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(54) **Inhalátorkomponens**

INHALER COMPONENT

The invention concerns an inhaler component for forming a vapour/air mixture or/and condensation aerosol by evaporation of a liquid material and, if appropriate, condensation of the formed vapour, comprising:

an electric heating element for evaporating a portion of the liquid material;

a wick with a capillary structure, which wick forms a composite with the heating element and supplies the heating element automatically with the liquid material;

a carrier plate, preferably a printed circuit board, which carries the composite and on which the heating element is electrically contacted;

a capillary gap formed at least partially by the carrier plate and automatically supplying the composite with the liquid material, by means of an end portion of the wick extending into the capillary gap;

a liquid container which contains the liquid material and from which the capillary gap draws the liquid material.

Terminology:

In the present patent application, the term "inhaler" pertains to medical as well as nonmedical inhalers. Moreover, the term refers to inhalers for administering of medications and substances not declared to be medications. The term furthermore pertains to smoking articles and cigarette replacement articles, such as are contained for example in European patent class A24F47/00B, insofar as these are intended to provide to the user a vapour/air mixture or/and a condensation aerosol. The term "inhaler" should also make no limitations as to how the vapour/air mixture or/and condensation aerosol formed is supplied to the user or his or her body. The vapour/air mixture or/and condensation aerosol can be inhaled into the lungs, but also taken only into the oral cavity without inhalation into the lungs.

By "capillary gap" is meant any gap which solely by virtue of the capillary action of its boundary walls produces a transport of liquid. Wicks, jacketed wicks or channels filled with wick material do not count as capillary gaps.

The use of the singular "composite" does not preclude the presence of several composites. The invention explicitly includes arrangements with several composites.

WO 2010/045671 (Helmut Buchberger) describes an inhaler component for the intermittent formation, synchronized with inhalation or drawing in, of a vapour/air mixture or/and condensation aerosol, consisting of (Fig. 9-12 and Fig. 17-18) a housing 3, a chamber 21 arranged in the housing 3, an air inlet opening 26 for the intake of air from the surroundings into the chamber 21, an electric heating element for evaporating a portion of a liquid material 16, wherein the vapour formed mixes in the chamber 21 with the air supplied through the air inlet opening 26, and the vapour/air mixture or/and condensation aerosol is formed. The inhaler component moreover comprises a wick with a capillary structure, which wick forms with the heating element a sheetlike composite 22 and supplies the heating element automatically with the liquid material 16 once more after an evaporation has taken place. The sheetlike composite 22 bears by two end sections against two electrically conducting platelike contacts 23, on whose surface the heating element is electrically contacted at the same time. The platelike contacts can alternatively be formed also by printed circuit boards or a shared printed circuit board. At least one heated section of the sheetlike composite 22 is arranged free of contact in the chamber 21, and the capillary structure of the wick in this section lies largely free at least on one side 24 of the sheetlike composite. The sheetlike composite 22 or its wick protrudes by one end into a capillary gap 41, which in turn is or can be capillary coupled to a liquid container 4 containing the liquid material 16. The liquid container 4 has an openable closure 18, which is still closed prior to use. The openable closure 18 can be manually opened by a user, whereupon the liquid material 16 floods a reservoir 45 and wets the capillary gap 41. The capillary gap 41 draws the liquid material 16 out of the liquid container 4 or reservoir 45 and transports it to the composite 22. The capillary gap 41 is essentially formed by one of the two platelike contacts 23 and a top piece 42 placed on its surface. Furthermore, a vent channel 52 is worked into the platelike contact 23, which connects the reservoir 45 and the liquid container 4 to the chamber 21. The vent channel 52 produces a pressure equalization by immediately replacing each portion of liquid material 16 getting into the capillary gap 41 with an equal volume portion of air.

The liquid container 4 in the view per Fig. 9 is arranged on top of the platelike contacts 23 supporting the composite 22. This arrangement proves to be quite space demanding and means that the dimensions of the inhaler component turn out to be relatively large. Another drawback is that the capillary gap 41 is very limited in its sheetlike dimension, inasmuch as the capillary gap when placed in vertical position is subjected to a partial vacuum due to the weight of the column of liquid in the reservoir 45 that is acting on it, which has to be compensated by the capillarity of the vent channel 52. But if the capillarity of the vent channel 52 is no longer enough to maintain the equilibrium, the entire liquid material 16 in the liquid container 4 is liable to run out through the capillary gap 41. Especially when several composites are to be arranged alongside each other (see Fig. 29), or/and when the wick is supposed to be infiltrated across two end sections spaced apart from each other, a correspondingly large sheetlike dimension of the capillary gap 41 is required, which can hardly be realized with the above-described arrangement per WO 2010/045671 due to the effects pointed out.

The problem which the invention proposes to solve is to eliminate the above indicated drawbacks of the arrangement known from the prior art. In particular, the problem which the invention intends to solve is to configure an inhaler component of the kind described above so that a relatively compact overall arrangement can be achieved with a correspondingly small design volume. Moreover, it should be possible to provide capillary gaps with a larger sheetlike dimension.

The problem is solved by the characterizing features of patent claim 1. Accordingly, it is provided that the capillary gap at least partially covers the liquid container on the outside, in a view perpendicular to the carrier plate. In the sense of the present invention, "covering" also applies when still other items are arranged between the capillary gap and the liquid container. If one considers that the components forming the capillary gap only require little space perpendicular to the carrier plate, it becomes understandable that design space can be economized with the arrangement according to the invention.

In one modification of the invention, the composite at least partially covers the liquid container, in a view perpendicular to the carrier plate. In the sense of the present invention, "covering" also applies when still other items are arranged between the composite and the liquid container. If one considers that the composite is generally a relatively thin structure, it is clear that further design space can be economized thanks to this further covering.

In one preferred embodiment of the invention, the carrier plate bears at least in part on the liquid container. The liquid container and the carrier plate are thus arranged in a stack one on top of the other. It is especially advantageous to the design when the liquid container has substantially the shape of a cuboid, and the carrier plate bears at least in part on a side surface of the cuboid. In this way, the available design space can be utilized optimally. The carrier plate preferably consists of a printed circuit board, especially a multilayered so-called multilayer printed circuit board. In this way, namely, the conductor tracks carrying the electric heating current to and from the unit can be divided among several layers, so that even very large heating currents can be transported for the most part loss-free.

The invention furthermore concerns an inhaler, containing an inhaler component according to the invention as described above. The inhaler component can also be only one part, especially an interchangeable part, of an inhaler.

The invention shall be described more closely with the help of a sample embodiment according to the drawings.

There are shown:

Fig. 1 an inhaler according to the invention, in different views;

Fig. 2 the inhaler of Fig. 1 with a reusable inhaler part and an interchangeable inhaler component in the decoupled state;

Fig. 3a and Fig. 3b the interchangeable inhaler component in different views;

Fig. 4a, Fig. 4b, Fig. 4c, Fig. 4d and Fig. 4e sectional views of the interchangeable inhaler component along line A-A in Fig. 3b in different assembly states;

Fig. 5 detail a of Fig. 4a in a magnified representation;

Fig. 6 detail b of Fig. 4b in a magnified representation;

Fig. 7 a carrier plate designed as a multilayer printed circuit board;

Fig. 8 a sectional view of the interchangeable inhaler component along line B-B in Fig. 3b;

Fig. 9 detail c of Fig. 8 in a magnified representation;

Fig. 10 a sectional view of the interchangeable inhaler component in the area of the composite along line C-C in Fig. 3b.

Fig. 1 shows an inhaler according to the invention, whose shape and size are configured such that the inhaler can be easily and conveniently handled by users. In terms of volume, the inhaler is only around half as big as a cigarette pack. The sample inhaler shown consists essentially of two parts, namely of an inhaler part 1 and an inhaler component 2.

The inhaler component 2 consists of a housing 3, which forms a mouthpiece 4 at one end face, similar to a tobacco pipe. The housing 3 is preferably made of plastic. The inhaler component 2 contains a liquid material, which is electrically evaporated inside the housing 3 and converted into an inhalable vapour/air mixture or/and condensation aerosol. The resulting vapour/air mixture or/and condensation aerosol is presented to the user via the mouthpiece 4. As the liquid material, one can basically use any substances and preparations which evaporate largely free of residue under atmospheric conditions. This condition is also fulfilled already when the particular substance or the particular preparation is diluted, for example dissolved in water or/and ethanol, and the solution evaporates largely free of residue. Thanks to a sufficiently large dilution in a highly volatile solvent such as water or/and ethanol, even substances which are otherwise hard to evaporate fulfil the aforementioned condition, and a thermal decomposition of the liquid material is prevented or significantly diminished. The aerosol particles produced by condensation generally have a mass median aerodynamic diameter (MMAD) less than 2 µm and thereby also reach the alveoli. The inhaler according to the invention is especially suitable for administering systemically acting substances -- especially those active substances which deploy their main action in the central nervous system. As an example, one can mention nicotine, whose boiling point is 246°C. The nicotine-containing aerosol particles are deposited primarily in the bronchi and alveoli, where the active substance instantly passes into the blood stream. A few seconds later nicotine reaches the brain in bundled concentration and can deploy its known effects there.

The inhaler part 1 consists of a main housing 5, which again is preferably made of plastic. The main housing 5 contains at least one battery 6 and an electric circuit 7 (shown by broken line in Fig. 1) as well as a switch 7a. The battery 6 and the electric circuit 7 provide the electric energy needed for the evaporation of the liquid material. The battery 6 consists preferably of a rechargeable battery, such as the type CGR18650K from Panasonic, www.industrial.panasonic.com. This is a cylindrical lithium ion cell of size 18650 with a storage capacity of 1650 mAh and a current load capacity of up to 30 A. Comparable cells are also made by other manufacturers in large numbers, such as Sony, Samsung, LG Chem.

As shown by Fig. 2, the inhaler part 1 and the inhaler component 2 can be separated from each other in the particular sample embodiment. This arrangement makes the inhaler part 1 reusable, which is basically sensible if one considers, first of all, that the inhaler part 1 does not make contact with the liquid material, and so is not contaminated with the liquid material, and secondly it contains components which are more long-lived than the components of the inhaler component 2. The inhaler component 2, once the liquid material has been used up, is properly disposed of as a whole by the user, and replaced by a new inhaler component 2. Accordingly, the inhaler component 2 constitutes an interchangeable disposable article. A proper disposal is especially indicated when the liquid material contains pharmaceuticals or toxins such as nicotine. Basically, of course, it would also be conceivable to make the inhaler part 1 and the inhaler component 2 as a single piece, i.e., inseparable from each other. But this configuration would not be as economical, for in this case all parts and components of the inhaler, i.e., the inhaler as a whole would form a disposable article for a single use. Of course, the invention in question also encompasses this embodiment, in which case the entire inhaler is to be considered as the inhaler component.

The mechanical coupling between the interchangeable inhaler component 2 and the reusable inhaler part 1 occurs via insert tongues 8a and guide tabs 9a formed by the housing 3, which fit into corresponding insert sockets 8b and guide grooves 9b formed by the main housing 5 of the reusable inhaler part 1. The insert tongues 8a and insert sockets 8b at the same time serve to introduce the electric energy into the interchangeable inhaler component 2 for evaporation of the liquid material, as shall be shown in greater detail below.

Fig. 3a and Fig. 3b show different views of the interchangeable inhaler component 2. Fig. 4-9 provide further information about the internal makeup of the inhaler component 2. Accordingly, the housing 3 of the inhaler component 2 has essentially a cuboidal shape. Inside the cuboidal housing 3 are the essential components for the formation of the vapour/air mixture or/and condensation aerosol. These include, in particular, the composites 10, which bring about the evaporation of the liquid material. In the specific sample embodiment, six composites 10 are arranged in a row, and the composites have a sheetlike shape. The sheetlike composites 10 each time consist of a wick and an electric heating element, which are joined together by their surfaces or are integrated in each other's surface. For example, the sheetlike composites 10 can be formed by a metal foil with layers of metal fabric sintered on it. Instead of the metal fabric, open-pore metal foams can also be used. The open-pore capillary structure of the fabric layers or metal foam sintered on the metal foil forms the wick, and the electrical resistance of the metal forms the heating element. Suitable metallic resistance materials are, for example, refined steels such as AISI 304 or AISI 316 as well as heating conductor alloys, especially NiCr alloys. The manufacture of such sheetlike composites 10 is within the prior art and is disclosed in detail, for example, in the already cited WO 2010/045671 (Helmut Buchberger).

As is best shown by Fig. 4b and Fig. 7, the sheetlike composites 10 bear by two end sections 10a, 10b against a carrier plate 11. The carrier plate 11 has a large recess 12, which is spanned by the composites 10 free of contact. The carrier plate 11 in the specific sample embodiment is designed as a printed circuit board, especially a multilayer printed circuit board. Suitable as the material for the printed circuit board 11 are basically all known printed circuit board materials, especially material types FR1 to FR5. The sheetlike composites 10 are electrically contacted in the area of the end sections 10a, 10b on conductor tracks 13 of the printed circuit board 11. In Fig. 7 the conductor tracks 13 are represented as black areas. In the case of the above described metal foil composites, the electrical contacting is done preferably by a soldering at the foil side, optionally after pretreatment with a suitable fluxing agent. Refined steels of material grades AISI 304 and AISI 316 can be soldered without problem by using for example a solder concentrate with the brand name "5050S-Nirosta" from the firm Stannol GmbH, www.stannol.de. Alternatively, the electrical contacting can consist of an adhesive connection by means of an electrically conductive adhesive, such as a silver-containing adhesive on an epoxy base. The mounting of the printed circuit board 11 with the sheetlike composites 10 and their contacting is done fully automatically, in which one can use the methods of the printed circuit board industry, which methods furthermore are also suitable for a mass production.

The printed circuit board 11 protrudes from the housing 3 in the form of the already aforementioned insert tongues 8a. The two insert tongues 8a serve to conduct the electric energy into the inhaler component 2. The electric energy is supplied to the composites 10 via the conductor tracks 13. According to Fig. 7, the conductor tracks 13 are arranged on both the front side 11a and the back side 11b of the printed circuit board 11, where the front side 11a is the mounting side – that is, the side on which the composites 10 are contacted. Further conductor tracks can also optionally be arranged in intermediate layers. The individual conductor track layers are advisedly joined together according to the prior art by means of so-called plated through-holes. Fig. 7 moreover shows the current flow. Accordingly, in the specific example, each time three composites 10 are connected together in series. In this way, the resulting heating resistance and thus the heating power and rate of evaporation can be influenced within certain limits. It can also be provided to have the individual electrical resistances of the six composites 10 of different size, for example, by varying accordingly the thickness of the metal foil. With these measures, the evaporation process can also be made dependent on location, similar to that of a cigarette.

At the front side 11a of the printed circuit board 11 is placed an essentially platelike top piece 14, preferably made of plastic (see Fig. 4c and Fig. 8-10). The top piece 14 has a recess 15, which correlates in size and arrangement with the recess 12 in the printed circuit board 11. In the most simple case, the top piece 14 bears directly on the end sections 10a, 10b of the sheetlike composites 10. In this way, the top piece 14 together with the printed circuit board 11 forms a capillary gap 16, whose clear width or gap width essentially corresponds to the thickness of the sheetlike composites 10 (see Fig. 9 and Fig. 10). The gap width is typically 0.2 mm. Fig. 4d shows the sheetlike dimension of the capillary gap 16 as a black area. The top piece 14 is secured to the printed circuit board 11 by an adhesive connection, namely via two projections 14a, 14b and a support angle 17.

The printed circuit board 11 bears with its back side 11b against a liquid container 19 containing the liquid material 18 (see Fig. 4a/4b, Fig. 8 and Fig. 10). The liquid container 19 or its wall is formed by the housing 3 and has a cuboidal shape. The printed circuit board 11 is preferably secured by means of an adhesive connection to the liquid container wall. The filling of the liquid container 19 with the liquid material 18 is done at the factory, at the end of the manufacturing process, preferably through a small hole in the container wall (not shown), and fully automatically by means of a cannula and a dispensing unit. The hole is closed after the filling, for example, being melted shut, and the entire inhaler component 2 is packaged in an air-tight manner.

The liquid container 19 has at its lower end two openings arranged close to each other – the supply opening 20 and the vent opening 21 (see Fig. 5, Fig. 6 and Fig. 9). The supply opening 20 matches up with an admission opening 22, which is formed by the edge of the printed circuit board 11 and an extension 23 of the liquid container wall (see Fig. 6 and Fig. 9). The extension 23 at the same time forms an end stop for the top piece 14. For rigidity, the extension 23 is braced by a web 24 against the housing 3. The supplying of the capillary gap 16 with the liquid material 18 occurs via the supply opening 20 and the admission opening 22 and is driven by the capillary forces acting in the capillary gap 16. In order for these capillary forces to work at all, it is necessary that the liquid material 18 properly wets all exposed surfaces. To ensure this, the affected structural parts – namely, the liquid container 19, the printed circuit board 11 and composites 10 and the top piece 14 – need to be made hydrophilic in a suitable process even prior to being assembled. Suitable processes are hydrophilic treatment in oxygen plasma as well as hydrophilic treatment by means of plasma polymerization. Both processes are offered, for example, by the firm Diener electronic GmbH u. Co. KG, www.plasma.de, in the context of contract manufacturing jobs. The mentioned firm, furthermore, is able to plan and set up corresponding customized layouts, also suitable for a mass production.

The vent opening 21 matches up with a vent groove 25 worked into the printed circuit board 11, which in turn communicates via the recess 12 with an interior space under atmospheric pressure. The vent opening 21 and the vent groove 25 bring about a pressure equalization in that each portion of liquid material 18 getting into the capillary gap 16 is immediately replaced by an equal-volume portion of air.

The overlapping arrangement of the printed circuit board 11 and the liquid container 19, as well as the above described arrangement of the supply opening 20, the admission opening 22 and the vent opening 21, make it possible to provide a relatively large capillary gap area, which is necessary when several composites 10 arranged alongside each other need to be supplied with the liquid material 18. The danger of liquid material 18 escaping somewhere on account of the action of gravity can be largely averted. In the upright position of the inhaler component 2 shown in Fig. 8 (an arrow shows the direction of gravity), approximately atmospheric pressure prevails in the vent opening 21, since the capillary gap 16 does not extend further downward in relation to the admission opening 22 (see Fig. 4d). In a position of the inhaler component 2 placed upside down (the mouthpiece 4 pointing downward), the liquid column in the capillary gap 16 can cause a partial vacuum, but this cannot act on the liquid material 18 in the liquid container 19, because an air cushion in the liquid container 19 interrupts the capillary coupling. During the filling of the liquid container 19 at the factory, one only needs to make sure that a small volume of air 26 remains to form the air cushion in the container.

Before discussing more closely the mode of operation of the inhaler according to the invention, we shall describe below some other elements of the inhaler component 2. Even though these elements might not be directly relevant to the invention, their description will help in the better understanding of the function of the inhaler component according to the invention as a whole, and further guarantee the implementability of the invention: between the top piece 14 and the housing 3 are arranged two open-pore absorbent sponges 27a, 27b (see Fig. 4e and Fig. 10). The space between the sponges together with the recess 15 forms a chamber 28 (see also Fig. 8), in which the actual formation of the vapour/air mixture or/and condensation aerosol takes place. The sponges 27a, 27b take up in their pores condensate deposits formed from the vapour phase and prevent freely mobile condensate deposits from forming in the inhaler component 2, which might impair the function of the inhaler component. Such condensate build-up can also constitute a problem from a hygiene standpoint, especially if they get into the oral cavity of a user via the mouthpiece 4. The sponges 27a, 27b consist preferably of a fine-pore fibre composite. The firm Filtrona Fibertec GmbH, www.filtronafibertec.com, specializes in the manufacture of such fibre composites, and it processes both cellulose acetate fibres bound by means of triacetin and thermally bound polyolefin and polyester fibres.

The sponges 27a, 27b bear against angle profiles 29a, 29b formed by a U-shaped carrier 29 (see Fig. 4e and Fig. 10). The carrier 29 is joined to the top piece 14 by an adhesive connection. The carrier 29 and angle profiles 29a, 29b preferably consist of a hydrophobic plastic. The hydrophobic material acts like a liquid barrier and makes sure that no liquid material 18 can get to the sponges 27a, 27b by capillary effects. In the leg 29c joining the angle profiles 29a, 29b, a depression 30 is worked into the side facing the top piece 14, which together with the top piece 14 forms an air nozzle 31 (see Fig. 9 and Fig. 10). The air nozzle 31, as will be further explained later on, serves to bring surrounding air into the chamber 28. So that condensate deposits do not block the air nozzle 31, it is recommended to cover the surface of the top piece 14 in the region of the air nozzle 31 with a thin hydrophobic adhesive tape (not shown).

The supplying of the inhaler component 2 with ambient air to form the vapour/air mixture or/and condensation aerosol occurs by an intake spout 32 formed by the housing 3 (see Fig. 3a/3b and Fig.8). The intake spout 32 is arranged on the side of the inhaler component 2 opposite the mouthpiece 4. This position protects best against entry of rain water. In the coupled state, the intake spout 32 of the inhaler component 2 extends through a hole 33 formed by the main housing 5 of the inhaler part 1 (see Fig. 2). In the intake spout 32 there is a flow restrictor 34. The flow restrictor 34 has the purpose of creating a flow resistance, similar to that of a cigarette, so that the user feels a similar drag when puffing on the device as when puffing on a cigarette. Specifically, the flow resistance for a flow rate of 1.05 L/min should be in the range of 8-16 mbar and have the most linear possible characteristic. The flow restrictor 34 is necessary when the resulting vapour/air mixture or/and condensation aerosol is to be supplied as in a cigarette, namely, as a puff into the oral cavity (puff volume around 20-80 mL), optionally followed by an inhalation into the lungs. This mode of operation is primarily recommended when the liquid material 18 contains nicotine. However, the flow restrictor 34 is dispensed with when the inhaler should allow a direct inhalation into the lungs in a single step, as is usually the case with most medicine inhalers. The flow restrictor 34 preferably consists of a fibre composite resembling a cigarette filter, the density of the material being attuned to the aforementioned flow characteristic. The material, once again, can be ordered from the firm Filtrona Fibertec GmbH, www.filtronafibertec.com.

In what follows, the function of the inhaler shall be described in detail: a user couples a new inhaler component 2 to the reusable inhaler part 1. The electric circuit 7 registers the coupling and optionally initiates the performance of certain preparatory operations, such as one or more evaporation cycles with the goal of supplying the composites 10 with fresh liquid material 18 or/and providing steady state conditions. Once these operations have been completed, the electric circuit 7 signals, for example by a light-emitting diode, the operational readiness of the inhaler. The user places the mouthpiece 4 of the inhaler in his mouth and operates the switch 7a. At the same time, he begins to draw on the mouthpiece 4. The resulting partial vacuum causes air from the surroundings to flow into the intake spout 32. Once the air has flowed past the flow restrictor 34, the stream bends at a right angle (see arrows in Fig. 8 and Fig. 9) and empties into a plenum chamber 35, where the air collects and is then supplied uniformly to the slotlike air nozzle 31. The air stream is accelerated in the air nozzle 31 and enters the chamber 28 with a high muzzle velocity.

The activating of the switch 7a has the effect of the circuit 7 turning on the heating current. The heating current is preferably switched on by means of a power MOSFET, while the supplied power can be adapted to the particular requirements by a duty cycle. This adaptation can also be done by the user within certain limits by way of an interface, making it possible for him to influence the quantity of aerosol or smoke produced. The heating current is switched on for a preset period of time ("heating period"), which is typically 1.0-1.8 seconds. The heating current is supplied to the composites 10 via the insert tongues 8a and the conductor tracks 13 of the printed circuit board 11 and brings about an instant heating of the composites 10 and the liquid material 18 built up in the wicks, whereupon the liquid material 18 evaporates. The vapour is emitted into the chamber 28, where it mixes with the air streaming in through the air nozzle 31. The arrangement and dimensioning of the air nozzle 31 accomplishes a uniform and rapid flow through the composites 10. This ensures that the vapour released from the composites 10 encounters approximately the same mixture conditions everywhere, and the mixture of vapour and air is intimate. The air brings about a cooling of the vapour, so that a condensation aerosol can also be formed, as long as the evaporated liquid material 18 contains substances with sufficiently low vapour pressure – so-called aerosol-forming substances. A typical example of such aerosol-forming substances is glycerol.

The vapour/air mixture or/and condensation aerosol formed in the chamber 28 finally flows through a cooler 36 in the sample embodiment before being presented to the user via the mouthpiece 4 for inhalation (see Fig. 4e and Fig. 8). The cooler 36 can consist, for example, of a porous filler material, a fleecelike fibre material, or an open-cell foam material whose pores are permeated by the resulting vapour/air mixture or/and condensation aerosol. The cooler 36 can also have a multistage design, where the individual cooler stages have different properties. If the material being evaporated contains nicotine, it may be advantageous to coat the cooler material of at least one cooler stage with a suitable absorbent, such as citric acid. The absorbent draws out the volatile nicotine fractions from the condensation aerosol flowing past, which would otherwise be deposited in the oral cavity and throat, which is neither pharmacokinetically nor organoleptically desirable. Moreover, fragrances such as menthol can be added to the cooler material.

Suitable fleecelike fibre materials can be ordered, for example, from the firm Freudenberg Vliesstoffe KG, www.freudenberg-filter.com. The material distributed under the designation Viledon® filter mats and consisting of polyolefin fibres is manufactured according to customer specification, it being possible to adapt the material properties so that the end product is as permeable as possible to the fine particles of the resulting condensation aerosol. A suitable foam material can be ordered, for example, from the firm Dunlop Equipment, www.dunlop-equipment.com. The mentioned supplier offers Ni-foam and NiCr-foam under the product designation Retimet® (Grade 80) with a porosity of 90-95% and a pore diameter of around 300 µm in plate form up to thicknesses of 15 mm. Following verbal communication with company representatives, even more fine-pore foams can also be manufactured from a technological standpoint. The metal foams can furthermore be additionally compacted by rollers. The plates can be further worked by laser cutting or wire erosion. Ni-foam and especially NiCr-foam are distinguished by high strength as well as high temperature and oxidation resistance. These properties suggest that the relatively costly metal foams should be recycled and reused at the end of the useful life of the inhaler component 2. If the liquid material 18 contains nicotine, the inhaler component 2 should basically only be sold to the consumer with an appropriate deposit. This will make sure that most of the cooler 36, sponges 27a, 27b and liquid container 19 contaminated with nicotine residues will be disposed of in a proper way for the environment and optionally recycled.

At the end of the heating period, the circuit 7 deactivates the switch 7a for a couple of seconds. The deactivation is indicated to the user, for example by a light-emitting diode, and is necessary so that the composites 10 can cool down, and the wicks can again soak up the liquid material 18. The liquid transport is originally induced by the capillarity of the composites 10 and their wicks. The wicks soak up the liquid material 18 via the composite end sections 10a, 10b from the capillary gap branches 16a, 16b (see Fig. 4b and Fig. 10). Thus, the wicks are infiltrated from two sides. The withdrawal of liquid material 18 from the capillary gap branches 16a, 16b induces a capillary pressure in the capillary gap 16, which has effects as far back as the liquid container 19, so that liquid material 18 can flow from the liquid container 19 through the supply opening 20 and the admission opening 22 into the capillary gap 16 (see arrows in Fig. 4b). The quantity of liquid material l18 withdrawn from the liquid container 19 is replaced by an equivalent quantity of air by way of a pressure equalization. The pressure equalization occurs through the vent groove 25 and the vent opening 21. Once the composites 10 and wicks are fully infiltrated with the liquid material 18, the inhaler is ready for another evaporation cycle.

Finally, as an example, a nicotine-containing preparation of the liquid material 18 which was evaporated in prototypes shall be disclosed (see table 1). The condensation aerosol formed and dispensed in this way was very close to the smoke of a conventional cigarette in regard to pharmacological, pharmacokinetic and organoleptic effects. All ingredients listed are also found in cigarette smoke.

Table 1:

Material	CAS Number	Weight %
Water	7732-18-5	52.92
Ethanol	64-17-5	3.80
Glycerol (E422)	56-81-5	40.10
Nicotine	54-11-5	1.60
Lactic acid (E270)	50-21-5	0.29
Succinic acid (E363)	110-15-6	0.32
Benzoic acid (E210)	65-85-0	0.26
Acetic acid (E260)	64-19-7	0.71
	total:	100.00

It should further be pointed out that the invention of course is not limited to one or more sheetlike composites 10 according to the sample embodiment just described. The composites 10 can likewise be in the form of a line or thread. Neither do the composites have to be flat or linear, but instead they can have any desired shape. Moreover, the composites can be electrically interconnected with each other in any desired manner. Finally the invention also encompasses devices in which the liquid container 19 can be separated from the housing 3, so that the liquid container 19, once empty, can be replaced by a new liquid container.

INHALÁTORKOMPONENS

Szabadalmi igénypontok

1. Inhalátorkomponens gőz/levegő elegy és/vagy kondenzációs aeroszol képzésére folyékony anyag (18) elpárologtatásával, továbbá adott esetben a képzett gőz kondenzációjával, amely tartalmaz
villamos fűtőelemet a folyékony anyag (18) egy részének elpárologtatásához;
kapilláris szerkezetű kanócot, amely kanóc a fűtőelemmel kompozitot (10) alkot és a fűtőelemet önműködően folyékony anyaggal (18) látja el;
hordozólapot (11), előnyösen nyomtatott áramköri lapot, amely a kompozitot (10) tartja és amelyen a fűtőelem villamos érintkezésekkel rendelkezik;
egy legalább részben a hordozólap (11) által képzett kapillárishézagot (16) a kompozitnak (10) a folyékony anyaggal (18) önműködően történő ellátására, ahol a kanóc egyik végtartománya a kapillárishézagba (16) nyúlik;
egy a folyékony anyagot (18) tároló folyadéktartályt (19), melyből a kapillárishézag (16) a folyékony anyagot (18) nyeri,
azzal jellemezve, hogy hordozólapra (11) merőleges nézetben a kapillárishézag (16) a folyadéktartályt (19) kívülről legalább részben fedi.

2. Az 1. igénypont szerinti inhalátorkomponens, **azzal jellemezve**, hogy hordozólapra (11) merőleges nézetben a kompozit (10) a folyadéktartályt (19) legalább részben fedi.

3. Az 1. vagy a 2. igénypont szerinti inhalátorkomponens, **azzal jellemezve**, hogy a hordozólap (11) a folyadéktartályon (19) legalább szakaszosan felfekszik.

4. A 3. igénypont szerinti igénypont szerinti inhalátorkomponens, **azzal jellemezve**, hogy a folyadéktartály (19) lényegében téglatest alakú, továbbá a hordozólap (11) a téglatest egyik oldallapján legalább szakaszosan felfekszik.

5. Inhalátor, amelynek egy az 1-4. igénypontok bármelyike szerinti inhalátorkomponense (2) van.

List of reference symbols

1	Reusable inhaler part
2	Interchangeable inhaler component
3	Housing
4	Mouthpiece
5	Main housing
6	Battery
7	Electrical circuit
7a	Switch
8a	Insert tongues
8b	Insert sockets
9a	Guide tabs
9b	Guide grooves
10	Sheetlike composites
10a, 10b	Composite end sections
11	Carrier plate, printed circuit board, multilayer printed circuit board
11a	Printed circuit board front side
11b	Printed circuit board back side
12	Recess
13	Conductor tracks
14	Top piece
14a, 14b	Projections
15	Recess
16	Capillary gap
16a, 16b	Capillary gap branches
17	Support angle
18	Liquid material
19	Liquid container
20	Supply opening
21	Vent opening
22	Admission opening
23	Extension
24	Web
25	Vent groove
26	Air volume, air cushion
27a, 27b	Open-pore absorbent sponges
28	Chamber
29	U-shaped carrier

29a, 29b	Angle profiles
29c	Leg
30	Depression
31	Air nozzle
32	Intake spout
33	Hole
34	Flow restrictor
35	Plenum chamber
36	Cooler

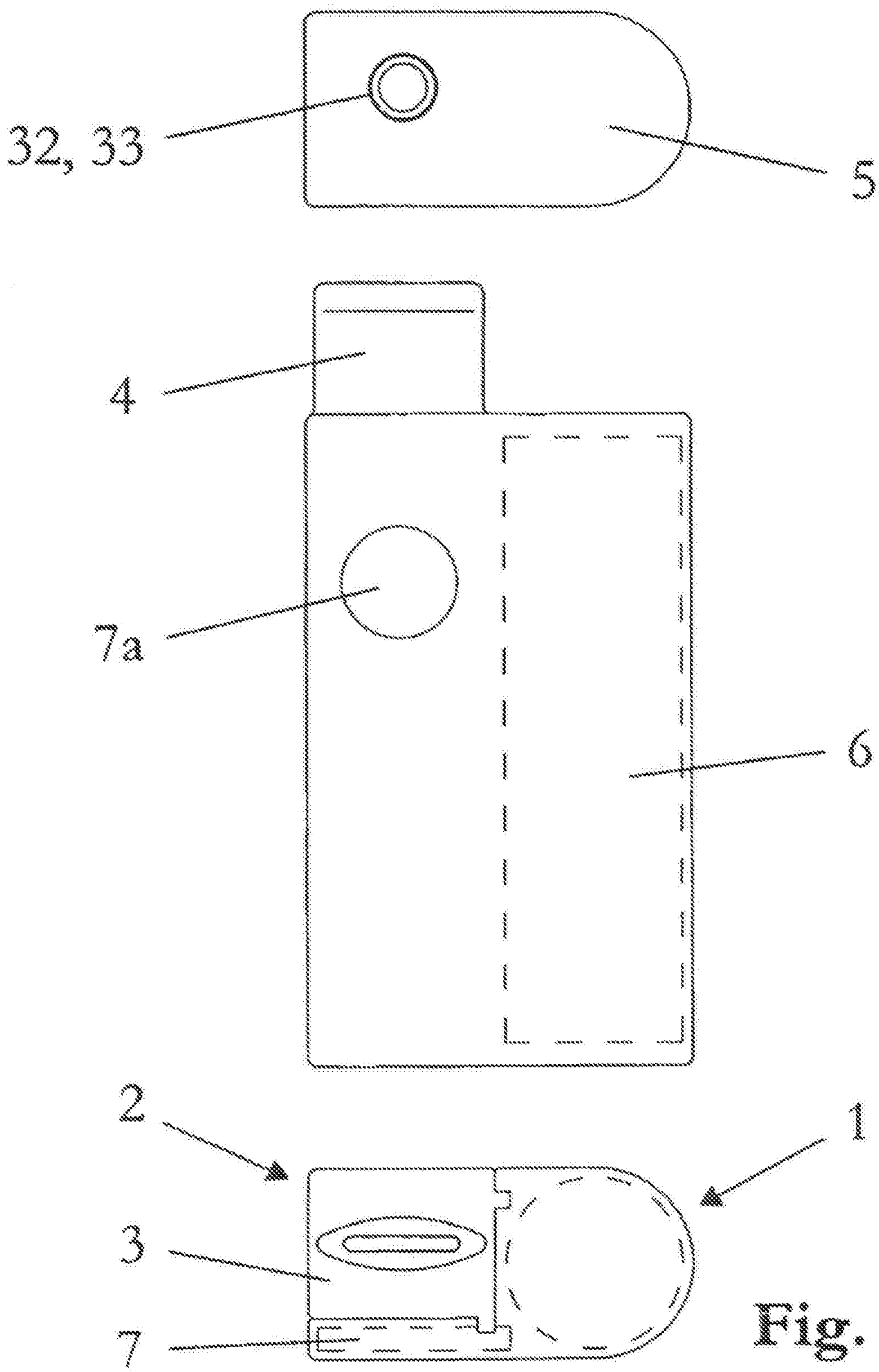

Fig. 1

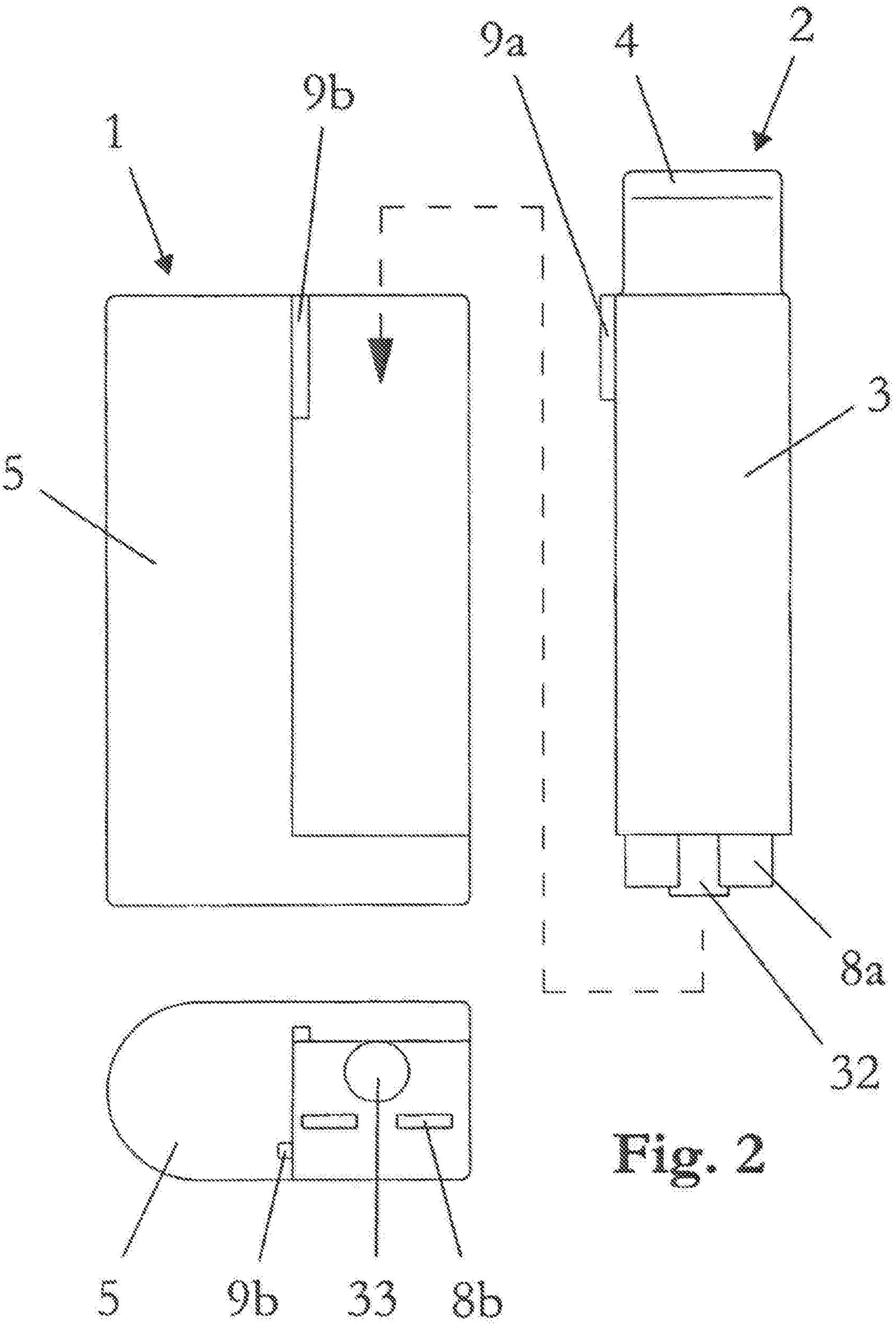

Fig. 2

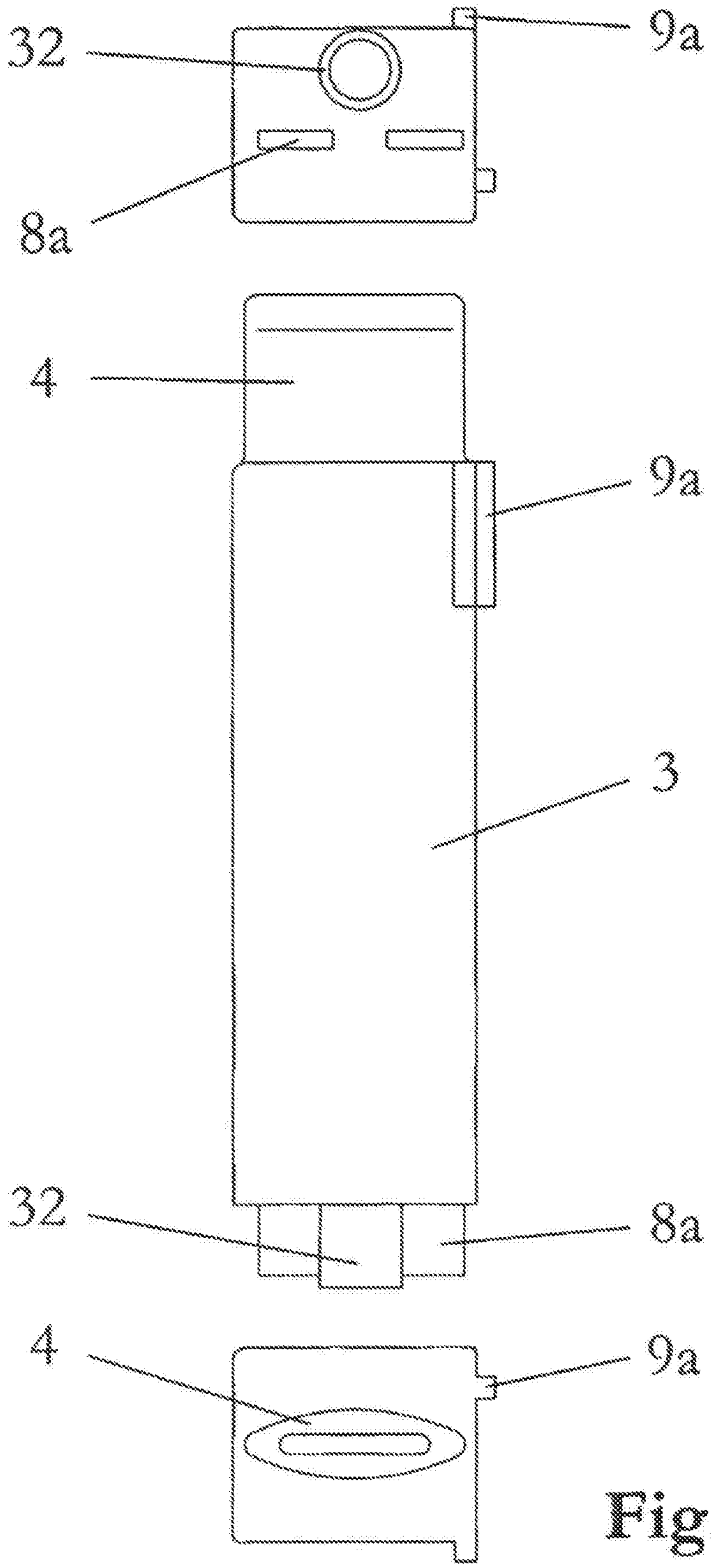

Fig. 3a

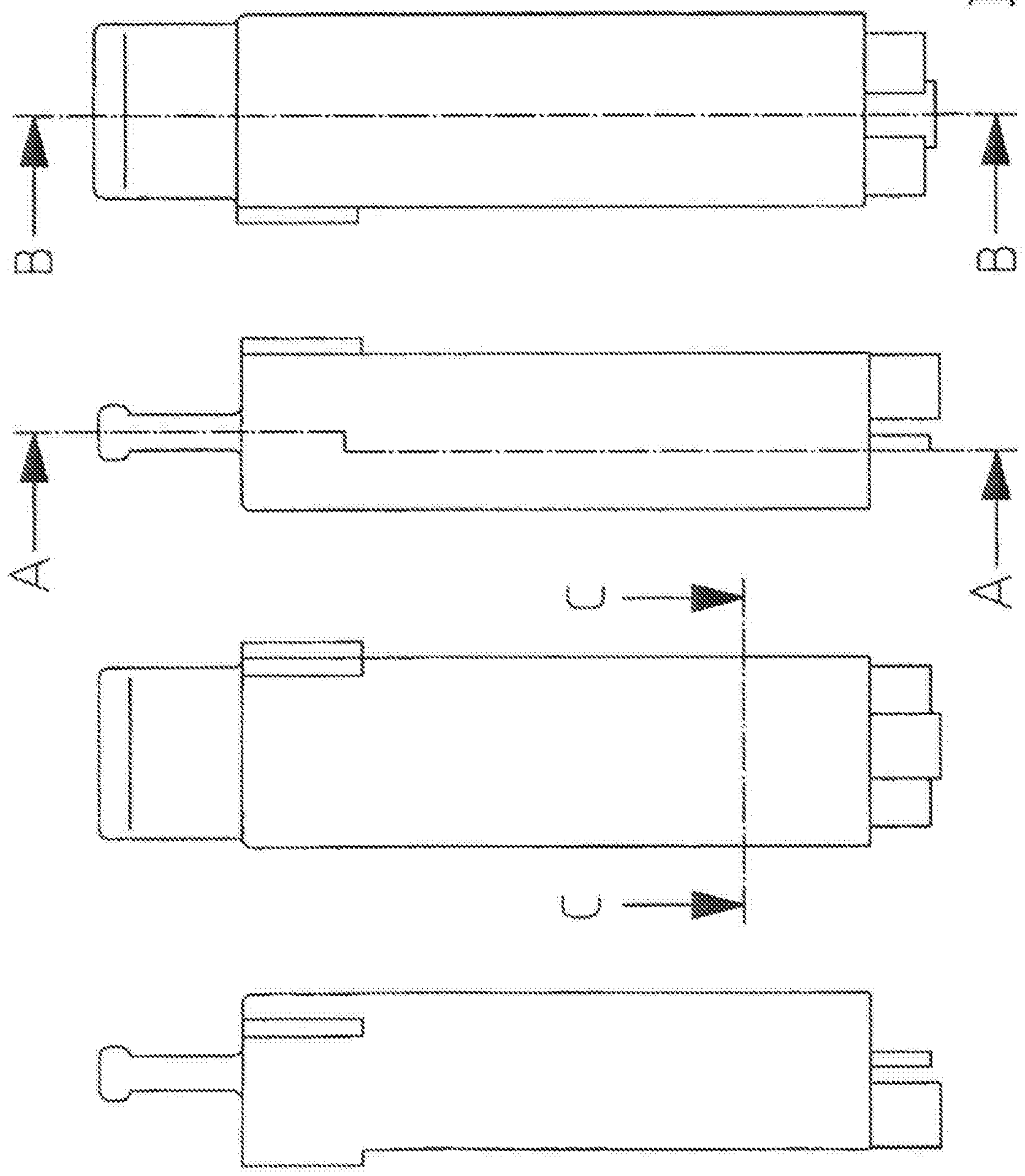

Fig. 3b

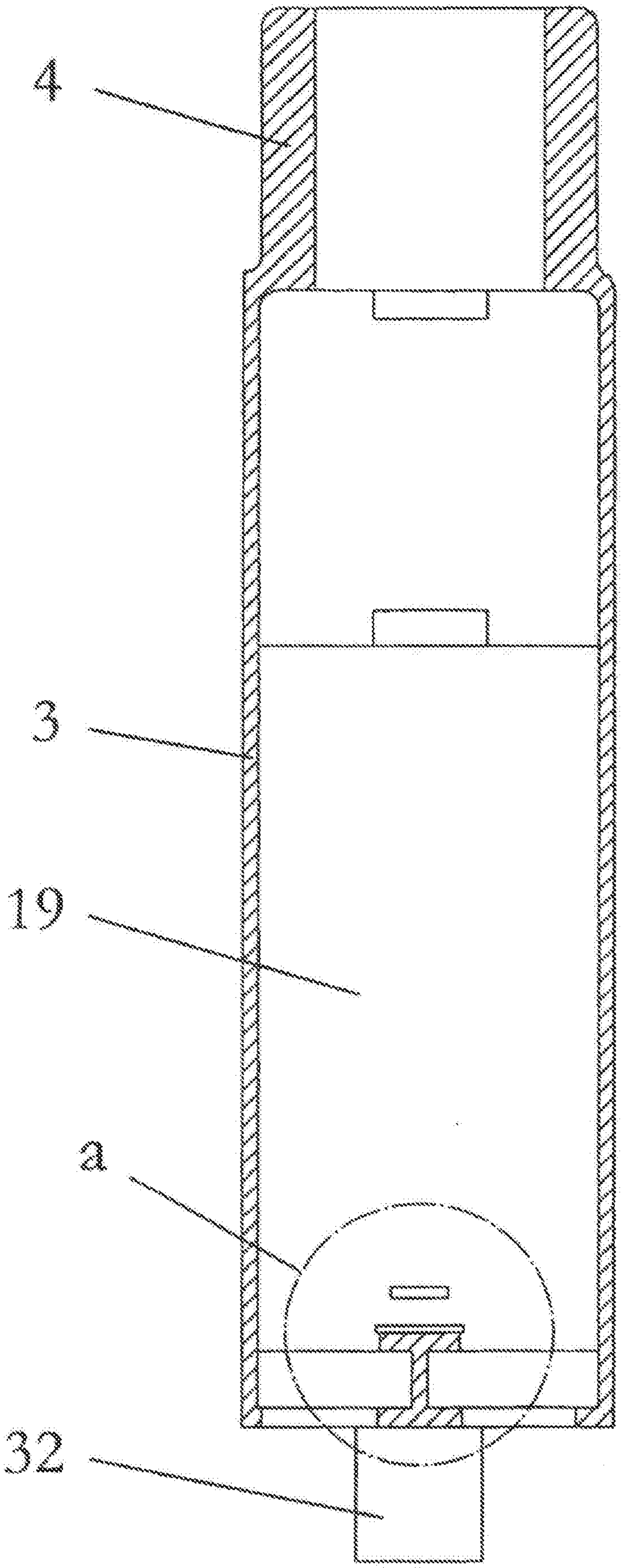

Fig. 4a

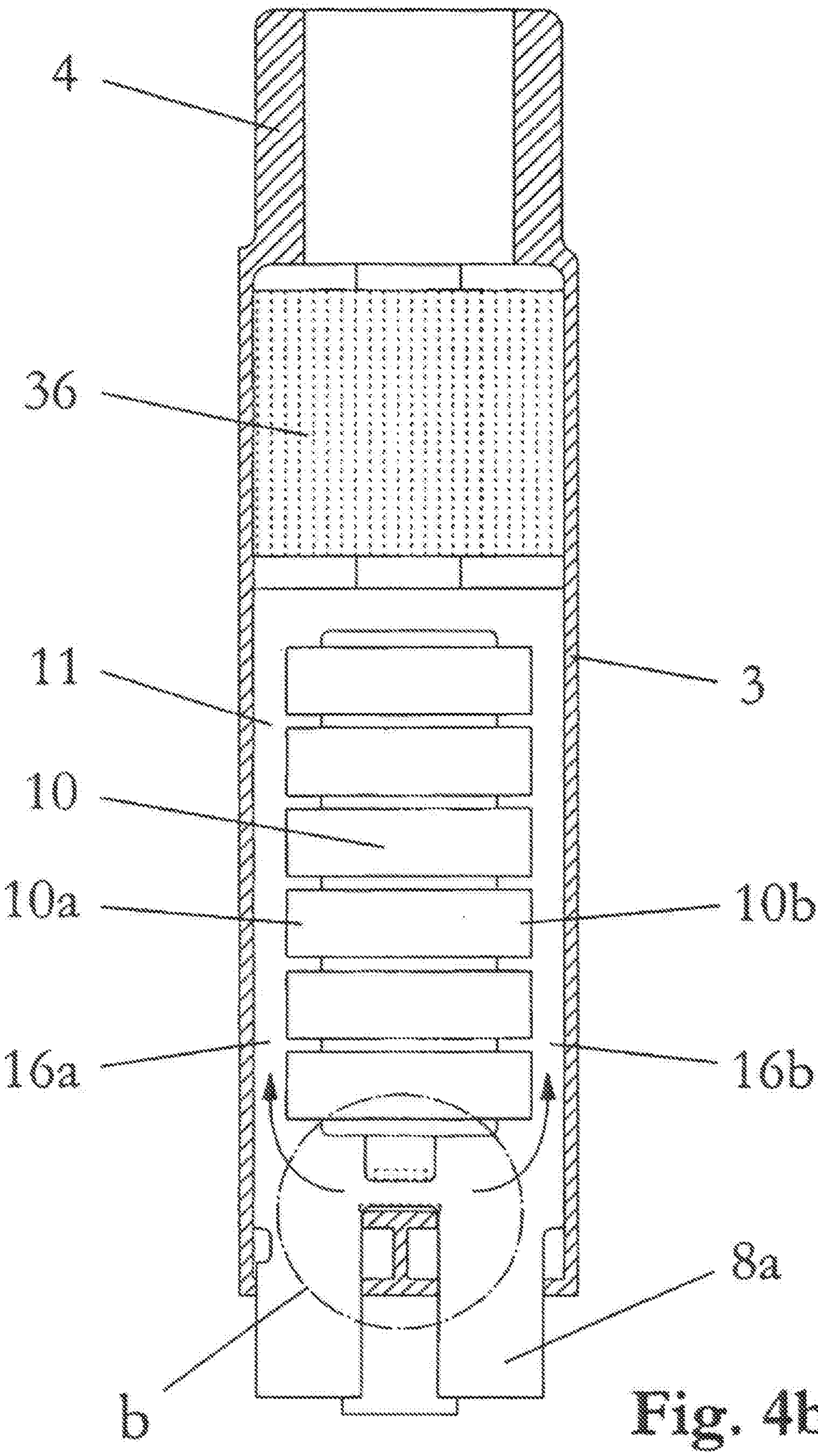

Fig. 4b

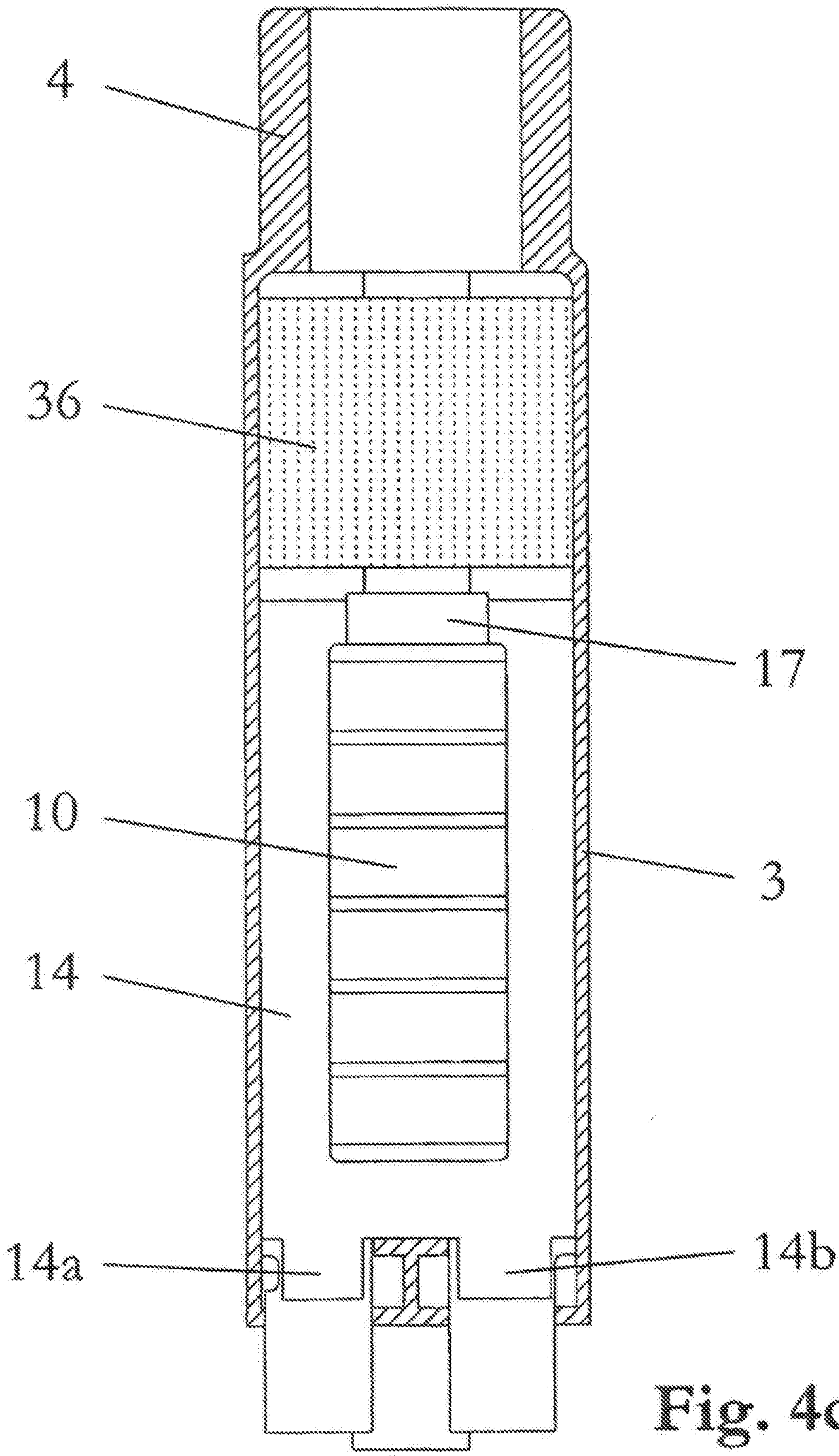

Fig. 4c

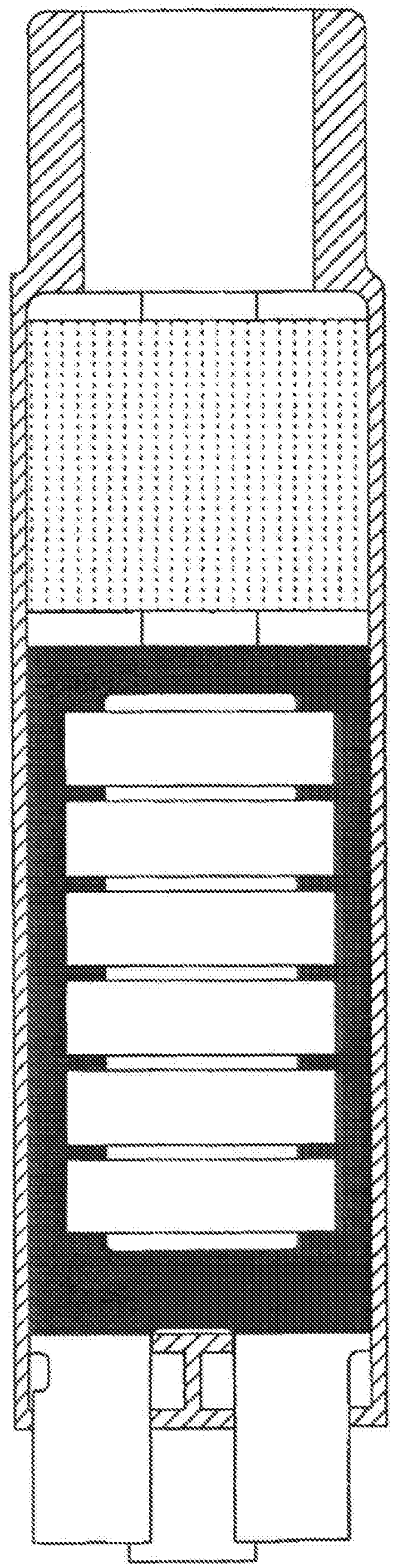

Fig. 4d

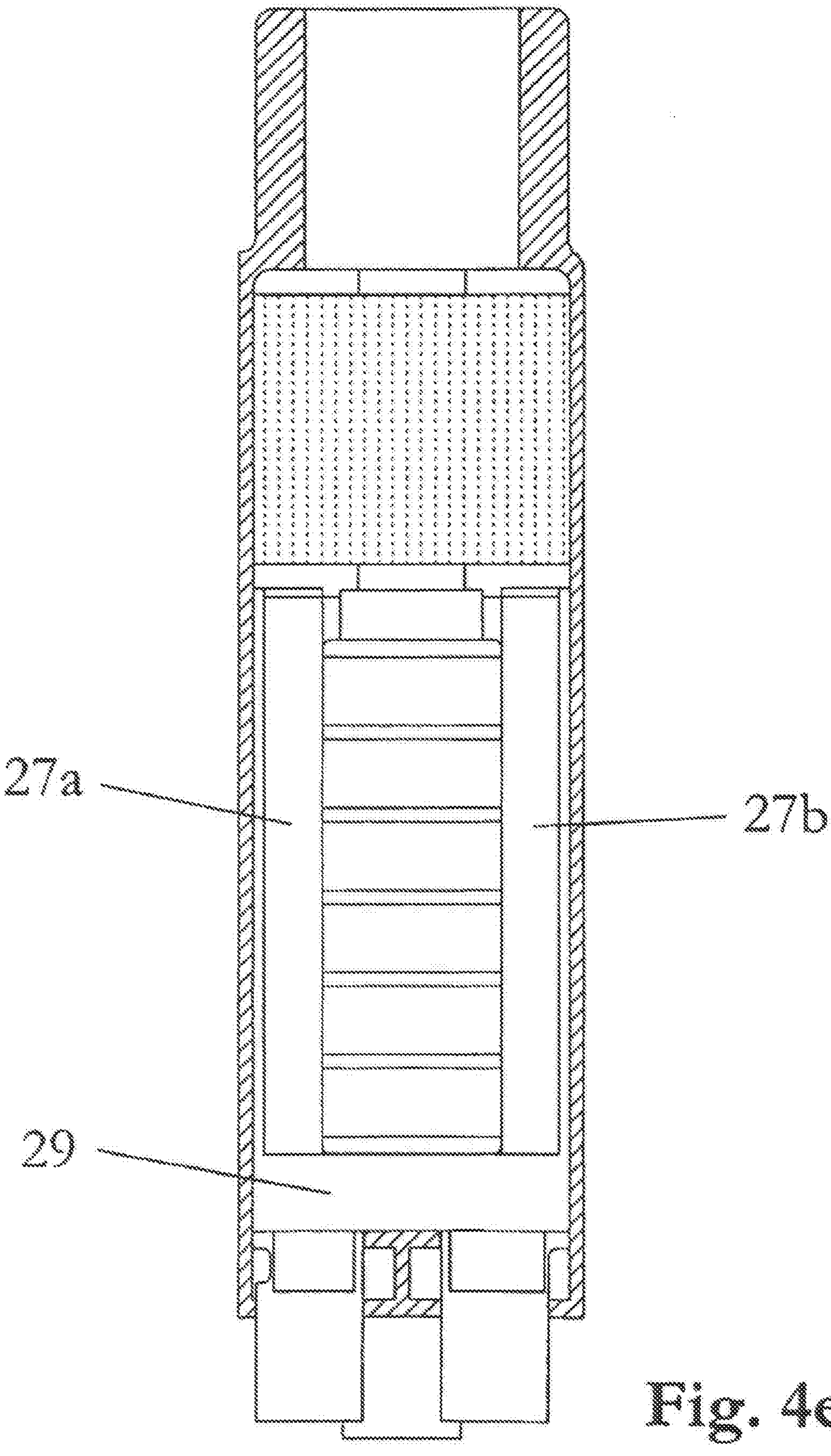

Fig. 4e

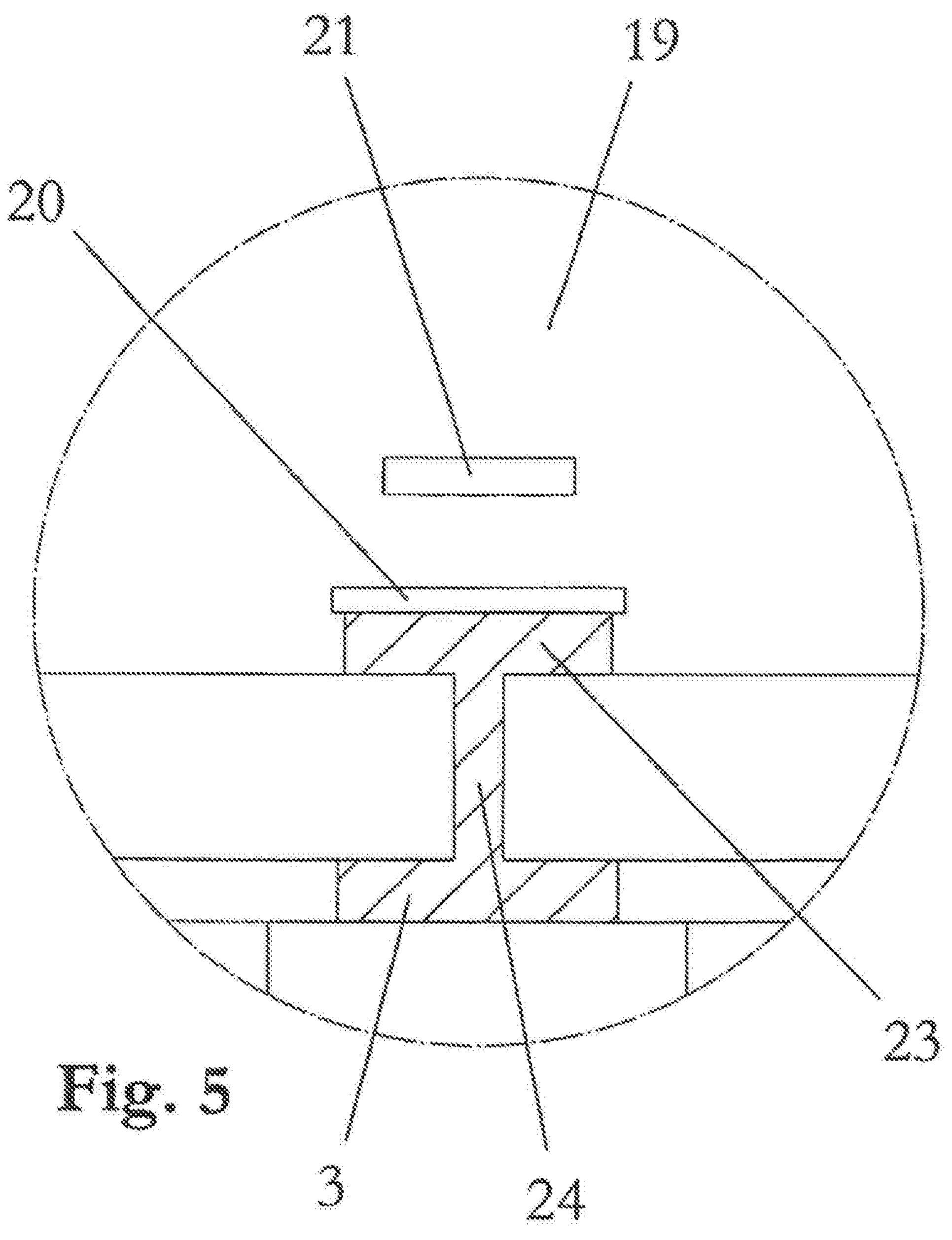

Fig. 5

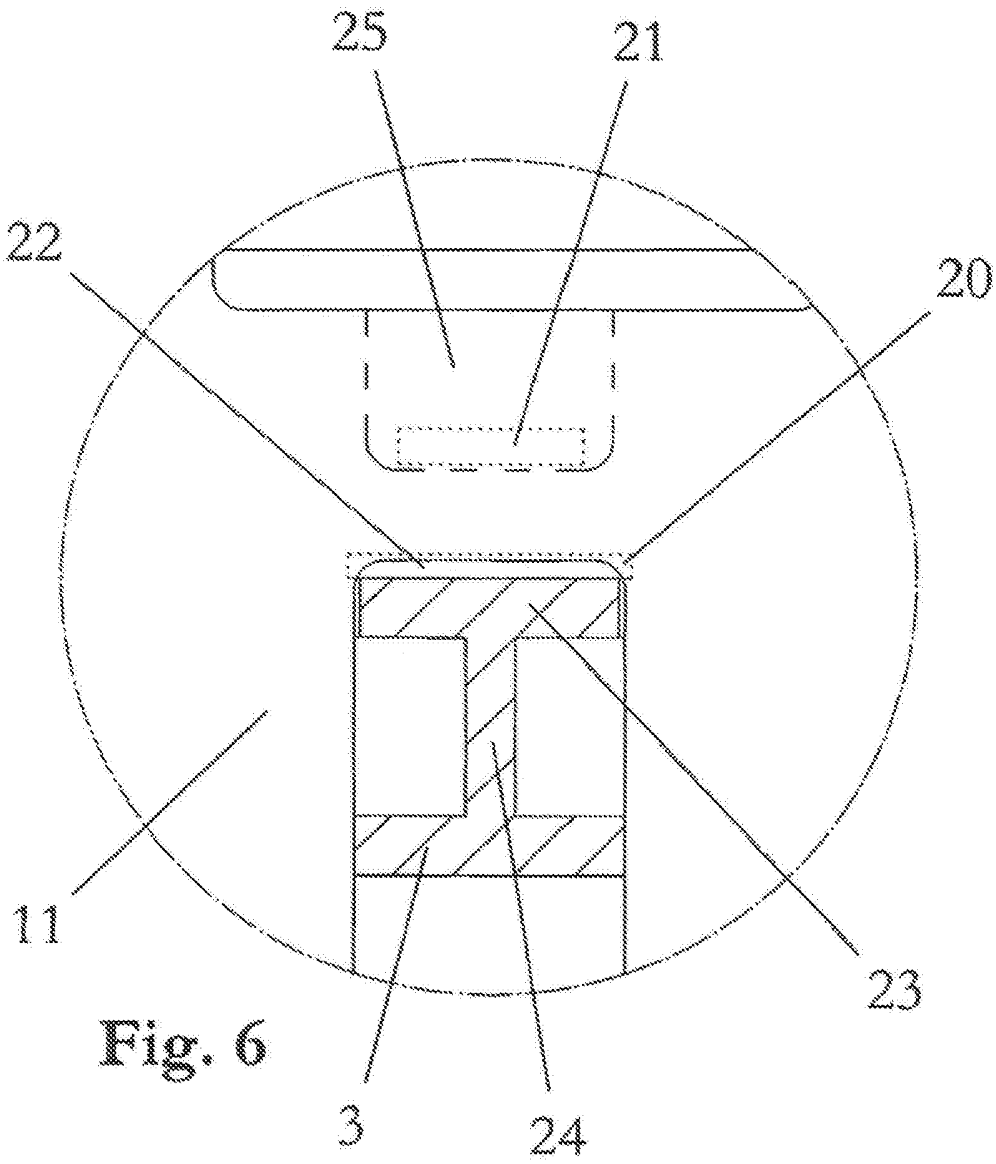

Fig. 6

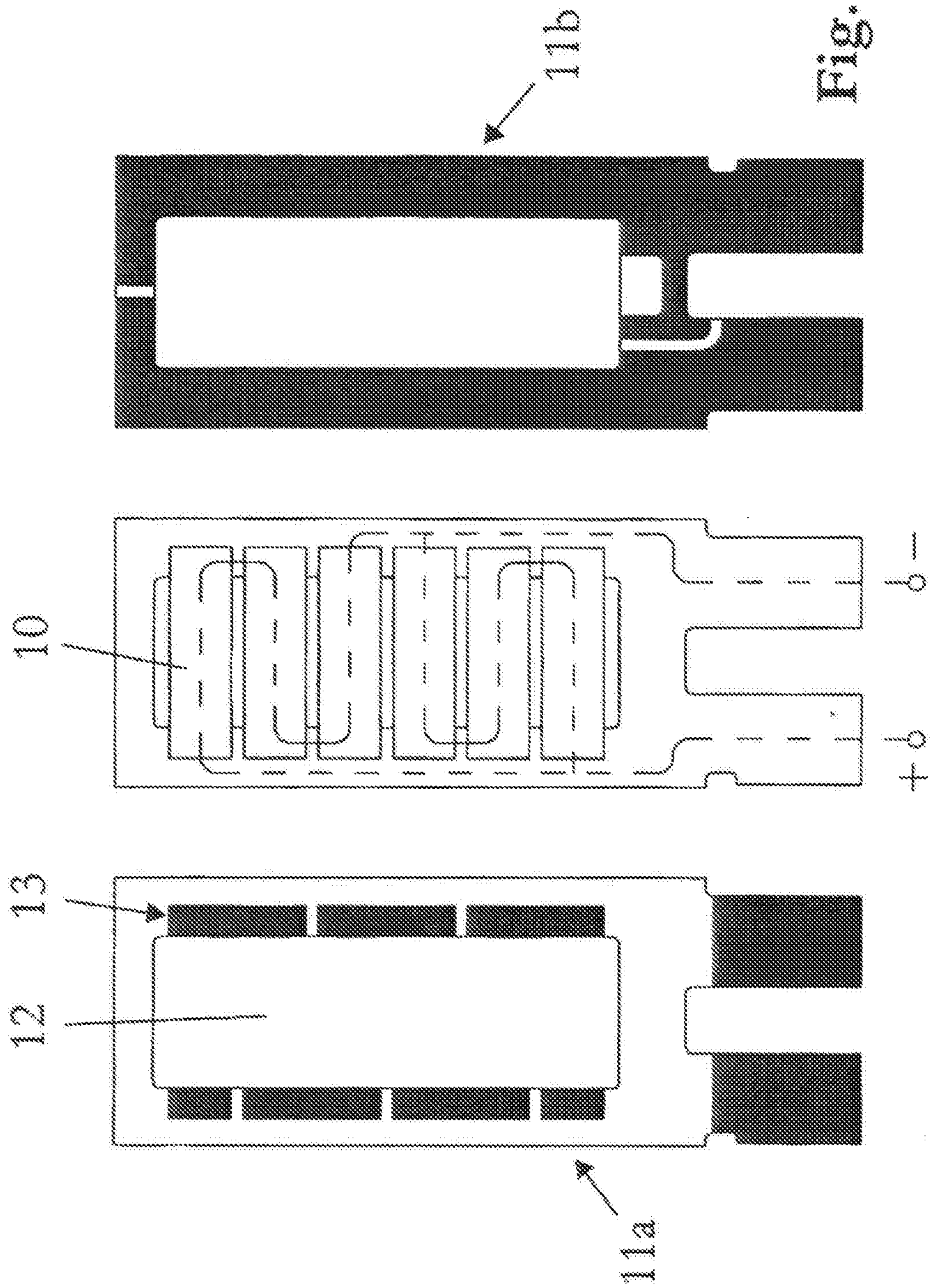

Fig. 7

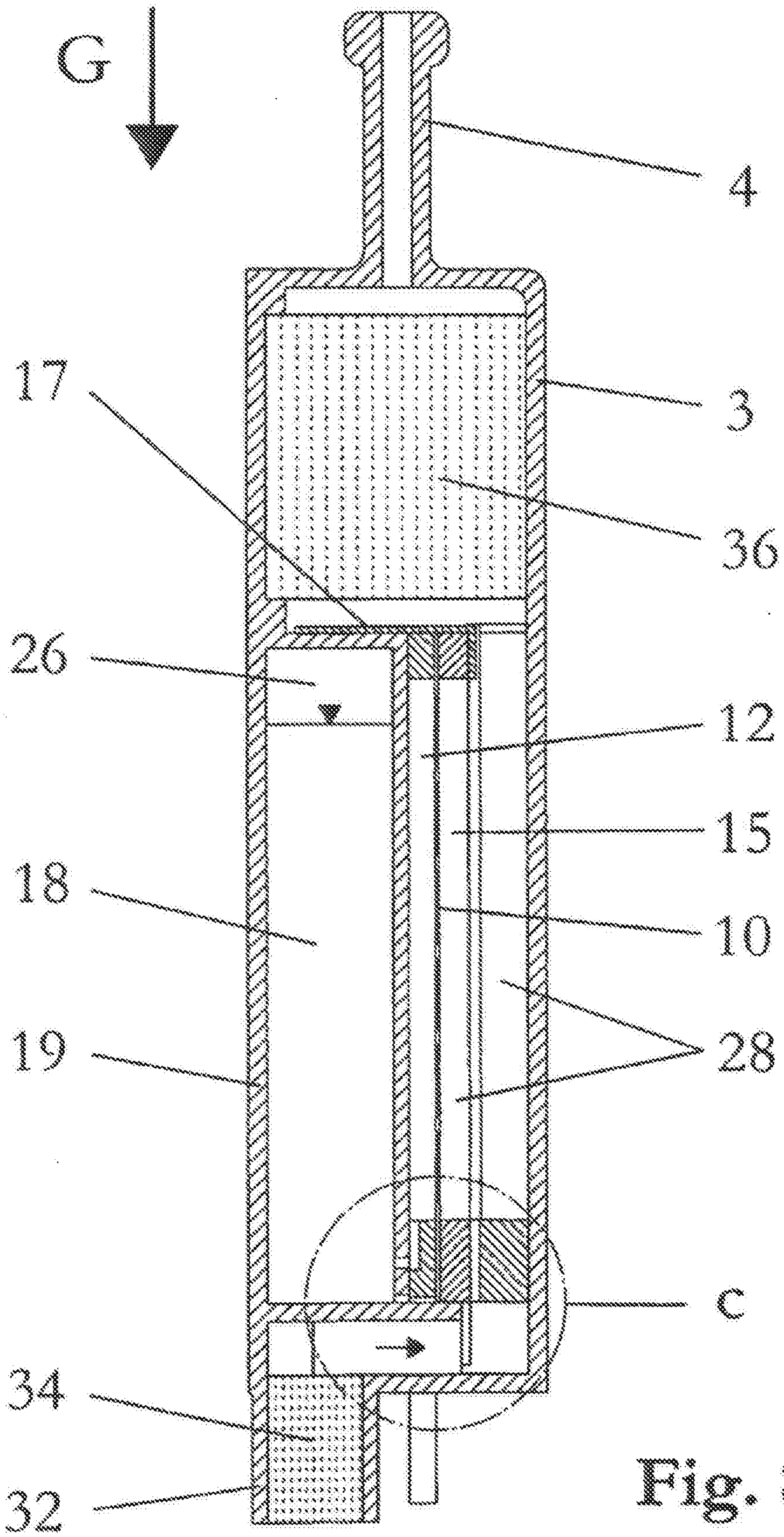

Fig. 8

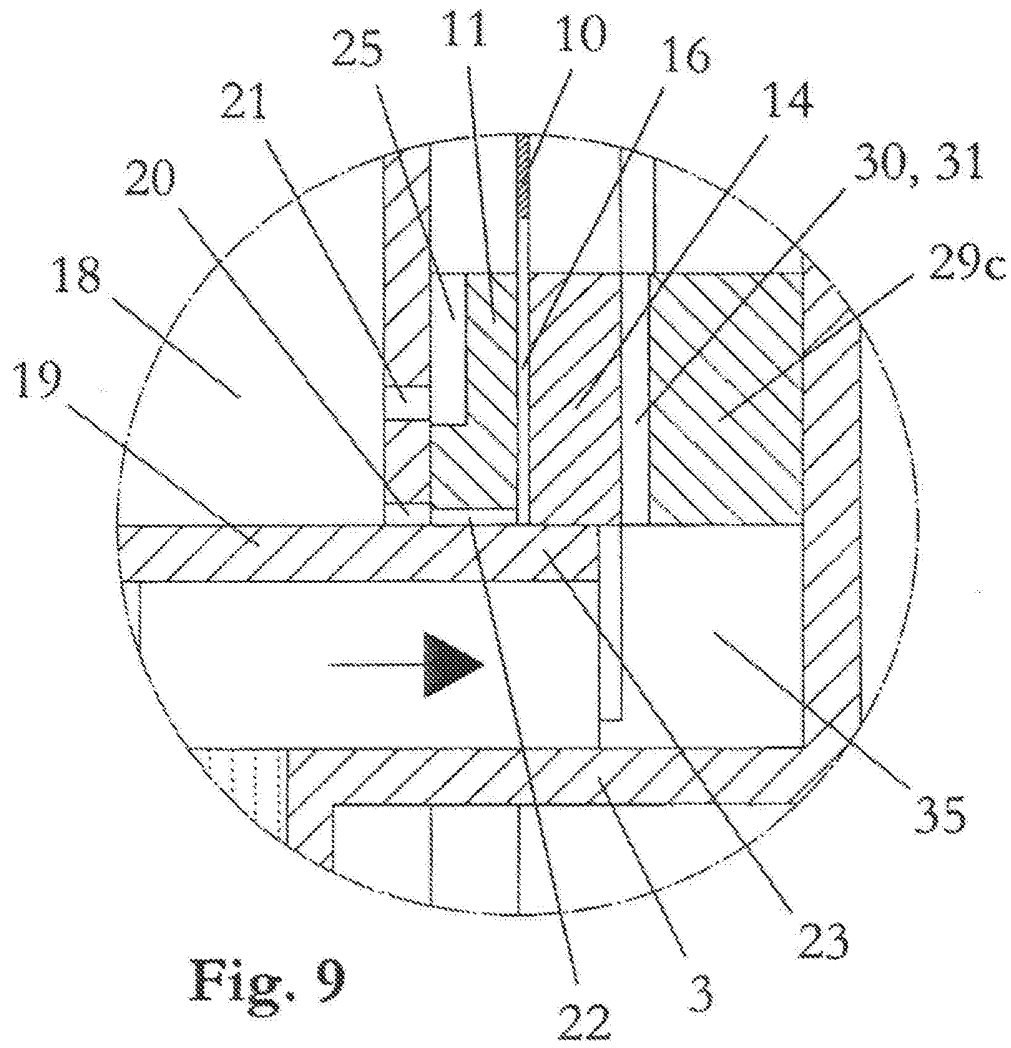

Fig. 9

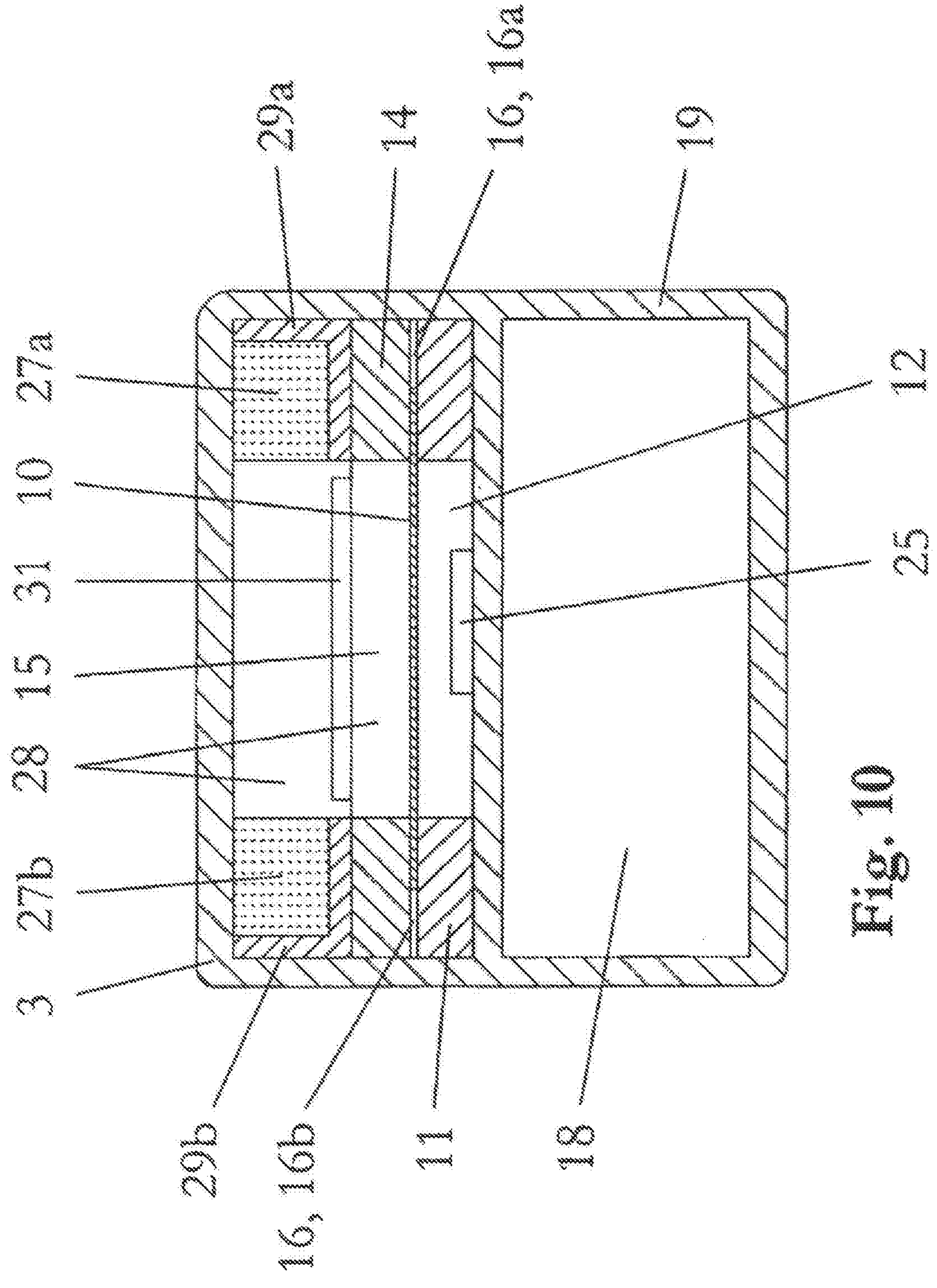

Fig. 10