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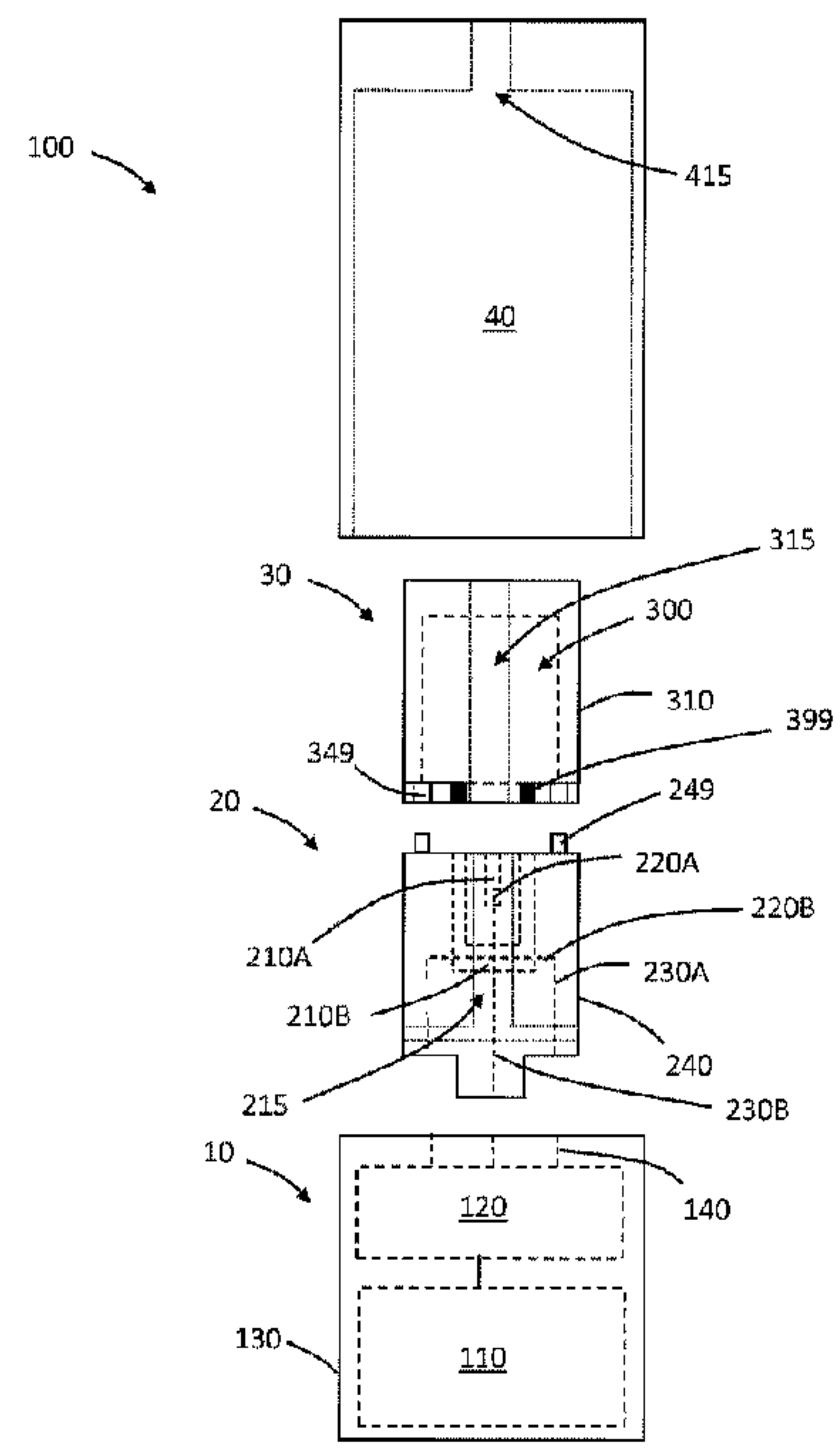

FIG. 1A

(57) Abrégé/Abstract:
An aerosol-generating system (100) includes a reservoir (300) containing an aerosol- forming substrate. The system also includes first and second heating elements (220A, 220B) and first and second liquid transfer elements (210A, 210B). The first and second heating elements (220A, 220B) are spaced apart from the reservoir in the direction of a longitudinal axis of the system. The first and second liquid transfer elements (210A, 210B) are arranged to deliver aerosol-forming substrate from the reservoir (300) to the heating elements (220A, 220B). The first liquid transfer element (210A) has first and second end portions and a portion between the first and second end portions at the first heating element (220A). The second liquid transfer element (210B) has first and second end portions and a portion between the first and second end portions at the second heating element (220B). The portion of the first liquid transfer element (210A) at the first heating element (220A) may extend in a first direction. The portion of the second liquid transfer element (210B) at the second heating element (220B) may extend in a second direction. The first and second directions may be different. The first direction may be substantially perpendicular to the second direction.

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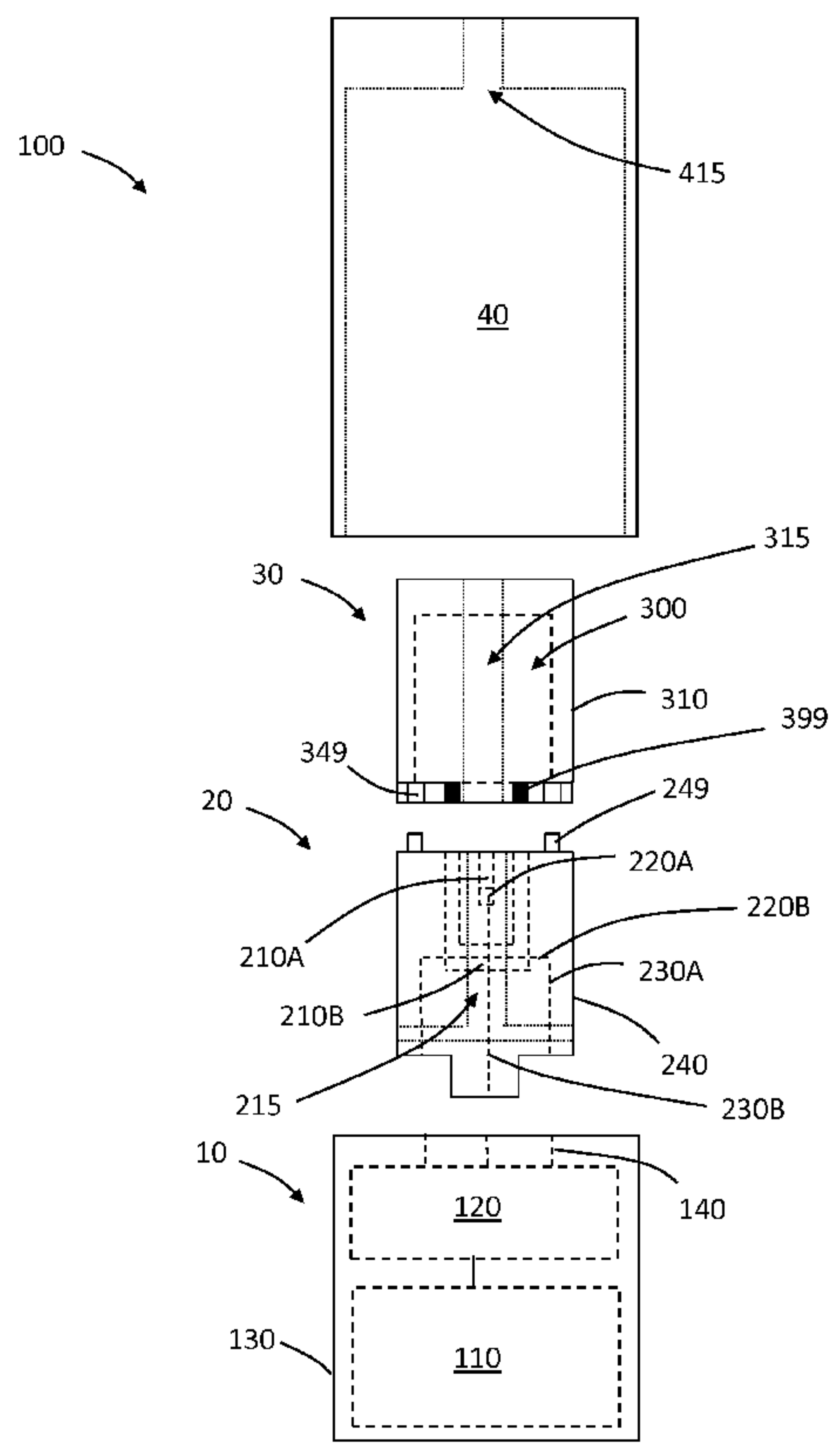

FIG. 1A

(57) Abstract: An aerosol-generating system (100) includes a reservoir (300) containing an aerosol- forming substrate. The system also includes first and second heating elements (220A, 220B) and first and second liquid transfer elements (210A, 210B). The first and second heating elements (220A, 220B) are spaced apart from the reservoir in the direction of a longitudinal axis of the system. The first and second liquid transfer elements (210A, 210B) are arranged to deliver aerosol-forming substrate from the reservoir (300) to the heating elements (220A, 220B). The first liquid transfer element (210A) has first and second end portions and a portion between the first and second end portions at the first heating element (220A). The second liquid transfer element (210B) has first and second end portions and a portion between the first and second end portions at the second heating element (220B). The portion of the first liquid transfer element (210A) at the first heating element (220A) may extend in a first direction. The portion of the second liquid transfer element (210B) at the second heating element (220B) may extend in a second direction. The first and second directions may be different. The first direction may be substantially perpendicular to the second direction.

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AEROSOL-GENERATING SYSTEM WITH MULTIPLE HEATING ELEMENTS

This invention relates to electrically heated aerosol-generating systems for generating an aerosol and associated devices, articles and methods. In particular, this invention relates to an electrically heated aerosol-generating system having multiple heating elements.

One type of aerosol-generating system is an electrically operated handheld aerosol-generating system. Known handheld electrically operated aerosol-generating systems may include a device portion comprising a battery and control electronics, and a replaceable cartridge portion comprising a supply of aerosol-forming substrate, and an electrically operated vaporizer. A cartridge comprising both a supply of aerosol-forming substrate and a vaporizer is sometimes referred to as a ‘cartomizer’. The vaporizer may comprise a coil of heater wire wound around an elongate wick soaked in liquid aerosol-forming substrate. The cartridge portion often comprises not only the supply of aerosol-forming substrate and an electrically operated vaporizer, but also a mouthpiece, on which the user may draw to cause aerosol to flow into the user’s mouth.

Some aerosol-generating systems that include multiple heating elements have been proposed. For example, devices having multiple coil and wick elements have been proposed. Such devices may enable an increase in the amount of aerosol produced for each puff by the user on the device.

Efficient packing of device elements can be an important factor for aerosol generating device. Such devices are commonly handheld and in many cases, a small size of device may be desirable. The presence of multiple heating elements may undesirably increase the size of the device.

It would be desirable to provide an aerosol-generating system, such as a handheld electrically operated system, including multiple heating elements and that is configured to enhance packing efficiency. It would also be desirable for such systems to manage liquid and air flow in the system so as to seek to efficiently generate the aerosol.

In a first aspect of the present invention there is provided an aerosol-generating system comprising: a reservoir for containing an aerosol-forming substrate; a first heating element spaced apart from the reservoir in the direction of a longitudinal axis of the aerosol-generating system; and a second heating element spaced apart from the reservoir in the direction of the longitudinal axis. The aerosol-generating system further comprises: a first liquid transfer element having first and second end portions and a portion between the first and second end portions at the first heating element; and a second liquid transfer element having first and second end portions and a portion between the first and second end portions at the second heating element. The first and second end portions of the first liquid transfer element are arranged to deliver aerosol-forming substrate from the reservoir to the first heating element. The first and second end portions of the second liquid transfer element are arranged to deliver aerosol-forming substrate from the reservoir to the second heating element.

By spacing the first and second heating elements from the reservoir in the direction of a longitudinal axis of the aerosol-generating system, the heating elements and liquid transfer elements may be more efficiently packaged in the system and thus can allow for smaller size aerosol-generating systems. In particular, the reservoir, heating elements and liquid transfer elements may be arranged in an end-to-end arrangement along a longitudinal axis of the aerosol-generating system, which may enable the aerosol-generating system to be thinner, or have a reduced width, compared to other aerosol-generating systems having multiple heating elements. These and other advantages of various aspects of the present invention will be evident based on the present disclosure.

A portion of the first liquid transfer element is arranged at the first heating element. The portion of the first liquid transfer element arranged at the first heating element is arranged relative to the first heating element such that the first heating element may transfer heat to the portion of the first liquid transfer element. Similarly, a portion of the second liquid transfer element is arranged at the second heating element. The portion of the second liquid transfer element arranged at the second heating element is arranged relative to the second heating element such that the second heating element may transfer heat to the portion of the second liquid transfer element. Thus, the portions of the first and second liquid transfer elements at the first and second heating elements may be described as being in thermal proximity to the first and second heating elements. In some embodiments, the first heating element may be in physical contact with the portion of the first heating element between the first and second end portions of the first heating element. In some embodiments, the second heating element may be in physical contact with the portion of the second heating element between the first and second end portions of the second heating element.

In some embodiments, the first and second end portions of the first liquid transfer element may be arranged in fluid contact with the reservoir and the first and second end portions of the second liquid transfer element may be arranged in fluid contact with the reservoir. The first and second end portions of the first liquid transfer element may be arranged in fluid contact with the reservoir at a first location and the first and second end portions of the second liquid transfer element may be arranged in fluid contact with the reservoir at a second location. The second location being spaced apart from the first location. The second location being spaced apart from the first location in the direction of the width of the aerosol-generating system.

In some embodiments, the system may further comprise a liquid retention medium, as described in more detail later on. The liquid retention medium may be arranged in fluid contact with the reservoir. The liquid retention medium may be arranged to deliver liquid aerosol-forming substrate from the reservoir to the first and second liquid transfer elements. The first and second end portions of the first liquid transfer element may be arranged in fluid contact with the liquid retention medium. The first and second end portions of the second liquid transfer element may also be arranged in fluid contact with the liquid retention medium. The first and second end portions of the first liquid transfer element may be arranged in fluid contact with the liquid retention medium at a first location and the first and second end portions of the liquid transfer element may be arranged in fluid contact with the liquid retention medium at a second location. The second location may be spaced apart from the first location. The second location may be spaced apart from the first location in the direction of the width of the aerosol-generating system.

As used herein, the terms 'fluid contact', 'fluid communication' and 'fluid connection' refer to parts, features or objects that are arranged relative to each other such that fluid may be transferred or communicated directly between the parts, features or objects that are in fluid contact, communication or connection.

In some embodiments, the first liquid transfer element may be substantially U-shaped, C-shaped or V-shaped. Similarly, in some embodiments, the second liquid transfer element may be substantially U-shaped, C-shaped or V-shaped. The first and second liquid transfer elements may be substantially the same shape. The first and second liquid transfer elements may be different shapes.

In some embodiments, the portion of the first liquid transfer element at the first heating element may extend substantially in a first direction and the portion of the second liquid transfer element at the second heating element may extend substantially in a second direction. The first and second end portions of the first heating element may extend substantially in a third direction, the third direction being different to the first direction. The first and second end portions of the second heating element may extend substantially in a fourth direction, the fourth direction being different to the second direction.

In some embodiments, the first direction may be the same as the second direction. In these embodiments, the first and second liquid transfer elements may be spaced apart in a direction substantially transverse to the longitudinal axis of the aerosol-generating system. In other words, the first and second liquid transfer elements may be spaced apart in the direction of the width of the aerosol-generating system. In some embodiments, the first direction may be different from the second direction, as described in more detail below.

In some embodiments, the first and second directions are substantially perpendicular to the longitudinal axis of the aerosol-generating system. In some embodiments, the third and fourth directions are substantially parallel to the longitudinal axis. In some embodiments, the third and fourth directions are substantially the same direction. In some embodiments, the first and second end portions of the first liquid transfer element may extend from the first heating element to the reservoir or the liquid transfer medium. In some embodiments, the first and second end portions of the second liquid transfer element may extend from the second heating element to the reservoir or the liquid transfer element.

In some embodiments, the spacing or distance between the first heating element and the reservoir may be the same.

In some embodiments, the spacing or distance between the first heating element and the reservoir may be different. In other words, one of the first and second heating elements may be spaced at a greater distance from the reservoir than the other, in the direction of the longitudinal axis of the system. As such, the first and second end portions of one of the first and second heating elements may be longer than the first and second end portions of the other heating element. Thus, the first and second heating elements may be located at different longitudinal positions of an airstream flow path through the system, which would place one of the first and second heating elements upstream of the other heating element. More efficient mass transfer of aerosol may occur by the longitudinal spacing of the heating elements.

The first end portion of the first liquid transfer element may comprise a first end and the second end portion of the first liquid transfer element may comprise a second end. The first end portion of the second liquid transfer element may comprise a first end and the second end portion of the second liquid transfer element may comprise a second end. The first and second ends of the first liquid transfer element may lie substantially on a common plane. The first and second ends of the second liquid transfer element may lie substantially on a common plane. In some embodiments, the first and second ends of the first and second liquid transfer elements may lie substantially on a common plane.

Arranging the ends of the first and second liquid transfer elements substantially on a common plane may further improve packaging efficiently in the aerosol-generating system and may allow for smaller size aerosol-generating systems. In particular, arranging the ends of the first and second liquid transfer elements on a common plane may facilitate an end-to-end arrangement of the first and second liquid transfer elements and the reservoir.

In some embodiments, the system comprises a vaporizing unit including the first and second liquid transfer elements and the first and second heating elements. The vaporizing unit may be configured to be releasably connected to a reservoir. The vaporizing unit may be configured to be arranged in an end-to end relationship with a reservoir along the longitudinal axis of the aerosol-generating system.

In a second aspect of the present invention there is provided a vaporizing unit for an aerosol-generating system, the vaporizing unit comprising: a reservoir connecting end configured to be releasably connected to a source of liquid aerosol-forming substrate; a first heating element spaced apart from the reservoir connecting end in the direction of a longitudinal axis of the vaporizing unit; and a second heating element spaced apart from the reservoir connecting end in the direction of the longitudinal axis. The vaporizing unit further comprises: a first liquid transfer element having first and second end portions and a portion between the first and second end portions at the first heating element; and a second liquid transfer element having first and second end portions and a portion between the first and second end portions at the second heating element. The first and second end portions of the first liquid transfer element are arranged to deliver liquid aerosol-forming substrate to the first heating element from a source of liquid aerosol-forming substrate when a source of liquid aerosol-forming substrate is connected to the vaporizing unit at the reservoir connecting end. The first and second end portions of the second liquid transfer element are arranged to deliver liquid aerosol-forming substrate to the second heating element from a source of liquid aerosol-forming substrate when a source of liquid aerosol-forming substrate is connected to the vaporizing unit at the reservoir connecting end.

The vaporizing unit may further comprise a liquid retention medium. The liquid retention medium may be arranged to deliver liquid aerosol-forming substrate from a source of liquid aerosol-forming substrate when a source of liquid aerosol-forming substrate is connected to the vaporizing unit at the reservoir connecting end. The liquid retention medium may be arranged at the reservoir connecting end of the vaporizing unit. The first and second end portions of the first liquid transfer element may be arranged in fluid contact with the liquid retention medium. The first and second end portions of the second liquid transfer element may be arranged in fluid contact with the liquid retention medium.

The portion of the first liquid transfer element at the first heating element may extend substantially in a first direction. The portion of the second liquid transfer element at the first heating element may extend substantially in a second direction. The first and second end portions of the first heating element may extend substantially in a third direction, the third direction being different to the first direction. The first and second end portions of the second heating element may extend substantially in a fourth direction, the fourth direction being different to the second direction.

The first and second directions may be substantially perpendicular to the longitudinal axis. In some embodiments, the first and second directions may be the same. Where the first and second directions are the same, the first and second liquid transfer elements may be spaced apart from each other in a direction substantially perpendicular to the longitudinal axis of the vaporizing unit. In some embodiments, the first and second directions may be different. Such embodiments are described in more detail below, in regards to the third and fourth aspects of the present invention.

The third and fourth directions may be substantially parallel to the longitudinal axis. In some embodiments, the third and fourth directions may be the same. Where the third and fourth directions are the same, the first and second ends of the first and second liquid transfer elements may extend substantially from the first and second heating elements towards the reservoir connecting end of the vaporizing unit.

The first end portion of the first liquid transfer element may comprise a first end and the second end portion of the first liquid transfer element may comprise a second end. The first end portion of the second liquid transfer element may comprise a first end and the second end portion of the second liquid transfer element may comprise a second end. The first and second ends of the first liquid transfer element may lie substantially on a common plane. The first and second ends of the second liquid transfer element may lie substantially on the common plane. This may enable the vaporizing unit to be releasably connected to a source of liquid aerosol-forming substrate regardless of the relative orientations of the vaporizing unit and the source of liquid aerosol-forming substrate.

In a third aspect of the present invention there is provided an aerosol-generating system comprising a reservoir containing an aerosol-forming substrate. The system includes first and second heating elements and first and second liquid transfer elements. The first and second liquid transfer elements are arranged to deliver aerosol-generating liquid to first and second heating elements. The first liquid transfer element extends in a first direction at the first heating element. The second liquid transfer element extends in a second direction at the second heating element. The first and second directions are different. The first direction may be substantially perpendicular to the second direction.

In a fourth aspect of the present invention, a vaporizer unit for an aerosol-generating system is provided. The vaporizer unit comprises first and second heating elements and first and second liquid transfer elements. The first and second liquid transfer elements are arranged to deliver aerosol-generating liquid to first and second heating elements. The first liquid transfer element extends in a first direction at the first heating element. The second liquid transfer element extends in a second direction at the second heating element. The first and second directions are different. The first direction may be substantially perpendicular to the second direction.

By orienting the liquid transfer elements in different directions, the liquid transfer elements may be more efficiently packaged in the system and thus can allow for smaller size vaporizing units. In addition, air flow across heating elements having liquid transfer elements oriented in different directions may provide more efficient transfer of aerosol to the air stream than for example where parallel liquid transfer elements are present. These and other advantages of various aspects of the present invention will be evident based on the present disclosure.

The above mentioned aspects of the present invention provide, among other things, systems that use electrical energy to heat a substrate, generally without combusting the substrate, to form an aerosol that may be inhaled by a user. The systems may be sufficiently compact to be considered hand-held systems. Some examples of systems of the invention can be characterized as aerosol-generating articles. As used herein, the term 'aerosol-generating article' includes an article that can deliver a nicotine-containing aerosol for inhalation by a user.

The terms 'aerosol-generating system', 'aerosol-generating article' and 'aerosol-generating assembly' refer to a system, an article or an assembly comprising an aerosol-forming substrate that releases volatile compounds to form an aerosol that may be inhaled by a user. The term 'aerosol-forming substrate' refers to a substrate capable of releasing, upon heating, volatile compounds, which may form an aerosol.

Any suitable aerosol-forming substrate may be used with the systems. Suitable aerosol-forming substrates may comprise plant-based material. For example, an aerosol-forming substrate may comprise tobacco or a tobacco-containing material containing volatile tobacco flavour compounds, which are released from the aerosol-forming substrate upon heating. In addition or alternatively, an aerosol-forming substrate may comprise a non-tobacco containing material. An aerosol-forming substrate may comprise homogenized plant-based material. An aerosol-forming substrate may comprise at least one aerosol former. An aerosol-forming substrate may comprise other additives and ingredients such as flavorants. An aerosol-forming substrate may comprise nicotine. An aerosol-forming substrate may be liquid at room temperature. For example, an aerosol forming substrate may be a liquid solution, suspension, dispersion or the like. In some preferred embodiments, an aerosol-forming substrate comprises glycerol, propylene glycol, water, nicotine and, optionally, one or more flavorant.

The aerosol-forming substrate may be stored in a liquid storage portion of a system of the present invention. The liquid storage portion may for example comprise a reservoir that contains the aerosol-forming substrate. The reservoir may comprise a liquid retention medium for example a porous material for storing liquid. The porous material may for example comprise a fibrous or spongy material, for example comprising polymer fibres, for example PET. The liquid storage portion may comprise a housing, for example defining the reservoir. The housing may be a rigid housing. As used herein ‘rigid housing’ means a housing that is self-supporting. The housing may be formed of any suitable material or combination of materials, such as a polymeric material or a metallic material, or glass. The housing of the liquid storage portion or cartridge may be formed by a thermoplastic material. Any suitable thermoplastic material may be used. One suitable thermoplastic material is acrylonitrile butadiene styrene.

The liquid storage portion may comprise an opening in communication with the reservoir through which the aerosol-forming substrate may be introduced into the reservoir or removed, such as by flowing, from the reservoir. The opening may be at the distal end. The terms ‘distal,’ ‘upstream,’ ‘proximal,’ and ‘downstream’ are used to describe the relative positions of components, or portions of components, of an aerosol-generating system. Aerosol-generating systems according to the invention may have a proximal end through which, in use, an aerosol exits the system for delivery to a user, and may have an opposing distal end. The proximal end of the aerosol-generating system may also be referred to as the mouth end. In use of such examples, a user draws on the proximal end of the aerosol-generating system in order to inhale an aerosol generated by the aerosol-generating system. The terms upstream and downstream are relative to the direction of aerosol movement through the aerosol-generating system when a user draws on the proximal end.

The term 'longitudinal' is used to describe the direction between the mouth end and the distal end of the aerosol-generating system. The system may have a length in the longitudinal direction. The system may have a longitudinal axis, along which the length of the system may be measured. The term 'length' is used to describe the maximum dimension in the longitudinal direction of the aerosol-generating system.

The term 'transverse' is used to describe the direction perpendicular to the longitudinal direction. The terms ‘width’ and 'diameter' are used to describe the maximum dimension in the transverse direction of the aerosol-generating system.

The liquid storage portion may be part of a consumable cartridge, capsule or liquid store, which the user can discard when the supply of the aerosol-forming substrate in the reservoir is diminished or depleted. The cartridge or capsule can then be replaced with another cartridge or capsule having a reservoir filled to an appropriate amount with aerosol-forming substrate. The housing of the liquid storage portion discussed above may be the housing of the cartridge or capsule.

The cartridge may, optionally, further include the liquid transfer elements, one or more heating element or both the liquid transfer elements and the one or more heating element. The liquid transfer elements and one or more heating element may be present in a vaporizing unit separate from the capsule or liquid store. The separate vaporizing unit and the capsule or liquid store may be releasably connectable. As used herein, 'releasably connectable' means that the releasably connectable parts may be connected to, and disconnected from each other, without significantly damaging either part. The parts may be connected and disconnected without any damage to either part. The capsule or liquid store may be connected to the vaporizing unit in any suitable manner, such as threaded engagement, snap-fit engagement, interference-fit engagement, magnetic engagement, or the like.

In some embodiments, the liquid transfer elements may be in fluid contact with the reservoir. In other embodiments, the system may further comprise a liquid retention medium. The liquid retention medium may be in fluid contact with the reservoir. The liquid transfer elements may be in fluid contact with the liquid retention medium. The first and second end portions of the first and second liquid transfer elements may be in fluid contact with the liquid retention medium.

If the system comprises a separate vaporizing unit and capsule or liquid store comprising the liquid storage portion, the liquid storage portion may comprise a valve positioned relative to the distal end portion opening to prevent the aerosol generating material from exiting the reservoir when the capsule is not connected to the vaporizing unit. The valve may be actuatable such that the act of connecting the capsule to the vaporizing unit causes the valve to opening and disconnecting the capsule from the vaporizing unit causes the valve to close. Any suitable valve may be used. One suitable valve is described in Chinese Patent Application Publication No. CN 104738816 A, which describes a rotary valve assembly. In the rotary valve assembly, a rotatable valve including a liquid outlet is arranged at an outlet end of a liquid retention medium or a liquid storage element. A connection element is provided which can be arranged in the liquid outlet of the valve. Rotation of the connection element on connection of the liquid retention medium or liquid storage element effects rotation of the valve to align the liquid outlet of the valve with an outlet of a liquid reservoir to allow passage of the liquid from the reservoir to a liquid inlet associated with a heater element. When the liquid retention medium or liquid storage element is removed, rotation of the connection element rotates the valve back to seal the liquid outlet of the reservoir.

If the one or more heating elements and the liquid transfer elements are contained in a vaporizing unit separate from the capsule, the vaporizing unit may further comprise a housing in which the heating elements and liquid transfer elements are disposed. The vaporizing unit may include an element that interacts with the valve of the capsule to open the valve and place the liquid transfer elements in fluid communication with the reservoir when the capsule is connected to the vaporizing unit. The housing of the vaporizing unit may be a rigid housing. At least a portion of the housing may comprise a thermoplastic material, a metallic material, or a thermoplastic material and a metallic material.

The capsule, regardless of whether it includes the liquid transfer elements, may comprise a liquid retention medium. The liquid retention medium may comprise liquid storage or liquid transfer material. A 'liquid transfer material' is a material that conveys liquid from one portion of the material to another. The liquid transfer material may comprise a capillary material. The liquid transfer material may advantageously be arranged to convey liquid from the reservoir to the liquid transfer element. Liquid transfer material may have a fibrous or spongy structure. The liquid transfer material may include a bundle, mat or other structure comprising fibres or filaments. For example the liquid transfer material may comprise a plurality of fibres or threads. The fibres or threads may be generally aligned to convey the liquid in the aligned direction. The liquid transfer material may comprise sponge-like or foam-like material. The liquid transfer material may comprise any suitable material or combination of materials. Examples of suitable materials are a sponge or foam material, ceramic, glass or graphite-based materials in the form of fibres or sintered powders, foamed metal or plastics material, a fibrous material, for example made of spun or extruded fibres, such as cellulose acetate, polyester, or bonded polyolefin, polyethylene, terylene or polypropylene fibres, nylon fibres or ceramic.

Regardless of whether the liquid transfer elements are in a vaporizing unit separate from the capsule or are included in a cartridge with the aerosol-forming substrate, the liquid transfer elements may be formed from any suitable liquid transfer material. For example, the liquid transfer material may comprise a capillary material as previously discussed in relation to the capsule except that in examples of the invention the liquid transfer material of the vaporizer unit may be suitable for use in contact with a heating element. For example, the liquid transfer elements may comprise fused silica or a porous ceramic material.

The liquid transfer elements may each include first and second portions in fluid contact with the reservoir and a portion in contact with a heating element. The portion in contact with the heating element is between the first and second portions. The first and second portions may extend substantially parallel to the longitudinal axis of the system, and the portion in contact with the heating element may extend substantially transverse to the longitudinal axis of the system.

A portion of the first liquid transfer element at the first heating element extends in a direction different than that of a portion of the second liquid transfer element at the second heating element. The direction that the portion of the first liquid transfer element extends may be perpendicular to the direction that the portion of the second liquid transfer element extends. The distance from the second heating element to the reservoir may be greater than the distance from the first heating element to the reservoir, and thus may be located at different longitudinal positions of an airstream flow path through the system, which would place the second heating element upstream of the first heating element.

More efficient mass transfer of aerosol may occur by the non-aligned arrangement of liquid transfer elements according to the present invention. For example, the surface area of the liquid transfer elements, particularly the portions of the liquid transfer elements at the heating elements, that may experience efficient contact with in the air stream may be greater than if the liquid transfer elements were stacked in an aligned orientation because the portion of the second liquid transfer element at the second heating element may block some air flow to the downstream and aligned portion of the first liquid transfer element at the first heating element.

In some embodiments, there may be provided an aerosol-generating system comprising: a reservoir for containing an aerosol-forming substrate; a first heating element; and a second heating element. The system may further comprise a first liquid transfer element arranged to deliver aerosol-forming substrate from the reservoir to the first heating element, the first liquid transfer element having a portion extending in a first direction at the first heating element. The system may further comprise a second liquid transfer element arranged to deliver aerosol-forming substrate from the reservoir to the second heating element, the second liquid transfer element having a portion extending in a second direction at the second heating element. The first and second directions may be different. The distance from the reservoir to the second heating element at the second liquid transfer element may be greater than the distance from the reservoir to the first heating element of the first liquid transfer element.

In some embodiments, there may be provided a vaporizing unit for an aerosol-generating system, the vaporizing unit comprising: a reservoir connecting end configured to be releasably connected to a source of liquid aerosol-forming substrate; a first heating element spaced apart from the reservoir connecting end in the direction of a longitudinal axis of the vaporizing unit; and a second heating element spaced apart from the reservoir connecting end in the direction of the longitudinal axis. The vaporizing unit may further comprise a first liquid transfer element arranged to deliver liquid aerosol-forming substrate aerosol-forming substrate to the first heating element from a source of liquid aerosol-forming substrate when a source of liquid aerosol-forming substrate is releasably connected to the reservoir connecting end. The vaporizing unit may further comprise a second liquid transfer element arranged to deliver liquid aerosol-forming substrate to the second heating element from a source of liquid aerosol-forming substrate when a source of liquid aerosol-forming substrate is releasably connected to the reservoir connecting end. The first liquid transfer element may have a portion extending in a first direction at the first heating element. The second liquid transfer element may have a portion extending in a second direction at the second heating element. The first and second directions are different. The distance from the reservoir connecting end to second heating element at the second liquid transfer element may be greater than the distance from the reservoir connecting end to the first heating element at the first liquid transfer element.

The material, shape, size, and construction of the first and second liquid transfer elements may be the same or different. The first and second liquid transfer elements may be of a suitable material, shape, size and construction such that both liquid transfer elements remain wet until the aerosol-forming substrate in the reservoir is depleted. For example, one or both of the materials and cross-sectional areas of the liquid transfer elements or portions of the liquid transfer elements may be varied to maintain wetness until the reservoir is depleted in both liquid transfer elements despite the distance of portions of the liquid transfer elements to the reservoir being different. The rate of transfer of liquid aerosol-forming substrate from the reservoir to the portion of the first and second liquid transfer elements in respective contact with the first and second heating elements may be substantially the same. Thus, the capacity of the liquid transfer material of the second liquid transfer element, which may be further from the reservoir at the second heating element, may be greater than the capacity of the liquid transfer material of the second liquid transfer element, which may be closer to the reservoir at the first heating element. For example, the second liquid transfer element may have a cross-sectional area greater than the cross-sectional area of the first liquid transfer element or the second transfer element may comprise material having a greater liquid transfer capacity that the first liquid transfer element. The first and second portions of each of the first and second liquid transfer elements may carry liquid aerosol-forming substrate to the portions of the first and second liquid transfer elements at the heating elements, for example in contact with the heating elements. First and second ends of each liquid transfer element may be in contact with a liquid retention material such as a fibrous sponge or pad. In use, the liquid retention material may be in fluid communication with the liquid aerosol-forming substrate in the reservoir. The first and second ends of the first liquid transfer element may be located at different positions, which provides different locations for feeding the liquid transfer element with liquid aerosol-forming substrate.

The first and second ends of the second liquid transfer element may also be located at different positions. The first and second ends of the first liquid transfer element and the first and second ends of the second liquid transfer element may be located at different positions from each other so that each end of each liquid transfer element is fed from a different location. Each end of each liquid transfer element may be longitudinally aligned with an opening in communication with the reservoir. Such an orientation may enhance feeding of the liquid transfer elements relative to liquid transfer elements that share a feeding location and may enhance mass transfer of an aerosol generated from the liquid substrate carried by the liquid transfer elements to an airstream through the system.

At least a portion of the liquid transfer element is located sufficiently close to the heating element so that liquid aerosol-forming substrate carried by the liquid transfer element may be heated by the heating element to generate an aerosol. At least a portion of the liquid transfer element, such as a portion between the first and second ends, may be in contact with the heating element.

Any suitable heating element may be employed. For example, the heating element may comprise a resistive filament. The term ‘filament’ is used throughout the specification to refer to an electrical path arranged between two electrical contacts. A filament may arbitrarily branch off and diverge into several paths or filaments, respectively, or may converge from several electrical paths into one path. A filament may have a round, square, flat or any other form of cross-section. A filament may be arranged in a straight or curved manner. One or more resistive filament may form a coil, mesh, array, fabric or the like. Application of an electric current to the heating element results in heating due to the resistive nature of the element. In some preferred embodiments, the heating element forms a coil that is wrapped around a liquid transfer element. The liquid transfer element may comprise a wick.

A heating element may comprise any suitable electrically resistive filament. For example, a heating element may comprise a nickel-chromium alloy.

A separate heating element may be associated with each liquid transfer element. The system may be configured such that the heating element associated with the first liquid transfer element and the heating element associated with the second liquid transfer element are heated at the same or different temperatures and for the same or different amounts of time. The heating elements may be independently controlled by electronic circuitry, by the nature, size and shape of the material selected (for example, to tune resistance), or the like. The heating elements may be arranged in series or in parallel or may be separately coupled to control electronic circuitry.

A system of the present invention may include one or more air inlet to allow air to enter the system to carry aerosol generated by heating of substrate carried by the liquid transfer elements though a mouth end opening when a user draws on the mouth end. The air inlets are upstream of the liquid transfer elements. The air inlets may be formed in a housing of a cartridge, if the cartridge includes the liquid transfer elements, a vaporizing unit, a part including a power supply or other suitable part of the system.

The vaporizing unit, or cartridge if the liquid transfer elements and heating elements are included in the cartridge, may comprise electrical contacts for electrically coupling the heating element to the power supply or other control electronics in a separate part of the system.

The vaporizing unit or the cartridge may be releasably connectable with the part containing the power supply. The vaporizing unit or the cartridge may be connected to the part containing the power supply in any suitable manner, such as threaded engagement, snap-fit engagement, interference-fit engagement, magnetic engagement, or the like.

The part containing the power supply may comprise a housing and the power supply may be disposed in the housing. The power supply may comprise a battery. The part may also comprise electronic circuitry disposed in the housing and electrically coupled to the power supply. The part may comprise contacts such that the contacts of the part electrically couple with the contacts of the vaporizing unit when the first part is connected with the vaporizing unit or cartridge. The contacts of the part are electrically coupled to the electronic circuitry and power supply. Thus, when the part is connected to the vaporizing unit or cartridge, the heating element may be electrically coupled to the power supply and circuitry.

The electronic circuitry may be configured to control delivery of an aerosol resulting from heating of the substrate to the user. Control electronic circuitry can be provided in any suitable form and may, for example, include a controller or a memory and a controller. The controller can include one or more of an Application Specific Integrated Circuit (ASIC) state machine, a digital signal processor, a gate array, a microprocessor, or equivalent discrete or integrated logic circuitry. Control electronic circuitry can include memory that contains instructions that cause one or more components of the circuitry to carry out a function or aspect of the control circuitry. Functions attributable to control circuitry in this disclosure can be embodied as one or more of software, firmware, and hardware.

The electronic circuitry may be configured to control the supply of power to the heating element dependent on the electrical resistance of the heating element or the one or more filaments.

The electronic circuitry may comprise a microprocessor, which may be a programmable microprocessor. The electronic circuitry may be configured to regulate a supply of power.

The part that includes the power supply may include a switch to activate the system. For example, the part may include a button that can be depressed to activate or optionally deactivate the system.

An aerosol-generating system of the present invention may include a cover that is disposable over at least the capsule or cartridge. For example, the cover includes a distal end opening that is configured to receive the capsule or cartridge. The cover may also extend over at least a portion of the vaporizing unit if the system includes a separate vaporizing unit, and may also extend over at least a portion of the part that contains the power supply. In preferred embodiments, the system includes a separate capsule and vaporizing unit and the cover extends over the capsule and the vaporizing unit and abuts a proximal end of the part containing the power supply. Alternatively, the cover may extend over the capsule and abut a proximal end of the vaporizing unit. The cover may be releasably securable in a position relative to at least the capsule. The cover may be releasably connectable to the capsule, the vaporizing unit if present, or the part containing the power supply to be retained in a position relative to the capsule. The cover may be connected to the capsule, vaporizing unit or part containing the power supply in any suitable manner, such as threaded engagement, snap-fit engagement, interference-fit engagement, magnetic engagement, or the like.

If the cover extends over an air inlet in, for example the cartridge, the vaporizing unit or the part comprising the power supply, a sidewall of the cover may define one or more air inlets to allow air to enter the air inlet in, for example the cartridge, the vaporizing unit or the part comprising the power supply.

The cover may define the mouth end of the aerosol-generating system. The cover may be generally cylindrical and taper inwardly towards the mouth end. The cover may comprise one part or multiple parts. For example, the cover may include a distal part and a releasable connectable proximal part that may serve as a mouthpiece. The cover may define a mouth end opening to allow aerosol resulting from heating of the aerosol-forming substrate to exit the device.

The cover may comprise a rigid elongate housing. The housing may comprise any suitable material or combination of materials. Examples of suitable materials include metals, alloys, plastics or composite materials containing one or more of those materials, or thermoplastics that are suitable for food or pharmaceutical applications, for example polypropylene, polyetheretherketone (PEEK) and polyethylene.

An aerosol-generating system according to the present invention, when all parts are connected, may have any suitable size. For example the system may have a length from about

50 mm to about 200 mm. The system may have a length from about 100 mm to about 190 mm. The system may have a length from about 140 mm to about 170 mm.

All scientific and technical terms used herein have meanings commonly used in the art unless otherwise specified. The definitions provided herein are to facilitate understanding of certain terms used frequently herein.

As used herein, the singular forms ‘a’, ‘an’, and ‘the’ encompass embodiments having plural referents, unless the content clearly dictates otherwise.

As used herein, ‘or’ is generally employed in its sense including ‘and/or’ unless the content clearly dictates otherwise. The term ‘and/or’ means one or all of the listed elements or a combination of any two or more of the listed elements.

As used herein, ‘have’, ‘having’, ‘include’, ‘including’, ‘comprise’, ‘comprising’ or the like are used in their open ended sense, and generally mean ‘including, but not limited to’. It will be understood that ‘consisting essentially of’, ‘consisting of’, and the like are subsumed in ‘comprising,’ and the like.

The words ‘preferred’ and ‘preferably’ refer to embodiments of the invention that may afford certain benefits, under certain circumstances. However, other embodiments may also be preferred, under the same or other circumstances. Furthermore, the recitation of one or more preferred embodiments does not imply that other embodiments are not useful, and is not intended to exclude other embodiments from the scope of the disclosure, including the claims.

It will be appreciated that features described in respect of one aspect of the invention mentioned above may also be applicable to other aspects of the invention.

Reference will now be made to the drawings, which depict one or more aspects described in this disclosure. However, it will be understood that other aspects not depicted in the drawings fall within the scope of this disclosure. Like numbers used in the figures refer to like components, steps and the like. However, it will be understood that the use of a number to refer to a component in a given figure is not intended to limit the component in another figure labeled with the same number. In addition, the use of different numbers to refer to components in different figures is not intended to indicate that the different numbered components cannot be the same or similar to other numbered components.

FIGS. 1A-C are schematic drawings of an example of an aerosol-generating system. **FIG. 1A** is a side view of disconnected parts and cover, and illustrates internal components of the parts. **FIG. 1B** is a side view of connected parts illustrating internal components of the parts. **FIG. 1C** is a side view of connected parts showing only exterior portions of the cover and part containing a power supply.

FIGS. 2A-B are schematic perspective views of an example of an aerosol-generating system. **FIG. 2A** shows the parts connected and the cover removed. **FIG. 2B** shows the system with the cover secured in place.

FIG. 3 is a schematic sectional view of an example of an aerosol-generating system having connected parts and cover, and illustrating a flow path.

FIG. 4 is a schematic face view of an example of a vaporizing unit showing liquid transfer elements disposed under proximal end plate.

FIG. 5 is a schematic perspective exploded view showing components of a vaporizing unit.

FIG. 6 is a schematic perspective exploded view showing components of a vaporizing unit.

The schematic drawings are not necessarily to scale and are presented for purposes of illustration and not limitation.

Referring now to **FIGS. 1A-C**, an aerosol-generating system **100** includes a first part **10**, a vaporizing unit **20**, a capsule **30**, and a cover **40**. The first part **10** is releasably connectable to the vaporizing unit **20**. The vaporizing unit **20** is releasably connectable to the capsule **30**. The cover **40** is disposable over the vaporizing unit **20** and capsule **30**. The cover **40** is releasable securable in a position relative to the vaporizing unit **20** and capsule **30**. In some examples (not depicted) the components of the vaporizing unit and capsule, may comprise a single unit.

The first part **10** comprises a housing **130** in which a power supply **110** and electronic circuitry **120** are disposed. The electronic circuitry **120** is electrically coupled to the power supply **110**. Electrical conductors **140** may connect contacts (not shown) for example exposed through, positioned on, or integral to the housing **130**.

The vaporizing unit **20** comprises a housing **240** in which liquid transfer elements **210A**, **210B** and heating elements **220A**, **220B** are disposed. The first liquid transfer element **210A** is substantially U-shaped, having first and second end portions and a central portion between the first and second end portions. The central portion of the first liquid transfer element **210A** is in thermal connection with the first heating element **220A**. The second liquid transfer element **210B** is also substantially U-shaped, having first and second end portions and a central portion between the first and second end portions. The central portion of the second liquid transfer element **210B** is in thermal connection with the second heating element **220B**. Electrical conductors **230A, 230B** electrically couple the heating elements **220A**, **220B** to electrical contacts (not shown) exposed through, positioned on, or integral to the housing **240**. When the vaporizing unit **20** is connected to the first part **10** (for example, as shown in **FIG. 1B**), the heating element **220** is electrically coupled with the circuitry **120** and power supply **110**. The heating elements **220A**, **220B** may be connected in any suitable manner, such as in parallel, in series, or separately coupled to electrical circuitry **120**.

The capsule **30** comprises a housing **310** defining a reservoir **300** in which a liquid aerosol-forming substrate (not shown) is stored. When the capsule **30** is connected to the vaporizing unit **20**, the reservoir **300** and thus the aerosol-forming substrate is in fluid communication with the liquid transfer elements **210A**, **210B**.

The capsule **30** may include valves **399** configured to be closed when the vaporizing unit **20** and capsule **30** are not connected (such as in **FIG. 1A**) and configured to be open when the vaporizing unit **20** and capsule **30** are connected (such as in **FIG. 1B**). The valves **399** are aligned with distal openings in the capsule **30** and proximal openings in the vaporizing unit **20** such that when the valves are open, liquid aerosol-forming substrate in the reservoir **300** is in communication with liquid transfer elements **210A**, **210B**.

The vaporizing unit **20** includes proximal protruding elements **249** configured to be received in recesses **349** of the capsule **30** to securely couple the vaporizing unit **20** and the capsule **30**. A mechanism (not shown) coupled to valve **349** may be positioned in one or more recesses **349** such that when protruding element **249** is inserted into recess **349**, the valve **399** opens and when protruding element **249** is withdrawn from recess **349**, the valve **399** closes.

Also shown in **FIGS. 1A** and **1B** are passageways for air or aerosol flow through the system **100**. The vaporizing unit **20** comprises inlets in housing in communication with passageway **215** that extends to the proximal end of the vaporizing unit **20**. A central passageway **315** extends through the capsule **30** and is in communication with the passageway **215** of the vaporizing unit **20** when the vaporizing unit **20** and the capsule **30** are connected. The cover **40** comprises a central passageway **415**. The central passageway **415** of the cover **40** is in communication with the central passageway **315** of the capsule **30** when the cover **40** is disposed over the capsule **30**.

In the embodiment depicted in **FIGS. 1A-C**, the cover **40** is configured to be disposed over the vaporizing unit **20** and the capsule **30**. Preferably, a smooth transition is formed across the outer surface of the system **100** at the transition between the cover **40** and the first part **10**. The cover **40** may be maintained in position in any suitable manner, such as such as threaded engagement, snap-fit engagement, interference-fit engagement, magnetic engagement, or the like to any one or more of the first part **10**, vaporizing unit **20**, or capsule **30** (engagement not shown).

Referring now to **FIGS. 2A-B**, an aerosol-generating system **100** of the present invention includes a first part **10**, a vaporizing unit **20**, a capsule **30** and a cover **40**. The parts are generally as described with regard to **FIGS. 1A-C**. In some examples (not depicted) the components of the vaporizing unit may be included in the capsule, and the system would not include a separate vaporizing unit.

The connected system depicted in **FIGS. 2A-B** extends from a mouth end **101** to a distal end **102**. The housing of the capsule **30** defines an opening **35** in communication with a passage through the length of the capsule **30**. The passage defines a portion of an aerosol flow path through the system **100**. The housing of the vaporizing unit **20** defines an air inlet **240** in communication with a passage through the capsule **20**. The passage through the vaporizing unit **20** is in communication with the passage through the capsule **30**. The cover **40**, which is configured to cover the vaporizing unit **20** and the capsule **30**, comprises a sidewall defining an air inlet **44** that is in communication with the air inlet **240** of the vaporizing unit **20** when the cover **40** is secured in place relative to the other parts of the system. The housing of the cover **40** also defines a mouth end opening **45** that is in communication with the passage through the capsule **30**. Accordingly, when a user draws on the mouth end **101** of the system **100**, air enters inlet **44** of cover **40**, then enters inlet **240** of the vaporizing unit **20**, flows through the passage in the vaporizing unit **20**, through the passage in the capsule **30**, through the opening **35** at the proximal end of the capsule, and through the mouth end opening **45**.

In some examples (not shown), air inlets may be formed in the housing of the first part and a passage extends through the housing to a passage in the vaporizing unit.

The first part **10** of the aerosol-generating system depicted in **FIGS 2A-B** includes a button **15** that may be depressed to activate, and optionally, to deactivate the system. The button **15** is coupled to a switch of the circuitry of the first part **10**.

Also shown in the system **100** depicted in **FIG. 2A**, the housing of the first part **10** defines a rim **12** at the proximal end. The distal end of the cover **40** contacts the rim **12** when the cover **40** is secured in place over the vaporizing unit **20** and the capsule **30**. Preferably, the size and shape of the outer edge of the rim **12** of the housing of the first part **10** is substantially the same as the size and shape of the outer edge of the distal end of the cover **40** so that a smooth along the outer surface of the system is formed at the junction of the first part and the cover.

Referring now to **FIG. 3**, a flow path through the system **100** is illustrated by thick arrows. As in **FIGS. 1A-C** and **2A-B**, the system includes a first part **10**, vaporizing unit **20**, capsule **30**, and cover **40** disposed over the vaporizing unit **20** and the capsule **30** and in contact with a rim of the first part **10**. In some examples (not depicted) the components of the vaporizing unit may be included in the capsule, and the system might not include a separate vaporizing unit. When the parts of the system are connected, heating elements **220A**, **220B** are coupled to control electronics and power supply (not shown) of first part **10**, valves **399** are open to allow liquid aerosol-forming substrate to flow to liquid transfer elements **210A**, **210B**. Valves **399** may be opened by interaction of protruding elements **249** with mechanism (not shown) in recesses **349**.

When a user draws on the mouth end **101**, fresh air enters into the system through a sidewall **410** of the cover, such as through an air inlet **44** as depicted in **FIG. 2A**. The air may then flow into the vaporizing unit **20**, such as through inlet **240** as depicted in **FIG. 2A**, and through a passage **215** in vaporizing unit **20** with which liquid transfer elements **210A**, **210B** are in communication. The liquid transfer elements **210A**, **210B** which carry aerosol-forming substrate may be heated by heating elements **220A**, **220B** to cause aerosol to be generated from the heated substrate. The aerosol may be entrained in the air, which flows through a passage **315** in the capsule **30**, through a passage **415** in the cover **40** and out of the mouth end **101**, such as through mouth end opening **45** as depicted in **FIG. 2B**. The first **220A** and second **220B** heating elements are mounted in the flow passage of the system, spaced apart in the direction of flow through the passage.

Referring now to **FIG. 4**, a top-down view of an example of a vaporizing unit is shown. Liquid transfer elements **210A**, **210B** and heating elements **220A**, **220B** are depicted, but other components are not shown for purposes of illustration. The liquid transfer elements **210A**, **210B** and heating elements **220A**, **220B** are disposed under proximal end plate **280**, which defines a central opening **215** in communication with the flow path and openings **290A**, **290B**, **290C**, **290D** that are configured to be longitudinally aligned with corresponding distal end openings of a reservoir when vaporizing unit is connected to a capsule. As such, the proximal end plate 280 forms part of a capsule or reservoir connecting end of the vaporizing unit. The first and second heating elements **220A, 220B** are spaced at a distance from the proximal end plate 280 in the direction of a longitudinal axis of the vaporizing unit. The central portions of the first and second liquid transfer elements **210A, 210B** are arranged to extend in directions sustainably perpendicular to the longitudinal axis. The first and second end portions of the first and second liquid transfer elements **210A, 210B** extend between the central portions at the first and second heating elements **220A, 220B** and the openings of the proximal end plate **280**, sustainably in the direction of a longitudinal axis of the vaporizing unit. As such the first and second end portions of the first and second liquid transfer elements **210A, 210B** are arranged to deliver liquid aerosol-forming substrate from the reservoir to the first and second heating elements **220A, 220B** when the vaporizing unit is connected to a capsule. First and second ends of the liquid transfer elements **210A**, **210B** are positioned to be aligned with openings **290A**, **290B**, **290C**, **290D** such that each end may be separately fed, at least to some extent, from the reservoir. Heating elements **220A**, **220B** are depicted as coils wrapped around liquid transfer elements **210A**, **210B**.

As can be seen from **FIG. 4**, the arrangement of the liquid transfer elements **210A**, **210B** in a non-aligned manner increases the area of the liquid transfer elements that will be exposed to flow parallel to the longitudinal axis of the system through opening **215** relative to the area that would be exposed if the liquid transfer elements **210A**, **210B** were stacked in a parallel arrangement.

Referring now to **FIG. 5**, some components of a vaporizing unit are shown. The vaporizing unit comprises a proximal end plate **280** (such as depicted in **FIG. 4**), a pad of liquid retention material **270**, for example capillary material, and first **210A** and second **210B** liquid transfer elements. The end plate **280** and the liquid retention material **270** are arranged at a reservoir connecting end of the vaporizing unit. An annular element **216** extends from an inner surface of the plate **280**. Annular element **216** may serve to separate components of the fluid flow path of the liquid aerosol-forming substrate from the aerosol path, which includes flow through annular member **216**. The liquid retention material **270** forms a disc having two opposing substantially planar surfaces, and includes a central opening **275** configured to be disposed about the annular member **216**. Each of the first end **211A** and second end **213A** of the first liquid transfer element **210A** and the first end **211B** and second end **213B** of the second liquid transfer element **210B** substantially lie on a common plane, such that each end contacts a substantially planar surface of the liquid retention material **270**. Each end of the first and second liquid transfer elements **210A, 210B** contacts the liquid retention material **270** at a location longitudinally aligned with an opening, such as opening **290B**, that is in fluid communication with the reservoir, in use. The first and second end portions of each liquid transfer element **210A**, **210B** carry liquid aerosol-forming substrate to the respective central portions **212A**, **212B**. The central portion **212B** of the second liquid transfer element **210B** extends further from the liquid retention material **270**, and thus further from the reservoir, than the central portion **212A** of the first liquid transfer element **210A**. In this example, the first and second liquid transfer elements comprise fused silica wicks comprising a bundle of silica fibres. The diameter of the wick of the second liquid transfer element is greater than that of the wick of the first liquid transfer element to facilitate the transport of liquid to the second heating element. In this example, the second liquid transfer element **210B** has a diameter of about 3.5mm, while the diameter of the first liquid transfer element **210A** is about 2.5mm.

Referring now to **FIG. 6**, components of a vaporizing unit are shown. The vaporizing unit includes a distal end plate **280** and an annular sidewall **282** extending distally from the plate **280**. The pate **280** defines an aerosol flow path opening **275** and fluid flow path openings, such as opening **290B**, configured to be in fluid communication with a reservoir. The annular sidewall **282** is configured to receive a liquid retention material **270**, which may be placed in contact with the inner surface of the plate **280**. The liquid retention material 270 comprises a mat of polymer fibres, for example PET fibres. Annular sidewall **282** is also configured to receive first **210A** and second **210B** liquid transfer elements. Ends of first **210A** and second **210B** liquid transfer elements are configured to contact liquid retention material **270** at positions longitudinally aligned with fluid openings of plate **280**, such as opening **290B**. A first heating element **220A**, depicted as a coil, is in contact with a central portion of the first liquid transfer element **210A**. The first heating element **220A** is electrically coupled to first **230A1** and second **230A2** conductors, which may ultimately electrically couple with electronic circuitry and power supply. A second heating element **220B**, depicted as a coil, is in contact with a central portion of the second liquid transfer element **210B**. The second heating element **220B** is electrically coupled to first **230B1** and second **230B2** conductors, which may ultimately electrically couple with electronic circuitry and power supply. The vaporizing unit may include an annular outer housing **284** configured to receive the annular sidewall **282** and other components and to abut plate **280** at a rim about the sidewall **282**.

Various modifications and variations of the invention will be apparent to those skilled in the art without departing from the scope and spirit of the invention. Although the invention has been described in connection with specific preferred embodiments, it should be understood that the invention as claimed should not be unduly limited to such specific embodiments. Indeed, various modifications of the described modes for carrying out the invention which are apparent to those skilled in the mechanical arts, electrical arts, and aerosol generating article manufacturing or related fields are intended to be within the scope of the following claims.

CLAIMS:

1. An aerosol-generating system comprising:
a reservoir for containing an aerosol-forming substrate;
a first heating element spaced apart from the reservoir in the direction of a longitudinal axis of the aerosol-generating system;
a second heating element spaced apart from the reservoir in the direction of the longitudinal axis of the aerosol-generating system;
a first liquid transfer element having:
first and second end portions; and
a portion between the first and second end portions at the first heating element,
the first and second end portions of the first liquid transfer element being arranged to deliver aerosol-forming substrate from the reservoir to the first heating element; and
a second liquid transfer element having:
first and second end portions; and
a portion between the first and second end portions at the second heating element,
the first and second end portions of the second liquid transfer element being arranged to deliver aerosol-forming substrate from the reservoir to the second heating element.

2. An aerosol-generating system according to claim 1, wherein:
the first and second end portions of the first liquid transfer element are arranged in fluid contact with the reservoir; and
the first and second end portions of the second liquid transfer element are arranged in fluid contact with the reservoir.

3. An aerosol-generating system according to claim 2, wherein:
the first and second end portions of the first liquid transfer element are arranged in fluid contact with the reservoir at a first location; and
the first and second end portions of the second liquid transfer element are arranged in fluid contact with the reservoir at a second location, the second location being spaced apart from the first location.

4. An aerosol-generating system according to claim 3, wherein:

the system further comprises a liquid retention medium arranged in fluid contact with the reservoir;
the first and second end portions of the first liquid transfer element are arranged in fluid contact with the liquid retention medium; and
the first and second end portions of the second liquid transfer element are arranged in fluid contact with the liquid retention medium.

5. An aerosol-generating system according to claim 4, wherein:
the first and second end portions of the first liquid transfer element are arranged in fluid contact with the liquid retention medium at a first location; and
the first and second end portions of the liquid transfer element are arranged in fluid contact with the liquid retention medium at a second location, the second location being spaced apart from the first location.

6. An aerosol-generating system according to any preceding claim, wherein:
the first liquid transfer element is substantially U-shaped, C-shaped or V-shaped; and
the second liquid transfer element is substantially U-shaped, C-shaped or V-shaped.

7. An aerosol-generating system according to any preceding claim, wherein:
the portion of the first liquid transfer element at the first heating element extends substantially in a first direction;
the portion of the second liquid transfer element at the second heating element extends substantially in a second direction;
the first and second end portions of the first heating element extend substantially in a third direction, the third direction being different to the first direction; and
the first and second end portions of the second heating element extend substantially in a fourth direction, the fourth direction being different to the second direction.

8. An aerosol-generating system according to claim 7, wherein:
the first and second directions are substantially perpendicular to the longitudinal axis; and
the third and fourth directions are substantially parallel to the longitudinal axis.

9. An aerosol-generating system according to any preceding claim, wherein:

the first end portion of the first liquid transfer element comprises a first end and the second end portion of the first liquid transfer element comprises a second end;

the first end portion of the second liquid transfer element comprises a first end and the second end portion of the second liquid transfer element comprises a second end;

the first and second ends of the first liquid transfer element lie substantially on a common plane; and

the first and second ends of the second liquid transfer element lie substantially on the common plane.

10. An aerosol-generating system according to any preceding claim, wherein the system includes an air flow passage and the first and second heating elements are mounted in the air flow passage.

11. An aerosol-generating system according to any preceding claim, wherein:

the first heating element comprises a coil wound around the portion of the first liquid transfer element at the first heating element; and

the second heating element comprises a coil wound around the portion of the second liquid transfer element at the second heating element.

12. An aerosol-generating system according to any preceding claim, wherein the system comprises first and second releasably connectable parts, the first part comprising the reservoir and the second part comprising the first and second heating elements and the first and second liquid transfer elements.

13. An aerosol-generating system according to claim 13, wherein the system further comprises a third part, the third part being releasably connectable to the second part and the third part comprising a power supply.

14. A vaporizing unit for an aerosol-generating system, the vaporizing unit comprising:

a reservoir connecting end configured to be releasably connected to a source of liquid aerosol-forming substrate;

a first heating element spaced apart from the reservoir connecting end in the direction of a longitudinal axis of the vaporizing unit;

a second heating element spaced apart from the reservoir connecting end in the direction of the longitudinal axis;

a first liquid transfer element having first and second end portions and a portion between the first and second end portions at the first heating element, the first and second end portions being arranged to deliver liquid aerosol-forming substrate to the first heating element from a source of liquid aerosol-forming substrate connected to the vaporizing unit at the reservoir connecting end; and

a second liquid transfer element having first and second end portions and a portion between the first and second end portions at the second heating element, the first and second end portions being arranged to deliver liquid aerosol-forming substrate to the second heating element from a source of liquid aerosol-forming substrate connected to the vaporizing unit at the reservoir connecting end.

15. A vaporizing unit according to claim 14, wherein:

the vaporizing unit further comprises a liquid retention medium, the liquid retention medium being arranged to deliver liquid aerosol-forming substrate from a source of liquid aerosol-forming substrate, when a source of liquid aerosol-forming substrate is connected to the vaporizing unit at the reservoir connecting end;

the first and second end portions of the first liquid transfer element are arranged in fluid contact with the liquid retention medium; and

the first and second end portions of the second liquid transfer element are arranged in fluid contact with the liquid retention medium.

16. A vaporizing unit according to any of claims 14 or 15, wherein:

the portion of the first liquid transfer element at the first heating element extends substantially in a first direction;

the portion of the second liquid transfer element at the first heating element extends substantially in a second direction;

the first and second end portions of the first heating element extend substantially in a third direction, the third direction being different to the first direction; and

the first and second end portions of the second heating element extend substantially in a fourth direction, the fourth direction being different to the second direction.

17. A vaporizing unit according to claim 16, wherein:

the first and second directions are substantially perpendicular to the longitudinal axis; and

the third and fourth directions are substantially parallel to the longitudinal axis.

18. An aerosol-generating system comprising:
a reservoir for containing an aerosol-forming substrate;
a first heating element;
a second heating element;
a first liquid transfer element arranged to deliver aerosol-forming substrate from the reservoir to the first heating element, the first liquid transfer element having a portion extending in a first direction at the first heating element; and
a second liquid transfer element arranged to deliver aerosol-forming substrate from the reservoir to the second heating element, the second liquid transfer element having a portion extending in a second direction at the second heating element,
wherein the first and second directions are different,
wherein the distance from the reservoir to the second heating element at the second liquid transfer element is greater than the distance from the reservoir to the first heating element of the first liquid transfer element.

19. An aerosol-generating system according to claim 18, wherein the first and second directions are substantially perpendicular.

20. An aerosol-generating system according to claims 18 or 19, wherein the first and second liquid transfer elements have different cross-sectional areas.

21. An aerosol-generating system according to any one of claims 18 to 20, wherein the first and second liquid transfer elements comprise different materials.

22. An aerosol-generating system according to any one of claims 18 to 21,
wherein the first liquid transfer element has a first portion and a second portion, wherein the first heating element is between the first and second portions, wherein the first and second portions are arranged in fluid contact with the reservoir, and
wherein the second liquid transfer element has a first portion and a second portion, wherein the second heating element is between the first and second portions, wherein the first and second portions, wherein the first and second portions are arranged in fluid contact with the reservoir.

23. An aerosol-generating system according to any one of claims 18 to 22, wherein a portion of the first liquid transfer element is positioned in fluid contact with the reservoir at a first location, and a portion of the second liquid transfer element is positioned in fluid contact with the reservoir at a second location spaced apart from the first location.

24. An aerosol-generating system according to any one of claims 18 to 23, wherein the reservoir comprises a liquid retention medium and the first liquid transfer element and the second liquid transfer element are arranged in contact with the liquid retention medium.

25. An aerosol-generating system according to any one of claims 18 to 24, wherein the system includes an air flow passage and the first and second heating elements are mounted in the air flow passage, spaced apart in the direction of flow along the passage.

26. An aerosol-generating system according to any one of claims 18 to 25, wherein the first heating element comprises a coil wound around the portion of the first liquid transfer element that extends in the first direction at the first heating element, and wherein the second heating element comprises a coil wound around the portion of the second liquid transfer element that extends in the second direction at the second heating element.

27. An aerosol-generating system according to any one of claims 18 to 26, wherein the first heating element is configured to heat a portion of the first liquid transfer element at a first temperature; and wherein the second heating element is configured to heat a portion of the second liquid transfer element at a second temperature, wherein the first temperature is different from the second temperature.

28. An aerosol-generating system according to any one of claims 18 to 27, wherein the system comprises first and second releasably connectable parts, wherein the first part comprises the reservoir and wherein the second part comprises the first and second liquid transfer elements and the first and second heating elements.

29. An aerosol-generating system according to claim 28, further comprising a third part, the third part being releasably connectable to the second part and the third part comprising a power supply.

30. A vaporizing unit for an aerosol-generating system, the vaporizing unit comprising:

a reservoir connecting end configured to be releasably connected to a source of liquid aerosol-forming substrate;

a first heating element spaced apart from the reservoir connecting end in the direction of a longitudinal axis of the vaporizing unit;

a second heating element spaced apart from the reservoir connecting end in the direction of the longitudinal axis;

a first liquid transfer element arranged to deliver liquid aerosol-forming substrate aerosol-forming substrate to the first heating element from a source of liquid aerosol-forming substrate when a source of liquid aerosol-forming substrate is releasably connected to the reservoir connecting end, the first liquid transfer element having a portion extending in a first direction at the first heating element; and

a second liquid transfer element arranged to deliver liquid aerosol-forming substrate to the second heating element from a source of liquid aerosol-forming substrate when a source of liquid aerosol-forming substrate is releasably connected to the reservoir connecting end, the second liquid transfer element having a portion extending in a second direction at the second heating element,

wherein:

the first and second directions are different; and

the distance from the reservoir connecting end to second heating element at the second liquid transfer element is greater than the distance from the reservoir connecting end to the first heating element at the first liquid transfer element.

31. A vaporizing unit according to claim 30, further including a liquid retention medium, wherein the first liquid transfer element and the second liquid transfer element are arranged in contact with the liquid retention medium.

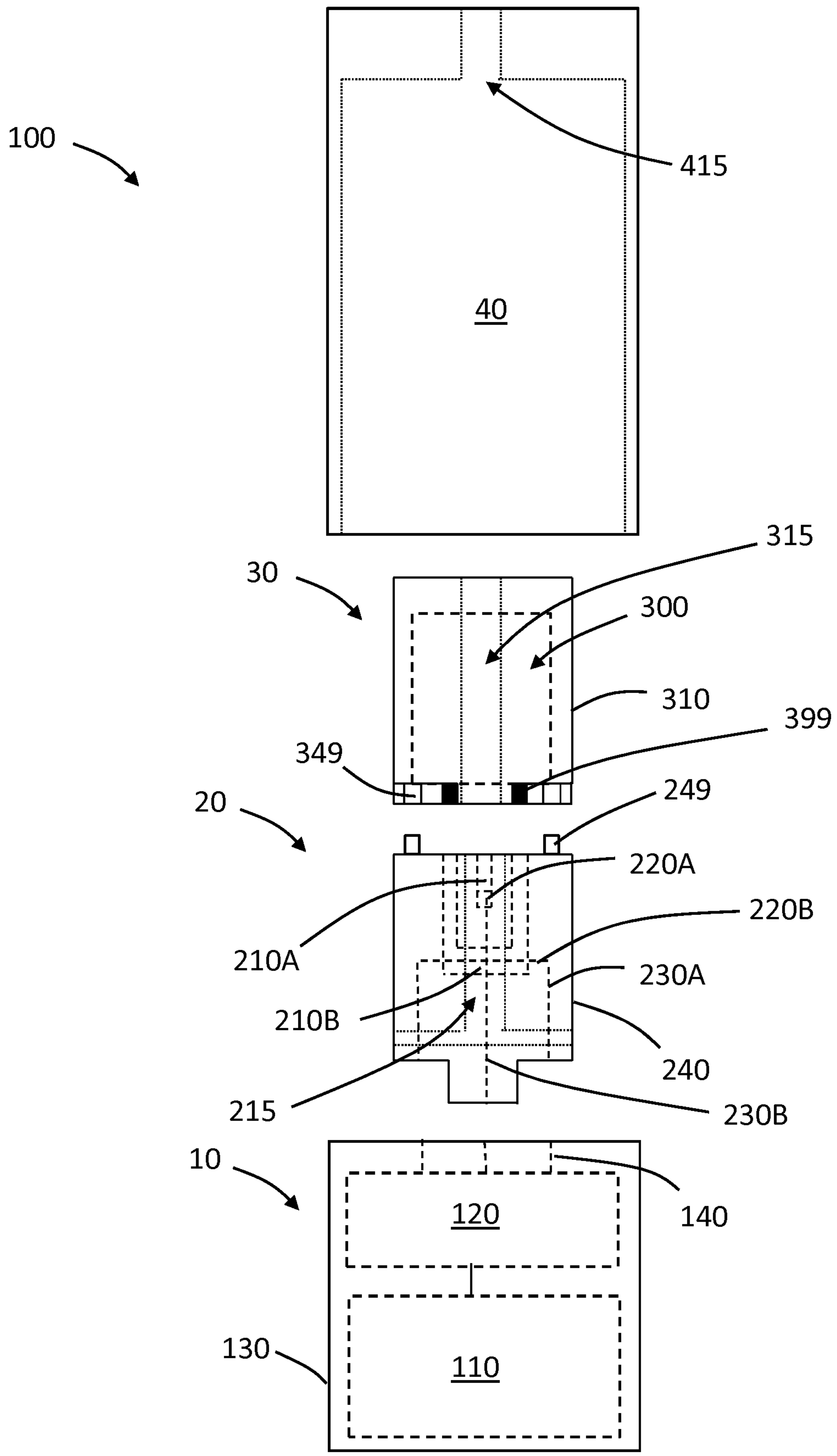
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FIG. 1A

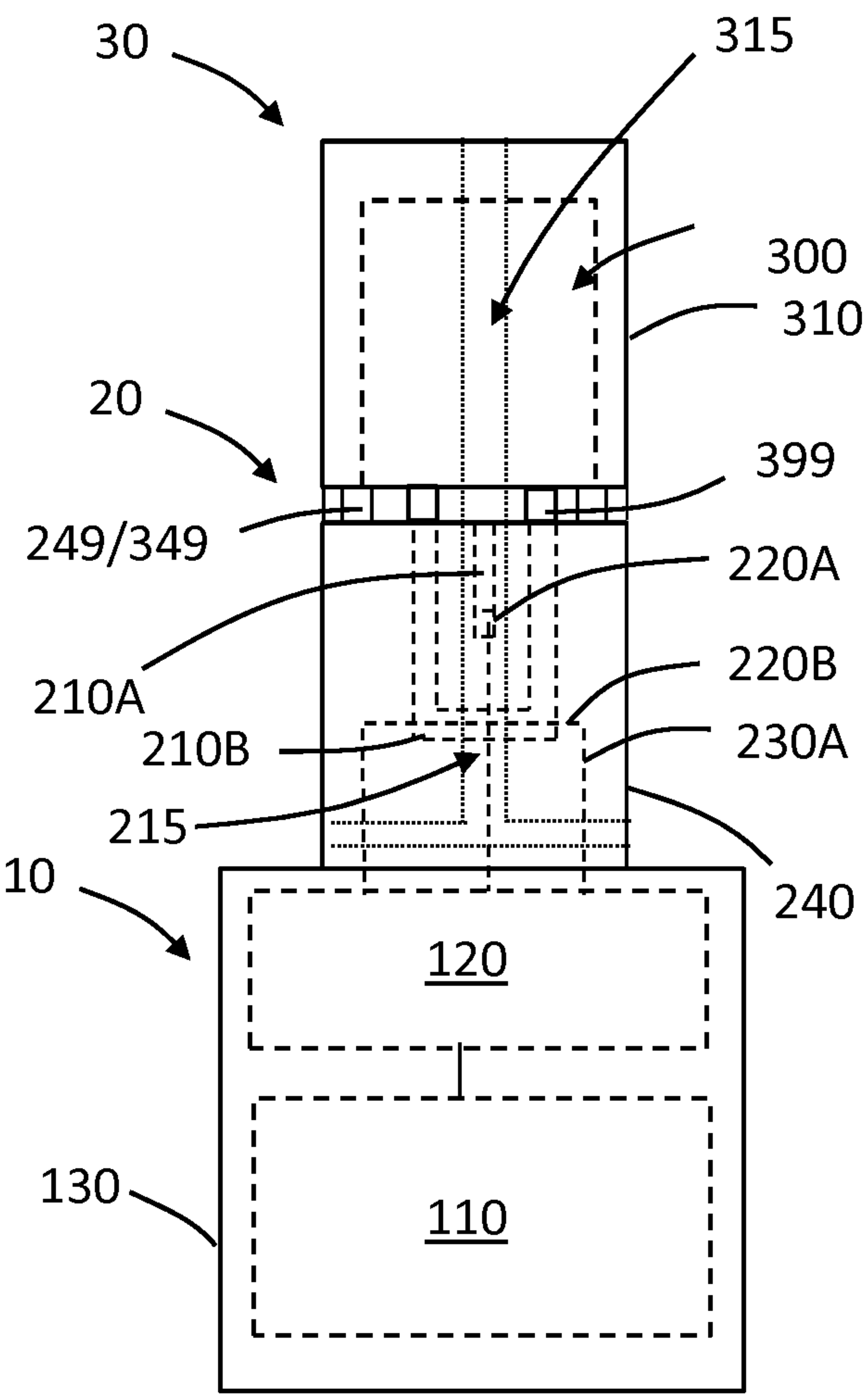
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FIG. 1B

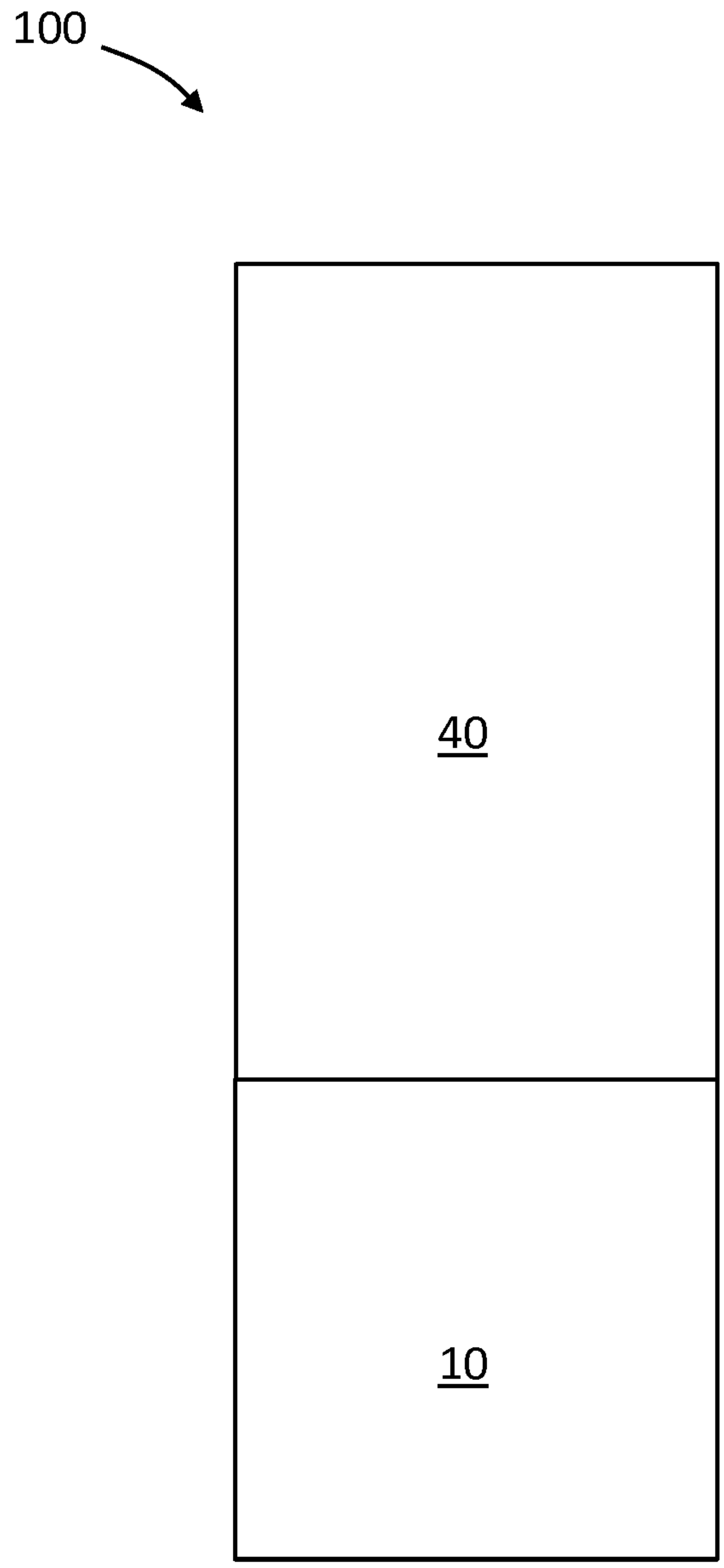
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FIG. 1C

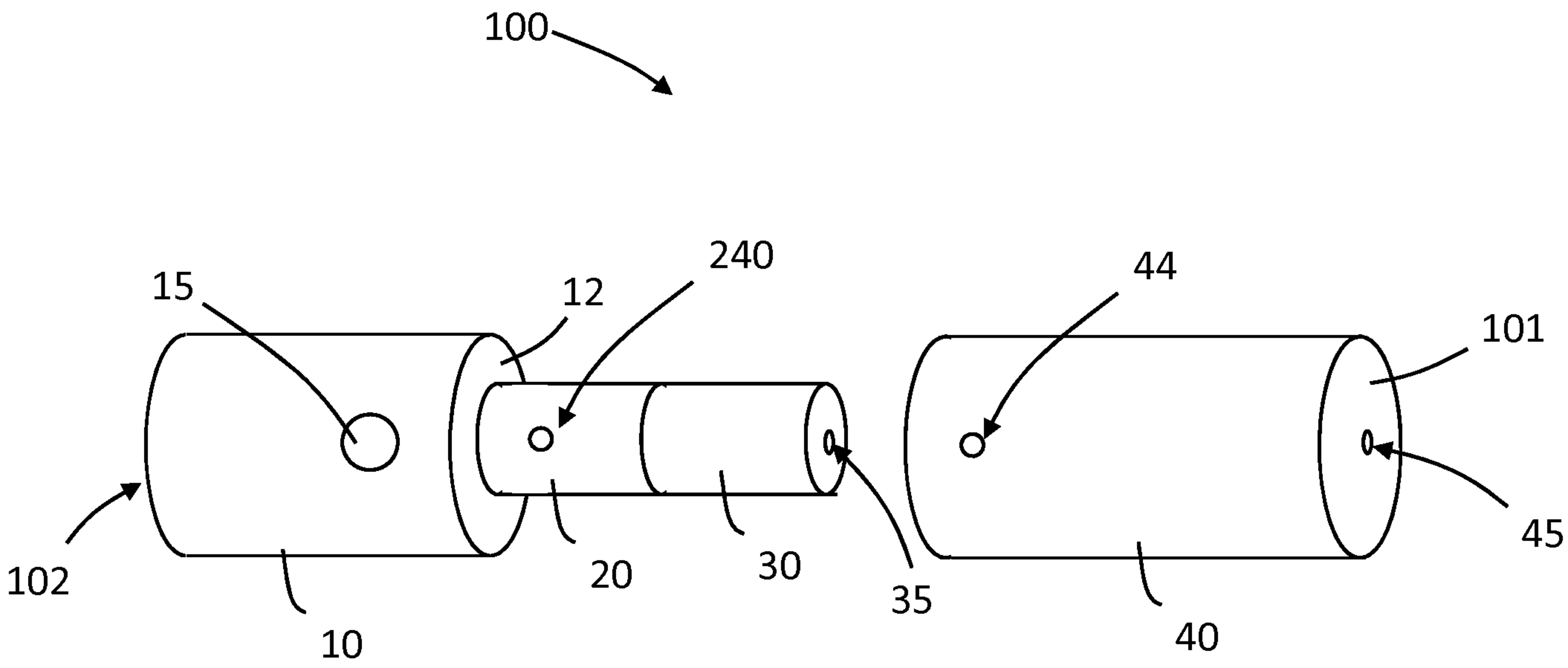

FIG. 2A

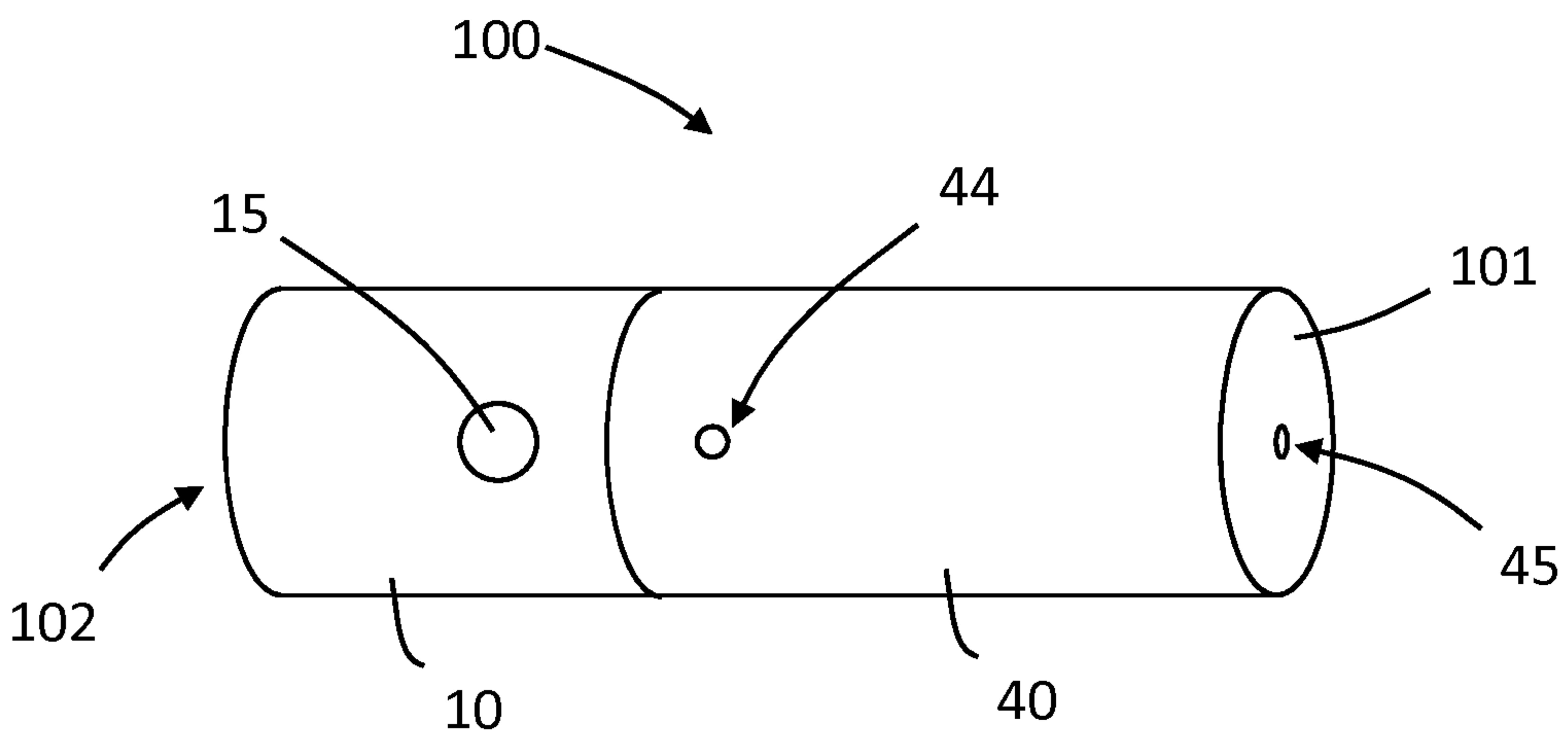

FIG. 2B

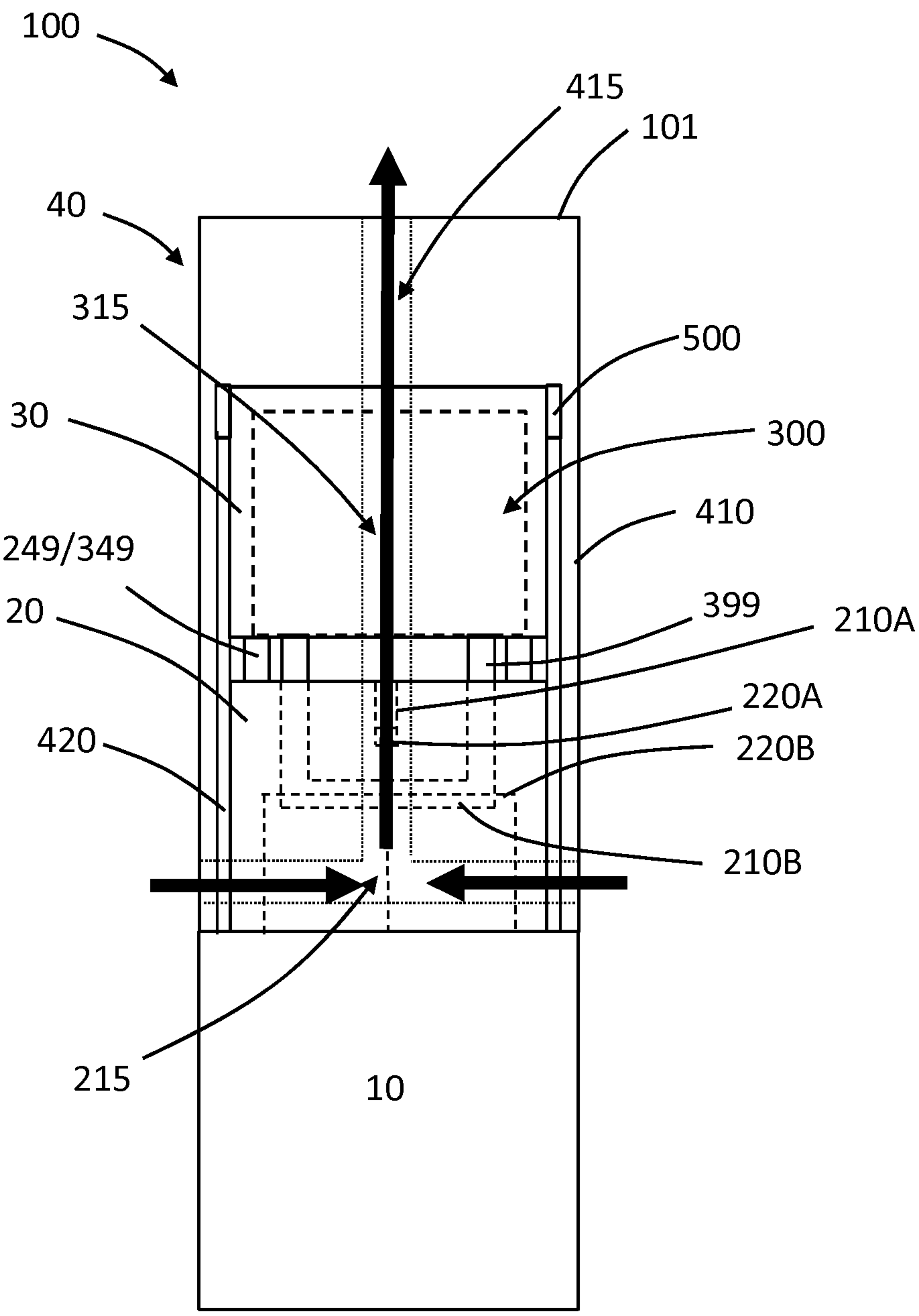
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FIG. 3

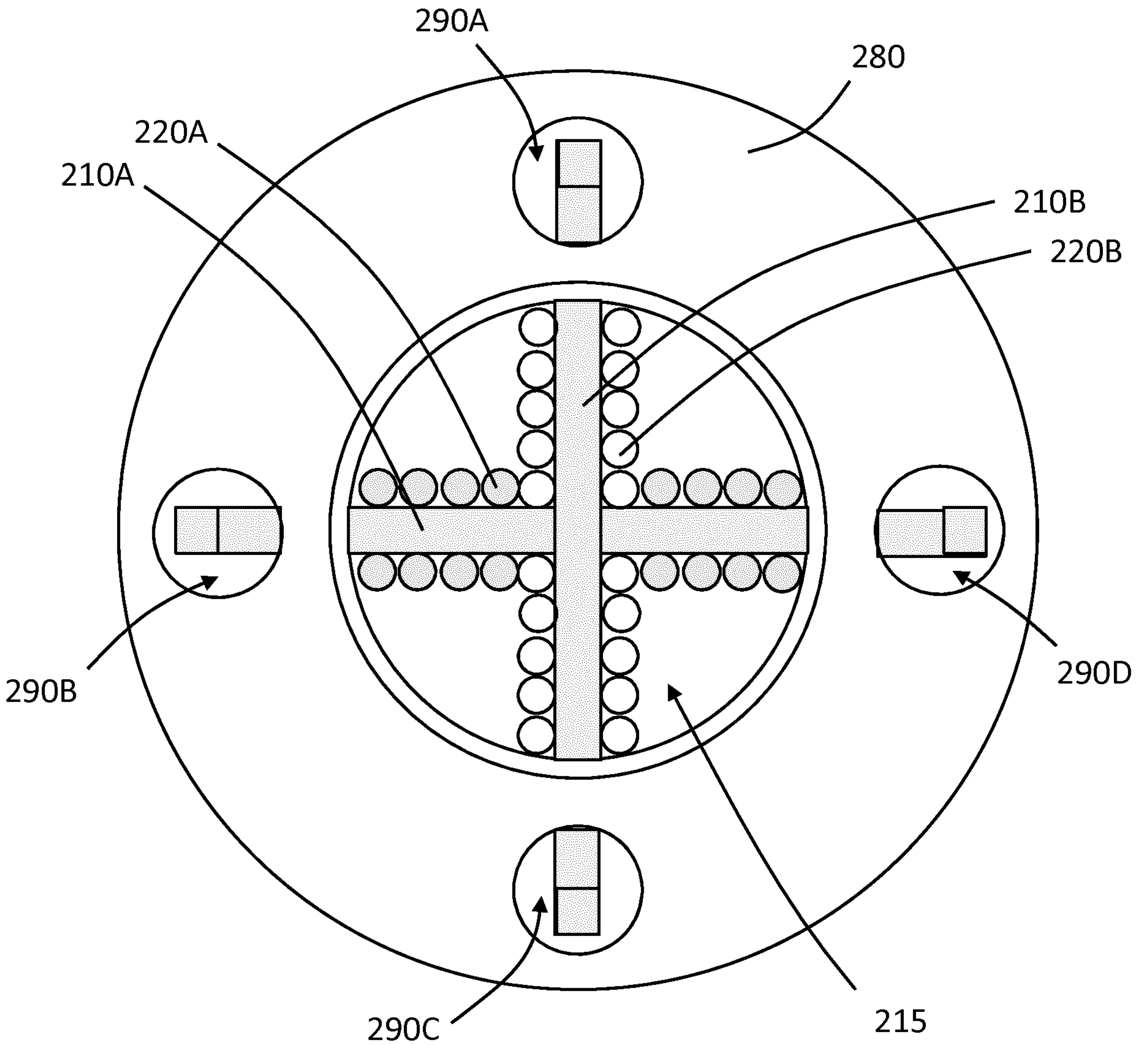

FIG. 4

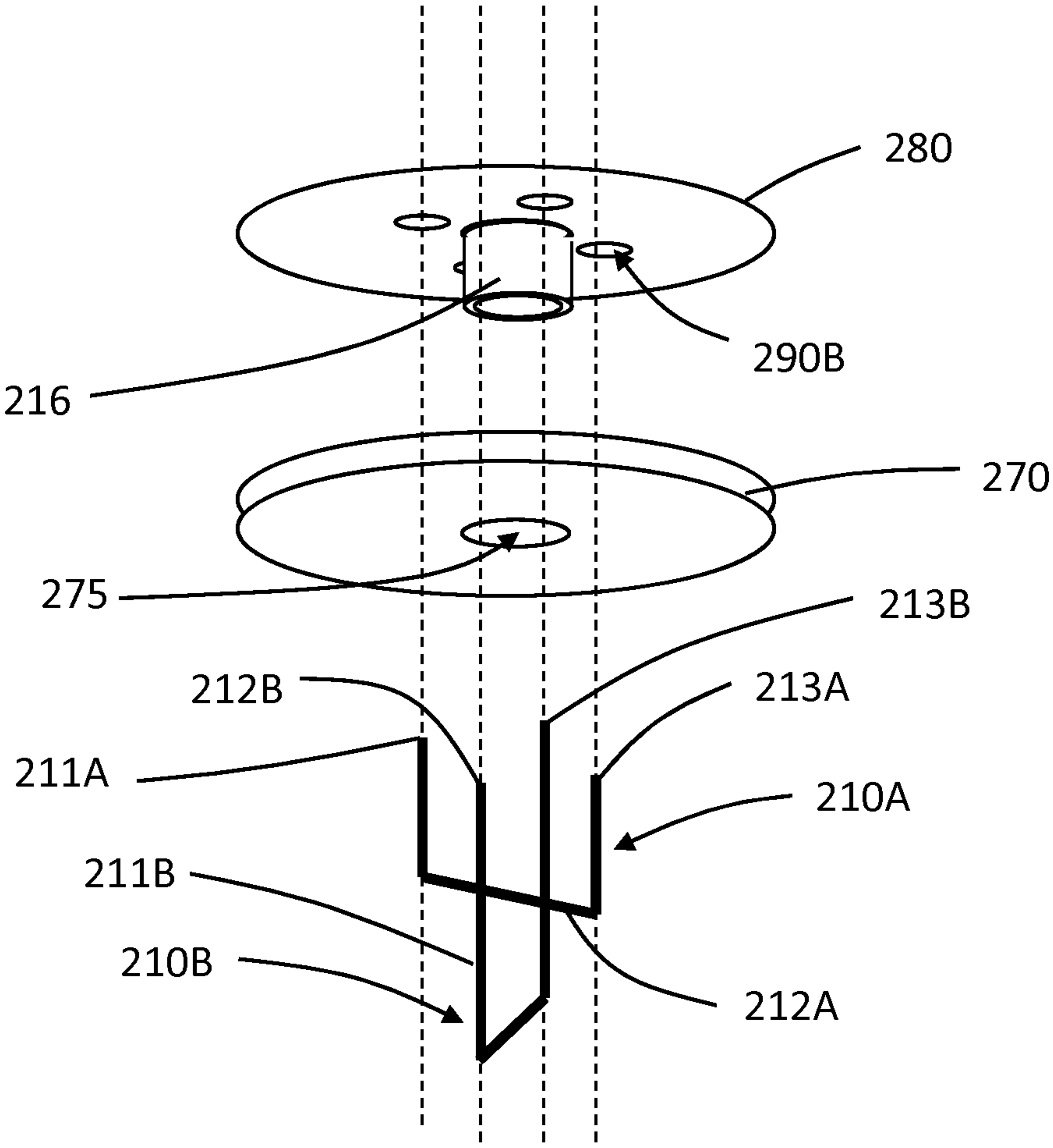

FIG. 5

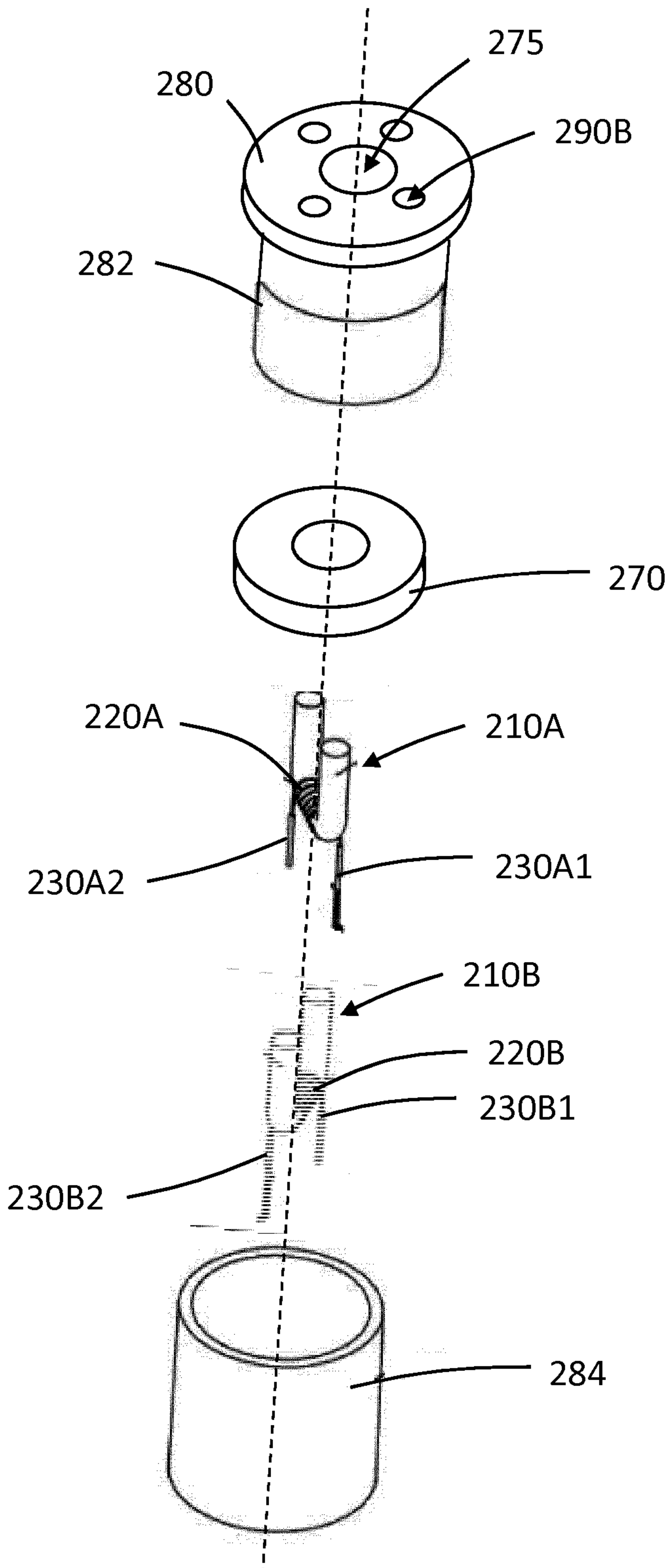
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FIG. 6


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FIG. 1A