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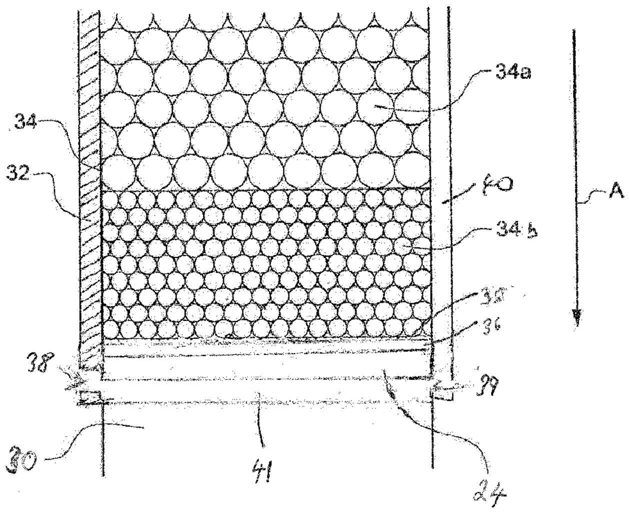

Fig. 5

(57) **Abstract:** An aerosol delivery system has a fluid-transfer article that has a first region for holding an aerosol precursor and a second region to which the aerosol precursor is transferred from the first region. The second region includes an activation surface which interacts thermally with a heater of the aerosol delivery system to form an aerosol from said aerosol precursor. At least a part of the heater is deformable, in response to a temperature change between a first and a second temperature. When at the second temperature, which normally is higher than the first temperature, the deformable part of the heater is spaced from the activation surface to define an air-flow pathway between the heater and activation surface, through which air can flow to transfer the aerosol to the user. At the first temperature, the deformable part of the heater moves into contact with the activation surface, to obstruct the air-flow pathway and reduces escape of aerosol precursor from the second part of the fluid-transfer article.

WO 2020/187941 A1

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AEROSOL DELIVERY SYSTEM

Field of the Invention

The present invention relates to an aerosol delivery system, and an aerosol-generation apparatus for an aerosol delivery system. The present invention preferably relates to an aerosol delivery system including a heater configured to heat an aerosol precursor to generate an aerosolised composition for inhalation by a user, and to an aerosol-generation apparatus therefor.

Background

Pharmaceutical medicament, physiologically active substances and flavourings for example may be delivered to the human body by inhalation through the mouth and/or nose. Such material or substances may be delivered directly to the mucosa or mucous membrane lining the nasal and oral passages and/or the pulmonary system. For example, nicotine is consumed for therapeutic or recreational purposes and may be delivered to the body in a number of ways. Nicotine replacement therapies are aimed at people who wish to stop smoking and overcome their dependence on nicotine. Nicotine is delivered to the body in the form of aerosol delivery devices and systems, also known as smoking-substitute devices or nicotine delivery devices. Such devices may be non-powered or powered.

Devices or systems that are non-powered may comprise nicotine replacement therapy devices such as "inhalators", e.g. Nicorette® Inhalator. These generally have the appearance of a plastic cigarette and are used by people who crave the behaviour associated with consumption of combustible tobacco - the so-called hand-to-mouth aspect - of smoking tobacco. Inhalators generally allow nicotine-containing aerosol to be inhaled through an elongate tube in which a container containing a nicotine carrier, for example, a substrate, is located. An air stream caused by suction through the tube by the user carries nicotine vapours into the lungs of the user to satisfy a nicotine craving. The container may comprise a replaceable cartridge, which includes a cartridge housing and a passageway in the housing in which a nicotine reservoir is located. The reservoir holds a measured amount of nicotine in the form of the nicotine carrier. The measured amount of nicotine is an amount suitable for delivering a specific number of "doses". The form of the nicotine carrier is such as to allow nicotine vapour to be released into a fluid stream passing around or through the reservoir. This process is known as aerosolization and or atomization. Aerosolization is the process or act of converting a physical substance into the form of particles small and light enough to be carried on the air i.e. into an aerosol. Atomization is the process or act of separating or reducing a physical substance into fine particles and may include the generation of aerosols. The passageway generally has an opening at each end for communication with the exterior of the housing and for allowing the fluid stream through the passageway. A nicotine-impermeable barrier seals the reservoir from atmosphere. The barrier includes passageway barrier portions for sealing the passageway on both sides of the reservoir. These barrier portions are frangible so as to be penetrable for opening the passageway to atmosphere.

A device or a system that is powered can fall into two sub-categories. In both subcategories, such devices or systems may comprise electronic devices or systems that permit a user to simulate the act of smoking by producing an aerosol mist or vapour that is drawn into the lungs through the mouth and then exhaled. The electronic devices or systems typically cause the vaporization of a liquid containing nicotine and entrainment of the vapour into an airstream. Vaporization of an element or compound is a phase transition from the liquid phase to vapour i.e. evaporation or boiling. In use, the user experiences a similar satisfaction and physical sensation to those experienced from a traditional smoking or tobacco product, and exhales an aerosol mist or vapour of similar appearance to the smoke exhaled when using such traditional smoking or tobacco products.

A person of ordinary skill in the art will appreciate that devices or systems of the second, powered category as used herein include, but are not limited to, electronic nicotine delivery systems, electronic cigarettes, e-cigarettes, e-cigs, vaping cigarettes, pipes, cigars, cigarillos, vaporizers and devices of a similar nature that function to produce an aerosol mist or vapour that is inhaled by a user. Such nicotine delivery devices or systems of the second category incorporate a liquid reservoir element generally including a vaporizer or misting element such as a heating element or other suitable element, and are known, inter alia, as atomizers, cartomizers, or clearomizers. Some electronic cigarettes are disposable; others are reusable, with replaceable and refillable parts.

Aerosol delivery devices or systems in a first sub-category of the second, powered category generally use heat and/or ultrasonic agitation to vaporize a solution comprising nicotine and/or other flavouring, propylene glycol and/or glycerine-based base into an aerosol mist of vapour for inhalation.

Aerosol delivery devices or systems in a second sub-category of the second, powered category may typically comprise devices or systems in which tobacco is heated rather than combusted. During use, volatile compounds may be released from the tobacco by heat transfer from the heat source and entrained in air drawn through the aerosol delivery device or system. Direct contact between a heat source of the aerosol delivery device or system and the tobacco heats the tobacco to form an aerosol. As the aerosol containing the released compounds passes through the device, it cools and condenses to form an aerosol for inhalation by the user. In such devices or systems, heating, as opposed to burning, the tobacco may reduce the odour that can arise through combustion and pyrolytic degradation of tobacco.

Aerosol delivery devices or systems falling into the first sub-category of powered devices or systems may typically comprise a powered unit, comprising a heater element, which is arranged to heat a portion of a carrier that holds an aerosol precursor. The carrier comprises a substrate formed of a "wicking" material, which can absorb aerosol precursor liquid from a reservoir and hold the aerosol precursor liquid. Upon activation of the heater element, aerosol precursor liquid in the portion of the carrier in the vicinity of the heater element is vaporised and released from the carrier into an airstream flowing around the heater and carrier. Released aerosol precursor is entrained into the airstream to be borne by the airstream to an outlet of the device or system, from where it can be inhaled by a user.

The heater element is typically a resistive coil heater, which is wrapped around a portion of the carrier and is usually located in the liquid reservoir of the device or system. Consequently, the surface of the heater may always be in contact with the aerosol precursor liquid, and long-term exposure may result in the degradation of either or both of the liquid and heater. Furthermore, residues may build up upon the surface of the heater element, which may result in undesirable toxicants being inhaled by the user. Furthermore, as the level of liquid in the reservoir diminishes through use, regions of the heater element may become exposed and overheat.

The present invention has been devised in light of the above considerations.

Summary of the Invention

At its most general, the present invention proposes that an aerosol-generation apparatus has a heater, at least part of which (typically at least a part of a heating surface of which) deforms or moves during use, such as when the heater is active. The heater can thus act in conjunction with a fluid-transfer article which holds an aerosol precursor, a heating surface of the heater interacting with an activation surface of the fluid-transfer article.

In one proposal, when the heater is at a first temperature (e.g. room temperature), it may have a first position in which at least a part of the heating surface is adjacent or in contact with the activation surface. The heater then has a second position which is acquired or adopted when the heater is at a second temperature (e.g. at an elevated temperature to heat the aerosol precursor) in which at least a part of the heating surface is spaced from the activation surface. In the second position, there will then be an air-flow pathway between the heating surface and the activation surface, through which air can pass to receive aerosol and/or vapour corresponding to the heated aerosol precursor, which aerosol and/or vapour is then passed to the user. At the first temperature, the air-flow pathway between the heating surface and the activation surface may be obstructed, which prevents or reduces escape of aerosol precursor from the fluid-transfer article when the device is not being used.

In another general sense, the invention proposes that an aerosol-generation apparatus is provided, which has a heater mounted on a heat activatable movement element, which heat activatable movement element causes the heater to move towards or away from a fluid-transfer article which holds an aerosol precursor.

Preferably, the heat activatable movement element moves the heater between a position in which at least a part of its heating surface is in contact with an activation surface of the fluid-transfer article and another position in which said at least a part of the heating surface is spaced from that activation surface to define an air-flow pathway between the activation surface and the heater. In the first of these positions, the heater may restrict or prevent escape of aerosol precursor from the fluid-transfer article. In the second position, the heater is able to heat aerosol precursor which has been transferred to it from the fluid-transfer article, to form a vapour and/or a mixture of aerosol and vapour which is mixed with the air flowing between the activation surface and the heater, which can then pass to the user.

Normally, the heat to cause the heat activatable movement element to move the heater will be heat from the heater itself, so that activation of the heater itself triggers the heat activatable movement element to move the heater away from the activation surface.

In another general sense, the present invention proposes that an aerosol-generation apparatus is provided, which has a moveable heater, movement of the heater being caused by air flow between the heater and an activation surface of a fluid-transfer article which holds an aerosol precursor.

Thus, in such an arrangement, when the user sucks or inhales on the apparatus, they cause a movement of air through the apparatus, a part of that movement being the air flow which causes the heater to move. As the heater moves away from the fluid-transfer article an air-flow pathway is formed between the heater and the activation surface, and aerosol precursor on the heater is heated to release vapour and/or aerosol into the air which is passing to the user. When the user is not using the apparatus, and no air is flowing, at least a part of the heater is in contact with the fluid-transfer article and so prevents or reduces leakage of aerosol precursor from the fluid-transfer article.

According to a first aspect of the present invention, there is provided an aerosol-generation apparatus comprising a heater and a fluid transfer article, the fluid transfer article comprising a first region for holding an aerosol precursor and for transferring said aerosol precursor to an activation surface of a second region of said fluid-transfer article, said activation surface being disposed for thermal interaction with a heating surface of said heater. At least a part of said heater is moveable between a first position and a second position, at least part of said heating surface being adjacent or in contact with said activation surface when said heater is in said first position, and at least part of said heating surface being spaced from said activation surface when said heater is in said second position. An air-flow pathway is defined between said activation surface and said heating surface when said heater is in said second position and said air-flow pathway is at least partially obstructed due to said adjacence or contact between said at least part of heating surface and said activation surface when said heater is in said first position.

At least a part of said heating surface may be deformable in response to a temperature change between a first temperature and a second temperature, said at least a part of the said heating surface being in a first position at the first temperature and a second position at the second temperature. In the first position, at least a part of said heating surface may be adjacent or in contact with said activation surface such that said at least a part of said heating surface obstructs said air-flow pathway from passing between said at least a part of said heating surface and said activation surface and, in the second position, said at least a part of said heating surface is spaced from said activation surface such that said air-flow pathway passes between said heating surface and said activation surface unobstructed by said at least a part of said heating surface.

Normally, the second temperature is higher than the first temperature, so that deformation of the heater surface occurs as the heater temperature rises. In such circumstances, the first temperature may be e.g. room or ambient temperature, with the second temperature corresponding to an operating temperature of the heater when the user is using the apparatus.

In an embodiment, said heater is mounted on a heat activatable movement element, and said heat activatable movement element is arranged to move said heater between said first position and said second position. At least a part of said heating surface is in contact with said activation surface when said heater is in said first position.

Preferably, the heat activatable movement element is a bi-metallic element. The bi-metallic element is in thermal contact with the heater, such as by being in direct contact or connected via a heat transfer element.

Thus, it is desirable that the bi-metallic element is thermally connected to the heater so as to be heated thereby.

It is preferable that the heat activatable movement element is arranged to move the heater from the first position to the second position as the temperature of the heat activatable movement member rises.

In another embodiment, said heater may be arranged such that air flow between said heating surface and said activation surface causes said heater to move to said second position from said first position.

Optionally, said heater is biased towards said first position. This enables it to remain in contact with the activation surface when no air is flowing in the air-flow pathway, or if the apparatus is moved. The biasing may be resilient biasing means, such as a spring or resilient block.

Optionally, the heater may be mounted on a hinged element so that pivoting of the hinged element enables the movement of the heater between the first and second positions.

Preferably, either or both of the first and second regions are formed from a polymeric wicking material. That polymeric wicking material may comprise Polyetherimide (PEI) and/or Polyether ether ketone (PEEK) and/or Polytetrafluoroethylene (PTFE) and/or Polyimide (PI) and/or Polyethersulphone (PES) and/or Ultra-High Molecular Weight Polyethylene (UHMWPE) and/or Polypropylene (PP) and/or Polyethylene Terephthalate (PET).
The polymeric wicking material may be porous. When both the first and second regions are formed from a porous polymeric wicking material, the pore diameter in the first region of the fluid-transfer article may be greater than the pore diameter in the second region of the fluid-transfer article. This assists transfer of aerosol precursor from the first region to the second region.

According to a second aspect of the present invention, there is provided an aerosol-generation apparatus comprising a heater and a fluid transfer article, the fluid transfer article comprising a first region for holding an aerosol precursor and for transferring said aerosol precursor to an activation surface of a second region of said fluid-transfer article, said activation surface being disposed for thermal interaction with a heating surface of said heater, and an air-flow pathway is defined between an inlet and an outlet of said aerosol-generation apparatus, wherein at least a part of said heating surface is deformable in response to a temperature change between a first temperature and a second temperature, said at least a part of the said heating surface being in a first position at the first temperature and a second position at the second temperature, and wherein, in the first position, at least a part of said heating surface is adjacent or in contact with said activation surface such that said at least a part of said heating surface obstructs said air-flow pathway from passing between said at least a part of said heating surface and said activation surface and, in the second position, said at least a part of said heating surface is spaced from said activation surface such that said air-flow pathway passes between said heating surface and said activation surface unobstructed by said at least a part of said heating surface.

According to a third aspect of the present invention, there is provided an aerosol-generation apparatus comprising a heater and a fluid-transfer article, the fluid-transfer article comprising a first region for holding an aerosol precursor and for transferring said aerosol precursor to an activation surface of a second region of said article, said activation surface being disposed for thermal interaction with a heating surface of said heater, said heater being mounted on a heat activatable movement element, said heat activatable movement element being arranged to move said heater between a first position and a second position, at least a part of said heating surface being in contact with said activation surface when said heater is in said first position, and said at least a part of said heating surface being spaced from said activation surface when said heater is in said second position, whereby an air-flow pathway is defined between said activation surface and said heating surface when said heater is in said second position and said air-flow pathway is at least partially obstructed due to said contact between at least a part of said heating surface and said activation surface when said heater is in said first position.

According to a fourth aspect of the present invention, there is provided an aerosol-generation apparatus comprising a heater and a fluid-transfer article, the fluid-transfer article comprising a first region for holding an aerosol precursor and for transferring said aerosol precursor to an activation surface of a second region of said article, said activation surface being disposed for thermal interaction with a heating surface of said heater, said heater being moveable between a first position and a second position, at least part of said heating surface being in contact with said activation surface when said heater is in said first position, at least part of said heating surface being spaced from said activation surface when said heater is in said second position, whereby an air-flow pathway is defined between said activation surface and said heating surface when said heater is in said second position and said air-flow pathway is at least partially obstructed due to said contact between said at least part of heating surface and said activation surface when said heater is in said first position, said heater being arranged such that air flow between said heating surface and said activation surface causes said heater to move to said second position from said first position.

In a fifth aspect, the present invention may also provide an aerosol delivery system including an aerosol-generation apparatus in accordance with the first, second, third or fourth aspects discussed above, and a carrier. The carrier may then have a housing containing the heater and the fluid-transfer article. This housing may have an inlet and an outlet, the former being in communication with the inlet of the aerosol-generation apparatus and the latter being in communication with the outlet of the aerosol-generation apparatus. The air-flow pathway then may extend between the inlet and the outlet of the housing, so that movable air can be drawn in to the housing from the exterior, through the inlet, and out from the outlet to the user. When the apparatus is being used, the aerosol and/or vapour will be present in the air that passes to the user from the outlet.

The aerosol-generation apparatus may form part of an aerosol delivery system which has a carrier and include a housing containing the heater and the fluid-transfer apparatus. The housing may have an inlet and outlet, and the air-flow pathway extends to the inlet and outlet of the housing.

The invention includes the combination of the aspects and preferred features described except where such a combination is clearly impermissible or expressly avoided.

Summary of the Figures

So that the invention may be understood, and so that further aspects and features thereof may be appreciated, embodiments illustrating the principles of the invention will now be discussed in further detail with reference to the accompanying figures, in which:

Figure 1. is a perspective view illustration of a system for aerosol delivery according to one or more embodiments of the present invention;

Figure 2. is a cross-section side view illustration of part of an apparatus of the system for aerosol delivery of Figure 1;

Figure 3. is a cross-section side view illustration of the system and apparatus for aerosol delivery of Figure 1;

Figure 4. is a perspective view illustration of an aerosol carrier for use in the system for aerosol delivery according to one or more embodiments of the present invention;

Figure 5. is a cross-section side view of elements of an aerosol carrier and a part of an apparatus of the system for aerosol delivery according to one or more embodiments of the present invention;

Figure 6. is a cross-section side view of elements of an aerosol carrier and a part of an apparatus of the system for aerosol delivery according to one or more embodiments of the present invention, Figure 6 being perpendicular to Figure 5 and showing the heater in a heated state;

Figure 7. is a cross-section side view of elements of an aerosol carrier and a part of an apparatus of the system for aerosol delivery according to one or more embodiments of the present invention, Figure 7 corresponding to Figure 5, but showing the heater in a heated state;

Figure 8 is a cross-section side view of an aerosol carrier according to one or more embodiments of the present invention;

Figure 9. is a perspective cross-section side view of the aerosol carrier of Figure 9;

Figure 10. is a cross-section side view of elements of an aerosol carrier and a part of an apparatus of the system for aerosol delivery according to one or more alternative embodiments of the present invention;

Figure 11. is a cross-section side view of elements of an aerosol carrier and a part of an apparatus of the system for aerosol delivery according to one or more alternative embodiments of the present invention;

Figure 12. is a cross-section side view of elements of another aerosol carrier and a part of an apparatus of the system for aerosol delivery according to another alternative embodiment of the present invention, one configuration;

Figure 13. is a cross-section side view of elements of the aerosol carrier and a part of an apparatus of the system for aerosol delivery corresponding to Figure 12, but in an alternative configuration;

Figure 14. is a cross-section side view of elements of yet another aerosol carrier and a part of an apparatus of the system for aerosol delivery according to another embodiment of the present invention in one configuration;

Figure 15. is a cross-section side view of elements of the aerosol carrier and a part of an apparatus of the system for aerosol delivery corresponding to Figure 14, but in alternative configuration;

Figure 16. is a cross-section side view of elements of an aerosol carrier and a part of an apparatus of the system for aerosol delivery according to yet another embodiment of the present invention;

Figure 17. is a cross-section view of elements of an aerosol carrier and a part of an apparatus of the system for aerosol delivery corresponding to Figure 16, but in an alternative configuration;

Figure 18. is a cross-section side view of aerosol carrier according to one or more embodiments of the present invention;

Figure 19. is a perspective cross-section side view of the aerosol carrier of Figure 18,

Figure 20. is a cross-section side view of elements of an aerosol carrier and a part of an apparatus of the system for aerosol delivery according to one or more further embodiments of the present invention;

Figure 21. is a cross-section side view of elements of an aerosol carrier and a part of an apparatus of the system for aerosol delivery according to one or more further embodiments of the present invention;

Figure 22. is a cross-section side view of elements of another aerosol carrier and a part of an apparatus of the system for aerosol delivery according to another further embodiment of the present invention, one configuration;

Figure 23. is a cross-section side view of elements of the aerosol carrier and a part of an apparatus of the system for aerosol delivery corresponding to Figure 22, but in an alternative configuration;

Figure 24. is a cross-section side view of elements of yet another aerosol carrier and a part of an apparatus of the system for aerosol delivery according to another embodiment of the present invention;

Figure 25. is a cross-section side view of elements of the aerosol carrier and a part of an apparatus of the system for aerosol delivery corresponding to Figure 24, but in alternative configuration;

Figure 26. is a cross-section side view of aerosol carrier according to one or more embodiments of the present invention;

Figure 27. is a perspective cross-section side view of the aerosol carrier of Figure 26, and;

Figure 28. is an exploded perspective view illustration of a kit-of-parts for assembling the system according to one or more embodiments of the present invention.

Detailed Description of the Invention

Aspects and embodiments of the present invention will now be discussed with reference to the accompanying figures. Further aspects and embodiments will be apparent to those skilled in the art. All documents mentioned in this text are incorporated herein by reference.

In general outline, one or more embodiments in accordance with the present invention may provide a system for aerosol delivery in which an aerosol carrier may be inserted into a receptacle (e.g. a "heating chamber") of an apparatus for initiating and maintaining release of an aerosol from the aerosol carrier. Another end, or another end portion, of the aerosol carrier may protrude from the apparatus and can be inserted into the mouth of a user for the inhalation of aerosol released from the aerosol carrier cartridge during operation of the apparatus.

Hereinafter, and for convenience only, "system for aerosol delivery" shall be referred to as "aerosol delivery system".

Referring now to Figure 1, there is illustrated a perspective view of an aerosol delivery system 10 comprising an aerosol generation apparatus 12 operative to initiate and maintain release of aerosol from a fluid-transfer article in an aerosol carrier 14. In the arrangement of Figure 1, the aerosol carrier 14 is shown with a first end 16 thereof and a portion of the length of the aerosol carrier 14 located within a receptacle of the apparatus 12. A remaining portion of the aerosol carrier 14 extends out of the receptacle. This remaining portion of the aerosol carrier 14, terminating at a second end 18 of the aerosol carrier, is configured for insertion into a user's mouth. A vapour and/or aerosol is produced when a heater (not shown in Figure 1) of the apparatus 12 heats a fluid-transfer article in the aerosol carrier 14 to release a vapour and/or an aerosol, and this can be delivered to the user, when the user sucks or inhales, via a fluid passage in communication with an outlet of the aerosol carrier 14 from the fluid-transfer article to the second end 18.

The device 12 also comprises air-intake apertures 20 in the housing of the apparatus 12 to provide a passage for air to be drawn into the interior of the apparatus 12 (when the user sucks or inhales) for delivery to the first end 16 of the aerosol carrier 14, so that the air can be drawn across an activation surface of a fluid-transfer article located within a housing of the aerosol carrier cartridge 14 during use. Optionally, these apertures may be perforations in the housing of the apparatus 12.

A fluid-transfer article (not shown in Figure 1, but described hereinafter with reference to subsequent drawings) is located within a housing of the aerosol carrier 14. The fluid-transfer article contains an aerosol precursor material, which may include at least one of: nicotine; a nicotine precursor material; a nicotine compound; and one or more flavourings. The fluid-transfer article is located within the housing of the aerosol carrier 14 to allow air drawn into the aerosol carrier 14 at, or proximal, the first end 16 to flow across an activation surface of the fluid-transfer article. As air passes across the activation surface of the fluid-transfer article, an aerosol may be entrained in the air stream from a substrate forming the fluid-transfer article, e.g. via diffusion from the substrate to the air stream and/or via vaporisation of the aerosol precursor material and release from the fluid-transfer article under heating.

The substrate forming the fluid-transfer article 34 comprises a porous material where pores of the porous material hold, contain, carry, or bear the aerosol precursor material. In particular, the porous material of the fluid-transfer article may be a polymeric wicking material such as, for example, a sintered material. Particular examples of material suitable for the fluid-transfer article include: Polyetherimide (PEI); Polytetrafluoroethylene (PTFE); Polyether ether ketone (PEEK); Polyimide (PI); Polyethersulphone (PES); and Ultra-High Molecular Weight Polyethylene. Other suitable materials may comprise, for example, BioVyonTM (by Porvair Filtration Group Ltd) and materials available from Porex®. Further optionally, a substrate forming the fluid-transfer article may comprise Polypropylene (PP) or Polyethylene Terephthalate (PET). All such materials may be described as heat resistant polymeric wicking material in the context of the present invention.

The aerosol carrier 14 is removable from the apparatus 12 so that it may be disposed of when expired. After removal of a used aerosol carrier 14, a replacement aerosol carrier 14 can be inserted into the apparatus 12 to replace the used aerosol carrier 14.

Figure 2 is a cross-sectional side view illustration of a part of apparatus 12 of the aerosol delivery system 10. The apparatus 12 comprises a receptacle 22 in which is located a portion of the aerosol carrier 14. In one or more optional arrangements, the receptacle 22 may enclose the aerosol carrier 14. The apparatus 12 also comprises a heater 24, which opposes an activation surface of the fluid-transfer article (not shown in Figure 2) of the aerosol carrier 14 when an aerosol carrier 14 is located within the receptacle 22.

Air flows into the apparatus 12 (in particular, into a closed end of the receptacle 22) via air-intake apertures 20. From the closed end of the receptacle 22, the air is drawn into the aerosol carrier 14 (under the action of the user inhaling or sucking on the second end 18) and expelled at the second end 18. As the air flows into the aerosol carrier 14, it passes across the activation surface of the fluid-transfer article. Heat from the heater 24, which opposes the activation surface of the fluid-transfer article, causes vaporisation of aerosol precursor material at the activation surface of the fluid-transfer article and an aerosol is created in the air flowing over the activation surface. Thus, through the application of heat in the region of the activation surface of the fluid-transfer article, an aerosol is released, or liberated, from the fluid-transfer article, and is drawn from the material of the aerosol carrier unit by the air flowing across the activation surface and is transported in the air flow via outlet conduits (not shown in Figure 2) in the housing of the aerosol carrier 14 to the second end 18. The direction of air flow is illustrated by arrows in Figure 2.

To achieve release of the captive aerosol from the fluid-transfer article, the fluid-transfer article of the aerosol carrier 14 is heated by the heater 24. As a user sucks or inhales on second end 18 of the aerosol carrier 14, the aerosol released from the fluid-transfer article and entrained in the air flowing across the activation surface of the fluid-transfer article is drawn through the outlet conduits (not shown) in the housing of the aerosol carrier 14 towards the second end 18 and onwards into the user's mouth.

Turning now to Figure 3, a cross-sectional side view of the aerosol delivery system 10 is schematically illustrated showing the features described above in relation to Figures 1 and 2 in more detail. As can be seen, apparatus 12 comprises a housing 26, in which are located the receptacle 22 and heater 24. The housing 26 also contains control circuitry (not shown) operative by a user, or upon detection of air and/or vapour being drawn into the device 12 through air-intake apertures 20, i.e. when the user sucks or inhales. Additionally, the housing 26 comprises an electrical energy supply 28, for example a battery. Optionally, the battery comprises a rechargeable lithium ion battery. The housing 26 also comprises a coupling 30 for electrically (and optionally mechanically) coupling the electrical energy supply 28 to control circuitry (not shown) for powering and controlling operation of the heater 24.

Responsive to activation of the control circuitry of apparatus 12, the heater 24 heats the fluid-transfer article (not shown in Figure 3) of aerosol carrier 14. This heating process initiates (and, through continued operation, maintains) release of vapour and/or an aerosol from the activation surface of the fluid-transfer article. The vapour and/or aerosol formed as a result of the heating process is entrained into a stream of air being drawn across the activation surface of the fluid-transfer article (as the user sucks or inhales). The stream of air with the entrained vapour and/or aerosol passes through the aerosol carrier 14 via outlet conduits (not shown) and exits the aerosol carrier 14 at the second end 18 for delivery to the user. This process is briefly described above in relation to Figure 2, where arrows schematically denote the flow of the air stream into the device 12 and through the aerosol carrier 14, and the flow of the air stream with the entrained vapour and/or aerosol through the aerosol carrier cartridge 14.

Figures 4 to 7 schematically illustrate the aerosol carrier 14 in more detail (and, in Figures 5 to 7, features within the receptacle in more detail). Figure 5 illustrates internal components of the aerosol carrier 14 in one configuration at one temperature, and Figures 6 and 7 illustrate internal components of the aerosol carrier 14 in another configuration at another temperature.

Fig. 4 illustrates the exterior of the aerosol carrier 14, which comprises housing 32 for housing said fluid-transfer article (not shown) and at least one other internal component. The particular housing 32 illustrated in Figure 4 comprises a tubular member, which may be generally cylindrical in form, and which is configured to be received within the receptacle of the apparatus. First end 16 of the aerosol carrier 14 is for location to oppose the heater of the apparatus, and second end 18 (and the region adjacent the second end 18) is configured for insertion into a user's mouth.

Figures 5 to 7 illustrate some internal components of the aerosol carrier 14 and of the heater 24 of apparatus 12.

As described above, the aerosol carrier 14 comprises a fluid-transfer article 34. Optionally, there may be a conduction element 36 (as shown in Figure 5) being part of the heater 24. In one or more arrangements, the aerosol carrier 14 is located within the receptacle of the apparatus such that the activation surface of the fluid-transfer article opposes the heater of the apparatus and receives heat directly from the heater of the apparatus. When aerosol carrier 14 is located within the receptacle of the apparatus such that the activation surface 35 of the fluid-transfer article is located to oppose the heater 24 of the apparatus, the conduction element 36 is disposed between the rest of the heater 24 and the activation surface of the fluid-transfer article. Heat may be transferred to the activation surface via conduction through conduction element 36 (i.e. application of heat to the activation surface is indirect).

Further components not shown in Figures 5 to 7 comprise: an inlet conduit, via which air can be drawn into the aerosol carrier 14; an outlet conduit, via which an air stream entrained with aerosol can be drawn from the aerosol carrier 14; a filter element; and a reservoir for storing aerosol precursor material and for providing the aerosol precursor material to the fluid-transfer article 34.

In Figures 5 to 7, the aerosol carrier is shown as comprising the fluid-transfer article 34 located within a housing 32. The fluid transfer article 34 comprises a first region 34a holding an aerosol precursor. In one or more arrangements, the first region of 34a of the fluid transfer article 34 comprises a reservoir for holding the aerosol precursor. The first region 34a can be the sole reservoir of the aerosol carrier 14, or it can be arranged in fluid communication with a separate reservoir, where aerosol precursor is stored for supply to the first region 34a. As shown in Figures 5 to 7, the material forming the first region of 34a comprises a porous structure, whose pore diameter size varies between one end of the first region 34a and another end of the first region 34a. In the illustrated examples of Figures 5 to 7, the pore diameter size decreases from a first end remote from heater 24 (the upper end is as shown in the figure) to a second end. Although the figure illustrates the pore diameter size changing in a step-wise manner (i.e. a first part with pores having a diameter of first size, and a second part with pores having a diameter of second, smaller size), the change in pore size in the first region 34a may be gradual rather than step-wise. This configuration of pores having a decreasing diameter size can provide a wicking effect, which can serve to draw fluid through the first region 34a, towards heater 24.

The fluid transfer article 34 also comprises a second region 34b. Aerosol precursor is drawn from the first region of 34a to the second region 34b by the wicking effect of the material forming the first region of 34a. Thus, the first region 34a is configured to transfer the aerosol precursor to the second region 34b of the article 34. The second region 34b terminates in an activation surface 35, which is the surface facing the heater 24.

The second region 34b may itself comprise a porous structure. It is then preferable that the pore diameter size of the porous structure of the second region 34b is smaller than the pore diameter size of the immediately adjacent part of the first region 34a.

The first region 34a of the fluid transfer article need not be of porous polymer material as described above. It may instead be a simple hollow reservoir filled with liquid aerosol precursor. The liquid aerosol precursor will then pass directly from the first region 34a to the second region 34b. Similarly, the second region 34b, need not be of porous polymer material. Instead, it may be of any material with a 'wicking' action which will transfer aerosol precursor from the first region 34a to the activation surface 35, for example a fibrous wick.

Figure 5 then illustrates the configuration of the device at a first temperature, such as room temperature. As shown in Figure 5, in this configuration the heater 24 occupies a position such that conduction element 36 is in contact, or immediately adjacent, the activation surface 35 of the second region 34b, and there is a gap 41 between the heater 24 and the coupling 30. The housing 32 has an opening 38 therein, which may receive air from the apertures 20, and another opening 39 leading to a duct 40 within the housing 32, which duct 40 leads to the second upstream end 18 of the aerosol carrier 14. Thus, in the position shown in Figure 5, air can pass from the apertures 20 through the opening 38 into the gap 37 between the heater 24 and the coupling 30 and from the gap 41 through the opening 38 into the duct 40 and hence to the second end 18. That air flow is obstructed by the heater 24 from reaching the activation surface 35.

In the position shown in Figure 5, the parts of the periphery of the heater 24 visible in the Figure are not attached to the housing 32, and are free to move. On the other hand, the parts of the periphery of the heater 24 perpendicular to the view of Figure 5 are attached to the housing 32, or to a mechanical barrier or seating adjacent the housing 32, to hold those parts of the periphery of the heater 24 in place.

When the heater 24 is activated, it will heat up. The materials of the heater 24, including the conduction element 36, are chosen so that they expand under such heating, and so the heater 24, including the conduction element 36, will deform as part of its periphery is held in position and part is free to move. In particular, the heater 24 will deform from the position shown in Figure 5 to the position shown in Figure 6, with the view of Figure 6 being perpendicular to the view of Figure 5. The effect of this deformation is to create a space 42 between the conduction element 36 and the activation surface 35, which space 42 is in communication with the openings 38 and 39 (the openings not being visible in Figure 6). Thus, space 42 now forms part of an air-flow pathway between the openings 38 and 39, which air-flow pathway passes between the activation surface 35 and the conduction element 36.

Figure 6 illustrates how, because parts of the periphery of the heater 24 are held in place due to their attachment to the housing 32 or by a mechanical barrier or seating, the heater 24 adopts a domed shape perpendicular to the view in Figure 5. Figure 7 shows a view perpendicular to Figure 6, to illustrate that the space 42 communicates with the openings 38 and 39. Thus, the movement of the heater between the position shown in Figure 5, and the position shown in Figures 6 and 7, has the effect of unblocking, or removing the obstruction from, the air-flow pathway extending between the opening 38 and the opening 39 which passes between the activation surface 35 and the conduction element 36 of the heater 24. In the obstructed position of Figure 5, the heater 24 prevents aerosol precursor reaching any air flowing between the openings 38 and 39, whereas in the position shown in Figures 6 and 7, the activation surface 35 is exposed to air flowing between the openings 38 and 39.

When the device is not being used, and the heater 24 is in the position shown in Figure 5, aerosol precursor will pass to the activation surface 35, and be deposited on the heater 24 if there is any clearance between the conduction element 36 and the activation surface 35, or at least be in contact with the conduction element 36 if there is no such clearance, and the conduction element 36 is in contact with the activation surface 35. When the device is in use, and the heater heats up, such aerosol precursor at the activation surface, or on the conduction element 36, will be heated by the heat generated by the heater 24, and vaporised in the space 42. That vapour, or a mixture of aerosol and vapour, will then mix with air flowing between the openings 38 and 39 through the space 42 as the user draws on the mouthpiece at end 18, and air and the vapour or mixture of vapour and aerosol will pass through the opening 39, and through the duct 40, to the end 18, and hence to the user.

Thus, droplets of aerosol precursor will be transferred from the second part 34b of the fluid transfer article to the conduction element 36, and move away from the activation surface 35 as the heater 24 changes from the position shown in Figure 5 to the position shown in Figures 6 and 7. Those droplets of aerosol precursor will then be wholly or partially vaporised by the elevated temperature of the conduction element 36, with additional aerosol precursor passing from the activation surface 35 into the space 42 also being vaporised. In practice, aerosol precursor may “pool” in the space 42, until it is vaporised, although the amount of aerosol precursor which is on the conduction element 36 or in the space 42 is preferably determined so that substantially all of it will be vaporised when the heater 24 is active.

Thus, the configuration of the second region 34b of the fluid transfer article may be chosen so as to deposit a specific amount of aerosol precursor on the conduction element 36 when the conduction element 36 is in the position shown in Figure 5, to ensure consistent amounts of vapour and/or a mixture of vapour and aerosol getting in to the air flow.

Once the user desists to inhale or suck, the air flow will stop. The heater may be allowed to cool in this state, to return to the position shown in Figure 5 from the position shown in Figure 6 so that there is a cyclic operation with the air-flow pathway between the activation surface 35 and the conduction element 36 being closed or open (obstructed or un-obstructed) through a cycle of inhalations by the user. Alternatively, the heater 24 may remain heated between inhalations by the user, with the space 42 being filled with vaporised aerosol precursor between inhalations.

The materials of the heater 24, including the conduction element 36, are preferably chosen such that their thermal expansion is consistent, allowing there to be a known relationship between the temperature of the heater 24 and the distance the central part of the heater 24 moves away from the activation surface 35. In this way, the distance between the activation surface 35 and the conduction element 36, and hence the size of the air-flow pathway between the activation surface 35 and conduction element 36, can be chosen to achieve a satisfactory volumetric flow rate when the user inhales. Attachment of parts of the periphery of the heater 24 to the casing 32, and the non-attachment of other parts of the periphery, allows the heater to “dome” as illustrated in Figure 6, to open or un-obstruct the air-flow pathway between the activation surface 35 and the conduction element 36.

As noted above, the conduction element 36 may be absent in some arrangements, in which case the second part 34b of the fluid transfer article will receive heat directly from the heater 24.

Also, in the arrangements of Figures 5 to 7, the whole of the heater 24 deforms as the temperature changes. It may be possible to have an arrangement in which only part of the heater, such as the conduction element 36, deforms as the temperature changes. In general, it is the heating surface of the heater which must deform to allow air to reach the space 42 between the activation surface 35 and the heater 24.

The conduction element 36, if present, may comprise a thin film of thermally conductive material, such as, for example, a metal foil (for example, aluminium, brass, copper, gold, steel, silver, or an alloy comprising anyone of the foregoing together with thermally conductive plastics and/or ceramics).

In the illustrative examples of Figures 5 to 7, the first region 34a of the fluid-transfer article 34 is located at an "upstream" end of the fluid-transfer article 34 and the second region 34b is located at a downstream" end of the fluid-transfer article 34. That is, aerosol precursor is wicked, or is drawn, from the "upstream" end of the fluid-transfer article 34 to the "downstream" end of the fluid-transfer article 34 (as denoted by arrow A in Figure 5).

In the arrangement shown in Figures 5 to 7, the apertures 38, 39 are on opposite sides of the housing 32. Figures 8 and 9 show an alternative configuration, in which the fluid-transfer article is annular. In Figures 8 and 9, the heater 24, including the conduction element 36, is illustrated in a position corresponding to that shown in Figures 6 and 7, where the conduction element 36 is spaced from the activation surface 35. This enables the air flow in the apparatus to be illustrated. However, as in the arrangement of Figures 5 to 7, when the heater is cool, the heater 24 will move, so that the conduction element 36 is in contact with, or is immediately adjacent, the activation surface 35. The deformation of the heater 24 may have to be slightly greater than in Figure 5, to ensure that it contacts, or is immediately adjacent, the activation surface 35, which itself is annular due to the annular configuration of the second part 34b of the fluid transfer article. The operation of the embodiment of Figures 8 and 9 is otherwise similar to that of the embodiments of Figures 5 to 7.

Thus, Figures 8 and 9 illustrate an aerosol carrier 14 according to one or more possible arrangements in more detail. Figure 8 is a cross-section side view illustration of the aerosol carrier 14 and Figure 9 is a perspective cross-section side view illustration of the aerosol carrier 14.

As can be seen from Figures 8 and 9, the aerosol carrier 14 is generally tubular in form. The aerosol carrier 14 comprises housing 32, which defines the external walls of the aerosol carrier 14 and which defines therein a chamber in which are disposed the fluid-transfer article 34 (adjacent the first end 16 of the aerosol carrier 14) and internal walls defining the fluid communication pathway 48. Fluid communication pathway 48 defines a fluid pathway for an outgoing air stream from the channels 40 to the second end 18 of the aerosol carrier 14. In the examples illustrated in Figures 8 and 9, the fluid-transfer article 34 is an annular shaped element located around the fluid communication pathway 48.

In walls of the housing 32, there are provided inlet apertures 50 to provide a fluid communication pathway for an incoming air stream to reach the fluid-transfer article 34, and particularly the one or more channels 40 defined between the activation surface of the fluid-transfer article 34 and the conduction element 36 (or between the activation surface and the 15 heater).

In the illustrated example of Figures 8 and 9, the aerosol carrier 14 further comprises a filter element 52. The filter element 52 is located across the fluid communication pathway 48 such that an outgoing air stream passing through the fluid communication pathway 48 passes through the filter element 52.

With reference to Figure 8, when the heater is activated and a user sucks on a mouthpiece of the apparatus (or on the second end 18 of the aerosol carrier 14, if configured as a mouthpiece), air is drawn into the carrier through inlet apertures 50 extending through walls in the housing 32 of the aerosol carrier 14. On activation of the heater, the conduction element 36 will deform to move clear of the activation surface 35. There is thus, as in other embodiments, an air-flow pathway defined between the activation surface 35 and the conduction element 36. An incoming air stream 42a from a first side of the aerosol carrier 14 is directed to a first side of the second part 34b of the fluid-transfer article 34 (e.g. via a gas communication pathway within the housing of the carrier). An incoming air stream 42b from a second side of the aerosol carrier 14 is directed to a second side of the second part 34b of the fluid-transfer article 34 (e.g. via a gas communication pathway within the housing of the carrier).

When the incoming air stream 42a from the first side of the aerosol carrier 14 reaches the first side of the second part 34b, the incoming air stream 42a from the first side of the aerosol carrier 14 flows between the second part 34b and the conduction element 36 (or between the second part 34b and heater 24 in arrangements where the conduction element 36 is absent). Likewise, when the incoming air stream 42b from the second side of the aerosol carrier 14 reaches the second side of the second part 34a, the incoming air stream 42b from the second side of the aerosol carrier 14 flows between the second part 34a and the conduction element 36 (or between the second part 34b and heater 24). The air streams from each side flowing are denoted by dashed lines 44a and 44b in Figure 9.

As these air streams 44a and 44b flow, aerosol precursor on the conduction element 36 (or on the heater 24) is entrained in air streams 44a and 44b. In use, the heater 24 of the apparatus 12 should raise a temperature of the conduction element 36 to a sufficient temperature to release, or liberate, captive substances (i.e. the aerosol precursor) to form a vapour and/or aerosol, which is drawn downstream. As the air streams 44a and 44b continue their passages, more released aerosol precursor is entrained within the air streams 44a and 44b. When the air streams 44a and 44b entrained with aerosol precursor meet at a mouth of the outlet fluid communication pathway 48, they enter the outlet fluid communication pathway 48 and continue until they pass through filter element 52 and exit outlet fluid communication pathway 48, either as a single outgoing air stream, or as separate outgoing air streams 46 (as shown). The outgoing air streams 46 are directed to an outlet, from where it can be inhaled by the user directly (if the second end 18 of the aerosol capsule 14 is configured as a mouthpiece), or via a mouthpiece. The outgoing air streams 46 entrained with aerosol precursor are directed to the outlet (e.g. via a gas communication pathway within the housing of the carrier).

Turning now to consider figures 10 to 19, an alternative proposal for the apparatus of the system for aerosol delivery will now be described. It is to be appreciated that the alternative apparatus of figures 10 to 19 shares several components with the apparatus described above, and is intended to be used with the same general configuration of carrier 14 described above and shown in Figure 4. Details of the carrier 14 will therefore not be described again in detail. Parts corresponding to those in Figures 1 to 9 are indicated by the same reference numerals.

In Figures 10 and 11, the heater 24 is connected via a linkage 60 to a bi-metallic element 62. One end 64 of the bi-metallic element 62 is free to move, whilst the other end 66 is held by a mounting 68 which maintains a fixed relationship with the housing 32. The bi-metallic element 62 is mounted proximate the heater 24 so that it receives heat from the heater 24 when the heater 24 is active. In this arrangement it is preferable that the linkage 60 is adapted to conduct heat from the heater 24 to the bi-metallic element 62, so that it acts as a conduction path for heat. Additional heat will reach the bi-metallic element 62 from the heater 24 by radiation or convection.

Figure 10 shows the position of the heater 24 when the heater is not activated (e.g. when the bi-metallic element 62 is at room or ambient temperature). When in this position, the conduction element 36 is in contact with the activation surface 35. However, when the heater 24 becomes activated to generate heat, that heat is transferred from the heater 24 to the bi-metallic element 62 (possibly via the linkage 60, if provided) and the bi-metallic element 62 deforms to the position shown in Figure 11 (deforming occurred downwardly in the drawing). Since the mounting 68 is fixed with respect to the housing 32 and thus is also fixed with respect to the fluid-transfer article 34, the end 64 of the bi-metallic element 62 moves away from the fluid-transfer article 34, thereby moving the heater 24, and hence moving the conduction element 36 away from the activation surface 35.

Figures 10 and 11 also illustrate an opening 38 in the housing 32, which opening 38 is in communication with the air-intake apertures 20. A further opening 39 communicates with a duct 40 within the housing 32, which duct 40 communicates with the second end 18.

There is thus a fluid-flow path for air (hereinafter referred to as an air-flow pathway) between openings 38 and 39, linking the apertures 20 and the second end 18 of the aerosol carrier. In the arrangement shown in Figure 10, that air-flow pathway is blocked by the conduction element 36, due to its contact with the activation surface 35. However, when the heater 24 is activated, and deflection of the bi-metallic element 62 causes it to move from the position shown in Figure 5 to the position shown in Figure 11, the conduction element 36 is moved away from the activation surface 35, thereby unblocking the air-flow pathway between openings 38 and 39. Then, when the user sucks or inhales, air is drawn along the air-flow pathway.

As the conduction element 36 moves away from the activation surface 35, one or more droplets of the aerosol precursor will be deposited on the conduction element 36 and will be heated, to release vapour or a mixture of aerosol and vapour from the conduction element 36 into the air flowing in the air-flow pathway between the openings 38, 39. The vapour or mixture passes, as the user sucks and inhales, to the second end 18. The configuration of the second region 34b may be chosen so as to deposit a specific amount of liquid on the conduction element 36 each time the conduction element 36 moves from the position shown in Figure 10 to the position shown in Figure 11, to ensure consistent amounts of vapour and/or a mixture of vapour and aerosol getting in to the airflow.

Once the user desists to inhale or suck, and the heater 24 cools, the bi-metallic element 62 will revert back to its substantially straight configuration illustrated in Figure 10 such that the heater will return to the position shown in Figure 10 from the position shown in Figure 11. Hence, the conduction element 36 is brought back into contact with the activation surface 35 when there is no air flow, and the conduction element 36 will at least partially obstruct the end of the fluid-transfer article 34, reducing or preventing leakage of fluid from the fluid-transfer article 34 when the aerosol delivery system is not being actively used by the user.

As noted above, the conduction element 36 may be absent in some arrangements.

The conduction element 36, if present, may comprise a thin film of thermally conductive material, such as, for example, a metal foil (for example, aluminium, brass, copper, gold, steel, silver, or an alloy comprising anyone of the foregoing together with thermally conductive plastics and/or ceramics).

In the illustrative examples of Figures 10 and 11, the first region 34a of the fluid-transfer article 34 is located at an "upstream" end of the fluid-transfer article 34 and the second region 34b is located at a downstream" end of the fluid-transfer article 34. That is, aerosol precursor is wicked, or is drawn, from the "upstream" end of the fluid-transfer article 34 to the "downstream" end of the fluid-transfer article 34 (as denoted by arrow A in Figure 10).

As mentioned above, the conduction element 36 is optional. Figures 12 and 13 illustrate such an arrangement without such an element. Parts corresponding to those in Figures 10 and 11 are indicated by the same reference numerals. Thus, Figures 12 and 13 illustrate an arrangement in which the heater 24 is a single element, extending from the linkage 60, and is moved due to the action of the bi-metallic element 62 from the position shown in Figure 12 in which its upper surface is in contact with the activation surface 35, to the position shown in Figure 13 in which the air-flow pathway between the openings 38 and 39 is unblocked, and passes over the upper surface of the heater 24.

In the arrangements of Figures 10 to 13, the bi-metallic element 62 is held via separate mounting 68. Figures 14 and 15 illustrate an embodiment in which the bi-metallic element 62 is held by the casing 32 itself. Again, parts corresponding to those in Figures 10 to 13 are indicated by the same reference numerals. Thus, in the embodiment of Figures 14 and 15, the bi-metallic element 72 has its ends 74 and 76 in contact with the casing 32 to be held thereby. Again, there is a linkage 70 connecting the bi-metallic element 72 to the heater 24. In this case, the linkage 70 is at a central region of the bi-metallic element 72. Moreover, in this embodiment the heater 24 includes the conduction element 36. Again, this is optional.

When the heater 24 is activated, the bi-metallic element deforms. Since its ends 74 and 76 are fixed to the casing 32, its central part moves, moving the linkage 70 and hence the heater 24. Hence, the heater 24 moves from the position shown in Figure 14 in which the conduction element 36 is in contact with the activation surface 35 to the position shown in Figure 15 in which the conduction element 36 is spaced from the activation surface 35, and air may flow in the air-flow pathway between the openings 38 and 39.

All of the embodiments of Figures 10 to 15 make use of a bi-metallic element to move the heater 24. Figures 16 and 17 illustrate an alternative arrangement, in which there is a drive element 80 connected via a linkage 82 to the heater 24. A heat sensor 84 is also in contact with the heater 24. When that sensor 84 detects that the heater 24 is activated and heated, it sends a signal to the drive element 80 which activates the drive element 80 to move the linkage 82 away from the fluid-transfer article 34. Thus, when the sensor 84 detects that the heater 24 is activated, the drive element 80 moves the linkage 82 which moves the heater 24 away from the fluid-transfer article. When no heat is detected by the sensor 84 the apparatus is in the position shown in Figure 16, in which the conduction element 36 of the heater 24 is in contact with the activation surface 35. When the heater 24 is active, the drive element 80 causes it to adopt the position shown in Figure 17, in which the conduction element 36 is spaced from the activation surface 35, allowing air to pass along the air-flow pathway between the openings 38 and 39. This embodiment is otherwise the same as the embodiments of Figures 10 to 15. Again, the conduction element 36 is optional.

In the arrangements shown in Figures 10 to 17, the apertures 38, 39 are on opposite sides of the housing 32. Figures 18 and 19 show an alternative configuration, in which the fluid-transfer article 34 is annular, and the second part 34b is then in the form of annular diaphragm. In Figures 18 and 19, the heater 24 is illustrated in a position corresponding to that shown in Fig 11, where it is spaced from the activation surface 35. This enables the air flow in the apparatus to be illustrated. However, as in the arrangements of Figures 10 to 17, when the heater 24 is not activated, it takes up a position in which the conduction element 36 is in contact with the activation surface 35, that contact being itself annular. For simplicity, the arrangements for moving the heater 24 are not shown in Figures 18 and 19. In the arrangements of Figures 10 to 17, or indeed other arrangements, may be usual. Thus, Figures 18 and 19 illustrate an aerosol carrier 14 according to one or more possible arrangements in more detail. Figure 18 is a cross-section side view illustration of the aerosol carrier 14 and Figure 19 is a perspective cross-section side view illustration of the aerosol carrier 14.

As can be seen from Figures 18 and 19, the aerosol carrier 14 is generally tubular in form. The aerosol carrier 14 comprises housing 32, which defines the external walls of the aerosol carrier 14 and which defines therein a chamber in which are disposed the fluid-transfer article 34 (adjacent the first end 16 of the aerosol carrier 14) and internal walls defining the fluid communication pathway 48. Fluid communication pathway 48 defines a fluid pathway for an outgoing air stream from the channels 40 to the second end 18 of the aerosol carrier 14. In the examples illustrated in Figures 18 and 19, the fluid-transfer article 34 is an annular shaped element located around the fluid communication pathway 48.

In walls of the housing 32, there are provided inlet apertures 50 to provide a fluid communication pathway for an incoming air stream to reach the fluid-transfer article 34, and particularly the one or more channels 40 defined between the activation surface of the fluid-transfer article 34 and the conduction element 36 (or between the activation surface and the 15 heater).

In the illustrated example of Figures 18 and 19, the aerosol carrier 14 further comprises a filter element 52. The filter element 52 is located across the fluid communication pathway 48 such that an outgoing air stream passing through the fluid communication pathway 48 passes through the filter element 52.

With reference to Figure 19, when the heater 24 is active and a user sucks on a mouthpiece of the apparatus (or on the second end 18 of the aerosol carrier 14, if configured as a mouthpiece), air is drawn into the carrier through inlet apertures 50 extending through walls in the housing 32 of the aerosol carrier 14. As in the embodiments of Figures 10 to 17 the heating of the heater 24 causes the heater 24 to move to a position in which the activation surface 35 is separated from the conduction element 36 and an air-flow pathway, passing between the conduction element 36 and the activation surface is open.

An incoming air stream 42a from a first side of the aerosol carrier 14 is directed to a first side of the second part 34b of the fluid-transfer article 34 (e.g. via a gas communication pathway within the housing of the carrier). An incoming air stream 42b from a second side of the aerosol carrier 14 is directed to a second side of the second part 34a of the fluid-transfer article 34 (e.g. via a gas communication pathway within the housing of the carrier). When the incoming air stream 42a from the first side of the aerosol carrier 14 reaches the first side of the second part 34b, the incoming air stream 42a from the first side of the aerosol carrier 14 flows between the second part 34b and the conduction element 36 (or between the second part 34b and heater 24). Likewise, when the incoming air stream 42b from the second side of the aerosol carrier 14 reaches the second side of the second part 34a, the incoming air stream 42b from the second side of the aerosol carrier 14 flows between the second part 34a and the conduction element 36 (or between the second part 34b and heater 24). The air streams from each side are denoted by dashed lines 44a and 44b in Figure 19. As these air streams 44a and 44b flow, aerosol precursor on the conduction element 36 (or on the heater 24) is entrained in air streams 44a and 44b. In use, the heater 24 of the apparatus 12 to raise a temperature of the conduction element 36 to a sufficient temperature to release, or liberate, captive substances (i.e. the aerosol precursor) to form a vapour and/or aerosol, which is drawn downstream. As the air streams 44a and 44b continue their passages, more released aerosol precursor is entrained within the air streams 44a and 44b. When the air streams 44a and 44b entrained with aerosol precursor meet at a mouth of the outlet fluid communication pathway 48, they enter the outlet fluid communication pathway 48 and continue until they pass through filter element 52 and exit outlet fluid communication pathway 48, either as a single outgoing air stream, or as separate outgoing air streams 46 (as shown). The outgoing air streams 46 are directed to an outlet, from where it can be inhaled by the user directly (if the second end 18 of the aerosol capsule 14 is configured as a mouthpiece), or via a mouthpiece. The outgoing air streams 46 entrained with aerosol precursor are directed to the outlet (e.g. via a gas communication pathway within the housing of the carrier).

Turning now to consider figures 20 to 27, another alternative proposal for the apparatus of the system for aerosol delivery will now be described. It is to be appreciated that the alternative apparatus of figures 20 to 27 shares several components with the apparatuses described above, and is intended to be used with the same general configuration of carrier 14 described above and shown in Figure 4. Details of the carrier 14 will therefore not be described again in detail. Parts corresponding to those in Figures 1 to 19 are indicated by the same reference numerals.

In Figures 20 and 21, the heater 24 is mounted on a resilient element 90. That resilient element 90 may be e.g. a spring such as a coil spring, or may be a resilient block. The resilient element 90 biases the heater 24 towards the position shown in Figure 20, in which the conduction element 36 is in contact with the activation surface 35.

Figures 20 and 21 also illustrate an opening 38 in the housing 32, which opening 38 is in communication with the air-intake apertures 20. A further opening 39 communicates with a duct 40 within the housing 32, which duct 40 communicates with the second end 18.

There is thus a fluid-flow path for air (hereinafter referred to as an air-flow pathway) between openings 38 and 39, linking the apertures 20 and the second end 18 of the aerosol carrier. In the arrangement shown in Figure 20, that air-flow pathway is blocked by the conduction element 36, due to its contact with the activation surface 35.

However, when the user inhales or sucks, air is caused to move between the openings 38 and 39, causing an air pressure which acts against the biasing means to move the conduction element 36, and hence the rest of the heater, away from the activation surface 35. The heater 24 thus moves to the position shown in Figure 21, against the biasing force of the biasing element 90, in which the air-flow pathway between the openings 38 and 39 is unblocked. Thus, air can be drawn along the air-flow pathway through the duct 40 to the user. As can be appreciated, the biasing of the heater 24 into the position shown in Figure 20 needs to be sufficiently strong to hold it in that position, but not so strong that it will prevent air flow moving the heater to the position shown in Figure 21.

As the conduction element 36 moves away from the activation surface 35, one or more droplets of the aerosol precursor will be deposited on the conduction element 36 and heated, to release vapour or a mixture of aerosol and vapour from the conduction element 36 into the air flowing in the air-flow pathway between the openings 38, 39. The vapour or mixture passes, as the user sucks and inhales, to the second end 18. The configuration of the second region 34b may be chosen so as to deposit a specific amount of liquid on the conduction element 36 each time the conduction element 36 moves from the position shown in Figure 20 to the position shown in Figure 21, to ensure consistent amounts of vapour and/or a mixture of vapour and aerosol getting in to the airflow.

Once the user desists to inhale or suck, the flow of air between openings 38 and 39 will stop and the heater will return to the position shown in Figure 20 from the position shown in Figure 21 under the biasing influence of the biasing element 90. Hence, the activation surface 35 moves back in to contact with the conduction element 36 when there is no air flow, and the conduction element 36 will at least partially obstruct the end of the fluid-transfer article 34, reducing or preventing leakage of fluid from the fluid-transfer article 34 when the aerosol delivery system is not being actively used by the user.

As noted above, the conduction element 36 may be absent in some arrangements. The conduction element 36, if present, may comprise a thin film of thermally conductive material, such as, for example, a metal foil (for example, aluminium, brass, copper, gold, steel, silver, or an alloy comprising anyone of the foregoing together with thermally conductive plastics and/or ceramics).

In the illustrative examples of Figures 20 and 21, the first region 34a of the fluid-transfer article 34 is located at an "upstream" end of the fluid-transfer article 34 and the second region 34b is located at a downstream" end of the fluid-transfer article 34. That is, aerosol precursor is wicked, or is drawn, from the "upstream" end of the fluid-transfer article 34 to the "downstream" end of the fluid-transfer article 34 (as denoted by arrow A in Figure 20).

As mentioned above, the conduction element 36 is optional. Figures 22 and 23 illustrate an arrangement in which the conduction element 36 is omitted. Parts corresponding to those of the arrangement illustrated in Figures 20 and 21 are indicated by the same reference numerals. Thus, Figures 22 and 23 illustrate an arrangement in which the heater 24 is a single element, extending from the resilient element 90, and which is moved due to air flow along the air-flow pathway from the position shown in Figure 22 in which its upper surface is in contact with the activation surface 35, to the position shown in Figure 23 in which the air-flow pathway between the openings 38 and 39 is unblocked, and passes over the upper surface of the heater 24.

In the arrangement of Figures 20 to 23, the heater 24 is mounted on a resilient element 90, which biases the heater 24 in a upwards direction (in the orientation illustrated) so that its upper surface (which may be formed by the conduction element 36) is in contact with the activation surface 35. Figures 24 and 25 illustrate an arrangement in which the heater 24 is mounted on a hinged element 92 which pivots about a hinge 64. Figure 24 illustrates a configuration in which the hinged element 92 holds the conduction element 36 of the heater 24 in contact with the activation surface 35. This corresponds to e.g. the arrangement shown in Figure 20. When the user sucks or inhales, the flow of air causes the heater 24 to move hingedly to open the air-flow pathway between the openings 38 and 39. The element 92 hinges on the hinge 64 to a position shown in Figure 25 in which air can flow between the openings 38 and 39.

In the arrangements shown in Figures 20 to 25, the apertures 38, 39 are on opposite sides of the housing 32. Figures 26 and 27 show an alternative configuration, in which the fluid-transfer article is annular, and the second part 34b is then in the form of an annular diaphragm. In Figures 26 and 27, the heater 24 is illustrated in a position corresponding to that shown in Fig 21, where it is spaced from the activation surface 35. This enables the air flow in the apparatus to be illustrated. However, as in the arrangements of Figures 20 to 25, when the heater 24 is not activated it takes up a position in which the conduction element 36 is in contact with the activation surface 35, the contact being itself annular. Figures 26 and 27 show an arrangement in which the heater 24 is mounted on a resilient element 90, as in the arrangements of Figures 20 to 23. However, hinged arrangements such as illustrated in Figures 24 and 25 may also be possible. Thus, Figures 26 and 27 illustrate an aerosol carrier 14 according to one or more possible arrangements in more detail. Figure 26 is a cross-section side view illustration of the aerosol carrier 14 and Figure 27 is a perspective cross-section side view illustration of the aerosol carrier 14.

As can be seen from Figures 26 and 27, the aerosol carrier 14 is generally tubular in form. The aerosol carrier 14 comprises housing 32, which defines the external walls of the aerosol carrier 14 and which defines therein a chamber in which are disposed the fluid-transfer article 34 (adjacent the first end 16 of the aerosol carrier 14) and internal walls defining the fluid communication pathway 48. Fluid communication pathway 48 defines a fluid pathway for an outgoing air stream from the channels 40 to the second end 18 of the aerosol carrier 14. In the example illustrated in Figures 26 and 27, the fluid-transfer article 34 is an annular shaped element located around the fluid communication pathway 48.

In walls of the housing 32, there are provided inlet apertures 50 to provide a fluid communication pathway for an incoming air stream to reach the fluid-transfer article 34, and particularly the one or more channels 40 defined between the activation surface of the fluid-transfer article 34 and the conduction element 36 (or between the activation surface and the 15 heater).

In the illustrated example of Figures 26 and 27, the aerosol carrier 14 further comprises a filter element 52. The filter element 52 is located across the fluid communication pathway 48 such that an outgoing air stream passing through the fluid communication pathway 48 passes through the filter element 52.

With reference to Figure 27, when a user sucks on a mouthpiece of the apparatus (or on the second end 18 of the aerosol carrier 14, if configured as a mouthpiece), air is drawn into the carrier through inlet apertures 50 extending through walls in the housing 32 of the aerosol carrier 14. As in the embodiments of Figures 20 to 25 this causes the heater 24 to move to a position in which the activation surface 35 is separated from the conduction element 36 and an air-flow pathway, passing between the conduction element 36 and the activation surface is open.

An incoming air stream 42a from a first side of the aerosol carrier 14 is directed to a first side of the second part 34b of the fluid-transfer article 34 (e.g. via a gas communication pathway within the housing of the carrier). An incoming air stream 42b from a second side of the aerosol carrier 14 is directed to a second side of the second part 34a of the fluid-transfer article 34 (e.g. via a gas communication pathway within the housing of the carrier). When the incoming air stream 42a from the first side of the aerosol carrier 14 reaches the first side of the second part 34b, the incoming air stream 42a from the first side of the aerosol carrier 14 flows between the second part 34b and the conduction element 36 (or between the second part 34b and heater 24). Likewise, when the incoming air stream 42b from the second side of the aerosol carrier 14 reaches the second side of the second part 34a, the incoming air stream 42b from the second side of the aerosol carrier 14 flows between the second part 34a and the conduction element 36 (or between the second part 34b and heater 24). The air streams from each side are denoted by dashed lines 44a and 44b in Figure 27. As these air streams 44a and 44b flow, aerosol precursor on the conduction element 36 (or on the heater 24) is entrained in air streams 44a and 44b. In use, the heater 24 of the apparatus 12 to raise a temperature of the conduction element 36 to a sufficient temperature to release, or liberate, captive substances (i.e. the aerosol precursor) to form a vapour and/or aerosol, which is drawn downstream. As the air streams 44a and 44b continue their passages, more released aerosol precursor is entrained within the air streams 44a and 44b. When the air streams 44a and 44b entrained with aerosol precursor meet at a mouth of the outlet fluid communication pathway 48, they enter the outlet fluid communication pathway 48 and continue until they pass through filter element 52 and exit outlet fluid communication pathway 48, either as a single outgoing air stream, or as separate outgoing air streams 46 (as shown). The outgoing air streams 46 are directed to an outlet, from where it can be inhaled by the user directly (if the second end 18 of the aerosol capsule 14 is configured as a mouthpiece), or via a mouthpiece. The outgoing air streams 46 entrained with aerosol precursor are directed to the outlet (e.g. via a gas communication pathway within the housing of the carrier).

Figure 28 is an exploded perspective view illustration of a kit-of-parts for assembling an aerosol delivery system 10.

In any of the embodiments described above the second part 34b of the fluid transfer article may have a thickness of less than 5mm. In other embodiments it may have a thickness of: less than 3.5mm, less than 3mm, less than 2.5mm, less than 2mm, less than 1.9mm, less than 1.8mm, less than 1.7mm, less than 1.6mm, less than 1.5mm, less than 1.4mm, less than 1.3mm, less than 1.2mm, less than 1.1mm, less than 1mm, less than 0.9mm, less than 0.8mm, less than 0.7mm, less than 0.6mm, less than 0.5mm, less than 0.4mm, less than 0.3mm, less than 0.2mm, or less than 0.1mm.

As will be appreciated, in the arrangements described above, the fluid-transfer article 34 is provided within a housing 32 of the aerosol carrier 14. In such arrangements, the housing of the carrier 14 serves to protect the aerosol precursor-containing fluid-transfer article 34, whilst also allowing the carrier 14 to be handled by a user without his/her fingers coming into contact with the aerosol precursor liquid retained therein. In such arrangements, it will be appreciated that the carrier 14 has a multi-part construction.

The features disclosed in the foregoing description, or in the following claims, or in the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for obtaining the disclosed results, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

While the invention has been described in conjunction with the exemplary embodiments described above, many equivalent modifications and variations will be apparent to those skilled in the art when given this disclosure. Accordingly, the exemplary embodiments of the invention set forth above are considered to be illustrative and not limiting. Various changes to the described embodiments may be made without departing from the spirit and scope of the invention.

For the avoidance of any doubt, any theoretical explanations provided herein are provided for the purposes of improving the understanding of a reader. The inventors do not wish to be bound by any of these theoretical explanations.

Any section headings used herein are for organizational purposes only and are not to be construed as limiting the subject matter described.

Throughout this specification, including the claims which follow, unless the context requires otherwise, the words “have”, “comprise”, and “include”, and variations such as “having”, “comprises”, “comprising”, and “including” will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

It must be noted that, as used in the specification and the appended claims, the singular forms “a,” “an,” and “the” include plural referents unless the context clearly dictates otherwise. Ranges may be expressed herein as from “about” one particular value, and/or to “about” another particular value. When such a range is expressed, another embodiment includes from the one particular value and/or to the other particular value. Similarly, when values are expressed as approximations, by the use of the antecedent “about,” it will be understood that the particular value forms another embodiment. The term “about” in relation to a numerical value is optional and means, for example, +/- 10%.

The words "preferred" and "preferably" are used herein refer to embodiments of the invention that may provide certain benefits under some circumstances. It is to be appreciated, however, that other embodiments may also be preferred under the same or different circumstances. The recitation of one or more preferred embodiments therefore does not mean or imply that other embodiments are not useful, and is not intended to exclude other embodiments from the scope of the disclosure, or from the scope of the claims.

Claims:

1. An aerosol-generation apparatus comprising a heater and a fluid transfer article, the fluid transfer article comprising a first region for holding an aerosol precursor and for transferring said aerosol precursor to an activation surface of a second region of said fluid-transfer article, said activation surface being disposed for thermal interaction with a heating surface of said heater; wherein: at least a part of said heater is moveable between a first position and a second position, at least part of said heating surface being adjacent or in contact with said activation surface when said heater is in said first position, at least part of said heating surface being spaced from said activation surface when said heater is in said second position, whereby an air-flow pathway is defined between said activation surface and said heating surface when said heater is in said second position and said air-flow pathway is at least partially obstructed due to said adjacence or contact between said at least part of heating surface and said activation surface when said heater is in said first position.

2. An aerosol-generation apparatus according to claim 1, wherein: at least a part of said heating surface is deformable in response to a temperature change between a first temperature and a second temperature, said at least a part of the said heating surface being in a first position at the first temperature and a second position at the second temperature, and wherein, in the first position, at least a part of said heating surface is adjacent or in contact with said activation surface such that said at least a part of said heating surface obstructs said air-flow pathway from passing between said at least a part of said heating surface and said activation surface and, in the second position, said at least a part of said heating surface is spaced from said activation surface such that said air-flow pathway passes between said heating surface and said activation surface unobstructed by said at least a part of said heating surface.

3. An aerosol-generation apparatus according to claim 2, wherein said second temperature is higher than said first temperature.

4. An aerosol-generation apparatus according to claim 1, wherein said heater is mounted on a heat activatable movement element, said heat activatable movement element being arranged to move said heater between said first position and said second position, said at least a part of said heating surface being in contact with said activation surface when said heater is in said first position.

5. An aerosol-generation apparatus according to claim 4, wherein said heat activatable movement element is a bi-metallic element.

6. An aerosol-generation element according to claim 5, wherein said bi-metallic element is thermally connected to said heater so as to be heated thereby.

7. An aerosol-generation apparatus according to any one of claims 4 to 6, wherein the heat activatable movement element is arranged to move the heater from the first position to the second position as the temperature of the heat activatable movement member rises.

8. An aerosol-generation apparatus according to claim 1, wherein said heater is arranged such that air flow between said heating surface and said activation surface causes said heater to move to said second position from said first position.

9. An aerosol-generation apparatus according to claim 8, wherein said heater is biased towards said first position.

10. An aerosol-generation element according to claim 8 or claim 9, wherein said heater is biased towards said first position by resilient biasing means.

11. An aerosol-generation apparatus according to any one claims 8 to 10, wherein said heater is mounted on a hinged element so as to be moveable between said first and second positions by pivoting of said hinged element.

12. An aerosol-generation apparatus according to any preceding claim, wherein at least said second region is formed from a polymeric wicking material.

13. An aerosol-generation apparatus according to claim 12, wherein said first and said second regions are both formed from said polymeric wicking material.

14. An aerosol-generation apparatus according to claim 12, or claim 13, wherein said polymeric wicking material is porous.

15. An aerosol-generation apparatus according to claim 14 as dependent on claim 13, wherein said polymeric wicking material is configured such that the pore diameter in said first region is greater than the pore diameter in said second region.

16. An aerosol delivery system comprising an aerosol-generation apparatus according to any preceding claim and a carrier comprising a housing containing said heater and said fluid-transfer article, said housing having an inlet and an outlet, said air-flow pathway extending to said inlet and said outlet.

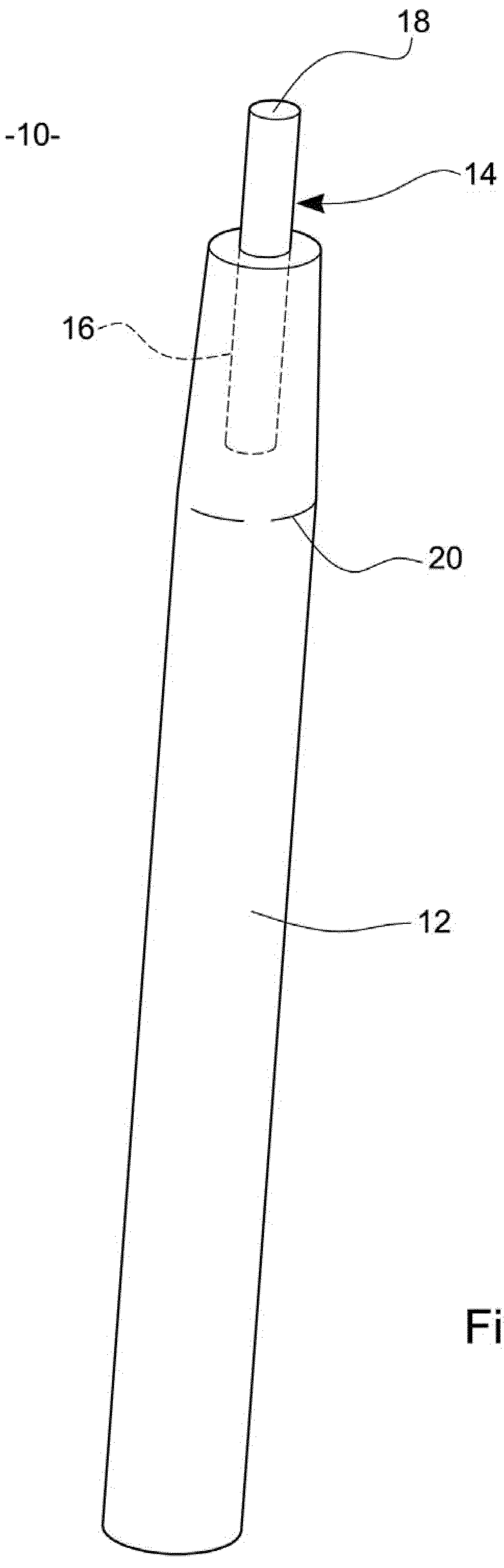

Fig. 1

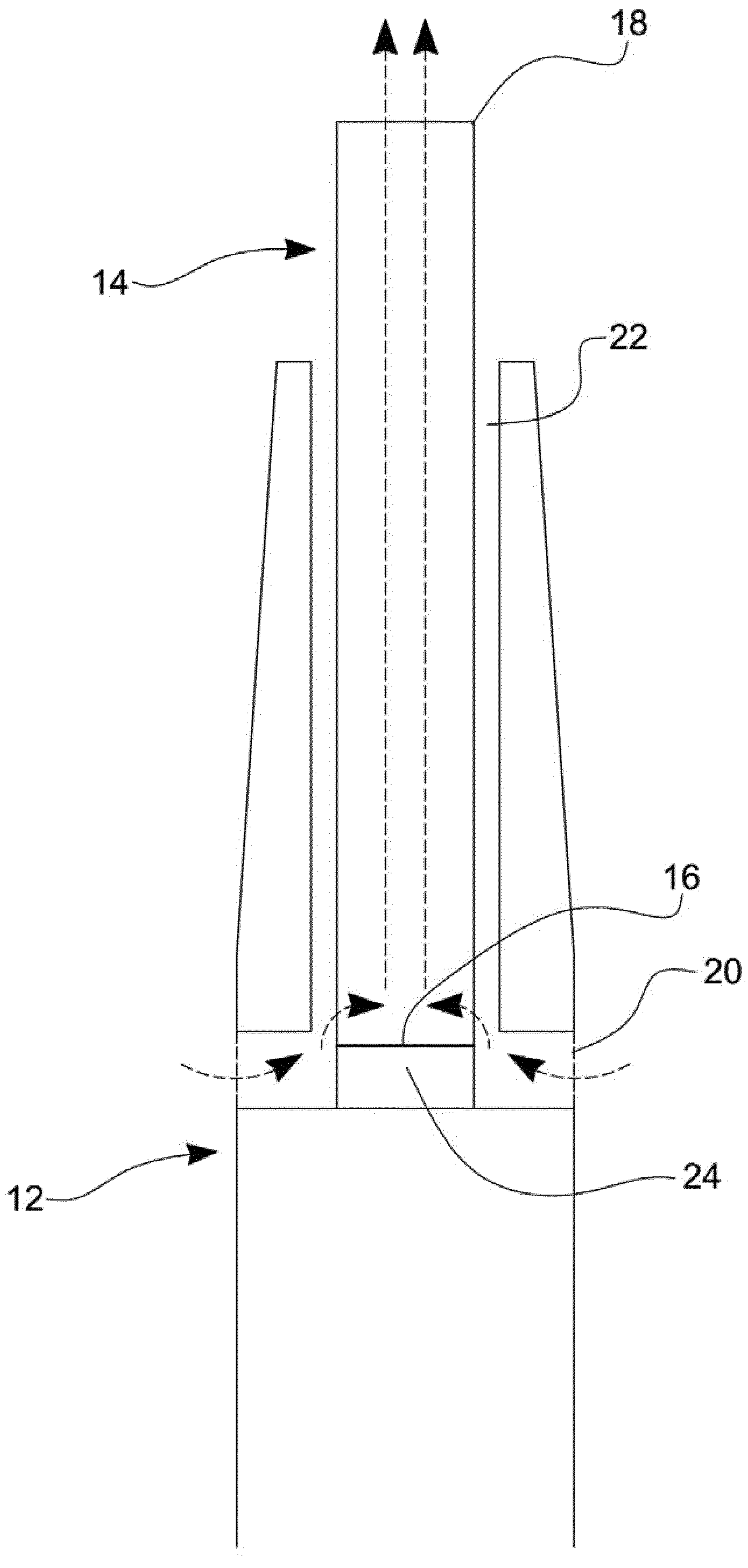

Fig. 2

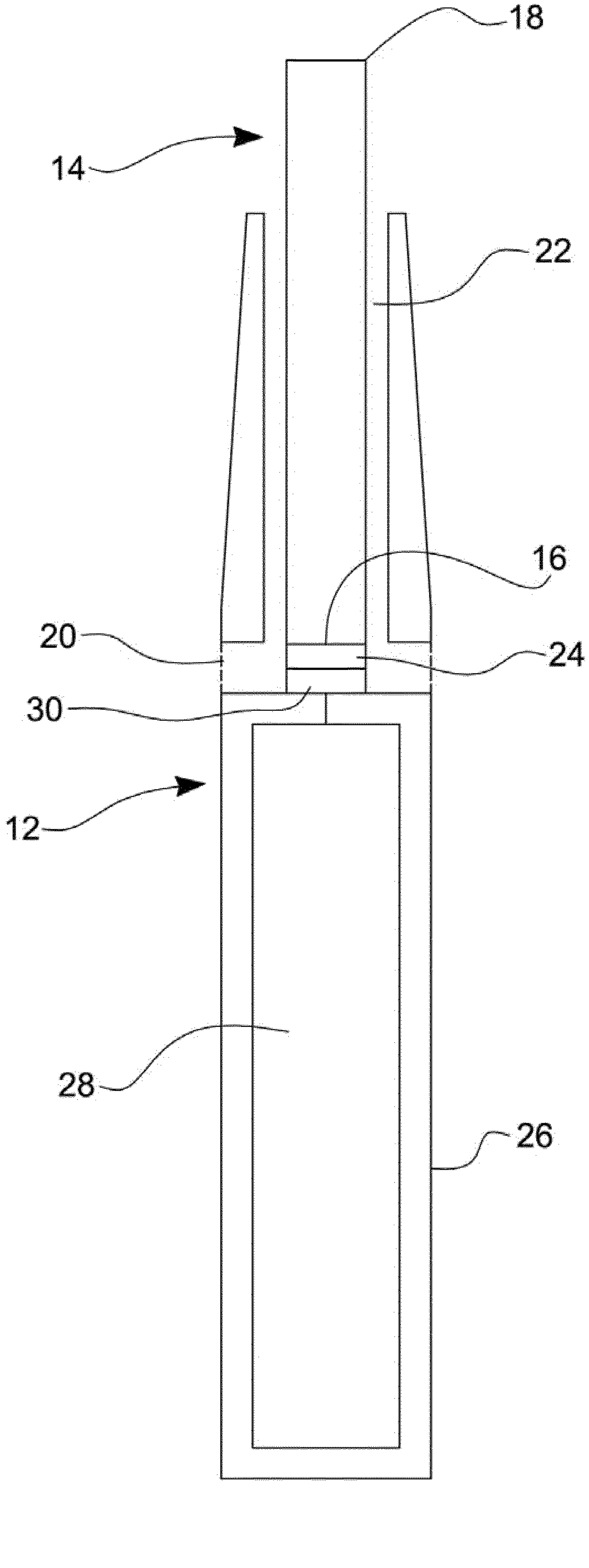

Fig. 3

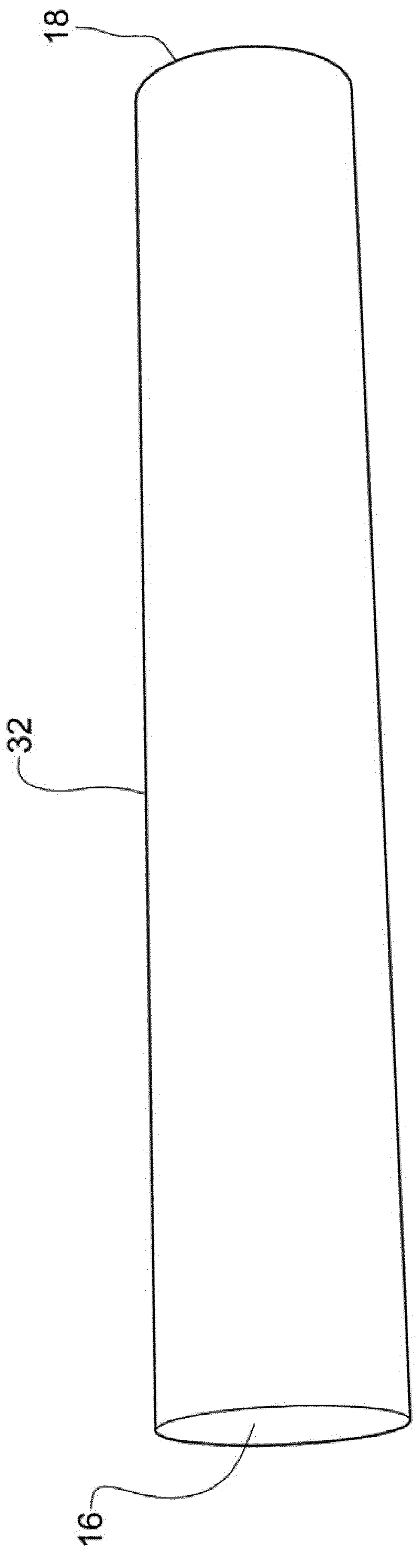

Fig. 4

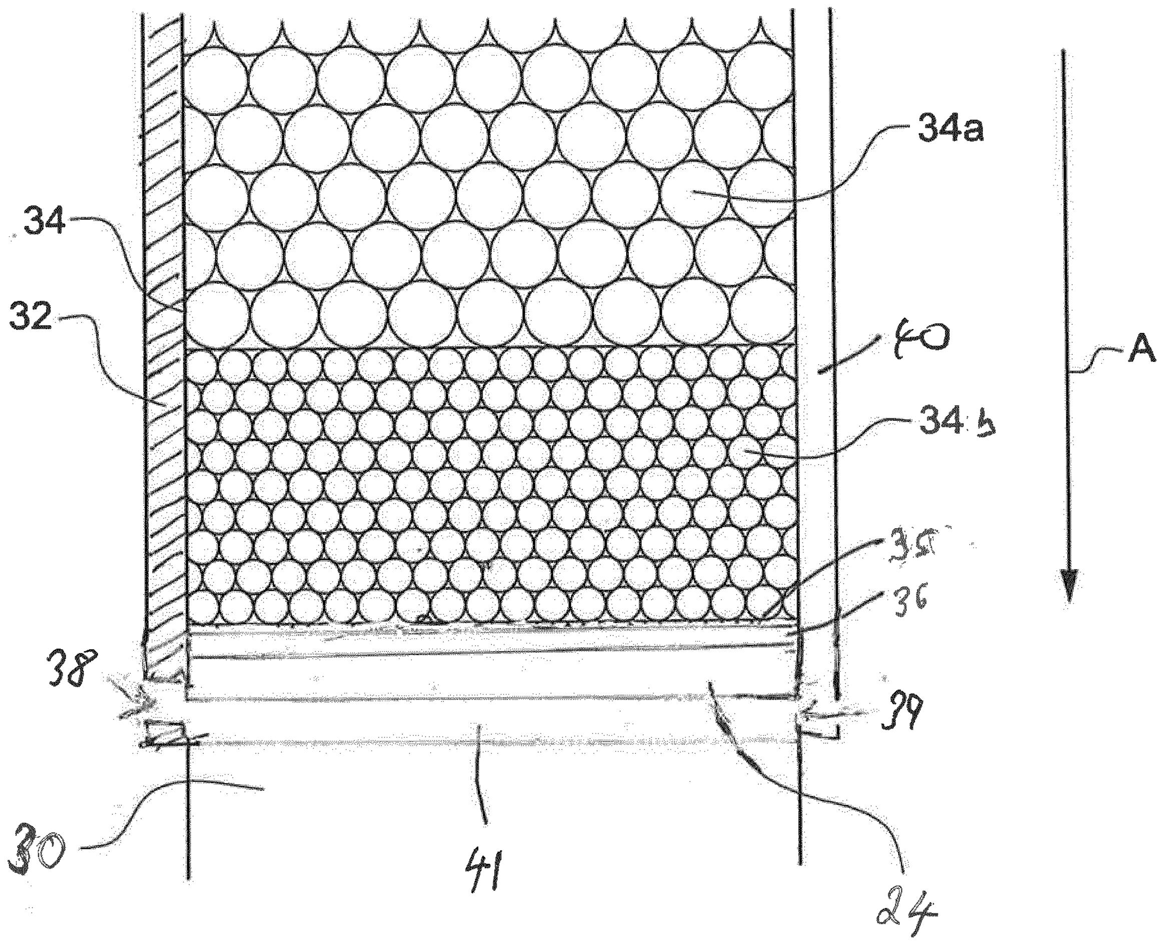

Fig. 5

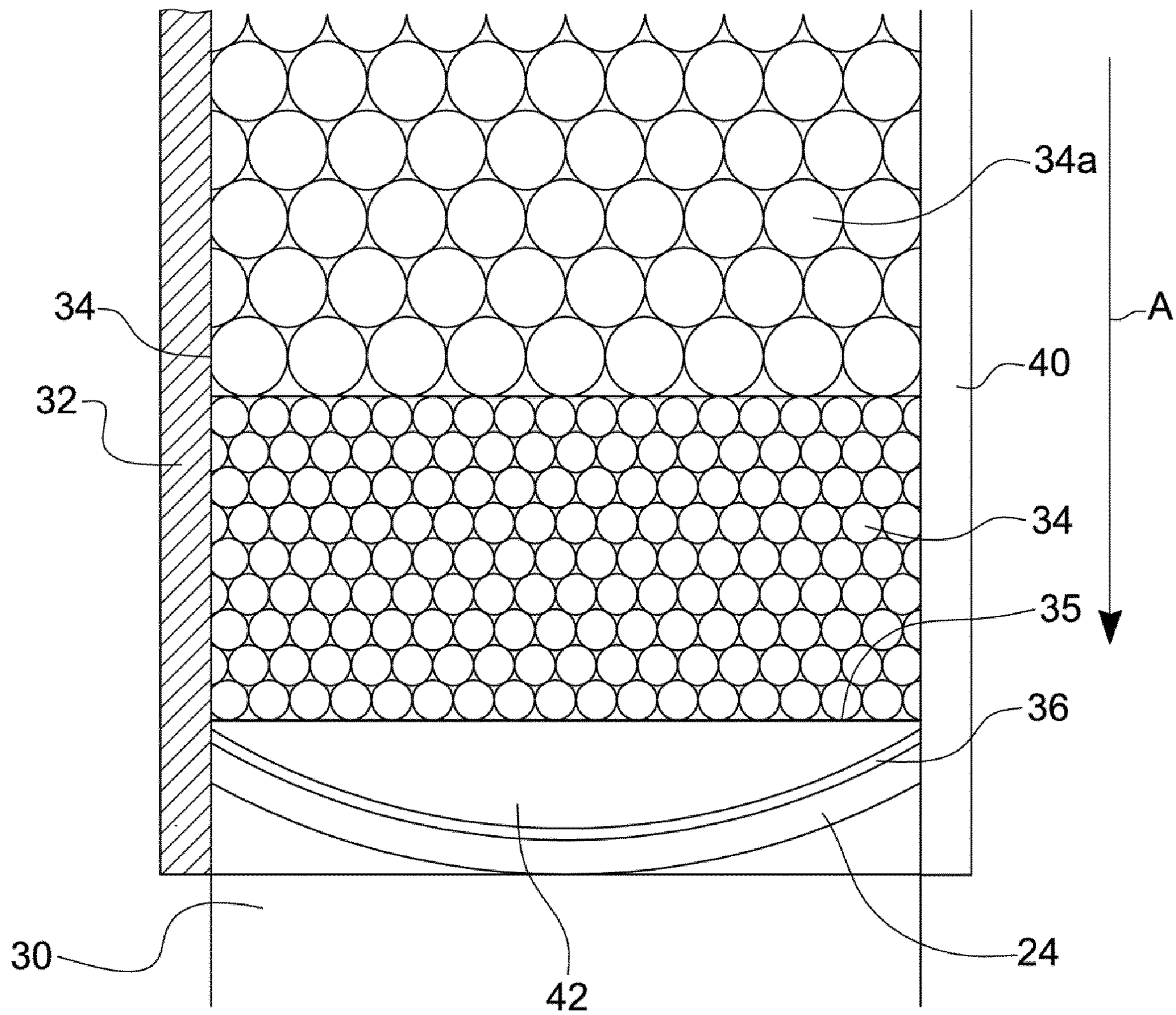

Fig. 6

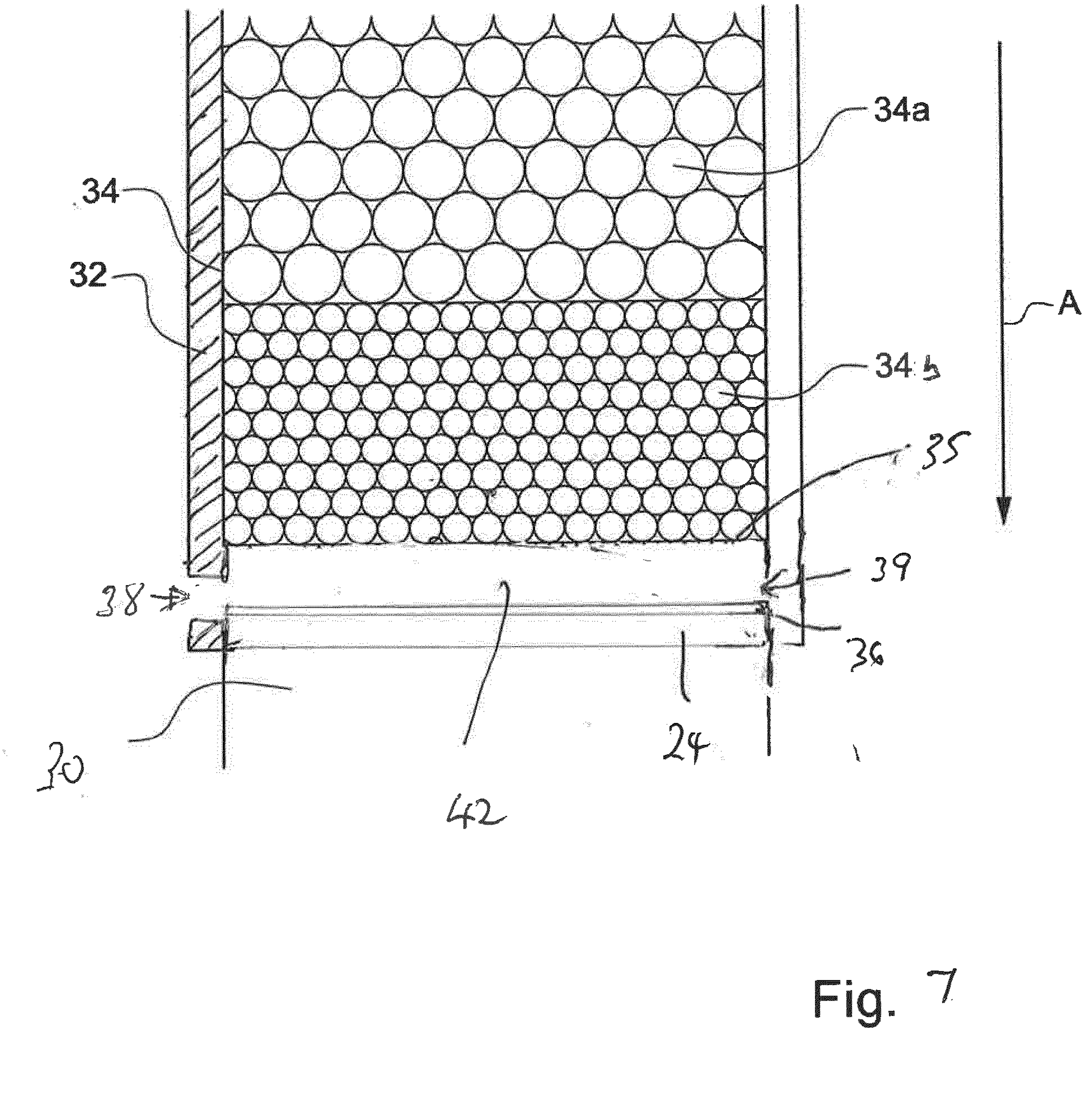

Fig. 7

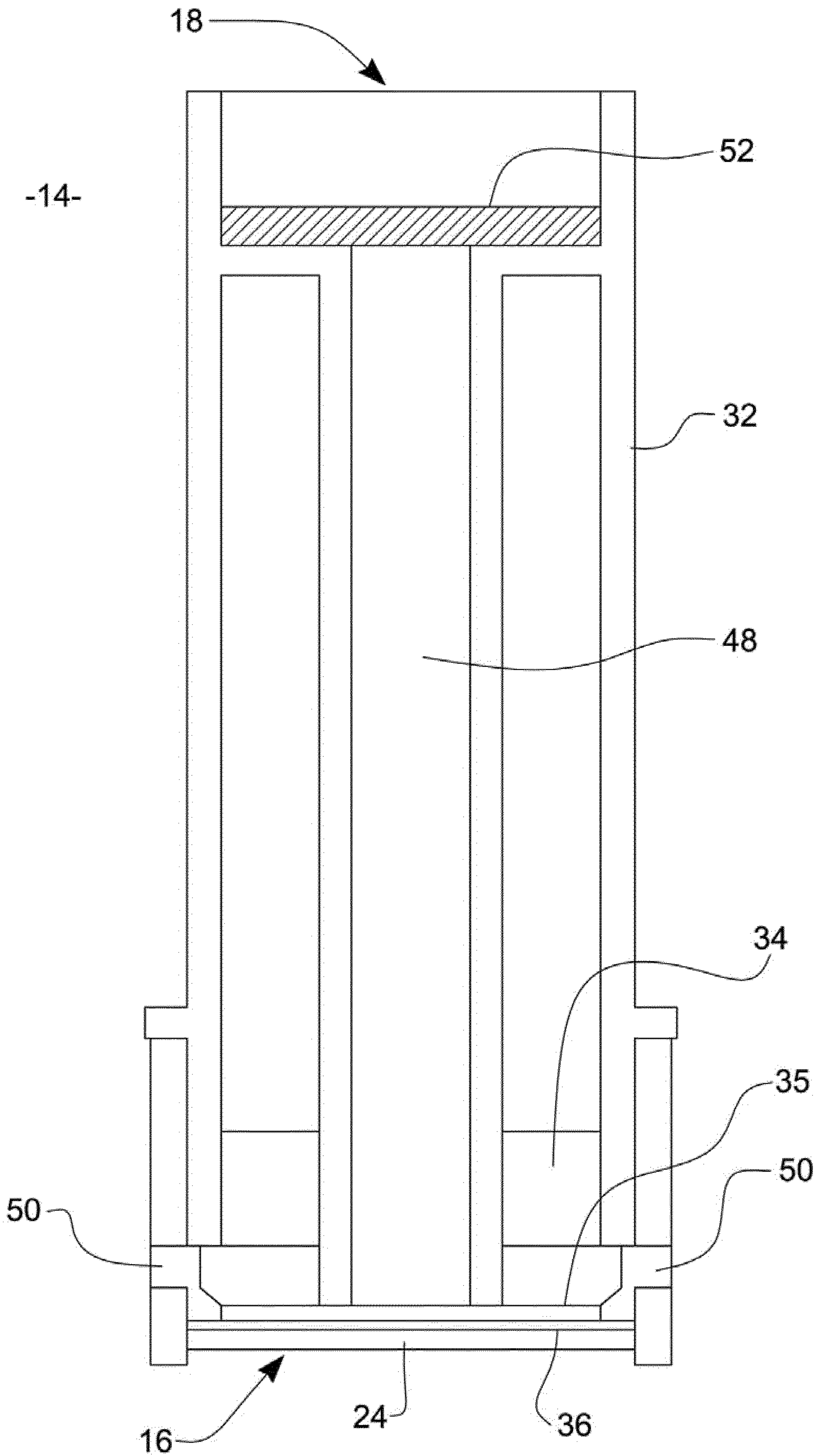

Fig. 8

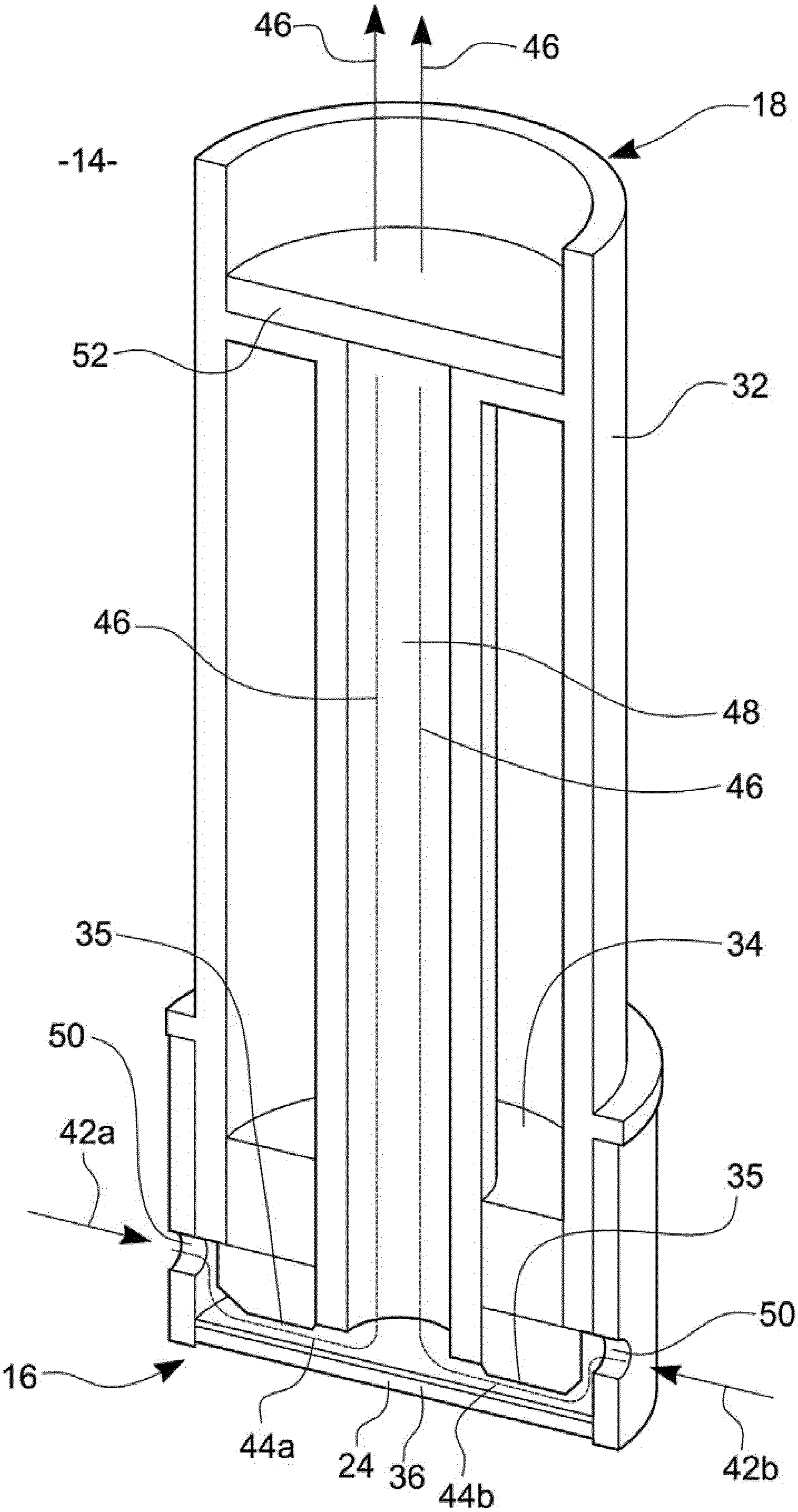

Fig. 9

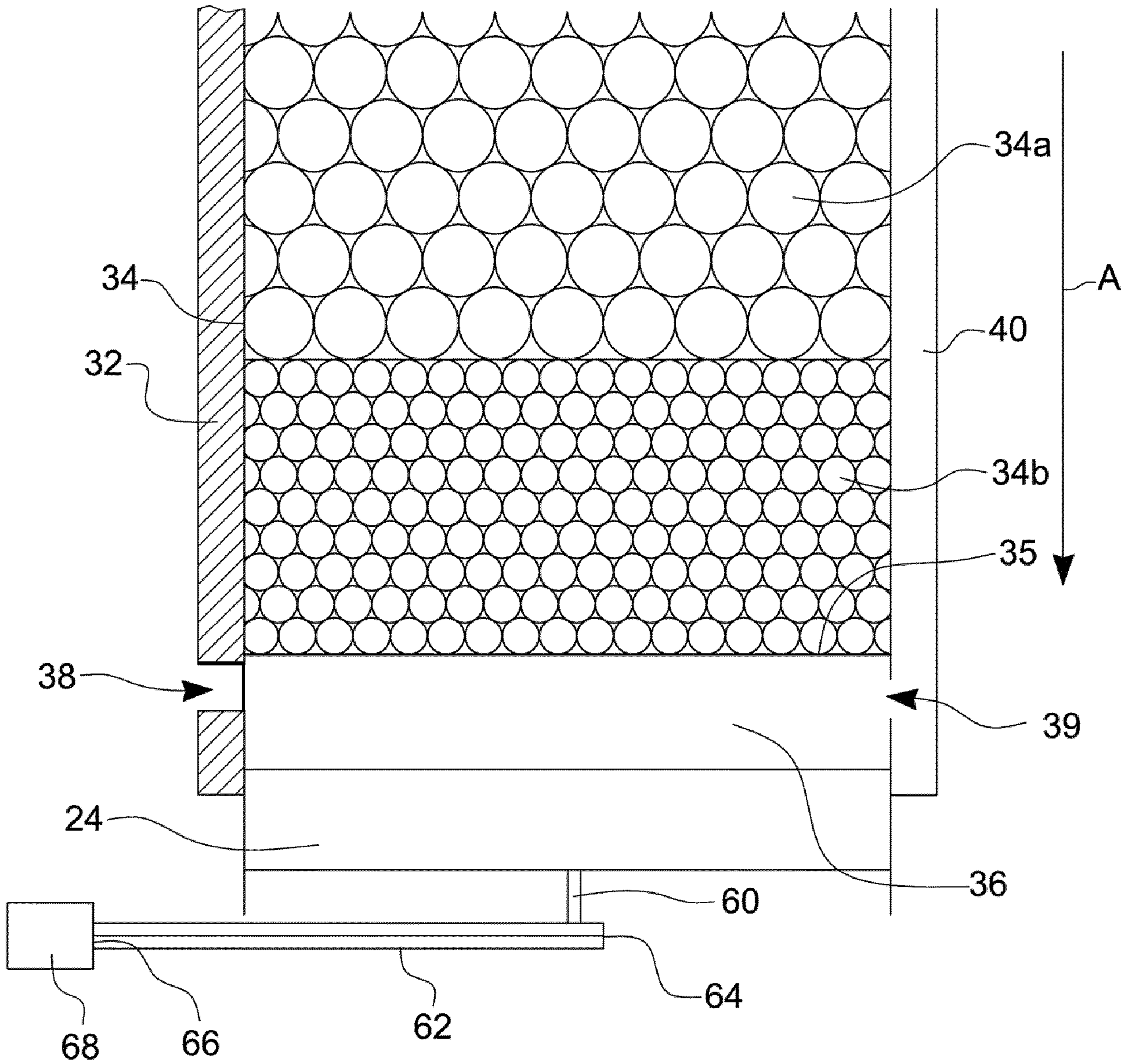

Fig. 10

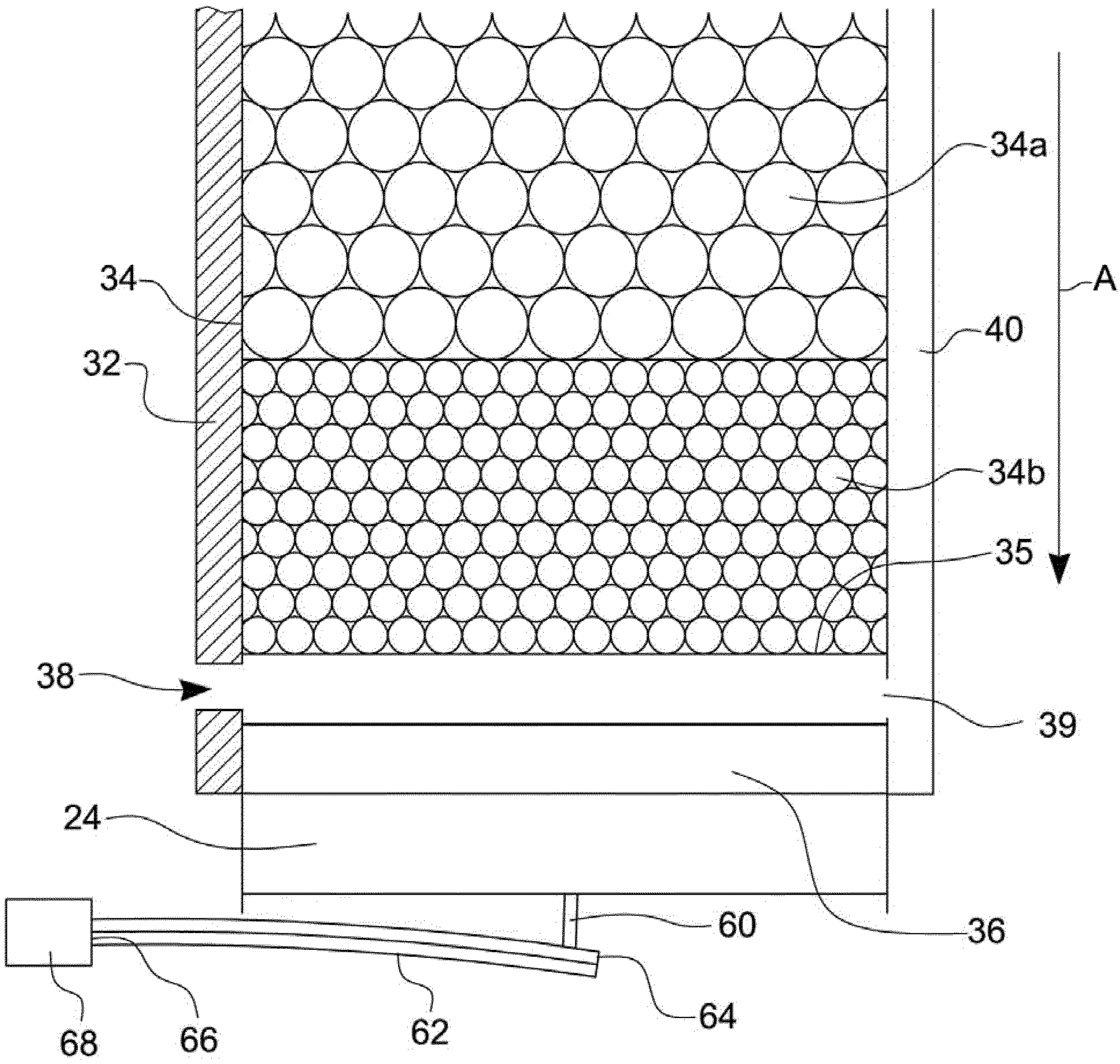

Fig. 11

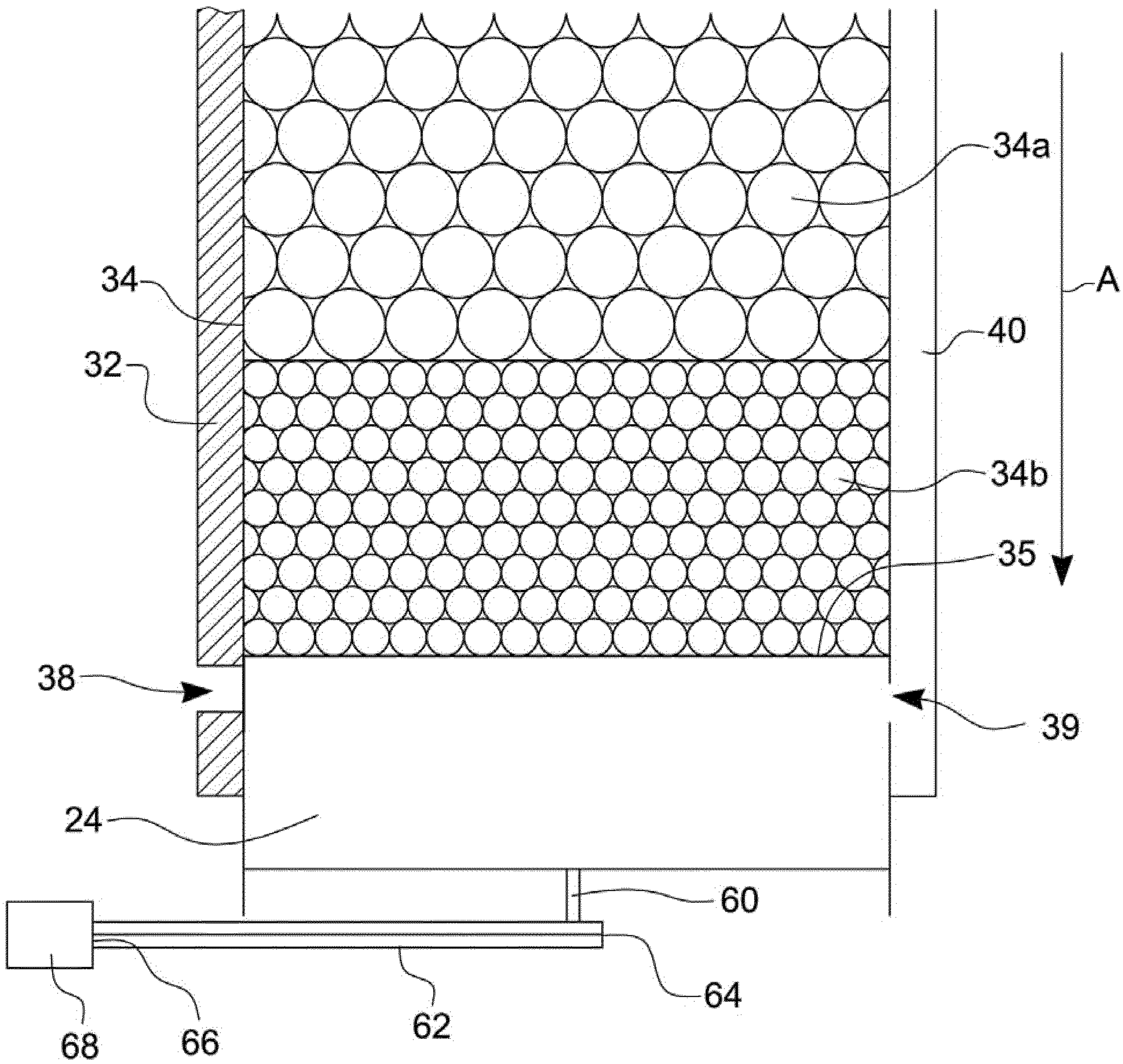

Fig. 12

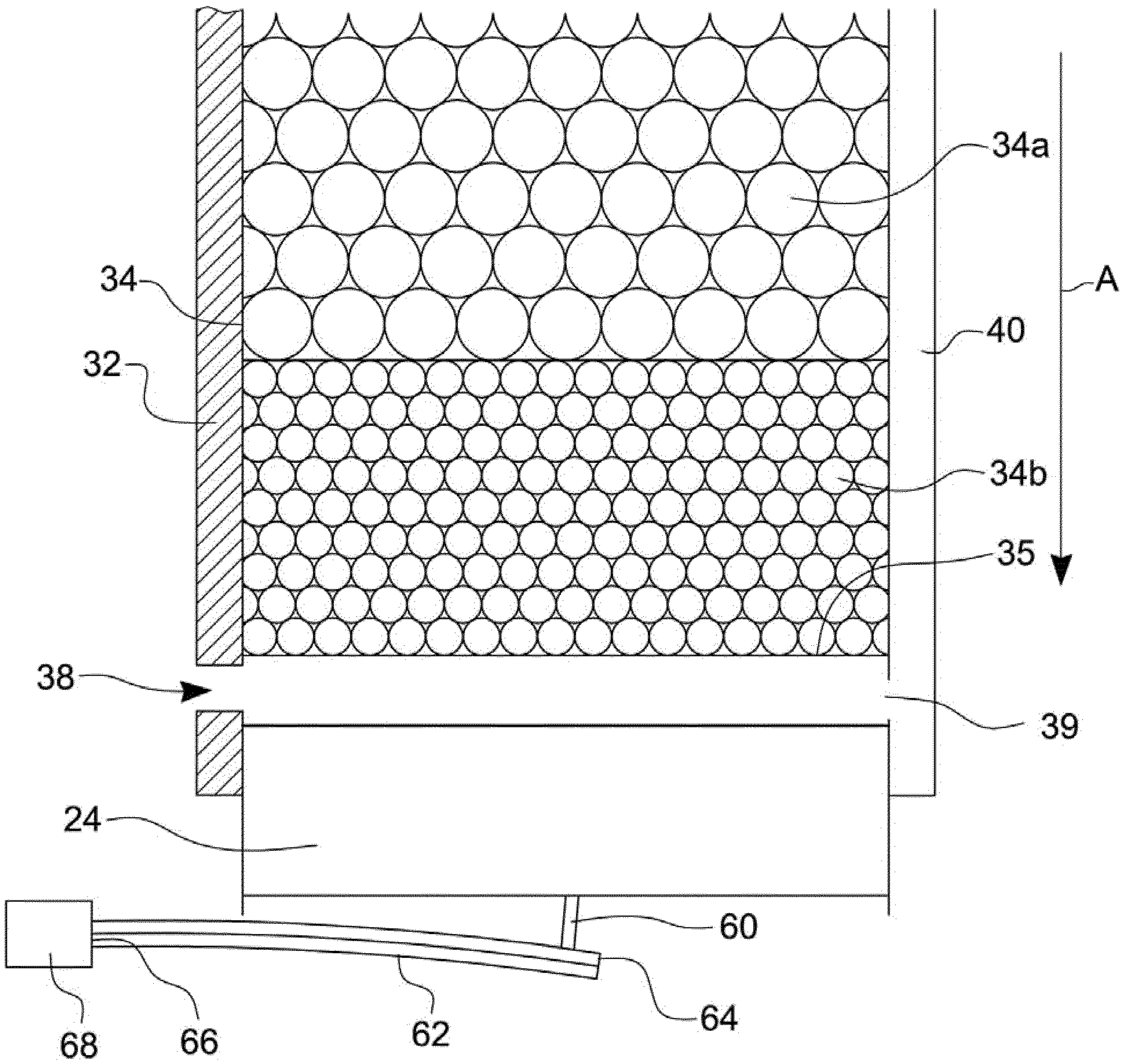

Fig. 13

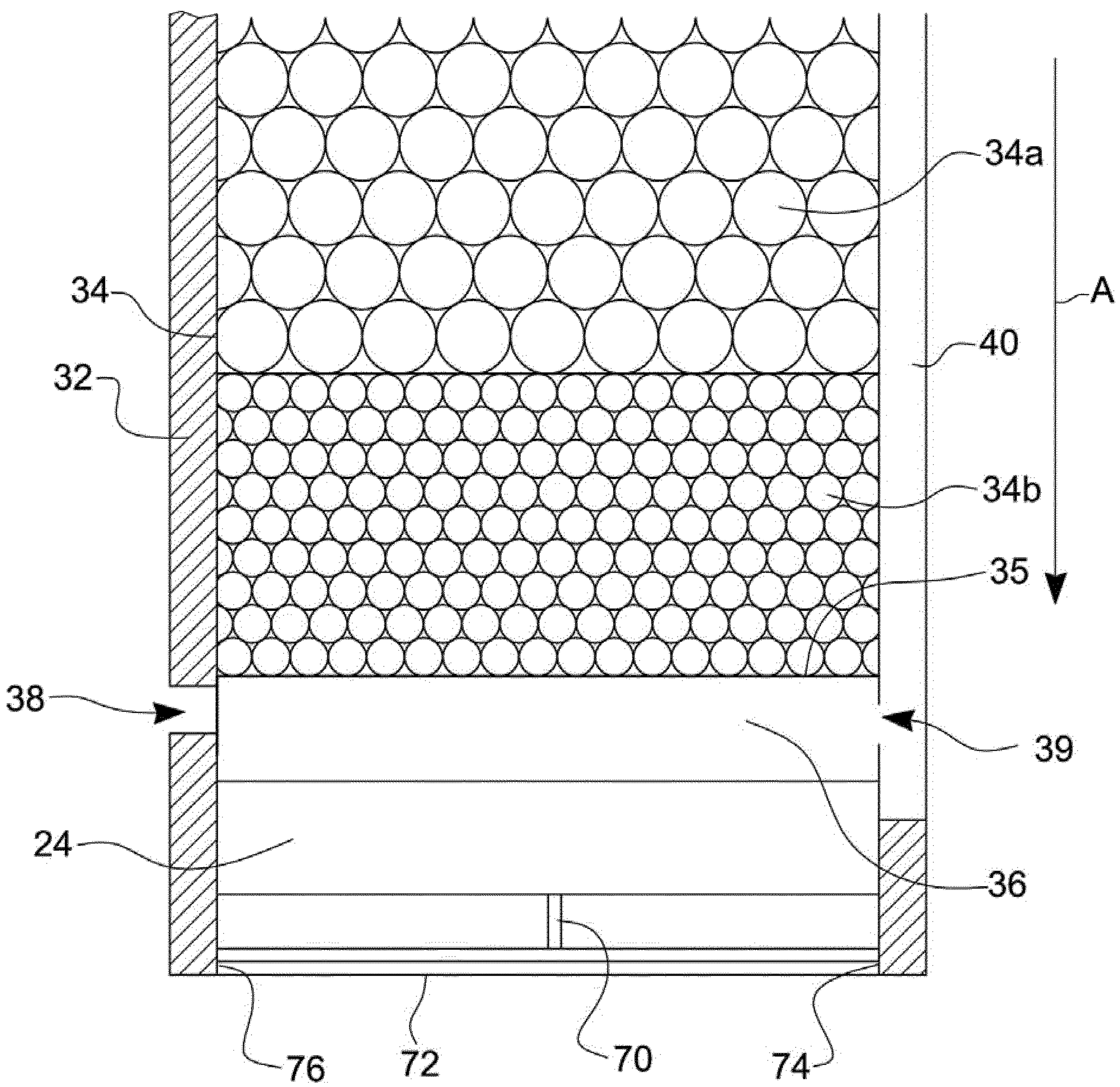

Fig. 14

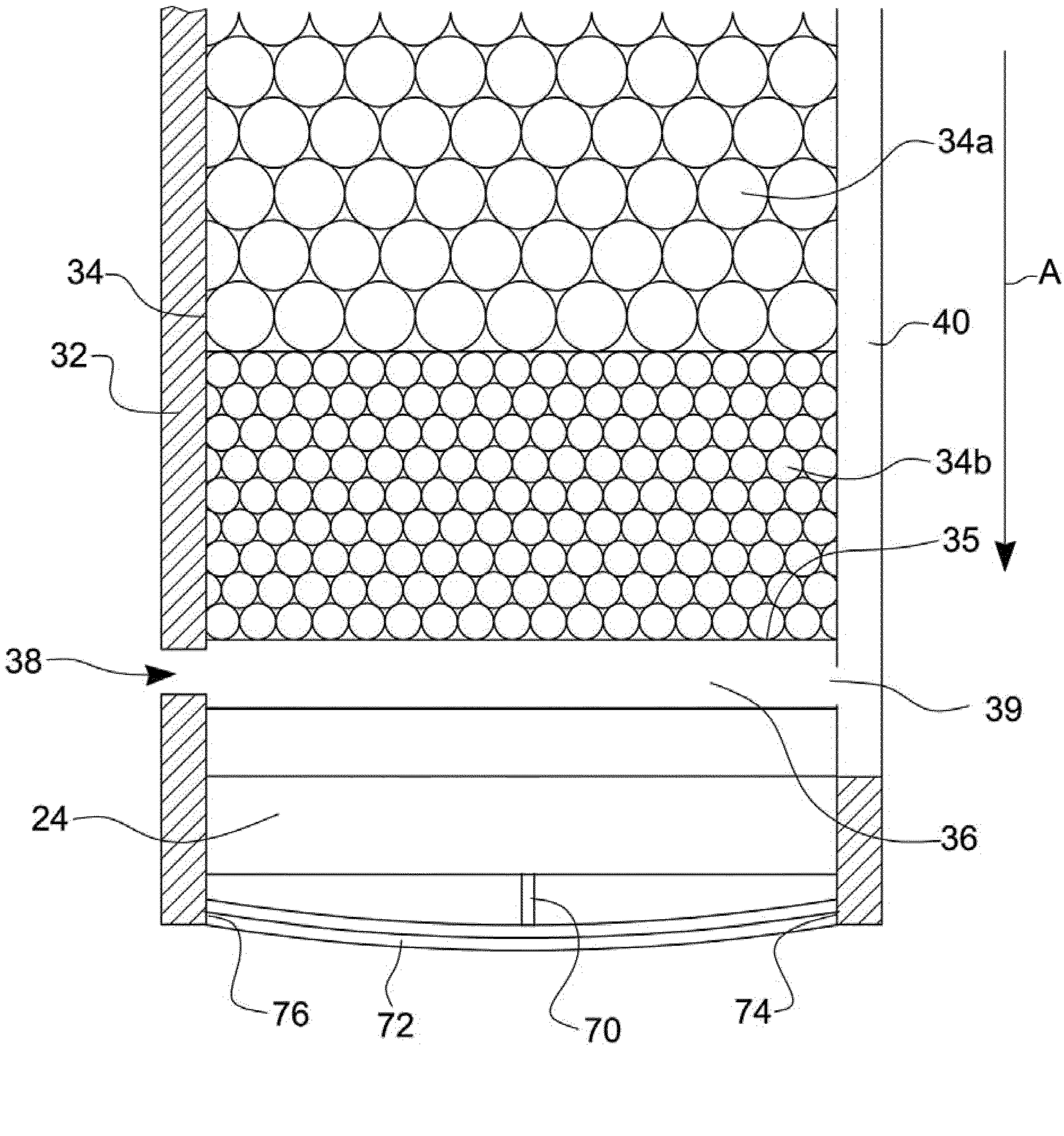

Fig. 15

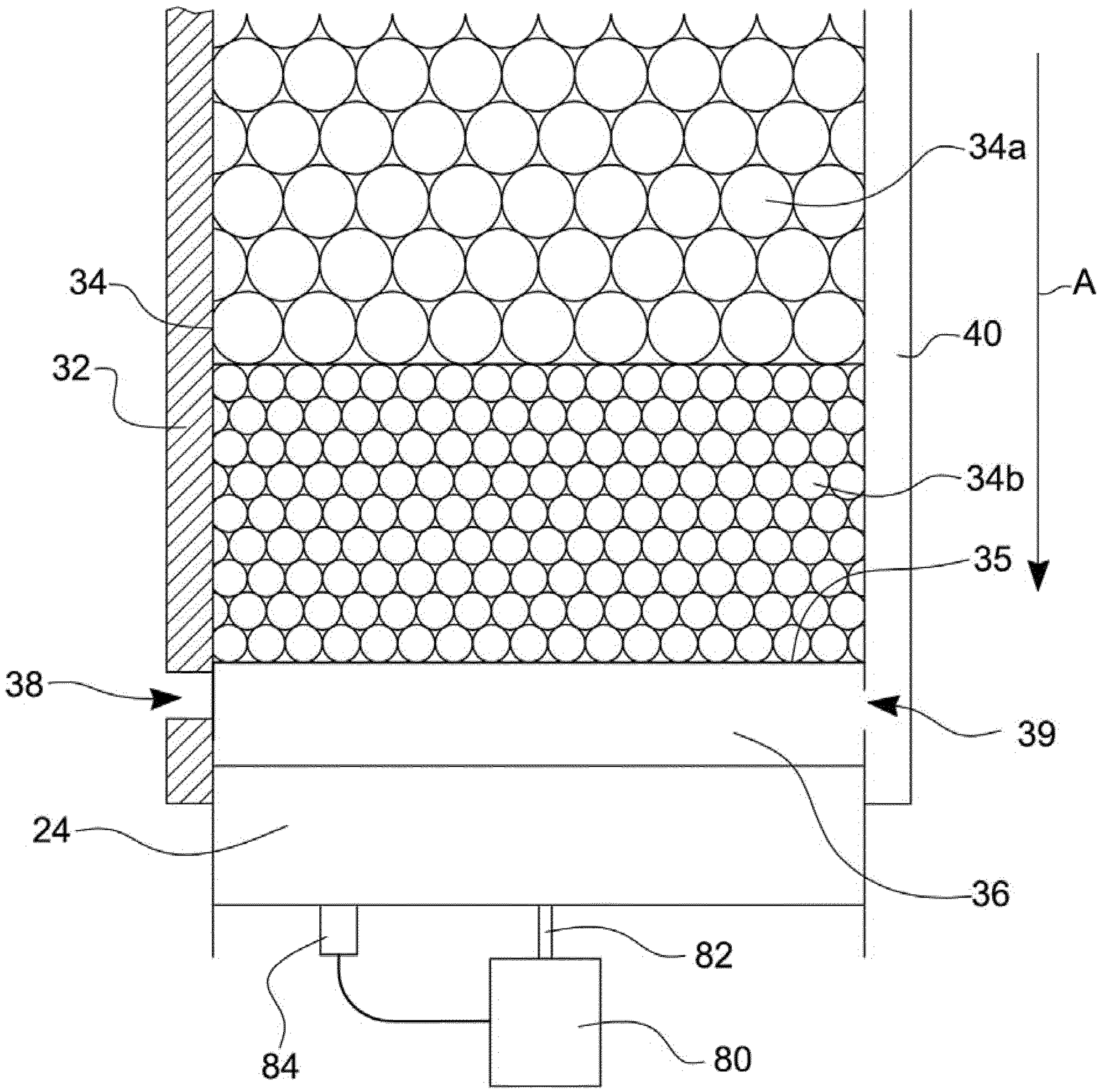

Fig. 16

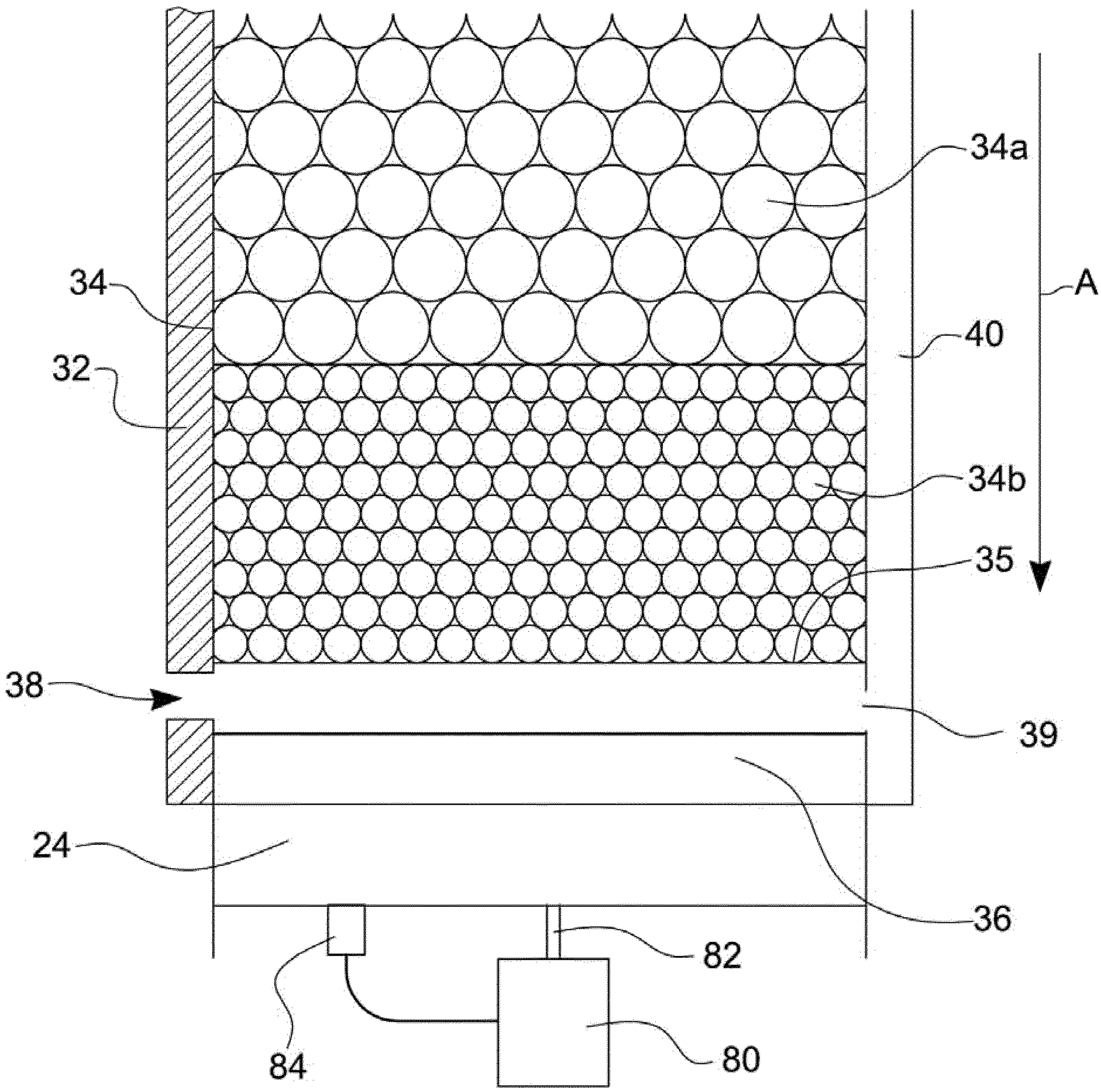

Fig. 17

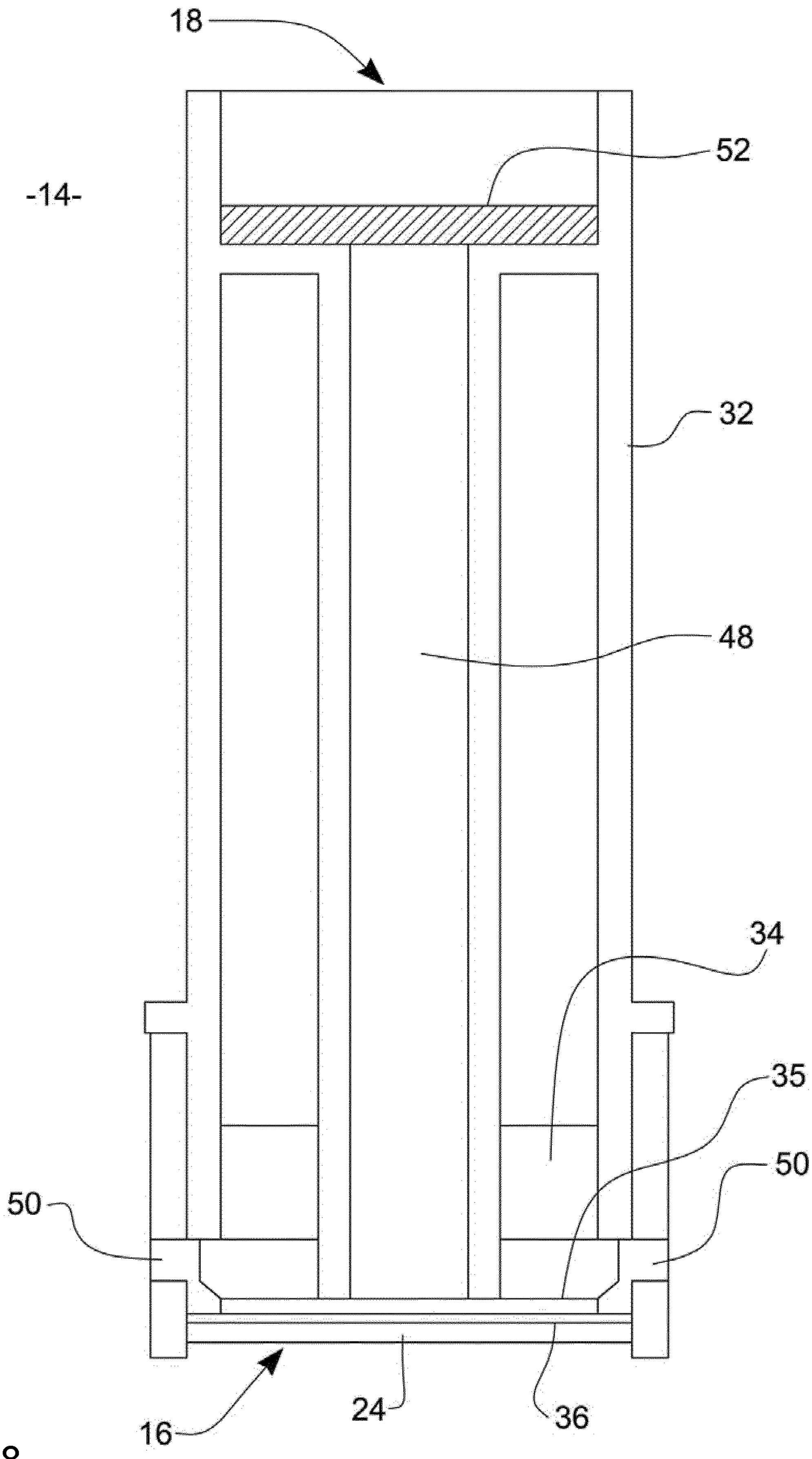

Fig. 18

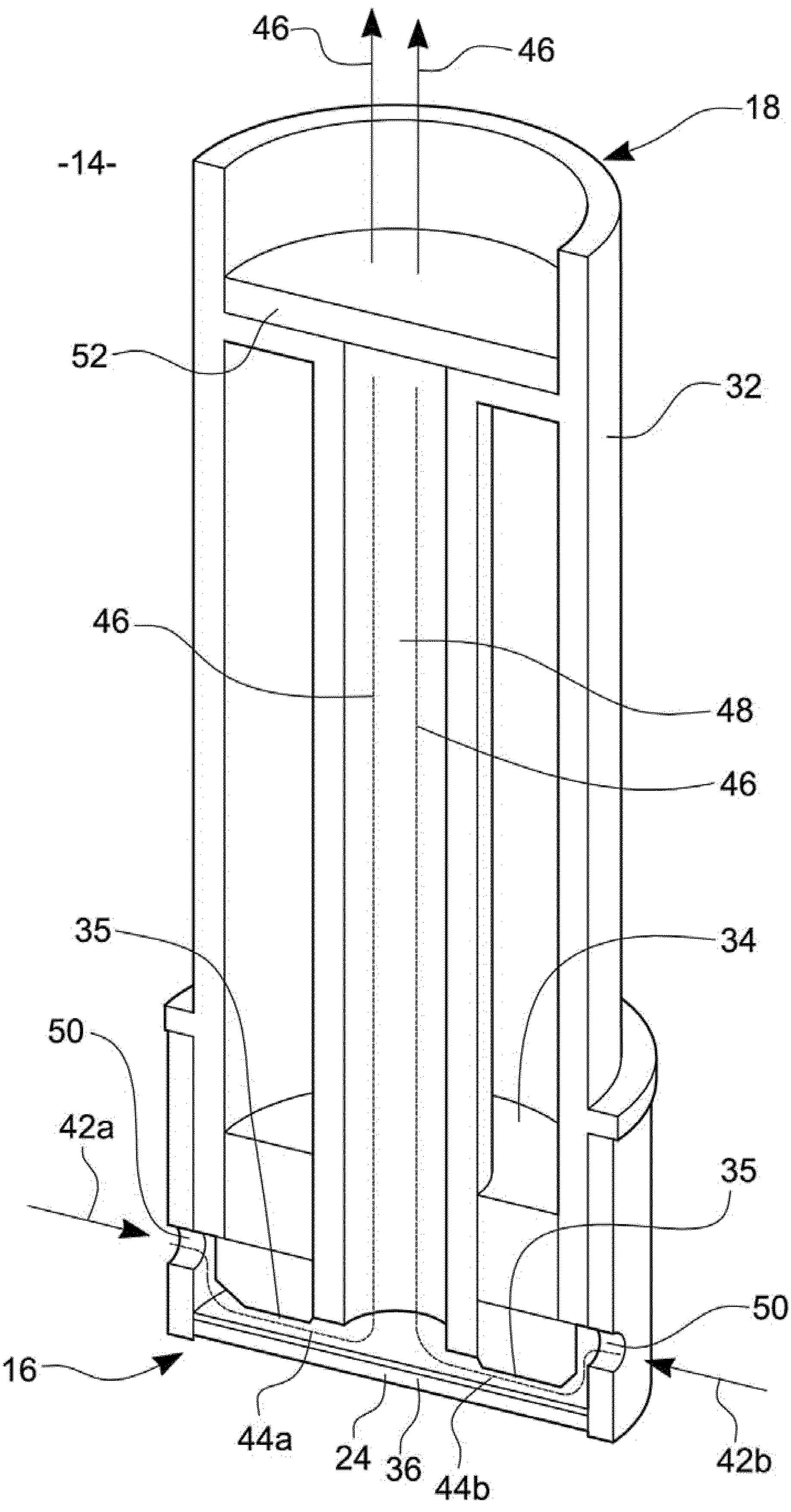

Fig. 19

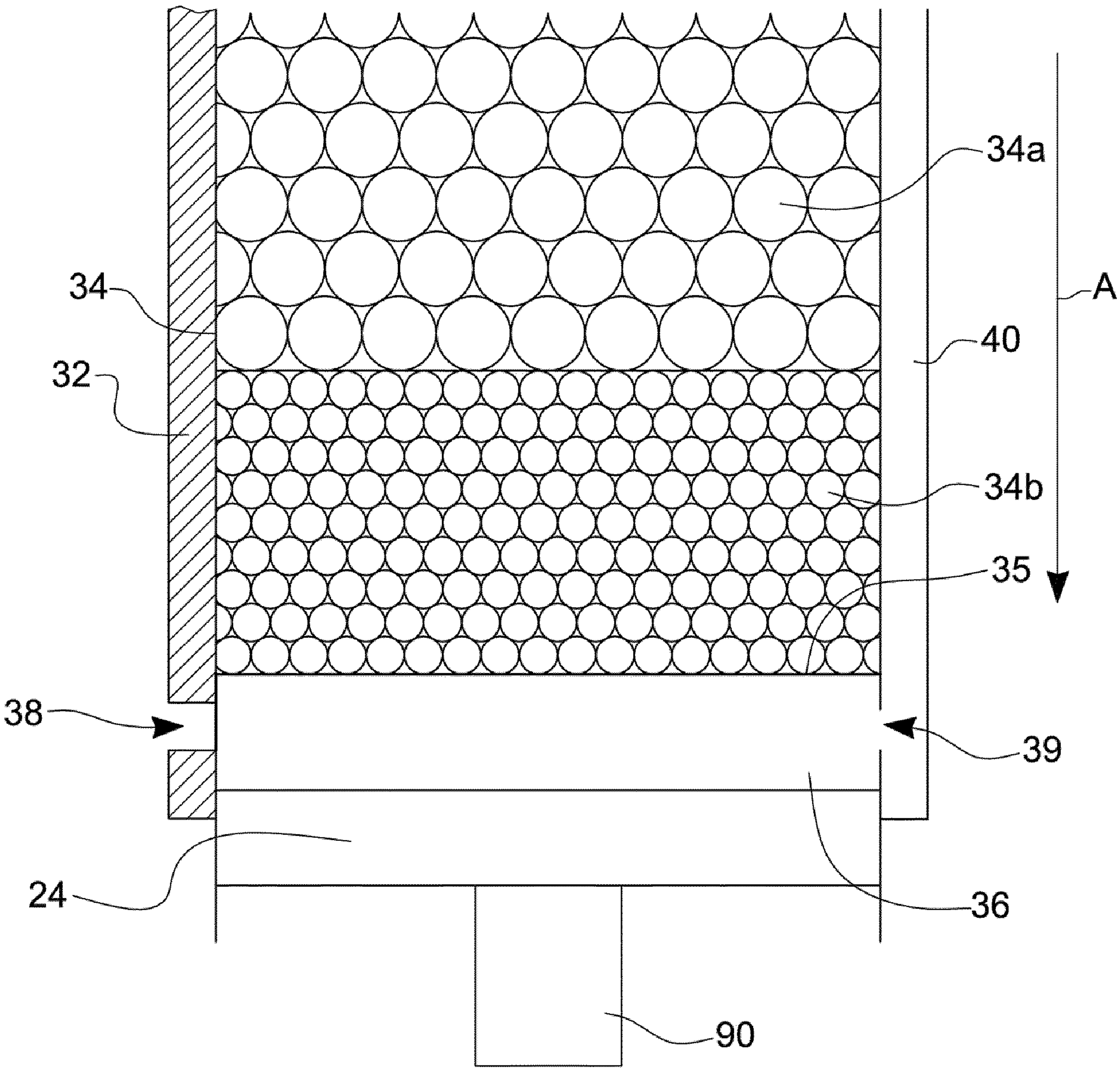

Fig. 20

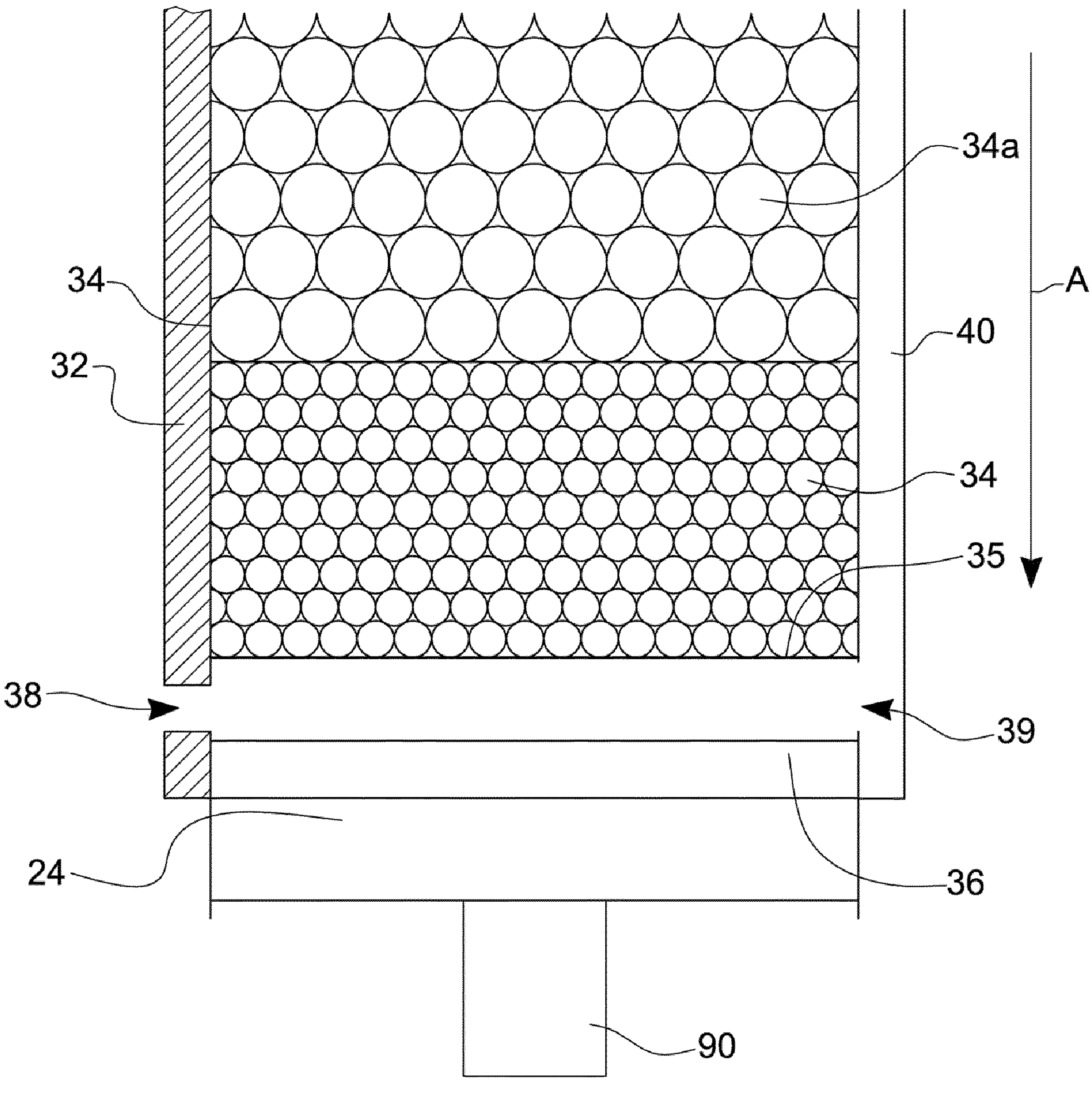

Fig. 21

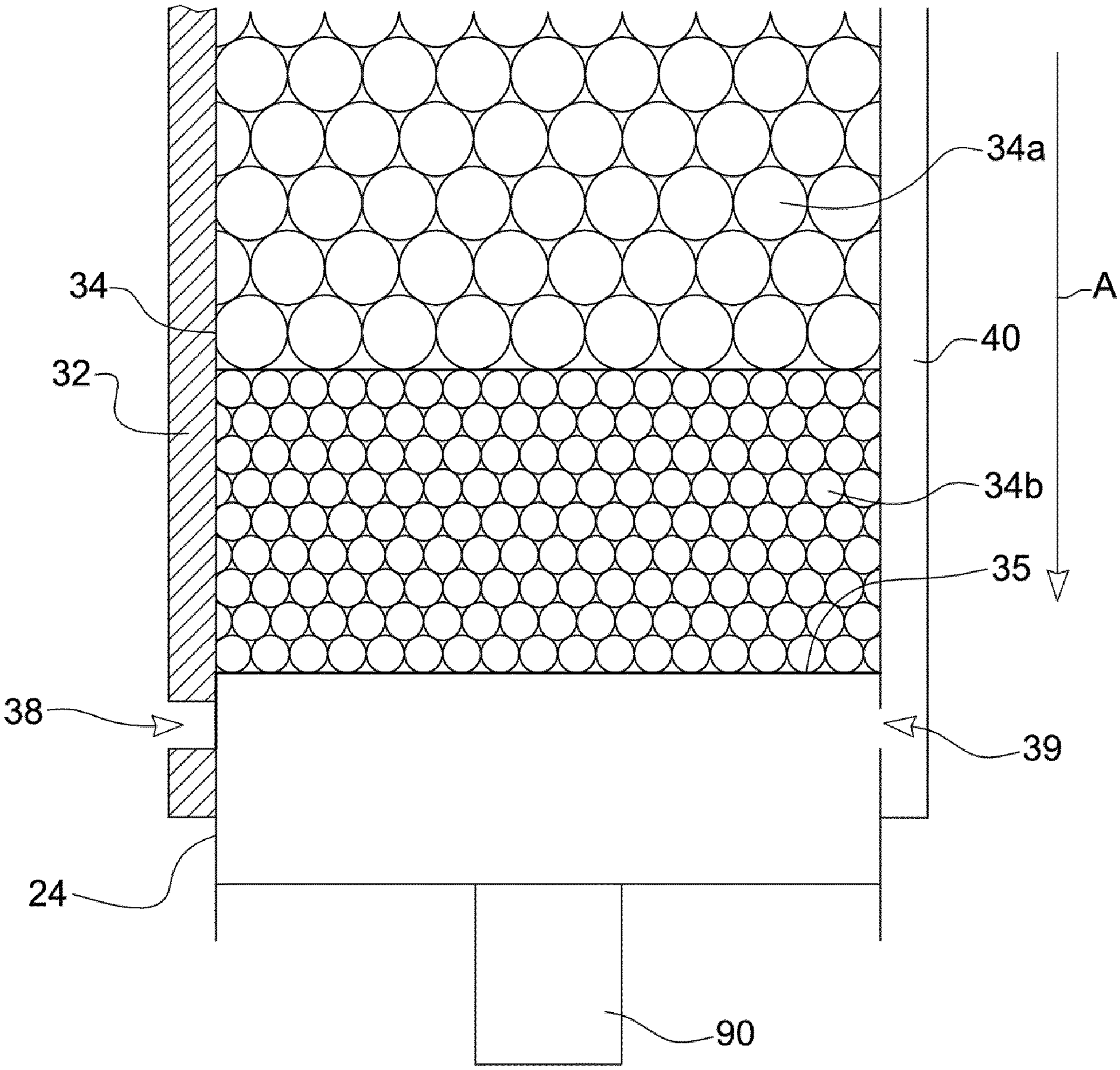

Fig. 22

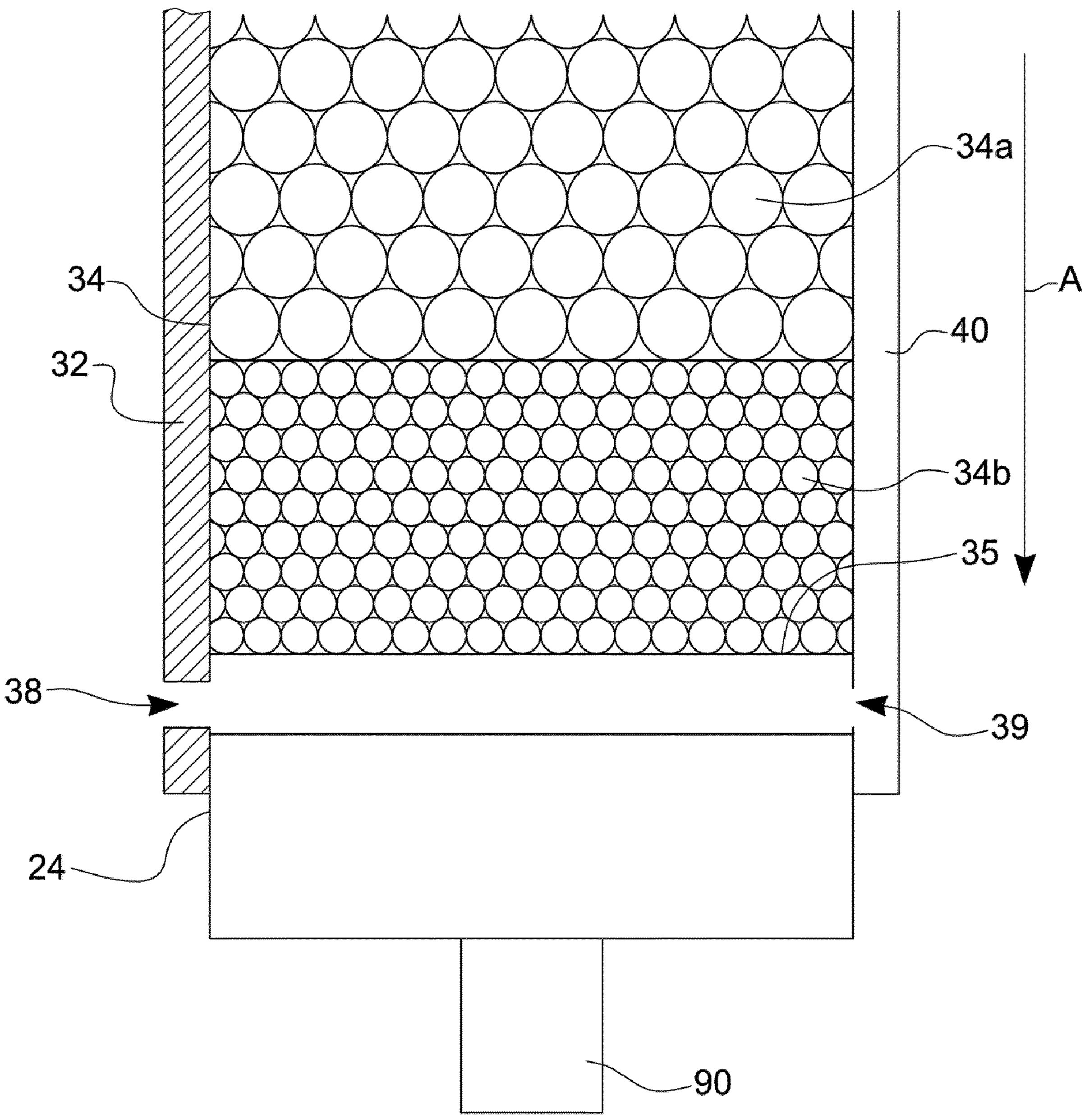

Fig. 23

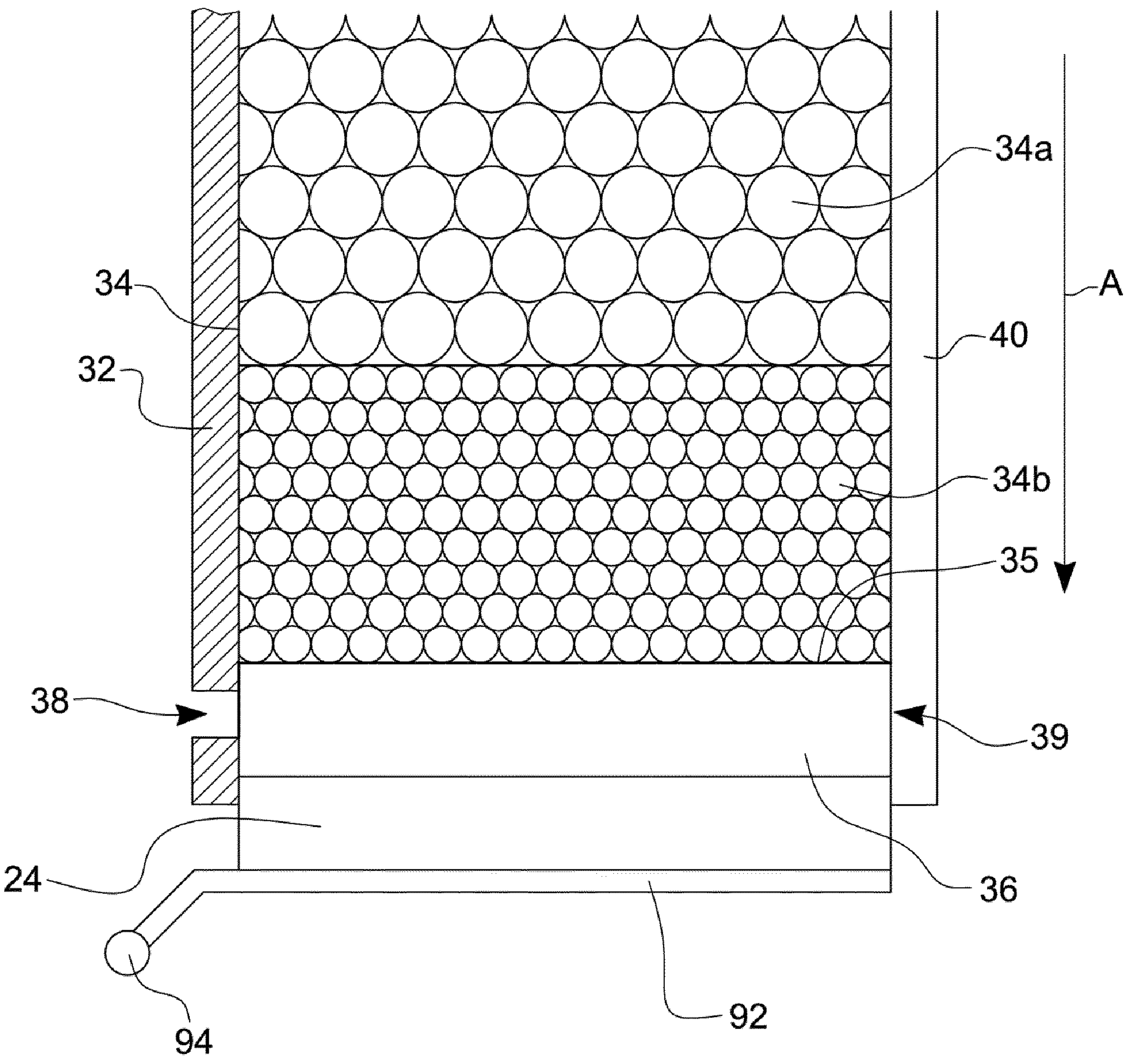

Fig. 24

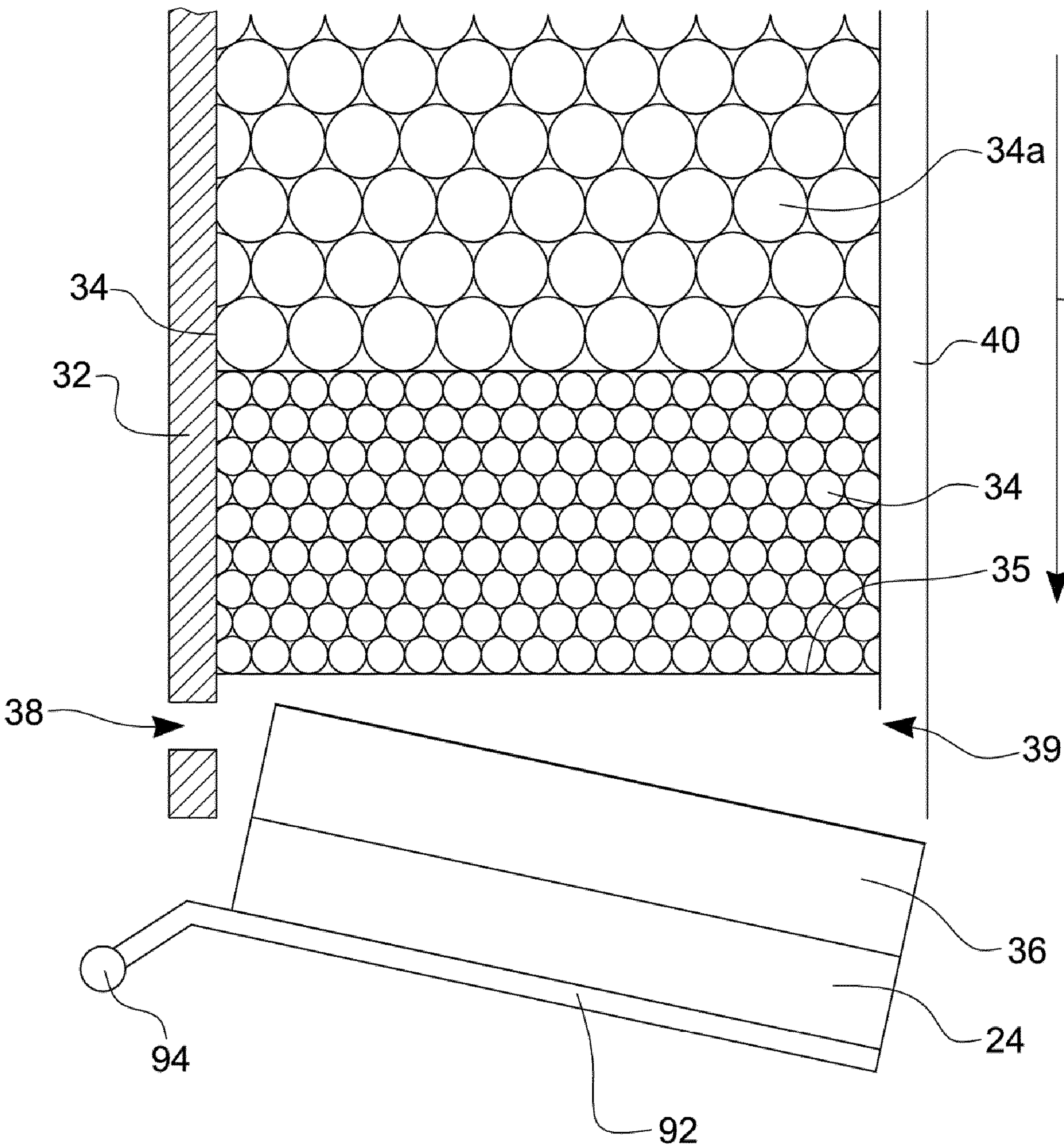

Fig. 25

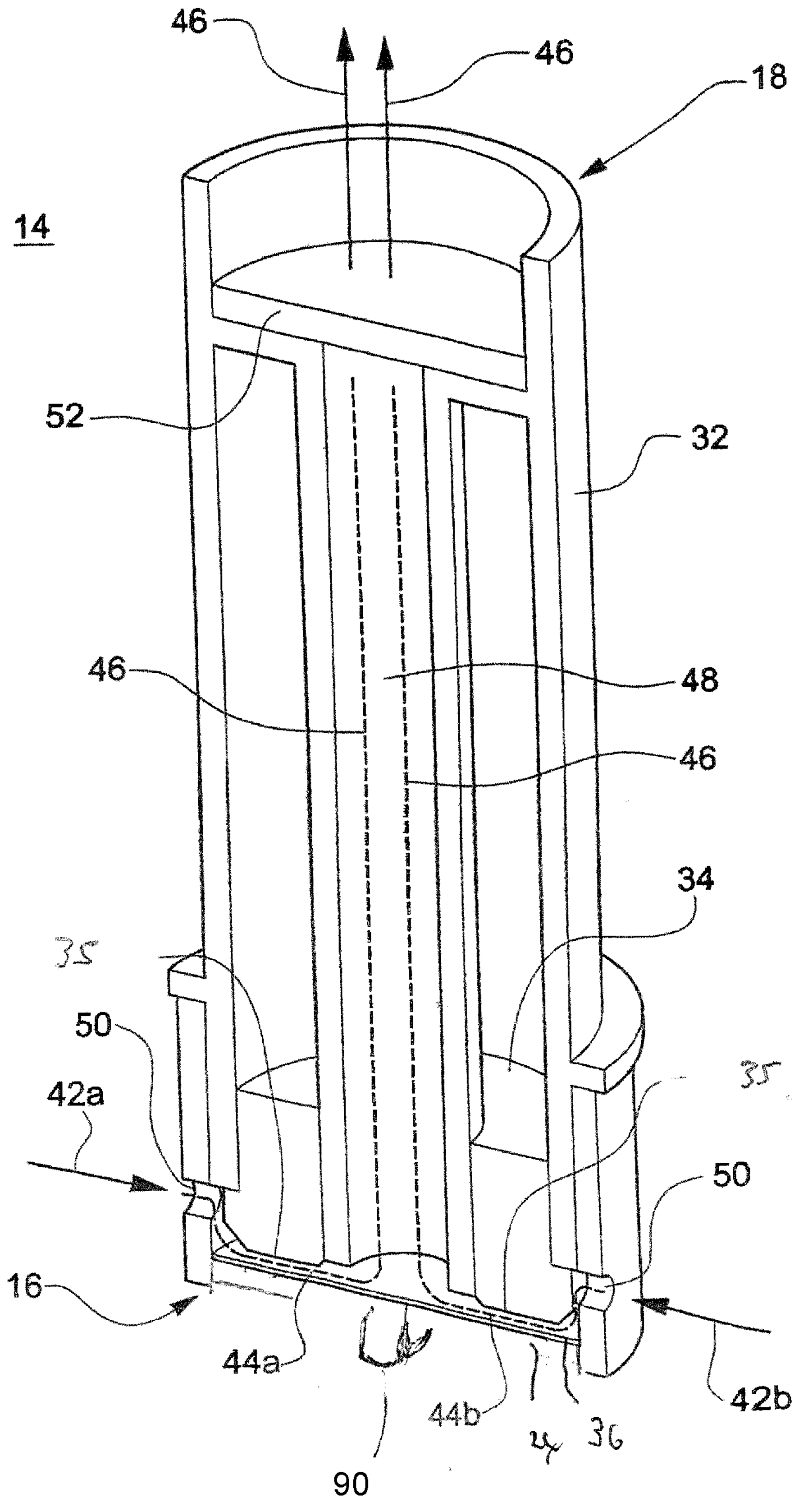

Fig. 26

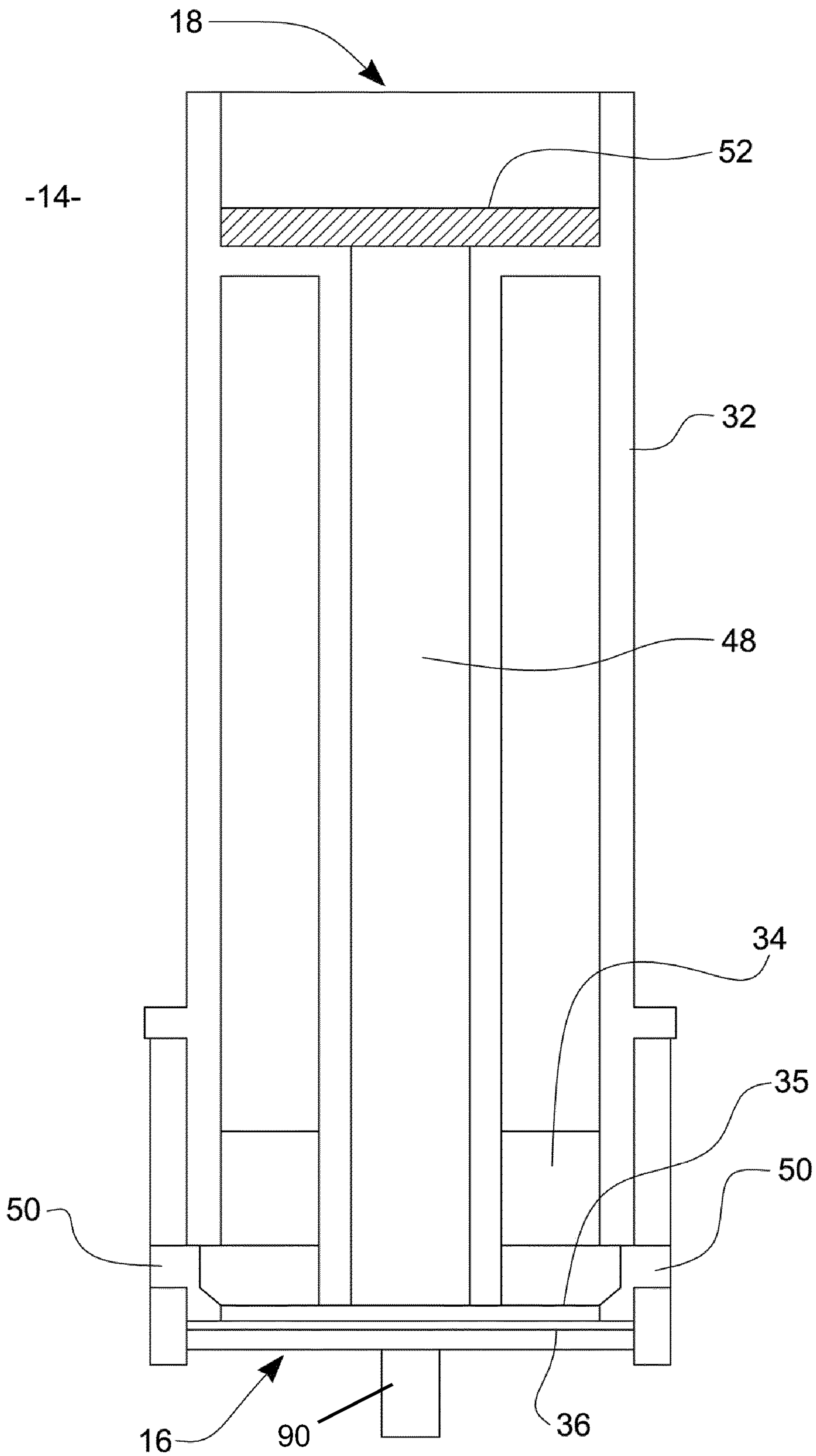

Fig. 27

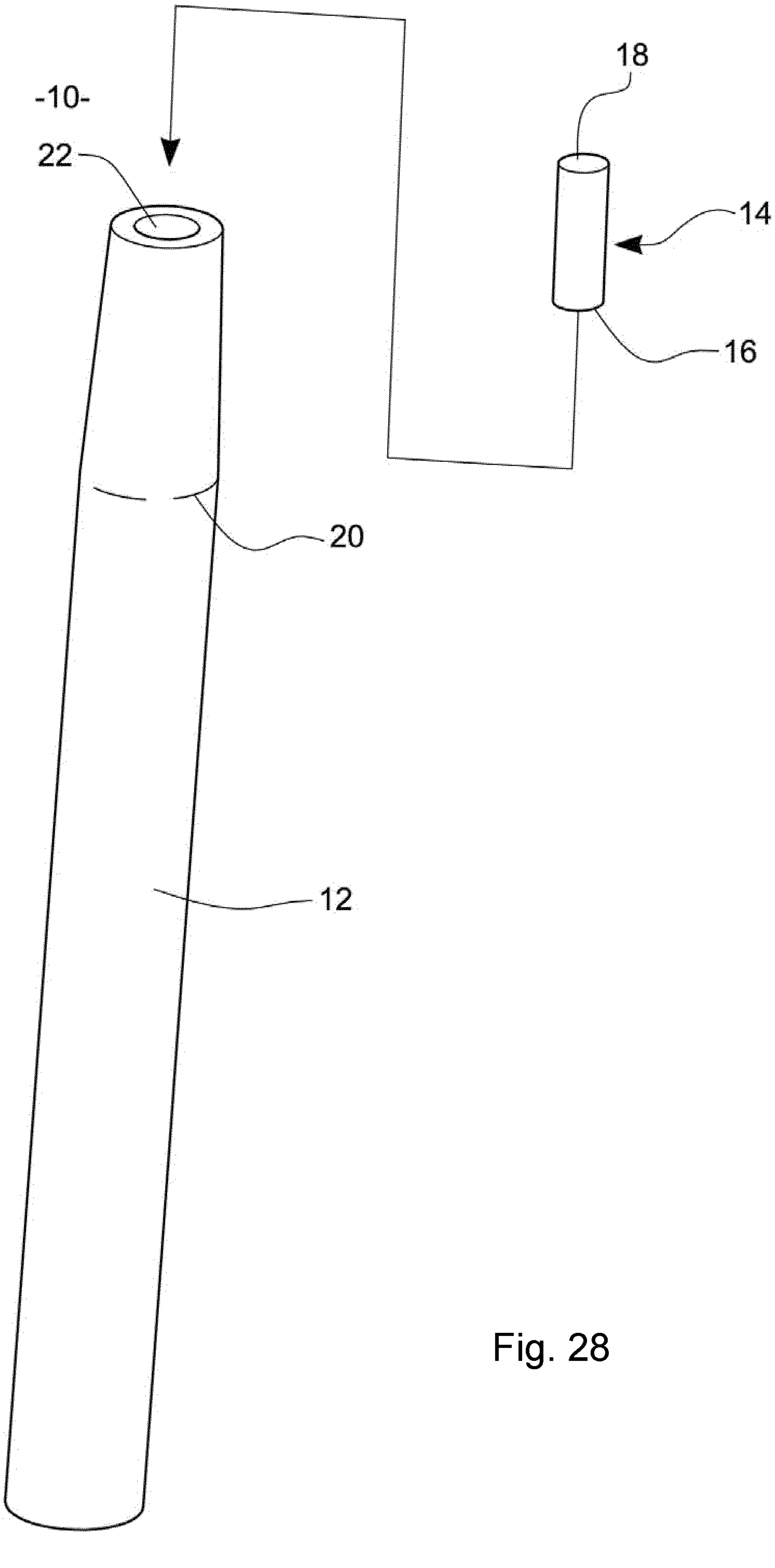

Fig. 28

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61M11/04 A24F47/00 A61M15/06
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61M A24F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2015/112750 A1 (NICOTINE TECHNOLOGY INC E [US]) 30 July 2015 (2015-07-30) abstract; figures 1, 8, 9 paragraphs [0129], [0226]	1-16
X	WO 2016/193365 A1 (FONTEM HOLDINGS 1 BV [NL]) 8 December 2016 (2016-12-08) abstract; figures 6-10 page 9, paragraph 2 page 10, last paragraph pages 11, 12	1-3,5-7, 16
A	WO 2018/197515 A1 (NERUDIA LTD [GB]) 1 November 2018 (2018-11-01) the whole document	1-16

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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 April 2020	06/05/2020

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Weijland, Albert

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2016/096728 A1 (PHILIP MORRIS PRODUCTS SA [CH]) 23 June 2016 (2016-06-23) abstract; claims 1-15 -----	1-16
A	US 2014/069424 A1 (POSTON JEFFREY [US] ET AL) 13 March 2014 (2014-03-13) abstract; claims 1-26 -----	1-16

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2020/057347

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2015112750 A1	30-07-2015	CN 106455705 A	22-02-2017
		EP 3096636 A1	30-11-2016
		US 2015216237 A1	06-08-2015
		US 2019261687 A1	29-08-2019
		WO 2015112750 A1	30-07-2015
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		EP 3100621 A1	07-12-2016
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