a 50/50 ratio, approximately a 55/45 ratio, approximately a 60/40 ratio, approximately a 65/35 ratio, approximately a 70/30 ratio, approximately a 75/25 ratio, approximately a 80/20 ratio, or approximately a 85/15 ratio (with either more of the tobacco leaves or more of the substance being present). One or both of the tobacco leaves and the substance can be formed and/or layered in sheets or strands (e.g., similar to the sheets of FIGS. **13**A-**13**B vertically aligned with respect to the bottom of the cartridge, similar to the sheets of FIG. **13**C diagonally aligned with respect to the bottom of the cartridge, in sheets aligned vertically with respect to the bottom of the cartridge, and/or the like), formed into block(s) or other shapes of one surrounded by the other (e.g., similar to the at least two blocks of tobacco leaves surrounded by the substance of FIG. **13**D), formed into pellets, boluses, beads, or other three-dimensional shapes of one ordered, interspersed, and/or interpenetrating within the other (e.g., similar to the interspersed substance within the tobacco leaves of FIG. **13**E), blended together into a homogenous or non-homogenous mixture (e.g., similar to the mixture of FIG. **13**F), disposed to occupy different portions of the cartridge (e.g., front and back, left and right, and/or the like), and/or the like.

[0196] In some aspects, the amounts and/or procedures or mechanisms by which the tobacco leaves and the substance are combined can affect the rate at which nicotine is extracted from the tobacco leaves during the course of a vaporizer device session. In order to achieve a vaporizer device session that will be satisfying to a combustible cigarette user, it can be desirable to combine the tobacco leaves and the substance in a manner that enables the humectant and nicotine to be substantially depleted as close in time as possible. It will be appreciated that "substantially depleted" can refer to conditions under which aerosol production drops off, the harsher taste of nicotine is not as noticeable, or a burnt taste is detected.

[0197] Accordingly, when combined with tobacco leaves and humectant, and heated at lower temperatures (e.g., 300 degrees to 400 degrees Fahrenheit or 150 degrees to 200 degrees Celsius), substances with characteristics similar to at least some of the characteristics of tobacco leaves can retain and release humectant at the same or similar rate to that of tobacco leaves, making aspects of the vaporizer device experience substantially the same as the experience of smoking a combustible cigarette.

[0198] Although the vaporizable material (e.g., tobacco leaves and/or substance with characteristics similar to at least some of the characteristics of tobacco leaves) is illustrated as occupying approximately 90% of the interior volume of the cartridge, in some implementations the vaporizable material may occupy approximately 80% of the interior volume of the cartridge, approximately 70% of the interior volume of the cartridge, approximately 60% of the interior volume of the cartridge, approximately 50% of the interior volume of the cartridge, or less. It will be appreciated that, in some aspects, the interior volume of the cartridge may include or exclude the space occupied by other components of the cartridge (such as the shaft **326**, **426**, **526**, **626**).

[0199] FIGS. **14**A-**14**C illustrates top perspective views of vaporizer device **1000**, consistent with implementations of the current subject matter. As illustrated in FIG. **14**A, the vaporizer device **1000** can include a vaporizer body **1010** and a mouthpiece **1030**, having an airflow outlet **1039**, attached to the vaporizer body **1010**. In some implementations, when the mouthpiece **1030** is closed on the top of the vaporizer body **1010**, the shape of mouthpiece **1030** can be such that a portion of the top of the vaporizer body **1010** is occluded (e.g., at least a portion of the ledge **1021**) while another portion of the top of the vaporizer body **1010** remains exposed. Within this exposed region, one or more airflow inlets **1033** may be at least partially exposed (e.g., to ambient air). Additionally or alternatively one or more outputs **1017** in the form of at least one LED (e.g., in the form of a solid light bar) can be provided within the exposed region between the intersection of the vaporizer body **1010** and the mouthpiece **1030**.

[0200] As illustrated in FIG. **14**B, the mouthpiece **1030** of the vaporizer device **1000** can be opened to provide access to a receptacle **1018** (e.g., for insertably receiving a cartridge **120**, **220**, **320**, **420**, **520**, **620**, **720**, **1020**). In some implementations, airflow can be provided to a cartridge in the receptacle **1018** via the one or more airflow inlets **1033**, illustrated as a slit, which can be substantially the same on the opposite side of the vaporizer body **1010**. As illustrated, the underside of the mouthpiece **1030** can include an airflow outlet channel **1038** in fluid communication with the airflow outlet **1039**.

[0201] As illustrated in FIG. **14**C the one or more airflow inlets **1033** in the vaporizer body **1010** may instead take the form of a plurality of through-holes. Additionally or alternatively, as illustrated the one or more outputs **1017** in the form of at least one LED can comprise a plurality of LEDs (e.g., in the form of a strip of five LEDs). The vaporizer device **1000** can include the same components of, and otherwise operate in the same manner as, any of the vaporizer device **100** of FIG. **1**, vaporizer device **200** of FIGS. **2**A-**2**B, vaporizer devices **400***a-i* of FIGS. **4**A-**4**I, vaporizer device **500** of FIGS. **5**A-**5**B, and/or any other vaporizer device described herein, except as noted.

[0202] FIGS. **15**A-**15**C illustrates top perspective views of vaporizer device **1100**, consistent with implementations of the current subject matter.

[0203] As illustrated in FIG. **15**A, the vaporizer device **1100** can include a vaporizer body **1110** and a mouthpiece **1130**, having an airflow outlet **1139**, attached to the vaporizer body **1110**. As illustrated in FIG. **15**B, the mouthpiece **1130** of the vaporizer device **1100** can be opened to reveal a cartridge **1120** within the vaporizer body **1110**. As further illustrated, a lid of the cartridge **1120** can rest upon at least a portion of the ledge **1121** of the vaporizer body. As illustrated in FIG. **15**C, the cartridge **1120** can be removed from the receptacle **1118** of the vaporizer body **1110** (e.g., for disposal after use). As further illustrated, the shape of the receptacle **1118** and/or ledge **1121** can be complementary to the shape of the cartridge **1120**, which can allow the cartridge to sit lower within the receptacle **1118** while still being easily removable. The vaporizer device **1100** can include the same components of, and otherwise operate in the same manner as, any of the vaporizer device **100** of FIG. **1**, vaporizer device **200** of FIGS. **2**A-**2**B, vaporizer devices **400***a-i* of FIGS. **4**A-**4**I, vaporizer device **500** of FIGS. **5**A-**5**B, vaporizer device **1000** of FIG. **14**A-**14**C, and/or any other vaporizer device described herein, except as noted.

[0204] In some implementations, any of the cartridges described herein (e.g., cartridges **120**, **220**, **320**, **420**, **520**, **620**, **720**, **820**, **920**,**1120**) can include a filter component, such the within any of the shafts described herein (e.g., **326**, **426**, **526**, **626**) and/or another location downstream of the shafts. Additionally or alternatively, the vaporizer devices described herein (e.g., one or more of the vaporizer devices **100**, **200**, **400**, **500**, **1000**, **1100**) can include a filter component outside of the cartridge, such as within the airflow outlet channels described herein (e.g., airflow outlet channels **438**, **538**, **1038**). In various implementations, the filter component can be configured to add components to the inhalable aerosol (e.g., flavors such as menthol) or strip components from the inhalable aerosol (e.g., nicotine and/or HPHCS).

[0205] The filter component can be similar to a traditional filter such as cellulose acetate and/or could include cotton, charcoal, beads, and/or the like, as long as the construction of the filter component allows airflow therethrough. In some implementations, the filter component can by cylindrical in shape. However, in other implementations the filter component can be an obstruction of any form, such as a baffle, webbing, and/or the like. In some aspects, providing a filter component downstream of where the vaporizable material **102**, **402** is heated to form vaporized material can aid in cooling the temperature of the aerosol passing therethrough, restrict or otherwise control airflow, and/or the like.

[0206] In any of the implementations described herein, the features defining the airflow path(s) (e.g., holes **425**, **525**, **625***a*, **625***b*, **725***b* of the cartridges **420**, **520**, **620**, **720**) can vary in geometry (e.g., shape, size, angle), location, number, and/or the like. Each of these variables can impact airflow within a vaporizer device **100**, **200**, **400**, **500**, **1000**, **1100** and the components thereof (e.g., a cartridge **120**, **320**, **420**,

520, **620**, **1020**, **1120**), and may provide drastically different user experiences via providing inhalable aerosols with different properties to a user. Such properties include but are not limited to average particle size, ratio of air to vaporized material, ratio of solid to liquid particles, percentage of active ingredient, temperature, and/or the like, which can be further complicated by properties of the vaporizable material **102**, **402** itself (e.g., flavor).

[0207] For example, a smaller hole can provide more resistance to airflow attempting to pass through the hole, thereby increasing the velocity, speed, and/or force of the air that does pass through the hole. Conversely, a larger hole can provide less resistance to airflow attempting to pass through the hole, thereby decreasing the velocity, speed, and/or force of the air that does pass through the hole. Due to decreased velocity/speed, a larger hole can provide for increased residence time (e.g., the amount of time heated air is present within the vaporizable material **102**, **402**), but due to decreased force, a larger hole can reduce the amount of vaporized material that is carried in the airflow path(s) **431**, **432**, **531**, **532**, **631**, **632**. Accordingly, in some implementations, the features defining the airflow path(s) can be tuned to alter the user's experience with the goals of creating an inhalable aerosol with particular properties in mind.

[0208] The features defining the airflow path(s) described herein include but are not limited to airflow inlets **433**, **434**, **533**, **1033**, airflow channels **435**, **436**, **438**, **535**, **538**, **1038**, airflow outlets **439**, **539**, **1039**, holes and/or channels within the cartridges **120**, **320**, **420**, **520**, **620**, **1020**, **1120** (e.g., including holes **425**, **525**, a plurality of through-holes **325***a*, **325***b*, **625***a*, **625***b*, **725***b*, one or more channels **329***a*, **529***a*, **629***a*, a central opening **328***a*, **628***a*, one or more entrance holes **329***b*, **629***b*, **729***b* one or more exit holes **328***b*, **628***b*, **728***b*, one or more shaft through-holes **327**, **627**, and/or the like), components of the cartridge **120**, **320**, **420**, **520**, **620**, **1020**, **1120** (e.g., including a base component **324***a*, a perforated lid **324***b*, a top barrier **324***c*, container **322**, **422**, **522**, **622**, **722**, a shaft **326**, **426**, **526**, **626**, and/or the like), the vaporizable material **102**, **402**, and/or the like.

[0209] Although "smaller" hole is a relative term and only depends on the existence of a larger hole (of any size), it is contemplated that a smaller hole can include a hole with a diameter that is around 1 mm or less (e.g., 0.5 mm to 1.2 mm). Similarly, although "larger" hole is a relative term, it is contemplated that a larger hole can include a hole with a diameter that is around 1 mm or more (e.g., 1.0 mm to 3.0 mm).

[0210] In some implementations, a component of the vaporizer device **100**, **200**, **400***a*-*i* can be configured to cover none, one, or any number of holes to allow a user to customize their experience to their personal preference (e.g., by ultimately affecting the properties of the inhalable aerosol delivered to the user). For example, vaporizer cartridges **120**, **320**, **420**, **520**, **620**, **720**, **1120** may be provided with certain holes covered (e.g., by a sticker), and a user may be able to uncover any number of the covered holes to change their experience. Uncovering one or more of the initially covered holes can change a user's experience by providing additional air to one or more locations within the cartridge, thereby providing a larger airflow stream (e.g., via less restriction), a lower-density vapor (e.g., via less residence time within the cartridge), and/or the like. These optionally exposed or covered air holes can affect either or both of an amount of air that is heated and/or otherwise comes directly into contact with the vaporizable material and an amount of "bypass air" that is combined with the heated air mass containing vaporized material released by heating the vaporizable material. Affecting the ratio of these two air streams can impact temperature of the aerosol inhaled by a user of a vaporizer device and may also affect a distribution of one or more compounds of the vaporized material between the gas and condensed phases when the user receives air passing through the vaporizer device.

[0211] Additionally or alternatively, different implementations of vaporizer cartridges **120**, **320**, **420**, **520**, **620**, **720**, **1120** can be sold, such that a user can select a cartridge that provides them with their preferred user experience. Cartridges can also be produced with pre-set air inlet orifices for either or both of the inlet air that is heated and/or passes through or near the heated vaporizable material and bypass air that is not hated but instead joined with a heated air mass containing vaporized material (e.g., one or more compounds converted to the gas phase by heating the vaporizable material). Different cartridges may include different inlet orifice and/or outlet orifice configurations (e.g., cross-sectional orifice area, orifice shape, orifice locations, number of instances of offices, and/or other airflow-impacting characteristics, etc.) for these two air streams to affect characteristics of the resulting aerosol as it is delivered to the user through at least one outlet during inhalation (e.g., based on varying either or both the cross-sectional orifice area and number of orifices in particular locations).

Terminology

[0212] It will be appreciated that the terms "proximal" and "distal" are used herein to refer to relative locations of the referenced devices and/or components. Although "proximal" is generally used to refer to a location that is at or near a user when the device and/or component is in use, and "distal" is generally used to refer to a location that is away from a user when the device and/or component is in use, these terms are not intended to be absolute. For example, a "proximal" end and/or a "distal" end of a component need not be the absolute furthest points on the referenced ends, and can instead refer to a general region at or near the referenced end. Further, opposing "proximal" ends and "distal" ends of a component need not be completely and/or perfectly opposite each other, as the shapes of each end may differ and/or the component may not be perfectly linear (e.g., one or more longitudinal dimensions of the component may be of different lengths).

[0213] When a feature or element is herein referred to as being "on" another feature or element, it can be directly on the other feature or element or intervening features and/or elements may also be present. In contrast, when a feature or element is referred to as being "directly on" another feature or element, there are no intervening features or elements present. It will also be understood that, when a feature or element is referred to as being "connected", "attached" or "coupled" to another feature or element, it can be directly connected, attached or coupled to the other feature or element or intervening features or elements may be present. In contrast, when a feature or element is referred to as being "directly connected", "directly attached" or "directly coupled" to another feature or element, there are no intervening features or elements present.

[0214] Although described or shown with respect to one implementation, the features and elements so described or shown can apply to other implementations. It will also be appreciated by those of skill in the art that references to a structure or feature that is disposed "adjacent" another feature may have portions that overlap or underlie the adjacent feature.

[0215] Terminology used herein is for the purpose of describing particular implementations and implementations only and is not intended to be limiting. For example, as used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, steps, operations, elements, components, and/or groups thereof. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items and may be abbreviated as "/".

[0216] In the descriptions above and in the claims, phrases such as "at least one of" or "one or more of" may occur followed by a conjunctive list of elements or features. The term "and/or" may also occur in a list of two or more elements or features. Unless otherwise implicitly or explicitly contradicted by the context in which it used, such a phrase is intended to mean any of the listed elements or features individually or any of the recited elements or features in combination with any of the other recited elements or features. For example, the phrases "at least one of A and B;" "one or more of A and B;" and "A and/or B" are each intended to mean "A alone, B alone, or A and B together." A similar interpretation is also intended for lists including three or more items. For example, the phrases "at least one of A, B, and C;" "one or more of A, B, and C;" and "A, B, and/or C" are each intended to mean "A alone, B alone, C alone, A and B together, A and C together, B and C together, or A and B and C together." Use of the term "based on," above and in the claims is intended to mean, "based at least in part on," such that an unrecited feature or element is also permissible.

[0217] Spatially relative terms, such as "forward", "rearward", "under", "below", "lower", "over", "upper" and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if a device in the figures is inverted, elements described as "under" or "beneath" other elements or features would then be oriented "over" the other elements or features. Thus, the exemplary term "under" can encompass both an orientation of over and under. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly. Similarly, the terms "upwardly", "downwardly", "vertical", "horizontal" and the like are used herein for the purpose of explanation only unless specifically indicated otherwise.

[0218] Although the terms "first" and "second" may be used herein to describe various features/elements (including steps), these features/elements should not be limited by these terms, unless the context indicates otherwise. These terms may be used to distinguish one feature/element from another feature/element. Thus, a first feature/element discussed below could be termed a second feature/element, and similarly, a second feature/element discussed below could be termed a first feature/element without departing from the teachings provided herein.

[0219] As used herein in the specification and claims, including as used in the examples and unless otherwise expressly specified, all numbers may be read as if prefaced by the word "about" or "approximately," even if the term does not expressly appear. The phrase "about" or "approximately" may be used when describing magnitude and/or position to indicate that the value and/or position described is within a reasonable expected range of values and/or positions. For example, a numeric value may have a value that is +/−0.1% of the stated value (or range of values), +/−1% of the stated value (or range of values), +/−2% of the stated value (or range of values), +/−5% of the stated value (or range of values), +/−10% of the stated value (or range of values), etc. Any numerical values given herein should also be understood to include about or approximately that value, unless the context indicates otherwise. For example, if the value "10" is disclosed, then "about 10" is also disclosed. Any numerical range recited herein is intended to include all sub-ranges subsumed therein. It is also understood that when a value is disclosed that "less than or equal to" the value, "greater than or equal to the value" and possible ranges between values are also disclosed, as appropriately understood by the skilled artisan. For example, if the value "X" is disclosed the "less than or equal to X" as well as "greater than or equal to X" (e.g., where X is a numerical value) is also disclosed. It is also understood that the throughout the application, data is provided in a number of different formats, and that this data, represents endpoints and starting points, and ranges for any combination of the data points. For example, if a particular data point "10" and a particular data point "15" are disclosed, it is understood that greater than, greater than or equal to, less than, less than or equal to, and equal to 10 and 15 are considered disclosed as well as between 10 and 15. It is also understood that each unit between two particular units are also disclosed. For example, if **10** and **15** are disclosed, then 11, 12, 13, and 14 are also disclosed.

[0220] Although various illustrative implementations are described above, any of a number of changes may be made to various implementations without departing from the teachings herein. For example, the order in which various described method steps are performed may often be changed in alternative implementations, and in other alternative implementations one or more method steps may be skipped altogether. Optional features of various device and system implementations may be included in some implementations and not in others. Therefore, the foregoing description is provided primarily for exemplary purposes and should not be interpreted to limit the scope of the claims.

[0221] One or more aspects or features of the subject matter described herein can be realized in digital electronic circuitry, integrated circuitry, specially designed application specific integrated circuits (ASICs), field programmable gate arrays (FPGAs) computer hardware, firmware, software, and/or combinations thereof. These various aspects or features can include implementation in one or more computer programs that are executable and/or interpretable on a programmable system including at least one programmable processor, which can be special or general purpose, coupled to receive data and instructions from, and to transmit data and instructions to, a storage system, at least one input device, and at least one output device. The programmable system or computing system may include clients and servers. A client and server are generally remote from each other and typically interact through a communication network. The relationship of client and server arises by virtue of computer programs running on the respective computers and having a client-server relationship to each other.

[0222] These computer programs, which can also be referred to programs, software, software applications, applications, components, or code, include machine instructions for a programmable processor, and can be implemented in a high-level procedural language, an object-oriented programming language, a functional programming language, a logical programming language, and/or in assembly/machine language. As used herein, the term "machine-readable medium" refers to any computer program product, apparatus and/or device, such as for example magnetic discs, optical disks, memory, and Programmable Logic Devices (PLDs), used to provide machine instructions and/or data to a programmable processor, including a machine-readable medium that receives machine instructions as a machine-readable signal. The term "machine-readable signal" refers to any signal used to provide machine instructions and/or data to a programmable processor. The machine-readable medium can store such machine instructions non-transitorily, such as for example as would a non-transient solid-state memory or a magnetic hard drive or any equivalent storage medium. The machine-readable medium can alternatively or additionally store such machine instructions in a transient manner, such as for example, as would a processor cache or other random access memory associated with one or more physical processor cores.

[0223] The examples and illustrations included herein show, by way of illustration and not of limitation, specific implementations in which the subject matter may be practiced. As mentioned, other implementations may be utilized and derived there from, such that structural and logical substitutions and changes may be made without departing from the scope of this disclosure. Such implementations of the inventive subject matter may be referred to herein individually or collectively by the term "invention" merely for convenience and without intending to voluntarily limit the scope of this application to any single invention or inventive concept, if more than one is, in fact, disclosed. Thus, although specific implementations have been illustrated and described herein, any arrangement calculated to achieve the same purpose may be substituted for the specific implementations shown. This disclosure is intended to cover any and all adaptations or variations of various implementations. Combinations of the above implementations, and other implementations not specifically described herein, will be apparent to those of skill in the art upon reviewing the above description.

1. A vaporizer device for generating an inhalable aerosol, the vaporizer device comprising:

a receptacle;

one or more heating elements positioned to heat the receptacle;

a cartridge configured to be inserted into the receptacle, the cartridge comprising:

a container comprising vaporizable material, the container configured to heat the vaporizable material when the heating element heats the receptacle;

a lid comprising a plurality of first air inlets configured to direct air into the container, the lid further comprising at least one air outlet; and

a structure within the container, the structure configured to direct the air through the vaporizable material to form a vaporized material;

at least one condensation chamber configured to condense the vaporized material into the inhalable aerosol, the at least one condensation chamber in fluid communication with the at least one air outlet; and

a mouthpiece comprising a mouthpiece outlet configured to deliver the inhalable aerosol to a user, the mouthpiece outlet in fluid communication with the at least one condensation chamber.

2. (canceled)

3. The vaporizer device of claim **1**, wherein the one or more heating elements are positioned at, against, near, and/or along one or more walls of the receptacle.

4. The vaporizer device of claim **3**, wherein the one or more walls of the receptacle comprise a bottom receptacle wall that is distal to the mouthpiece, and wherein the one or more walls of the receptacle further comprise one or more side walls extending in a longitudinal dimension that is perpendicular to the bottom receptacle wall.

5. The vaporizer device of claim **4**, wherein a first heating element of the one or more heating elements extends along at least a portion of the one or more side walls of the receptacle.

6. The vaporizer device of claim **4**, wherein a first heating element of the one or more heating elements is wrapped around at least a portion of an exterior of the receptacle.

7. (canceled)

8. The vaporizer device of claim **4**, wherein a second heating element of the one or more heating elements extends along at least a portion of the bottom receptacle wall.

9. The vaporizer device of claim **4**, wherein the bottom receptacle wall comprises a second heating element of the one or more heating elements, and wherein the second heating element is in direct contact with the cartridge.

10.-**14**. (canceled)

15. The vaporizer device of claim **1**, wherein the container of the cartridge comprises a non-vapor permeable material.

16.-**18**. (canceled)

19. The vaporizer device of claim **1**, wherein the structure comprises a baffle or a shaft comprising a plurality of shaft through-holes

20. The vaporizer device of claim **1**, further comprising an airflow path configured to deliver the inhalable aerosol to the user, the airflow path comprising the plurality of air inlets, the plurality of through-holes, the at least one condensation chamber, the at least one air outlet, and the mouthpiece outlet.

21. The vaporizer device of claim **19**, wherein the shaft comprises the at least one condensation chamber, and wherein the at least one condensation chamber is in fluid communication with one or more of the plurality of air inlets, the one or more of the plurality of air inlets configured to direct air into the at least one condensation chamber to promote nucleation of the vaporized material into the inhalable aerosol.

22. The vaporizer device of claim **1**, wherein the mouthpiece comprises the at least one condensation chamber, and wherein the mouthpiece further comprises at least one air inlet in fluid communication with the at least one condensation chamber, the at least one air inlet configured to direct air into the at least one condensation chamber to promote nucleation of the vaporized material into the inhalable aerosol.

23. (canceled)

24. The vaporizer device of claim **1**, wherein the mouthpiece further comprises an air inlet configured to direct air into the vaporizer device.

25. The vaporizer device of claim **1**, wherein the lid further comprises at least one second air inlet configured to direct air toward a combined airflow path of the vaporized material to thereby promote nucleation of the vaporized material into the inhalable aerosol.

26.-**27**. (canceled)

28. The vaporizer of claim **1**, wherein the structure comprises at least one first hole and at least one second hole, the at least one first hole being configured to direct the air passing through the plurality of air inlets of the lid into the container and the at least one second hole being configured to direct the vaporized material toward the at least one air outlet of the lid, and wherein the combination of the at least one first hole and the at least second hole allows air ingress and air egress into and out of the cartridge through the lid.

29. The vaporizer of claim **28**, wherein air ingress through the at least first hole passes through the lid in a first direction, and wherein air egress through the at least one second holes passes through the lid in a second direction that is different than the first direction.

30. The vaporizer of claim **29**, wherein the first direction and the second direction are opposite directions relative to each other.

31.-**38**. (canceled)

39. The vaporizer device of claim **1**, wherein the structure comprises a filter upstream of the at least one air outlet.

40. The vaporizer device of claim **1**, wherein the structure is further configured to direct the vaporized material towards the at least one air outlet.

41. The vaporizer device of claim **1**, wherein the at least one condensation chamber is positioned within the cartridge.

42. The vaporizer device of claim **1**, wherein the lid comprises a filter assembly.

43. The vaporizer device of claim **42**, wherein the filter assembly comprises a first layer and an absorbent layer, wherein the at least one condensation chamber is defined within the absorbent layer.

44. The vaporizer device of claim **43**, wherein the filter assembly further comprises a second layer, wherein the absorbent layer is positioned between the first layer and the second layer.

45. The vaporizer device of claim **44**, wherein each of the first layer, second layer, and absorbent layer has at least one through-hole extending therethrough.

46. The vaporizer device of claim **43**, wherein the absorbent layer comprises at least one aeration hole, wherein the at least one aeration hole is in fluid communication with the condensation chamber.

* * * * *