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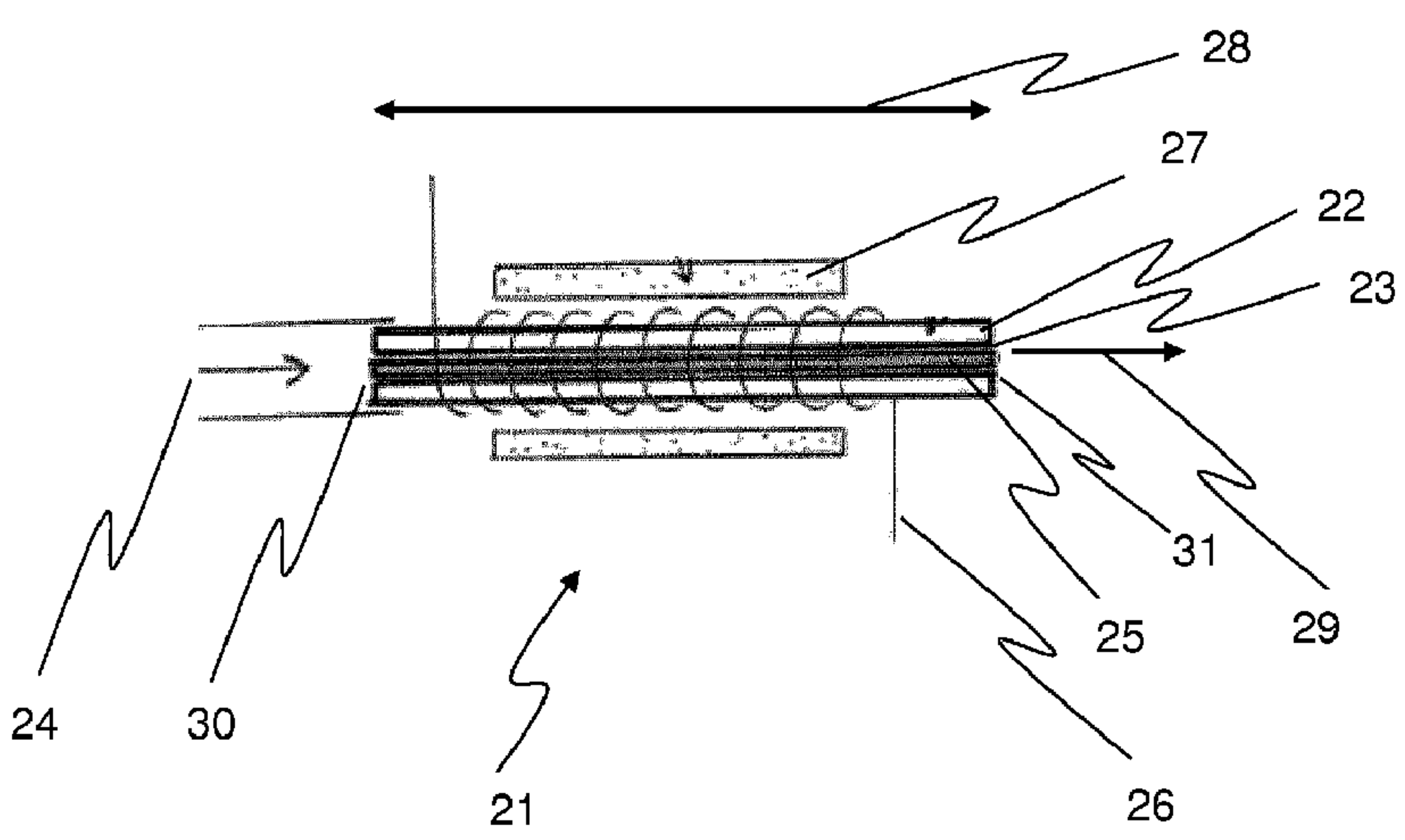
(54) Titre : VAPORISATEUR POUR SYSTEME DE GENERATION D'AEROSOL ET PROCEDE DE VAPORISATION
(54) Title: VAPORIZER FOR AN AEROSOL-GENERATING SYSTEM AND VAPORIZING METHOD

Fig. 1



(57) Abrégé/Abstract:
The present invention proposes a vaporizer (21) for an aerosol- generating system. The vaporizer comprises a tube element (22), a mesh (25), and a heater (26). The tube element has an inner volume (23) for receiving an amount of liquid aerosol-forming

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(57) Abrégé(suite)/Abstract(continued):
substrate. The mesh is provided in the inner volume of the tube element. The heater is provided outside of the tube element. The heater is configured for heating the mesh and the received amount of liquid aerosol-forming substrate to a temperature sufficient to volatilize at least a part of the received amount of liquid aerosol-forming substrate. The present invention also proposes a method for generating an aerosol.

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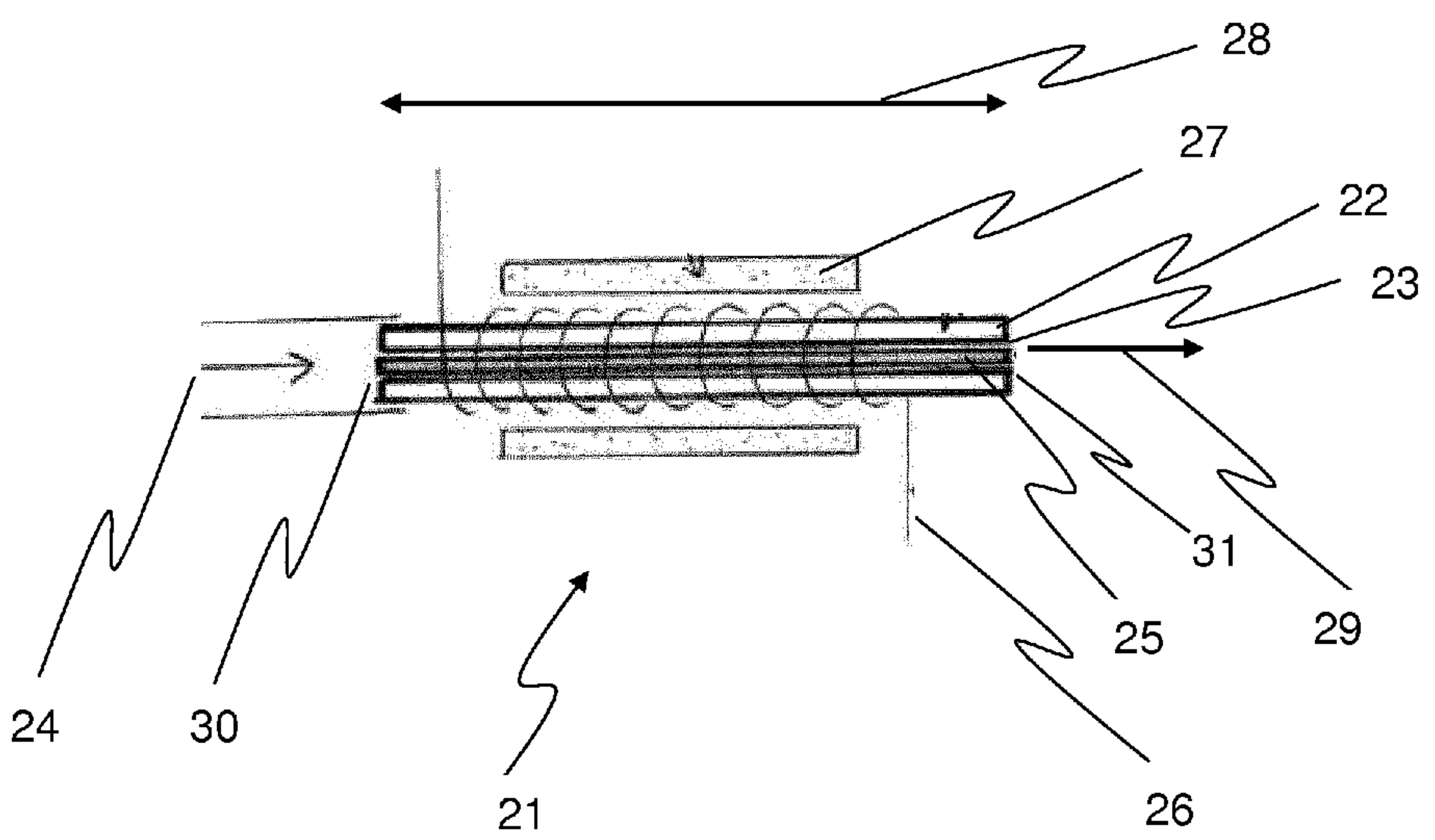

(57) Abstract: The present invention proposes a vaporizer (21) for an aerosol- generating system. The vaporizer comprises a tube element (22), a mesh (25), and a heater (26). The tube element has an inner volume (23) for receiving an amount of liquid aerosol-forming substrate. The mesh is provided in the inner volume of the tube element. The heater is provided outside of the tube element. The heater is configured for heating the mesh and the received amount of liquid aerosol-forming substrate to a temperature sufficient to volatilize at least a part of the received amount of liquid aerosol-forming substrate. The present invention also proposes a method for generating an aerosol.

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VAPORIZER FOR AN AEROSOL-GENERATING SYSTEM AND VAPORIZING METHOD

The present invention relates to a vaporizer for an aerosol-generating system and to a vaporizing method for evaporating a liquid aerosol-forming substrate. In particular, the invention relates to handheld aerosol-generating systems, such as electrically operated aerosol-generating systems.

Known aerosol-generating systems comprise a liquid storing portion for storing a liquid aerosol-forming substrate and an electrically operated vaporizer having a heater for evaporating the aerosol-forming substrate. An aerosol to be inhaled (e.g. “puffed”) by a user is generated when the evaporated aerosol-forming substrate condenses in an airflow passing the heater. The liquid aerosol-forming substrate may be dispensed directly onto the heater of the vaporizer. In this case the dispensed liquid tends to cool the heater locally. As an undesired consequence, amounts of liquid may drip from low temperature areas of the heater without being vaporized. This issue may be solved by delivering the liquid aerosol-forming substrate to the vaporizer by means of a wick. The wick may be made of a porous wicking material. Such a porous wicking material is capable of retaining the liquid and spreading the liquid on the surface of the heater. These known wicks are often enclosed, and heated, by the heater. The heater vaporizes the liquid retained in the wick. A problem often observed in these known aerosol generating systems is leakage of liquid from them, which can be inconvenient if they are carried in a pocket of the trousers of a user.

Hence, it would be desirable to have a vaporizer for an aerosol-generating system and a vaporizing method that provide sufficient vaporization of a liquid aerosol-forming substrate and are capable of avoiding that an amount of liquid drips from the heater.

The above mentioned and further objects of the invention are achieved by a vaporizer suitable for an aerosol-generating system. The vaporizer comprises a tube element, a mesh, and a heater. The tube element has an inner volume for receiving an amount of liquid aerosol-forming substrate. The mesh is provided in the inner volume of the tube element. The heater is configured for heating the tube element. The heater is provided outside of the tube element. The tube element is preferably thermally conductive. The heater is configured for heating the mesh and the received amount of liquid aerosol-forming substrate to a temperature sufficient to volatilize at least a part of the received amount of liquid aerosol-forming substrate.

Preferably, the mesh is not heated directly by a resistive heater. Instead, the mesh is heated by a surrounding heated tube element. The liquid aerosol-forming substrate is heated indirectly through the heated tube and through the mesh using heat conduction. The mesh improves spreading the liquid aerosol-forming substrate over a heated surface. This enables improved vaporization. As the mesh is heated by heat conduction from the tube element, the surface of the mesh is uniformly heated. Thus, vaporization is further improved. As the liquid is heated in the inner volume of the tube element and is also retained by the mesh, liquid cannot undesirably leak out or drip from the vaporizer. Thus, vaporization of most or even all of the supplied liquid is ensured.

The mesh may be a metal mesh. The mesh may have the shape of a full cylinder. The external diameter of the mesh may be smaller than the inner diameter of the tube element. The mesh may be arranged at the centre of the tube element. The liquid aerosol-forming substrate may spread between the inner surface of the tube segment and the external surface of the mesh. Thus, the liquid aerosol-forming substrate may form a thin hollow liquid cylinder between these two surfaces. The vaporizer may heat this thin hollow liquid cylinder orthogonal on all points of this thin hollow liquid cylinder. The vaporizer may heat orthogonal with respect to the outside and the inside of the thin hollow liquid cylinder. The distance to travel from one side of the liquid layer to the other side may be essentially identical from all points of the thin liquid hollow liquid cylinder. Thus, the heat transfer from the vaporizer to the liquid aerosol-forming substrate may be improved. Contrarily, in the case of a tube segment without a mesh, heat transfers from the outer surface of a full liquid cylinder through the full liquid cylinder. In this configuration, the distance to travel for heat is different depending on the point on the full liquid cylinder where heat applies. Therefore, vaporization is much less uniform and much less effective, particularly at the center of the full liquid cylinder.

The tube element is made from any thermally conductive material. The tube element may be made from aluminium or alumina. The tube element may extend in its longitudinal direction within the range from 10 millimetres to 40 millimetres and may have an outer diameter in the range of 0.5 millimetres to 4.0 millimetres, preferably within a range of 1.5 millimetres to 2.5 millimetres. The inner volume of the tube element may have a diameter in the range from 0.3 millimetres to 2.3 millimetres, preferably within a range of 1.0 millimetres to 1.6 millimetres.

The mesh may be a metal mesh made from at least one metal material. The metal mesh may be formed by a wire material. The wire material may have a diameter in the range from 0.01 millimetres to 0.04 millimetres, preferably in the range from 0.02 millimetres to 0.03 millimetres. The wire material may have a uniform diameter. The mesh may have hole size apertures in the range from 0.01 millimetres to 0.04 millimetres, preferably in the range from 0.02 millimetres to 0.03 millimetres. The wire material may for example be stainless steel. The metal mesh may be woven. The metal mesh may have a woven wire mesh pattern. The mesh pattern may be dimensioned in accordance to a surface tension and/or viscosity of the liquid aerosol-forming substrate such that the spreading of the liquid aerosol-forming substrate over the surface of the mesh is maximized. The metal mesh improves spreading of the liquid aerosol-forming substrate on the surface of the mesh. The metal mesh is heat conductive. Moreover, the metal mesh is resistant to high heating temperatures. The metal mesh improves heating and vaporization of the liquid aerosol-forming substrate disposed in the inner volume of the tube element. Moreover, the metal mesh is stable over a wide range of heating temperatures. Thus, the average lifetime of the vaporizer is improved.

Preferably, the mesh is a rolled mesh. The term rolled means that the mesh is not flat, but that the mesh is curved. The term rolled includes the meaning of curved, rolled and rolled up. The rolled mesh may have an opened cross section, e.g. open to an upward direction for a U-shaped rolled mesh. Such a mesh is preferably arranged in the vaporizer such that for intended vaporizer use the direction of the opening is the upward direction. The mesh may be curved or rolled around a longitudinal axis or direction of the tube element. The mesh may be curved or rolled around the intended flow direction of the liquid aerosol-forming substrate supplied to the inner volume of the tube element. The mesh may be rolled such that two end surfaces of the mesh face or contact each other. The mesh may be rolled-up like a rolled-up carpet. The mesh may be rolled up such that the mesh is layered. The mesh may comprise a first mesh layer and a second mesh layer, wherein the first mesh layer is wrapped around the second mesh layer. The mesh may have an arc-shaped cross section. The mesh may have a cross section of circular, elliptical or helical shape. The cross section may be uniform along the longitudinal direction of the tube element.

Preferably, the mesh extends along a longitudinal direction of the tube element. Thus, the liquid aerosol-forming substrate can be heated uniformly by the tube element and the mesh. Therefore, vaporization is improved.

Preferably, the mesh extends from one end to another end of the tube element. Thus, the liquid aerosol-forming substrate can be spread and heated along the entire length of the tube element. This improves vaporization of the liquid aerosol-forming substrate.

Preferably, the tube element has a free open end. Preferably, the tube element is adapted for receiving the liquid aerosol-forming substrate at an end of the tube element opposite to the free open end of the tube element. The free open end may be adapted for allowing vapor from the liquid aerosol-forming substrate to escape from the inner volume of the tube element. The free open end reduces a flow resistance of the liquid aerosol-forming substrate in the inner volume of the tube element. Thus, spreading of the liquid aerosol-forming substrate in the inner volume towards the free open end is improved.

Preferably, the tube element has a closed free end. Preferably, the tube element is adapted for receiving the liquid aerosol-forming substrate at an end of the tube element opposite to the closed free end of the tube element. The tube element having the closed free end further comprises at least one outlet for allowing aerosol to escape from the inner volume of the tube element. The closed end allows avoiding that liquid aerosol-forming substrate may drip out from the tube element. The tube element comprises a number of micro perforations. The micro perforations are through holes extending from the inner volume to the outer circumferential surface of the tube element. The micro perforations are adapted to allow escaping of vaporized liquid aerosol-forming substrate from the inner volume of the tube element. Each micro perforation may have a diameter in the range of 50 to 250 micrometers. The micro perforations may be arranged on one or more circumferential rings. The micro perforations may be arranged equally-spaced in circumferential direction, e.g. at 0 degree and 180 degree or spanning angles of 45 degrees with each other. The micro perforations may be arranged equally-spaced along the longitudinal direction of the tube element. For a tube element having an open end, the micro perforations are preferably arranged in a middle section of the longitudinal dimension of the tube element. The micro perforations are preferably arranged in a section adjacent to the closed free end of the tube element.

Preferably, the tube element is electrically isolated. In particular, the tube element may be electrically isolated from its outer circumferential surface to its inner circumferential surface. This avoids a possible short-circuit between the metal mesh and the heater being a metal heater. The tube element is preferably thermally conductive and electrically non-conductive.

Preferably, the heater comprises an electrical resistive heater. The electric resistive heater may be a metal heater. The electric resistive heater may be a coil heater. The electric resistive heater may be wrapped around the tube element. The electric resistive heater may be partially incorporated in the tube element. The electric resistive heater may extend along the, preferably whole, longitudinal direction of the tube element.

Preferably, the heater is surrounded or encapsulated by a thermal insulation element. The thermal insulation element may cover the entire heater. This allows to conserve heat energy and to avoid dissipating heat to the surroundings and to other components of an aerosol-generating system besides to the vaporizer.

Preferably, the heater does not extend into the inner volume of the tube element. This allows achieving a uniform temperature distribution within the inner volume. Thus, vaporization is improved. Moreover, a short-circuit between a metal heater and the metal mesh can be avoided. Furthermore, it prevents that residues of liquid aerosol-forming substrate adhere at the heater portion extending into the inner volume.

Preferably, the vaporizer is free of a wicking material. In particular, the inner volume of the tube element is free of wicking material, thereby simplifying its construction.

According to a second aspect of the present invention, an aerosol-generating system is presented which comprises a vaporizer as presented above and a delivery unit. The delivery unit is adapted for supplying a predetermined amount of the liquid aerosol-forming substrate to the inner volume of the tube element of the vaporizer. The delivery unit is preferably a micropump. A determined amount of liquid aerosol-forming substrate is pumped from a liquid storage portion of the aerosol-generating system to the vaporizer. Such a design can allow the production of cartridges without vaporizers. Due to the improved liquid transport, tubing segments and vaporizers may not need to be disposed once the liquid storage portion is empty. By using a pump instead of a passive medium to draw liquid, only the actually required amount of liquid aerosol-forming substrate may be transported to the vaporizer. Liquid aerosol-forming substrate may only be pumped upon demand, for example in response to a puff by a user.

The micropump may allow on-demand delivery of liquid aerosol-forming substrate at a low flow rate of for example approximately 0.5 to 2 microlitres per second for intervals of variable or constant duration. The micropump can be carefully tuned in order to deliver the appropriate amount of liquid aerosol-forming substrate to vaporizer. Consequently, the amount of delivered liquid aerosol-forming substrate can be determined from the amount of pump cycles.

The micropump may be configured to pump liquid aerosol-forming substrates that are characterized by a relatively high viscosity as compared to water. The viscosity of a liquid aerosol-forming substrate may be in the range from about 10 to 500 Millipascalseconds, preferably in the range from about 17 to 86 Millipascalseconds.

When adjusting the flow rate, more energy may be required to vaporize the higher amount of delivered liquid aerosol-forming substrate at the vaporizer. Therefore, the temperature settings of the vaporizer may be adjusted in accordance to the liquid flow rate.

The temperature of the heating element is preferably controlled by electric circuitry. Once a puff has been detected and the heater and/or the tube element of the vaporizer has reached the operating temperature, the electric circuitry may activate the micropump and set a determined flow rate for delivering liquid aerosol-forming substrate to the inner volume of the tube element of the vaporizer for the duration of the puff.

Both the micropump and the heater may be triggered by a puff detection system. Alternatively, the micropump and the heater may be triggered by pressing an on-off button, held for the duration of a puff.

Preferably, the micropump is configured to deliver a determined amount of liquid aerosol-forming substrate from the liquid storage portion to the inner volume of the tube element of the vaporizer upon performing one pump cycle.

As used herein, the terms ‘upstream’, ‘downstream’, ‘proximal’, ‘distal’, ‘front’ and ‘rear’, are used to describe the relative positions of components, or portions of components, of the aerosol-generating system in relation to the direction in which a user draws on the aerosol-generating system during use thereof.

The aerosol-generating system may comprise a mouth end through which in use an aerosol exits the aerosol-generating system and is delivered to a user. The mouth end may also be referred to as the proximal end. In use, a user draws on the proximal or mouth end of the aerosol-generating system in order to inhale an aerosol generated by the aerosol-generating system. The aerosol-generating system comprises a distal end opposed to the proximal or mouth end. The proximal or mouth end of the aerosol-generating system may also be referred to as the downstream end and the distal end of the aerosol-generating system may also be referred to as the upstream end. Components, or portions of components, of the aerosol-generating system may be described as being upstream or downstream of one another based on their relative positions between the proximal, downstream or mouth end and the distal or upstream end of the aerosol-generating system.

Preferably, the aerosol-generating system further comprises a tubing segment through which the liquid aerosol-forming substrate is delivered from the micropump to the vaporizer, and wherein the vaporizer is arranged downstream of an open end of the tubing segment.

Preferably, the aerosol-generating system comprises a main unit and a cartridge, wherein the cartridge may be removably coupled to the main unit, wherein the main unit may comprise a power supply, wherein the liquid storage portion may be provided in the cartridge, and wherein the micropump may be provided in the main unit. Preferably, the main unit further comprises the vaporizer. The main unit may comprise the tubing segment.

The aerosol-generating system according to an embodiment of the present invention may further comprise electric circuitry connected to the vaporizer and to an electrical power source. The electric circuitry may be configured to monitor the electrical resistance of the vaporizer, and preferably to control the supply of power to the vaporizer dependent on the electrical resistance of the vaporizer.

The electric circuitry may comprise a controller with a microprocessor, which may be a programmable microprocessor. The electric circuitry may comprise further electronic components. The electric circuitry may be configured to regulate a supply of power to the vaporizer. Power may be supplied to the vaporizer continuously following activation of the system or may be supplied intermittently, such as on a puff-by-puff basis. The power may be supplied to the vaporizer in the form of pulses of electrical current.

The aerosol-generating system advantageously comprises a power supply, typically a battery, for example within the main body of the housing. The power supply may be a form of charge storage device such as a capacitor. The power supply may require recharging and may have a capacity that allows for the storage of enough energy for one or more inhaling experiences; for example, the power supply may have sufficient capacity to allow for the continuous generation of aerosol for a period of around six minutes or for a period that is a multiple of six minutes. In another example, the power supply may have sufficient capacity to allow for a predetermined number of puffs or discrete activations of the heater assembly.

For allowing ambient air to enter the aerosol-generating system, a wall of the housing of the aerosol-generating system, preferably a wall opposite the vaporizer, preferably a bottom wall, is provided with at least one semi-open inlet. The semi-open inlet preferably allows air to enter the aerosol-generating system, but no air or liquid to leave the aerosol-generating system through the semi-open inlet. A semi-open inlet may for example be a semi-permeable membrane, permeable in one direction only for air, but is air- and liquid-tight in the opposite direction. A semi-open inlet may for example also be a one-way valve. Preferably, the semi-open inlets allow air to pass through the inlet only if specific conditions are met, for example a minimum depression in the aerosol-generating system or a volume of air passing through the valve or membrane.

The liquid aerosol-forming substrate is a substrate capable of releasing volatile compounds that can form an aerosol. The volatile compounds may be released by heating the liquid aerosol-forming substrate. The liquid aerosol-forming substrate may comprise plant-based material. The liquid aerosol-forming substrate may comprise tobacco. The liquid aerosol-forming substrate may comprise a tobacco-containing material containing volatile tobacco flavour compounds, which are released from the liquid aerosol-forming substrate upon heating. The liquid aerosol-forming substrate may alternatively comprise a non-tobacco-containing material. The liquid aerosol-forming substrate may comprise homogenised plant-based material. The liquid aerosol-forming substrate may comprise homogenised tobacco material. The liquid aerosol-forming substrate may comprise at least one aerosol-former. The liquid aerosol-forming substrate may comprise other additives and ingredients, such as flavourants.

The aerosol-generating system may be an electrically operated aerosol-generating system. Preferably, the aerosol-generating system is portable. The aerosol-generating system may have a size comparable to a conventional cigar or cigarette. The aerosol-generating system may have a total length between approximately 30 millimetres and approximately 150 millimetres. The aerosol-generating system may have an external diameter between approximately 5 millimetres and approximately 30 millimetres.

According to a third aspect of the present invention, a method for generating an aerosol is presented. The method comprises the steps of delivering an amount of liquid aerosol-forming substrate to an inner volume of a tube element of a vaporizer, thereby wetting a mesh provided in the inner volume of the tube element with at least a part of the delivered amount of liquid aerosol-forming substrate; heating the mesh and the delivered amount of liquid aerosol-forming substrate to a temperature sufficient to volatilize at least a part of the delivered amount of liquid aerosol-forming substrate, by a heater provided outside the tube element. The heater preferably comprises an electrical resistive heater.

Features described in relation to one aspect may equally be applied to other aspects of the invention.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a schematic view of a vaporizer in accordance with an embodiment of the present invention;

Fig. 2A is a cross section view, side view, and top view of a tube element with a closed end of a vaporizer in accordance with an embodiment of the present invention;

Fig. 2B is a cross section view, side view, and top view of a tube element with a closed end of another vaporizer in accordance with an embodiment of the present invention;

Fig. 3 is a cross section view, side view, and top view of a tube element with an open end of a vaporizer in accordance with an embodiment of the present invention;

Fig. 4A is a perspective and a topside view of an aerosol-generating system in accordance with an embodiment of the present invention; and

Fig. 4B is a perspective view of an aerosol-generating system in accordance an embodiment of the present invention.

Fig. 1 is a schematic view of a vaporizer in accordance with an embodiment of the present invention. The vaporizer 21 comprises a tube element 22, a mesh 25, and a heater 26. The tube element 22 has an inner volume 23 extending in a longitudinal direction 28 of the tube element 22 and the vaporizer 21. The mesh 25 is configured as a rolled metal mesh arranged in the inner volume 23 and extending in the longitudinal direction 28 from one end 30 to the other end 31 of the tube element 22. The external diameter of the mesh 25 is smaller than the diameter of inner volume 23, so that the liquid can spread around the mesh and circulate within the inner volume 23.

A fluid inlet 24 for supplying liquid aerosol-forming substrate to the inner volume 23 is arranged at the one end 30. The other end 31 is configured as an open end for letting escape vaporized liquid aerosol-forming substrate along a direction indicated by arrow 29. The heater 26 is configured as a metal coil which is helically wrapped around the outer circumference of the tube element 22 and along the longitudinal direction 28. A thermal insulation element 27 is wrapped around the heater 26 along the longitudinal direction 28. During operation of the vaporizer, liquid aerosol-forming substrate is supplied via fluid inlet 24 to the inner volume 23 and spreads along the entire mesh 25. An electric current is applied to the heater 26 for heating the tube element 22 and everything in its inner volume 23. The heat of the tube element 22 is conducted to the inner volume 23 and the mesh 25. Thus, the liquid aerosol-forming substrate being spread over the mesh 25 in the inner volume 23 is heated. The liquid aerosol-forming substrate in the inner volume 23 is vaporized and escapes via the open end 31 along direction 29.

Fig. 2A is a cross section view, side view, and top view of a tube element 22 with a closed end of a vaporizer in accordance with an embodiment of the present invention. The tube element 22 has a uniform outer diameter of 1.90 millimetres, and the inner volume 23 has a uniform diameter of 1.30 millimetres. The tube element 22 has a length of 20 millimetres in longitudinal direction. The end 34 opposite to end 30 for receiving the liquid aerosol-forming substrate is closed. Six rings of micro perforations 33 are arranged 1 to 6 millimetres, respectively, distant from the end 34. Each ring comprises six micro perforation holes 33 of diameter 0.20 millimetres.

Fig. 2B is a cross section view, side view, and top view of a tube element 22 with a closed end of a vaporizer in accordance with an embodiment of the present invention. The tube element 22 of Fig. 2B is similar to the one shown in Fig. 2A. The only difference is that each ring of micro perforations only comprises two micro perforation holes arranged at 0 and 180 degrees, respectively.

Fig. 3 is a cross section view, side view, and top view of a tube element with an open end of a vaporizer in accordance with an embodiment of the present invention. The dimensions of the tube element 22 shown in Fig. 3 are the same as of Figures 2A and 2B. The tube element 22 of Fig. 3 is configured with an open end 35 instead of the closed end 34 of Figures 2A and 2B. Six rings of micro perforations with a respective distance of 1 millimetre are arranged in the middle section of the tube element 22. Similar to Fig. 2B, each ring of micro perforations comprises two micro perforation holes arranged at 0 and 180 degrees, respectively.

Fig. 4A and 4B are schematic illustrations of an aerosol-generating system. The aerosol-generating system comprises a main unit and a refillable or exchangeable cartridge with a liquid storage portion 3. The main unit comprises a main body 10 and a mouthpiece portion 12. The main body 10 contains a power supply 1, for example a battery such as a lithium iron phosphate battery, electronic circuitry 2, a cavity for holding a cartridge, a micropump 5 with an inlet and an outlet, and a vaporizer 7. Electrical connectors 8, 9 are provided at the sides of the main body 10 to provide an electrical connection between the electric circuitry 2, the power supply 1, and the vaporizer 7. Tubing segment 4 is provided to connect an outlet of the liquid storage portion to the inlet of the micropump. Tubing segment 6 leads the flow of liquid aerosol-forming substrate from the outlet of the micropump 5 to the fluid inlet of the vaporizer 7. The mouthpiece portion 12 comprises a plurality of air inlets 11 and an outlet 13. In use, a user sucks or puffs on the outlet 13 to draw air from the air inlets 11, through the mouthpiece portion 12 to the outlet 13, and thereafter into the mouth or lungs. Internal baffles are provided to force the air flowing through the mouthpiece portion 12. The vaporizer 7 is configured to heat the liquid aerosol-forming substrate directly after the liquid aerosol-forming substrate exits the tubing segment 6.

The cartridge is configured to be received in a cavity within the main body 10. The cartridge is preferably replaceable, so the user can exchange it with a new cartridge, when the aerosol-forming substrate provided in the cartridge is depleted. When inserting a new cartridge, a slider at the main body may be moved to expose the cavity. A new cartridge may be inserted into the exposed cavity. The outlet of the liquid storage portion is configured to connect to the inlet of the micropump 5. The main unit is portable and has a size comparable to a conventional cigar or cigarette.

The exemplary embodiments described above illustrate but are not limiting. In view of the above discussed exemplary embodiments, other embodiments consistent with the above exemplary embodiments will now be apparent to one of ordinary skill in the art.

CLAIMS

1. A vaporizer for an aerosol-generating system, the vaporizer comprising:

a tube element having an inner volume for receiving an amount of liquid aerosol-forming substrate,

a mesh provided in the inner volume of the tube element, and

a heater provided outside of the tube element, wherein the heater comprises an electrical resistive heater,

wherein the heater is configured for heating the mesh and the received amount of liquid aerosol-forming substrate to a temperature sufficient to volatilize at least a part of the received amount of liquid aerosol-forming substrate.

2. The vaporizer according to claim 1, wherein the heater is configured to indirectly heating the mesh and received amount of liquid aerosol-forming substrate by heat conduction via the tube element to the inner volume of the tube element.

3. The vaporizer according to claim 1 or 2, wherein the mesh is a metal mesh.

4. The vaporizer according to claim 1, 2 or 3, wherein the mesh is a rolled mesh.

5. The vaporizer according to anyone of the preceding claims, wherein the mesh extends along a longitudinal direction of the tube element.

6. The vaporizer according to anyone of the preceding claims, wherein the mesh extends from one end to another end of the tube element.

7. The vaporizer according to anyone of the preceding claims, wherein the tube element has a free open end.

8. The vaporizer according to anyone of the claims 1 to 6, wherein the tube element has a closed free end, and wherein the tube element comprises a number of micro perforations.

9. The vaporizer according to anyone of the preceding claims, wherein the tube element is electrically isolated.

10. The vaporizer according to anyone of the preceding claims, wherein the heater is surrounded by a thermal insulation element.

11. An aerosol-generating system, comprising a vaporizer according to anyone of the preceding claims and a delivery unit, preferably a micropump, for supplying a predetermined amount of the liquid aerosol-forming substrate to the inner volume of the tube element of the vaporizer.

12. A method for generating an aerosol, the method comprising the steps of:

delivering an amount of liquid aerosol-forming substrate to an inner volume of a tube element of a vaporizer, thereby wetting a mesh provided in the inner volume of the tube element with at least a part of the delivered amount of liquid aerosol-forming substrate,

heating the mesh and the delivered amount of liquid aerosol-forming substrate to a temperature sufficient to volatilize at least a part of the delivered amount of liquid aerosol-forming substrate, by a heater provided outside the tube element, wherein the heater comprises an electrical resistive heater.

Fig. 1

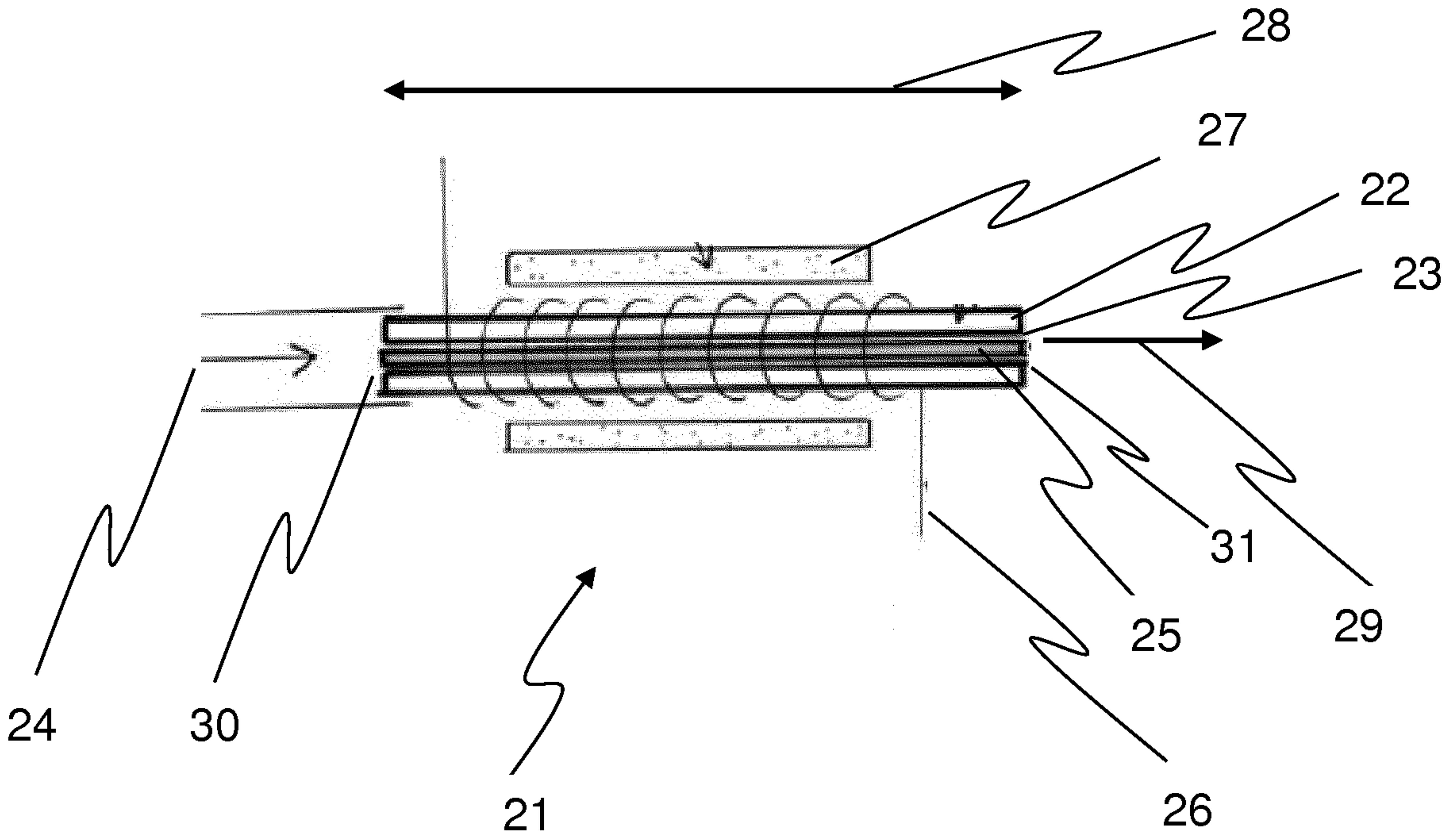


Fig. 2A

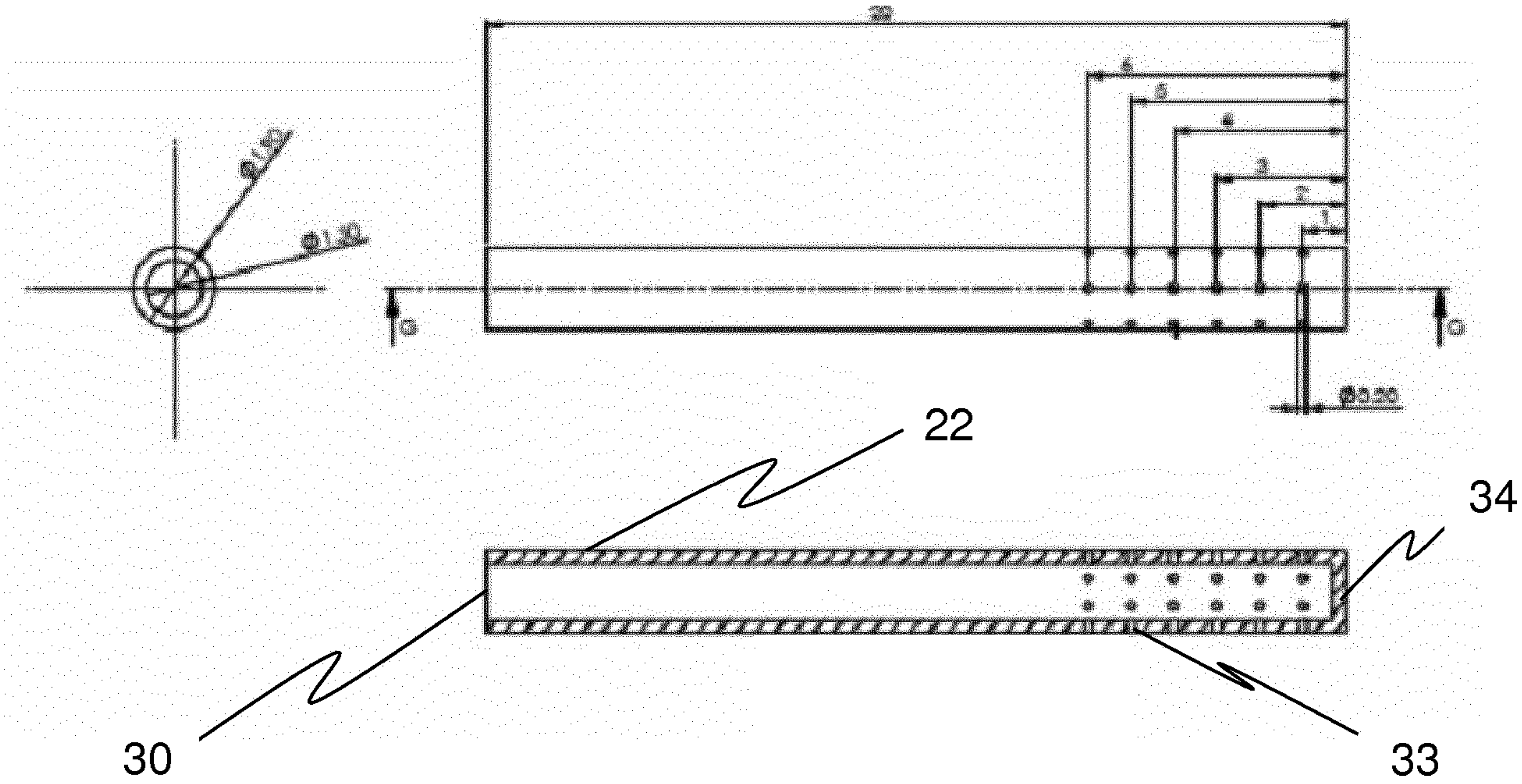


Fig. 2B

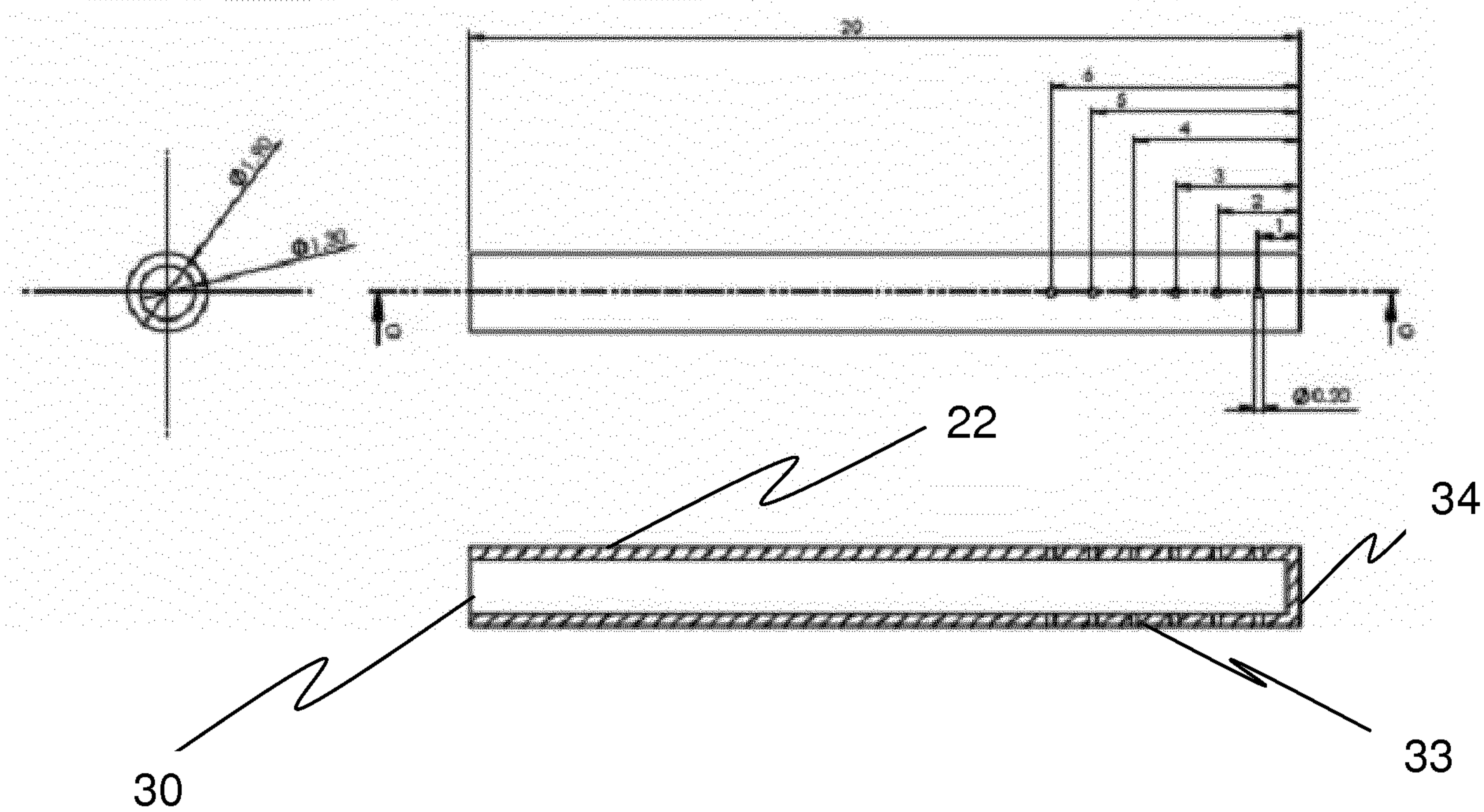


Fig. 3

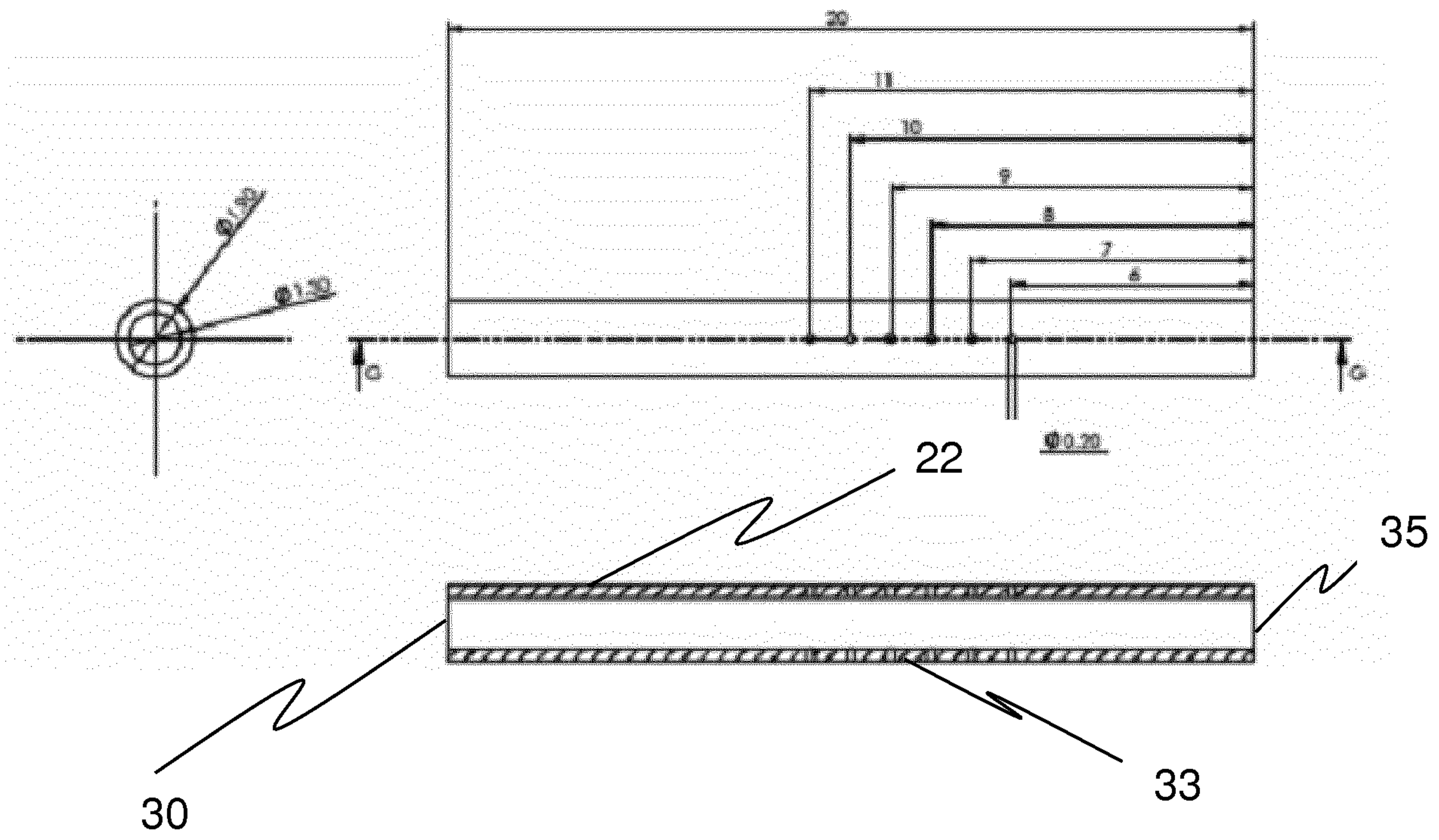


Fig. 4A

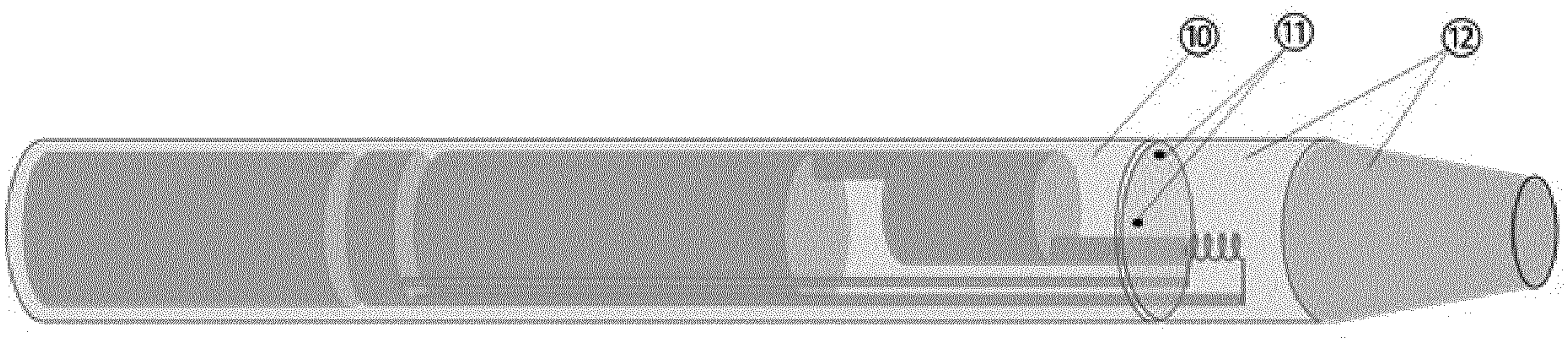
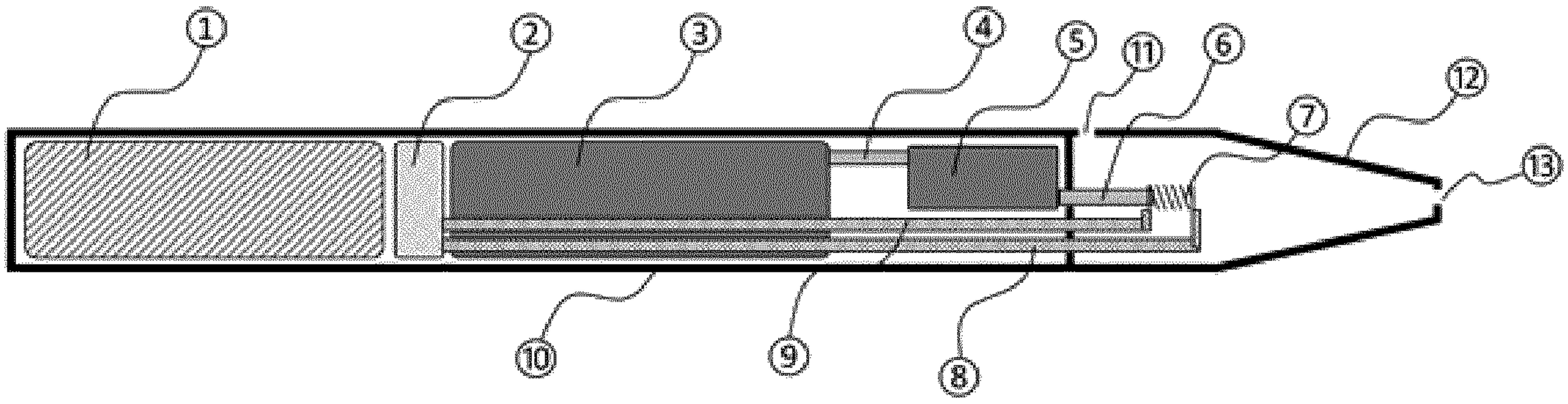
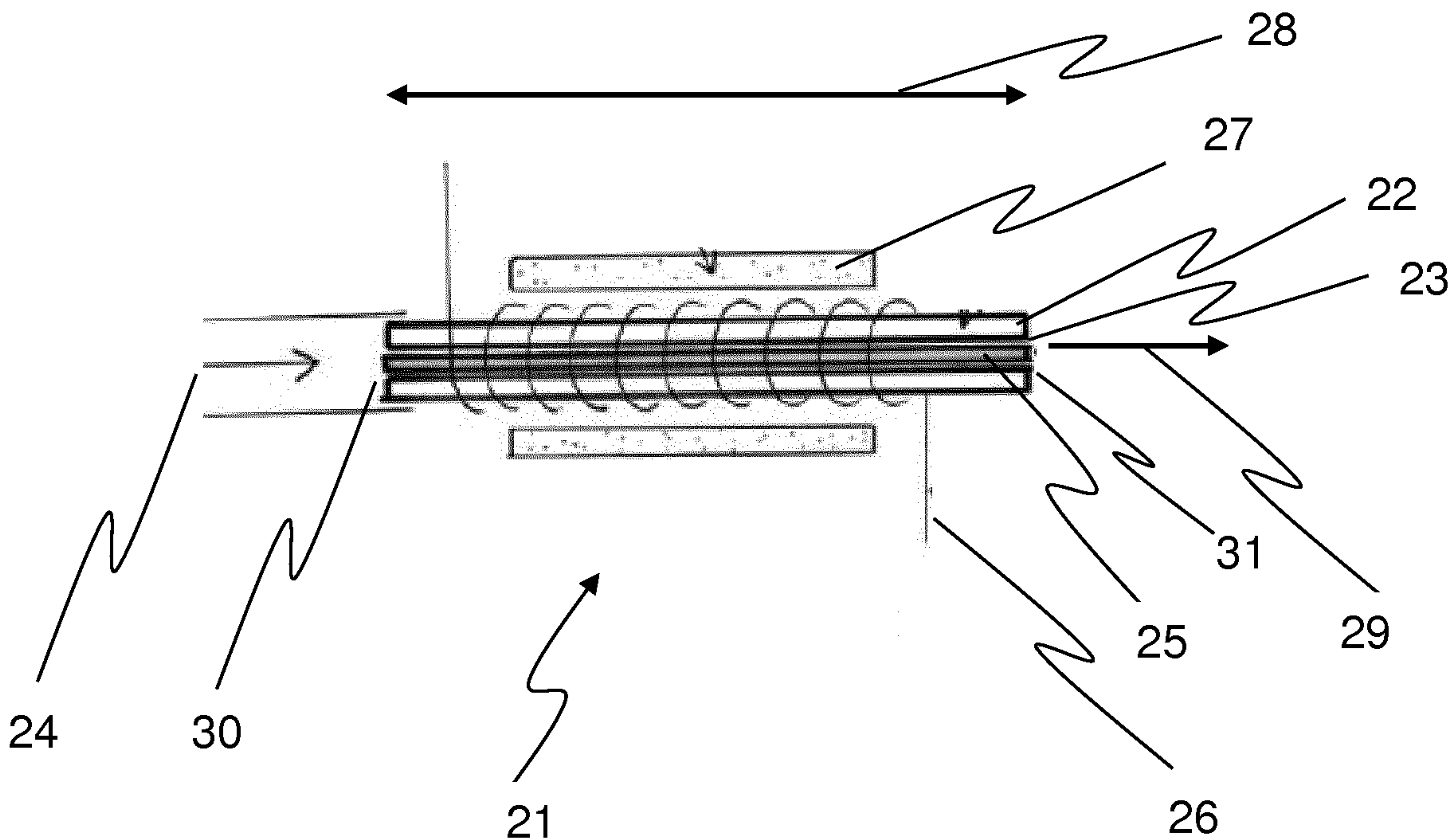


Fig. 4B

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