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(54) Title: SMOKING ARTICLE

(57) Abstract: A heat-not-burn (HNB) smoking article (1) comprises a dispensing mechanism (20) for controlling delivery of a controlled quantity of an aerosol generating material (2) into a heating chamber. A heating mechanism (22) heats the aerosol generating material (2) within the heating chamber in order to generate an aerosol.

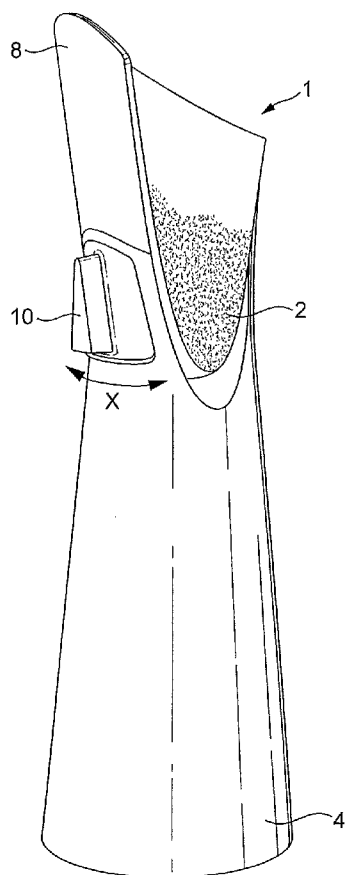


FIG. 1



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Smoking Article

Field

This specification describes a smoking article comprising a Heat-Not-Burn (HNB) product.

Background

HNB products which are sometimes also referred to as non-combustion type smoking articles, are being developed as a possible alternative to conventional cigarettes. HNB products generate aerosols by heating, rather than burning, tobacco and/or other smoking materials, for example herbs. Examples of generally tubular HNB cigarettes are known from US Publication No. US 2005/0066985 and US Patent No. 5,265,626.

Another existing technology is a vaporiser described in WO 2006/082571 (Oglesby and Butler). This vaporiser, for use with herbs, uses a combustion chamber where a fuel gas is combusted catalytically to provide heat indirectly to the herbs placed in a heating chamber, whereby the generated aerosol is delivered through a mouthpiece to a consumer.

Summary

Embodiments of a heat-not-burn (HNB) smoking article are described herein that comprise: a dispensing mechanism for controlling delivery of a controlled quantity of an aerosol generating material into a heating chamber; and a heating mechanism for heating the aerosol generating material within the heating chamber in order to generate an aerosol.

The act of controlling the quantity of the aerosol generating material (e.g. tobacco or tobacco substitute) which is loaded into the heating chamber means that the duration of the smoking experience can be tailored to suit the consumer. This is because only a sufficient amount of aerosol generating material for a few puffs is used (heated) at any one time. This differs from conventional smoking experiences in which a cigarette normally burns to the end regardless of the number of times a user draws on it.

One particular advantage of the HNB device described in more detail hereinafter is in providing a consumer freedom to move around from room to room, being able to puff or draw on the device on-demand. The consumer is free from the constraints of a confined duration of a smoking experience provided by a conventional cigarette or existing HNB cigarettes. This is possible because a controlled quantity of tobacco is dispensed into the heating chamber in response to a user operating a suitable switch or lever. This controlled quantity is arranged to deliver a pre-determined number of puffs, and the consumer activates the switch, at a convenient time, in order to generate another dose of aerosol and a further pre-determined number of puffs. The device would remain in a heated condition to enable rapid heating of the freshly dosed tobacco, thus reducing the time the consumer would have to wait before consuming the aerosol generated from freshly charged tobacco materials.

This has associated advantages of reducing wastage of tobacco materials during a conventional smoking experience when the user may chose to leave a cigarette in an ashtray for a period of time. In addition, by reducing the quantity of tobacco to be heated at any one time, there is an associated reduction in the time it takes to heat up the tobacco to generate an aerosol for consumption.

In addition, the Oglesby and Butler vaporiser *supra* requires the consumer to first switch on a gas supply, and then depress a piezo ignition switch to ignite butane gases to generate the required heating of the herbs. Consumer research has identified that these two separate actions are unintuitive because it is unclear which switch is required in order to stop the device from functioning. The device described herein combines both actions into one switch for example a sliding switch which has various soft stopping points to activate different parts of the process.

Brief description of the drawings

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

Figure 1 is a perspective view of an HNB device according to one aspect of the invention;

Figure 2 shows a front and side elevation of the HNB device of Figure 1 showing partial cut-away sections;

Figures 3a to 3d are schematic diagrams of a tobacco container according to one embodiment of the invention;

Figure 4 is a cross-section view from above, through at line A-A', of the HNB device of Figure 1;

Figure 5 is a schematic diagram of a simple dispensing, heating and disposal (DHD) mechanism;

Figures 6a to 6g are a series of diagrams similar to Figure 5;

Figure 7 is a schematic diagram of a vertical cross-section of the HNB device of Figure 2;

Figure 8 is a schematic diagram similar to Figure 7 showing flow paths through the HNB device;

Figure 9 is a flowchart of process steps through the smoking experience using an HNB device as described; and

Figures 10a to 10g are schematic diagrams showing a plurality of slider switch positions.

Detailed description

Figure 1 shows one embodiment of a smoking article 1 according to one aspect of the present invention. The smoking article 1 is a multi-use, heat not burn (HNB) device. The device 1 is arranged to house tobacco or a tobacco substitute 2 or other vaporisable material, a portion of which is heated during use to cause volatilisation of low boiling point components within the tobacco or tobacco substitute. This volatilisation is achieved while avoiding pyrolysis or combustion of the tobacco or volatiles. This leads to the creation of a vapour which is drawn through the device upon puffing by a consumer and is then condensed into an aerosol containing particles of liquid suspended in the vapours: this aerosol is then inhaled by the consumer. The volatilised components include water, nicotine, humectants and light volatiles which are present in the substrate (tobacco or tobacco substitute) which is being heated.

For simplicity, the remaining description refers to tobacco or tobacco material. However, it is to be appreciated that tobacco is not the only suitable aerosol generating material and that tobacco substitutes or other suitable vaporisable materials may be used.

In one embodiment the device comprises a generally cylindrical body or housing as shown in Figure 1, having a base section 4. In one embodiment, the device is arranged to stand upright on its base when not in use. An upper portion of the body extends to a mouthpiece 8 through which the generated aerosol is delivered to the consumer.

Situated on the body of the device is an actuating switch 10 which is arranged to control delivery of the smoking experience. In one embodiment, the actuating switch 10 is arranged to be operated in a lateral sliding movement. In another embodiment the actuating switch may be operated through rotational movement or through depression of a switch. A person skilled in the art will appreciate that other actuation movements may be suitable.

The actuating switch 10 controls delivery, heating and disposal of the tobacco or tobacco substitute within the device. The actuating switch 10 also controls the switching of the device heating system to be on or off. In one embodiment, the actuating switch has a slider 10 which is arranged to slide in a lateral direction such that the switch is arranged to pass a plurality of connection or stop points. Passing these connection or stop points causes electrical and/or mechanical actuation of device.

The slider may be arranged to slide vertically along the body or axially about the circumference of the body. This latter type of slider is shown in Figures 1 and 2 moving in the direction of the arrows X.

Figure 2 show a partial cut-away elevation and side view of the device shown in Figure 1. In addition to the mouthpiece 8, slider 10 and base 4, the device comprises: a fuel reservoir 12, for storing a suitable fuel, for example liquefied butane; a waste chamber 14 for storing expired tobacco or tobacco substitute 2' after it has been expended or used; a tobacco container 16 for storing the tobacco or tobacco substitute material 2; and a dispense, heat and dispose (DHD) mechanism 20, for controlling the dispensing, heating and disposal of the tobacco material 2, 2' within the device.

The DHD mechanism 20, described in greater detail, below comprises a heating chamber (not shown) in which the tobacco material is heated by a heating mechanism 22 during use. The heating mechanism comprises a

combustion chamber 24 which causes heat to be generated and transferred to the heating chamber, as described below.

As shown in Figure 2, the mouthpiece 8 of one embodiment has an outer wall 30 which forms part of the cylindrical body, and an inner wall 32 which is spaced apart from the outer wall 30 to form a shallow opening 34 through which the generated aerosol is dispensed or drawn. In one embodiment the inner wall 32 is formed from part of the tobacco container 16 which contains the tobacco material 2.

In one embodiment, the tobacco container 16 is housed permanently within the body of the device and comprises a first opening 38 for receiving a refill of the tobacco material 2, and a second opening 40 through which the tobacco material 2 is dispensed into the DHD mechanism 20.

The tobacco material 2 as shown in Figure 1 is cut rag tobacco, whereas the tobacco material 2 of Figure 2 is shown as porous balls of compressed tobacco. Alternative forms of tobacco materials or tobacco substitutes include pellets, capsules, tablets, dust, granules, flakes etc. It is appreciated that one skilled in the art could derive different forms of tobacco substrates which could be dispensed into the DHD mechanism.

The tobacco material is able to flow from the tobacco container 16 into the DHD mechanism so as to dispense a predetermined quantity of material, with consistent mass, into the tobacco heating chamber of the DHD. The tobacco materials or tobacco substitutes may also contain heat transfer improving agents such as metal foils or foil laminated tobacco to aid the heat transfer from the tobacco heating chamber into the tobacco structure and hence decrease the time required to achieve vaporisation from the substrate.

In an alternative embodiment, the tobacco container 16 is a disposable cartridge which contains the tobacco material 2. In this latter embodiment, the cartridge also has a feeder opening through which the tobacco material is dispensed into the DHD mechanism. In this embodiment, the body of the device has a cartridge cavity for receiving a disposable cartridge which is removable after the tobacco product has been used or if the consumer wishes to use a different tobacco material.

In one embodiment, the disposable cartridge comprises a removable cover over the feeder opening in the cartridge, such that upon insertion of a fresh cartridge the removable cover is at least partially displaced such that tobacco material from the cartridge is fed, under gravity, into the DHD mechanism 20. Therefore, upon insertion of a fresh cartridge into the device 1, the device is primed with tobacco ready for use. The removable cover may be at least partially displaced through piercing action in which the removable cover is pierced by a suitably positioned piercing portion, within the cartridge cavity, for receiving the disposable cartridge. A person skilled in the art will appreciate other mechanisms for removing or displacing the removable cover, for example, a pull tab may be removed when the disposable cartridge is loaded into the device in order to open the feeder opening.

In one embodiment, a suitable moveable cover may be arranged as a rotatable cover plate 50 and pin 52 arrangement as shown in Figures 3a to 3d, with respect to an example disposable cartridge shaped as a cylinder. This is for illustrative purposes only and is not intended as a limitation for the shape of the disposable cartridge.

The cover plate 50 may be arranged to be resiliently biased to reside in a closed position covering an opening 54 in the bottom of the tobacco container 16. In one embodiment, the action of inserting the tobacco container 16 into the device causes the rotatable cover plate 50 to rotate about an axis defined by the pin 52. This rotation causes the rotatable cover plate 50 to move to an open position such that the tobacco material 2 can flow through the opening into the DHD mechanism 20.

The disposable cartridge is arranged to compliment the shape of the opening in the body of the device and be secured in place. A person skilled in the art will appreciate how to design the device in relation to the disposable cartridge such that the rotatable cover plate can be forced to move/rotate as the cartridge is loaded into the device.

In addition, a person skilled in the art will appreciate various methods for securing the disposable cartridge in place. In one embodiment, the cartridge may be designed to enter a specific male–female locking relationship with the

device to prevent use of other non-approved refill cartridges and to ensure that the cartridge is held securely in the device during use. In one embodiment, the locking mechanism may be further arranged to enter a 'locked' status once the actuation switch is slide around from the off position, and similarly would unlock once the actuation switch is slid back to the off position.

In one embodiment, the tobacco container 16 of a refillable or disposable type has an indicator, for example a visual indicator, to communicate to the consumer the volume of tobacco material remaining within the tobacco container and to provide an indication as to when the container may need refilling or replacing. The visual indicator of one embodiment comprises at least a portion of the container 16 which is transparent to show the volume of tobacco 2 within the container. In another embodiment, the whole container of a refillable or disposable type would be made of a suitable high temperature polymer or plastic, which is transparent in order to show the level of tobacco contained inside.

From the tobacco container 16 the tobacco material 2 passes into the DHD mechanism, which is described with reference to Figures 3 to 6.

In one embodiment, the DHD mechanism 20 is based on a Wankel engine. Figure 4 shows a cross-section through the body of the device at A-A' in Figure 1. As shown, the body comprises an outer casing 60 and an inner cavity 62. Within the inner cavity, the DHD mechanism 20 comprises a rotating body 64 which defines three chambers: a tobacco in-feed chamber 66, a heating chamber 68, and a tobacco out-feed chamber 70. These three chambers are defined between the walls of the inner cavity 62 and the rotating body 64. A rotating mechanism 72 comprising a plurality of gears 74 is arranged to translate the movement of the slider in the actuation switch into rotational movement of the rotating body.

To explain the operation of the DHD mechanism 20, a simplified version of the mechanism is shown in Figure 5. The DHD mechanism operates in connection with the actuation switch and slider. Actuation of the slider 10, through the rotating mechanism 72 and the plurality of gears 74, causes the rotating body 64 to rotate one third of a revolution, which causes the following actions:

1. fresh tobacco 2 held in the tobacco in-feed chamber 66 is transferred to the heating chamber 68;
2. any old, used tobacco 2' previously in the heating chamber 68 is transferred to the tobacco out-feed chamber 70, where it falls due to gravity into the waste chamber 14 below; and
3. the previously empty tobacco out-feed chamber 70 rotates to become the tobacco in-feed chamber 66, which is filled, under gravity, with fresh tobacco material 2.

The above actions are confirmed with reference to Figure 6a to 6g. In Figure 6a, tobacco is dosed into the tobacco in-feed chamber 66. In Figure 6b, the slider is actuated and the rotating body 64 begins a rotation of 120°. In Figure 6c, the rotation continues such that the tobacco material 2 from the in-feed chamber 66 is transferred into the heating chamber 68. In Figure 6d, the 120° rotation is complete and a new dose of fresh tobacco material 2 is fed into the in-feed chamber 66.

The rotating body 64 remains in the position shown in Figure 6d while the heating mechanism 22 causes the tobacco to be heated sufficiently in order to generate an aerosol. The way in which the heating mechanism 22 operates to generate the aerosol is described in greater detail below.

After a predetermined number of puffs, or after a time when the consumer desires the device to load fresh tobacco, the consumer slides the slider 10 again and another rotation of 120° begins. Part way through the rotation, as shown in Figure 6f, the used tobacco material 2' previously in the heating chamber 68 is transferred to the tobacco out-feed chamber 70, where it drops into the waste chamber 14. In addition, the freshly dosed tobacco material previously in the in-feed chamber 66 (as shown in Figure 6d) is transferred into the heating chamber 68. Figure 6g is a repetition of Figure 6d. The phases of Figures 6d to 6f are repeated until the tobacco container 16 is empty or until the consumer switched the device off.

As described above, the heating mechanism 22 causes the tobacco within the heating chamber to be heated sufficiently to create the aerosol. This aerosol generating process is described in detail below with reference to Figures 7 and 8 which are schematic representations of a vertical cross-section of the device

of Figure 2. Figures 7 and 8 are not drawn to scale and show variations in the position of some of the features shown in Figure 2.

The heat generated from the heating mechanism 22 is conducted into the heating chamber 68 of the DHD mechanism 20, and in turn the tobacco or tobacco substitute 2 contained in the DHD mechanism 20 is heated by conduction and radiation effects. As the tobacco or tobacco substitute is heated, the low boiling point and volatile components begin to vaporise from the substrate to form vapours within the void space of the chamber. As the user puffs, these vapours are then entrained in the flow of the puff and pass through the channel to the mouthpiece and into the consumer's mouth.

The heating mechanism 22 is arranged to receive fuel from the fuel reservoir 12 and uses a combustion reaction in order to heat the tobacco material 2 within the DHD mechanism 20. In one embodiment, heating the tobacco material is achieved through gas catalytic combustion of low molecular weight hydrocarbons, for example, butane. A heat mechanism operating in this manner is known *per se* in the art and is for example described in WO 2006/082571. It will be appreciated by those skilled in the art that other heating mechanisms such as electro-resistive or chemical could be utilised to provide indirect heat to the device.

Fuel gas is stored in the fuel reservoir 12. In one embodiment, the fuel is butane, and more specifically is a butane based gas in liquid form. Other suitable fuels include liquefied propane, iso-butane and other clean burning, low molecular weight hydrocarbons which have high specific energy densities. In one embodiment, the fuel reservoir 12 is rechargeable and features a refilling valve 80 by which the consumer can recharge the reservoir 12 from a can of pressurised lighter fuel, which is commonly available.

Fuel delivery from the reservoir 12 is controlled through a pressure regulator, a temperature responsive valve, an isolating over-temperature control valve and an on/off evaporator valve. When the primary control of the evaporator valve is switched to an on/open position, fuel is delivered through the pressure regulator and valve system before it evaporates to a gas in the evaporator valve. The gas then flows through a nozzle to the venturi. When the evaporator valve is switched to the off/closed position, fuel delivery ceases, thus starving

any combustion reactions in the combustion chamber 22. This use of the evaporator valve is the primary control mechanism for the combustion reaction.

The secondary control mechanism is the temperature responsive valve, which opens flow of fuel gas when the measured temperature is below a set point temperature. The secondary control mechanism restricts or stops flow of fuel gas when above the set point temperature. In one embodiment, the temperature responsive valve could be a motorised valve connected to a feedback control loop with a thermocouple, whereby the control loop is set to react to temperature measured on the thermocouple. In another embodiment, the temperature responsive valve could be a bimetallic disc which is selected to deform at a chosen temperature and then seal the valve.

The third temperature control system acts as a fail-safe, whereby a plug of plastic material with a known melting point is placed in a cavity in the flow path of the fuel gas. If the temperature in the system exceeds the melting point of the plastic, it melts and plugs the flow path of the fuel gas, thus preventing further combustion. Thus, by selection of the correct temperature control systems, the device can be controlled to operate at a known temperature set point for the duration of the smoking experience.

As the fuel gas exits the evaporator valve through a nozzle, the fuel has high velocity and entrains air by passing through a venturi tube. This entrainment is important in order to achieve a combustible mixture of air and fuel. The velocity of the fuel is controlled by the fuel pressure and diameter of the nozzle on the outlet of the evaporator valve. This in turn affects the amount of air entrained into the flow. The air is entrained from a cavity between the DHD mechanism and the housing/casing, and an air inlet diffuser 82 is provided in the casing to allow for fresh air to enter the device, as shown in Figure 7.

Downstream of the venturi, a fuel distributor connects to the combustion chamber 22. The fuel distributor provides an even flow of fuel/air gas mixture to the combustion chamber for uniform combustion. The combustion chamber is of concentric cylindrical construction, containing an inner cylinder and outer cylinder which forms the external surface of the combustion chamber 22. The outer cylinder abuts a heating chamber wall 84 of the DHD mechanism

where as the inner cylinder is shorter in length to allow a flow path for gases to enter the cavity between the inner and outer cylinder walls and the heating chamber wall 84. The outer cylinder also contains one or more exhaust ports situated in the base of the cylinder to allow the exhaust gases to exit the combustion chamber.

A primary catalytic combustion element is located in centre of the inner cylinder of the combustion chamber and defines, together with the inner cylinder walls and the fuel distributor, a flame cavity within which the fuel gas/air mixture is initially burnt as a flame. In order to create the flame, an electrode extends into the flame cavity and is arranged within the combustion chamber 22 to cause a spark to arc between the electrode and a portion of the combustion chamber. This spark ignites the fuel/air gas mixture to burn as a flame. A piezo-electric ignition mechanism located within the device is coupled to the electrode for producing a voltage to cause the spark to arc between the electrode and the portion of the combustion chamber. The piezo-electric ignition mechanism is activated by the actuation switch 10 operated by the consumer during a first sliding action in order to switch the device on. This mechanism is described in further detail below.

During this flame combustion, the temperature of the fuel gas mixture and catalytic combustion element are raised because of the heat generation from the exothermic combustion reaction. When the catalytic combustion element reaches temperature and the combustion reaction can be sustained on the catalyst surface, the flame is extinguished. A thermal mass is positioned on the primary catalytic element in order to re-ignite the fuel gas mixture following periods of non-combustion which can occur when the temperature control mechanism stops flow of fuel to the combustion chamber 22.

Downstream of the catalytic element, the combustion chamber is shaped to provide a tortuous path for the exhaust gases of the combustion reaction. In this cavity between the inner combustion chamber wall and outer combustion chamber wall, a secondary catalytic combustion element is positioned to further enhance energy recovery from any unburnt fuel gases present in the exhaust gases. The exhaust gases then pass through the exhaust ports into the cavity between the combustion chamber and the device casing. In the casing, there is an exhaust diffuser 90 to allow the exhaust gases to pass through to

the atmosphere in a controlled manner. The exhaust gases are separated, by walls formed in the device casing, from the air inlet diffuser 82 for the combustion process, and also from an air inlet valve providing air 96 to a heating chamber within the DHD mechanism. The exhaust diffuser 90 and casing are designed to prevent the surface temperature of the device exceeding recommended safe touch temperature limits.

Heat from the combustion reaction is transferred into the combustion chamber walls by convection, conduction and radiation from the catalytic elements and the exhaust gases. This heat energy is further conducted throughout the combustion chamber walls into the heating chamber wall 84 of the DHD. Heat is also conducted to the temperature responsive valve and isolating over-temperature control valve, which act to form the feedback control loop described above.

It is appreciated by one skilled in the art that whilst the invention is currently shown orientated in a vertical position, it is possible to configure the device in a horizontal orientation, thus providing a similar action to that of smoking a conventional cigarette.

Each chamber or cavity in the DHD mechanism has an outer wall defined by the inner cavity of the DHD mechanism and an inner wall defined by the rotating body. The outer walls of each chamber do not rotate. The inner walls of each chamber rotate by one third of a revolution each time the switch is appropriately actuated.

In one embodiment, the outer wall of the heating chamber is air permeable to permit the flow of air into the heating chamber in order to create an air flow through to the mouthpiece when the user draws or puffs on the mouthpiece. As shown in Figure 7, an enclosed flow path is created from a diffuser on the casing, through to the heating chamber, through the heating chamber, and through an internal channel to the mouthpiece. When the user draws or puffs upon the mouthpiece, a flow of air is pulled through the flow path and entrains any vapours formed in the heating chamber of the DHD.

In one embodiment, the channel between the heating chamber 66 and mouthpiece 8 contains an aluminium baffle 108 which helps to cool the

vapours formed in the heating chamber during puffing. Other materials with good thermal conductivity could be utilised to help provide an additional cooling effect in the channel. Upon cooling, the vapours are condensed into small liquid particles suspended within the flow of air, thus creating an aerosol mixture of particles and vapour. In another embodiment, the channel could also include ventilation pores to mix cool air into the flow of vapours, and thus provide the cooling to aid condensation. In a further embodiment, the vapours maybe cooled by passing through a heat exchanger system which is cooled indirectly by a cooling fluid. One skilled in the art can see there are multiple ways to enact a cooling of the vapours to create a condensation effect.

In one embodiment, the tobacco out-feed chamber 70 has a flexible scraper which is arranged to remove residual tobacco from this chamber. The flexible scraper is fixed to the external wall of the DHD, and is constructed of a suitably flexible material as to allow the inner rotating body to pass it during the position of tightest fit. Since the inner rotating body of the DHD is of a rounded triangular shape, the scraper needs to have sufficient length to be able to contact the maximum distance from the external wall of the DHD to the inner rotating body.

In one embodiment, used/exhausted tobacco is moved into the tobacco out-feed chamber 70 during a first rotation of one third. As described above the used tobacco falls under gravity into the waste chamber 12. During a second rotation of one third, the flexible scraper operates to remove any residual tobacco from the tobacco out-feed chamber 70 which rotates onwards to become the tobacco in-feed chamber. In this manner, the flexible scraper prevents build up of any residual tobacco which could affect the operation of the DHD mechanism. The tobacco removed from the DHD mechanism is collected in a removable waste chamber situated underneath the tobacco out-feed chamber. This removable waste chamber is sized such that it can receive all the spent tobacco from a cartridge of fresh tobacco. The waste chamber 14 is removed by undoing a latch under on the base of the device, and slides out of the casing to enable disposal of the spent tobacco. The waste chamber 14 may be reusable or disposable.

As described above, the actuation switch may be arranged to operate in various configurations. Advantageously, in one embodiment a single switch is arranged

to 1) open the gas flow from the fuel reservoir, 2) arrange dispensing and disposal of fresh and used tobacco, respectively, and 3) ignition of the gas such that the fresh tobacco is heated within the heating chamber during the first activation of the device. In one embodiment, a single switch is arranged to travel through a plurality of stops as shown in Figure 10a to g. In addition, in one embodiment, actuating the switch from the off position to any other position causes the cartridge to be locked in place. The tobacco cartridge/container can therefore only be removed when the device is switched off.

From an 'off' position, the slider passes a first stop point which opens the gas flow from the fuel reservoir. Upon sliding in the same direction, to a second stop point, the dispensing mechanism is arranged to sweep old used tobacco into a waste chamber and dose a fresh portion of tobacco into the tobacco in-feed chamber and move the previously dosed portion into the heating chamber. Upon sliding further in the same direction, to a third stop point, the slider will strike the piezo-ignition mechanism to ignite the gas, thereby starting the heating process to deliver heat to the heating chamber and generate vapours from the freshly dispensed tobacco.

In one embodiment, the first, second and third stop points (referred to as positions B, D, and E respectively) are soft stopping points whereby the slider does not remain held in position at these points. An off position (position A) and a hold position (position C) are hard stopping points whereby the slider remains in position when the consumer moves the slider to, and leaves the slider at these positions. The activation of the slider switch is described in greater detail with respect to Figures 10a to 10g and Figure 9.

Upon first use, the slider is actuated, at step 300, from the off position (Figure 10a), through stopping points B, C and D to its maximum extent at the soft stopping point E (Figure 10b). When the slider passes position B, the gas valve is opened, at Step 310. When the slider passes position D, the tobacco material from the in-feed chamber is indexed, at Step 320, to the heating chamber.

When the slider reaches position E, the piezo ignition is struck, at Step 330, and the combustion process begins, at Step 340.

The slider is resiliently biased to return, at Step 350, to the hold position C between the first and second soft stopping points, positions B and D (Figure 10c). The resilient biasing of the slider in one embodiment is achieved through use of springs. A person skilled in the art will appreciate other ways to resiliently bias the slider to return, from the third stopping point, to the hold position.

When the heating chamber is sufficiently heated, an indicator on the device indicates, at Step 360, that the device is ready for use. The consumer draws in the device, at Step 370. The device may then be left, at Step 380, for any period of time that the consumer wishes. The consumer may then repeat Steps 370 and 380 for the desired number of puffs before the decision is made at Step 390 that the consumer wishes to load fresh tobacco into the heating chamber.

Actuation of the DHD mechanism dispenses a controlled quantity of tobacco into the heating chamber. The quantity of tobacco being dispensed is carefully controlled as it is derived from the volume of the tobacco in-feed cavity. This quantity of tobacco is arranged to generate a sufficient aerosol for a pre-determined number of puffs, for example, 2 to 3 puffs. A person skilled in the art will appreciate that any number of puffs may be determined as being an optimum number in order to permit the user better control over the timing of the smoking experience.

Advantages of supplying controlled portioned volumes of tobacco include reducing the time in which the tobacco is heated ready for consumption, when compared to heating the larger total volume of tobacco typically consumed in an experience or available in the container. Also, in controlling the timing and duration of the smoking experience the amount of wastage is minimised as the consumer activates the dosing mechanism by sliding the slider only when required. This means the consumer can safely leave the HNB device switched on for several minutes or longer before returning to the smoking experience, and during this time the remaining tobacco held in the cartridge is not being exhausted of vaporisable components.

Thereafter, the consumer moves the slider, at Step 400, to the second soft stopping point at position D. As before, fresh tobacco in the in-feed chamber is transferred, at step 410, into the heating chamber and the slider is biased to

return, at Step 420, to the hold position C (see Figures 5d and 5e). Steps 360 to 420 are repeated as often as desired until the consumer decides, at Step 430 that he wishes to end the user experience, or until it is determined, at Step 440 that the tobacco container is empty. Thereafter, the consumer moves the slider, at Step 450, to the OFF position (position A). In moving the slider to position A, the slider passes position B where the gas valve is closed, at Step 460. The combustion reaction is starved of fuel, at Step 470. The device cools down, at Step 480, and the indicator shows, at Step 490, that the device is not ready for use.

The slider can be retained in the off position by pushing the slider downwards into a notch. One skilled in the art may appreciate that there are other ways to ensure the slider remains in the off position upon, for example a latch, or a push locking mechanism.

The slider and actuating switch in the device are arranged to translate the lateral movement of sliding the switch into a rotary movement for rotating the rotating body in the DHD mechanism. In one embodiment, the DHD mechanism rotates in the horizontal plane. As such, a simple gear arrangement is arranged to translate the lateral movement of the slider between positions shown in Figure 5d to Figure 5e into a one-third rotation of the rotating body of the DHD. In an alternative embodiment, a rack and pinion style arrangement could be utilised to drive the rotation of the DHD mechanism.

The HNB device of one embodiment of the present invention is arranged to cause a controlled volume of tobacco to be heated, such that vapours form during the heating of the tobacco. These vapours are drawn into the mouthpiece upon puffing, where they cool and form a smoke-like aerosol. The advantages of this embodiment are that not all of the tobacco mass contained in a refill is heated together, so the remaining tobacco remains fresher for longer, and the time required to heat the tobacco before being able to draw vapours is reduced.

The HNB device of one embodiment of the present invention allows the consumer to rely on the device maintaining a fixed temperature after initial heating for a prolonged period of time, so that they can return to use the device after placing it down for a pause in consumption without having wasted the

consumable or having to wait for the system to heat up again. The duration the device can maintain the set temperature is longer than other HNB devices which are on the market, due to the larger fuel reservoir or battery. The different semantics of design and usage of this embodiment of the HNB device enable a larger space to incorporate the energy source and heating mechanisms when compared to the alternative HNB devices which simulate a cigarette.

Exhaust gases from the combustion of butane are, in one embodiment, distributed along thin chambers down the outside of the body of the and to atmosphere through a diffuser. Suitable insulating materials are used to prevent the consumer from burning their hands on the hot heating chamber during use. For example, thermo-insulating plastics such as PEEK or Ultem™, ceramics, aerogels, and other insulating materials may be used.

A person skilled in the art will appreciate that other mechanisms may be suitable in controlling the dispensing, heating and disposal of tobacco materials. Three example alternative embodiments are described below.

1) A screw thread dispenser is actuated through rotating a portion of the casing of the device through a screw thread on a complimentary portion of the casing. In this manner, from a first position tobacco is fed into an internal chamber which is conveyed, through a rotation motion, through a heating chamber and beyond to a waste chamber.

2) A capsule loading system uses a containing comprising a plurality of capsules. A part of the casing is rotated in order to load a capsule into the heating chamber one at a time. The same rotation process is arranged to sweep the used tobacco from the heating chamber into the waste container. This sweeping action may be provided using a wiper blade pivoted upon the centre of the chamber.

3) A wheel dispenser is arranged to feed tobacco using gravity into a wheel containing a plurality of compartments. The compartments rotate on the vertical plane, similar to a water wheel, and travel through a heating zone before gravity emptying into a waste chamber.

In addition, to the gas catalytic heating mechanism described above, an alternative heating means may be suitable for this purpose. For example, the heating mechanism may be arranged to use electrical, chemical or other combustion reactions of hydrocarbons in order to heat the heating chamber sufficiently.

In an alternative embodiment of the HNB device, the heating providing mechanism could be electro-resistive heating elements, and the power supply would be provided by a rechargeable power supply. In this embodiment, the electroresistive heating elements would be positioned underneath the heating chamber of the DHD. The temperature is controlled using a feedback control system with a thermocouple positioned on the heating chamber wall. In this embodiment, the HNB device is arranged to cooperate with a charging stand which is arranged to support the HNB device and provide a connection between an interface on the HNB device and an interface on the charging stand. The HNB device of this embodiment is arranged to comprise a circuit board for controlling the charging of the rechargeable power source and controlling the temperature the device is heating to. In one embodiment, the rechargeable power source is a rechargeable battery and the interfaces on the HNB device and the stand are electrical components.

In a further embodiment, the device maybe powered by mains supplied electrical power, heating only when placed into a cradle which remains wired to the mains electricity supply.

In one embodiment, the HNB device operating status is indicated by use of thermochromic ink on the surface of the device. The thermochromic ink changes colour depending upon the temperature of the device, and thus indicates when the device is ready for puffing. An alternative indicator utilises an array of LEDs, linked to a temperature sensor on the device. A further indicator could be a transparent window placed into the cylindrical wall of the combustion chamber which would allow the user to see the glowing inside the combustion chamber when the device is heating. A further indicator could utilise an LCD display which gives the consumer a read out of the device temperature and status, for example, remaining fuel or remaining battery charge. One skilled in the art can appreciate that there are multiple ways to indicate the device status and, or temperature.

In order to address various issues and advance the art, the entirety of this disclosure shows by way of illustration various embodiments in which the claimed invention(s) may be practiced and provide for superior HNB devices. The advantages and features of the disclosure are of a representative sample of embodiments only, and are not exhaustive and/or exclusive. They are presented only to assist in understanding and teach the claimed features. It is to be understood that advantages, embodiments, examples, functions, features, structures, and/or other aspects of the disclosure are not to be considered limitations on the disclosure as defined by the claims or limitations on equivalents to the claims, and that other embodiments may be utilised and modifications may be made without departing from the scope and/or spirit of the disclosure. Various embodiments may suitably comprise, consist of, or consist essentially of, various combinations of the disclosed elements, components, features, parts, steps, means, etc. In addition, the disclosure includes other inventions not presently claimed, but which may be claimed in future.

Claims

1. A heat-not-burn (HNB) smoking article comprising:
a dispensing mechanism for controlling delivery of a controlled quantity of an aerosol generating material into a heating chamber; and
a heating mechanism for heating the aerosol generating material within the heating chamber in order to generate an aerosol.
2. The HNB smoking article of claim 1, further comprising an actuation switch for actuating movement of the dispensing mechanism and controlling the heating mechanism.
3. The HNB smoking article of claim 2, wherein the actuation switch is resiliently biased toward a hold position in which the aerosol is generated, and the actuation switch, moved from an off position to the hold position, is arranged to pass an initiate position in order to initiate the heating mechanism.
4. The HNB smoking article of claim 3, wherein the actuation switch is arranged to actuate movement of the dispensing mechanism, to dose a fresh quantity of aerosol generating material into the heating chamber, when the switch is moved beyond a hold position to a dose position.
5. The HNB smoking article of any preceding claim, wherein the heating mechanism is arranged to heat the aerosol generating material using a heating mechanism selected from the group comprising: gas catalytic combustion, electrical heating element, chemical agent, and hydrocarbon combustion.
6. The HNB smoking article of claim 4, wherein the heating mechanism comprises a gas catalytic combustion chamber and during a first actuation of the actuation switch from the off position, the actuation switch is arranged to open a fuel valve when the switch passes the initiate position.
7. The HNB smoking article of claim 6, during a first actuation of the actuation switch from the off position, the actuation switch is arranged to

reach an ignite position, the actuation switch being arranged to ignite a quantity of fuel in to heat the heating chamber.

8. The HNB smoking article of any preceding claim, wherein the switching mechanism operates in one direction to control smoking experience, and an opposing direction to end the smoking experience.

9. The HNB smoking article of any preceding claim, wherein the dispensing mechanism is rotary mechanism selected from the group comprising a Wankel engine, screw dispenser, capsule loading dispenser, and wheel dispenser.

10. The HNB smoking article of any preceding claim, wherein the dispensing mechanism is a Wankel engine mechanism comprising a rotating body within a cavity, the rotating body and cavity defining an in-feed chamber for receiving fresh aerosol generating material, a heating chamber in which the aerosol material is heated to generate the aerosol, and a tobacco out-feed chamber for discarding used aerosol generating material.

11. The HNB smoking article of claim 10, as dependent on claim 4, wherein the rotating body is arranged to be rotated 120° when the actuating switch is moved to the dose position before returning to the hold position, such that i) the fresh aerosol generating material in the in-feed chamber is moved into the heating chamber, ii) the used aerosol generating material in the heating chamber is moved to the tobacco out-feed chamber, and iii) the empty out-feed chamber is moved to become the in-feed chamber to receive a further dose of aerosol generating material.

12. The HNB smoking article of any preceding claim, wherein the aerosol generating material is provided in a loose form to enable delivery of a predetermined quantity of material to the heating chamber.

13. The HNB smoking article of any preceding claim, wherein the aerosol generating material is tobacco or tobacco substitute material in a suitable form selected from the group comprising: ground cut rag; loose cut rag, pellets, capsules, tablets, balls in order to dispense a predetermined quantity of material into the heating chamber.

14. The HNB smoking article of any preceding claim wherein the dispensing mechanism also arranged to control movement of used aerosol generating material into waste compartment.
15. The HNB smoking article of claim 14, as dependent on claim 11 further comprising a flexible scraper within the dispensing mechanism for removing residual tobacco from the out-feed chamber as it is rotated 120° to become the in-feed chamber.
16. The HNB smoking article of any preceding claim, further comprising a refillable chamber for receiving aerosol generating material.
17. The HNB smoking article of any of claims 1 to 15, further comprising a chamber for receiving a cartridge for holding aerosol generating material.
18. The HNB smoking article of claim 17, further comprising a locking mechanism for locking the cartridge in place.
19. The HNB smoking article of claim 18, wherein the locking mechanism is arranged to lock the cartridge in place upon first activation of the HNB device from an off position.
20. The HNB smoking article of any preceding claim, further comprising an indicator for indicating a current operating status of the device.

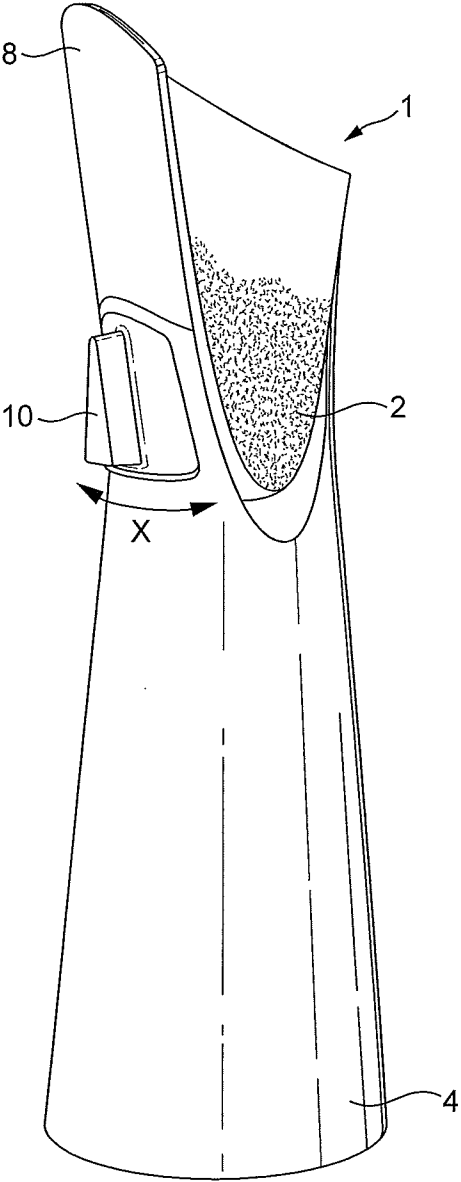


FIG. 1

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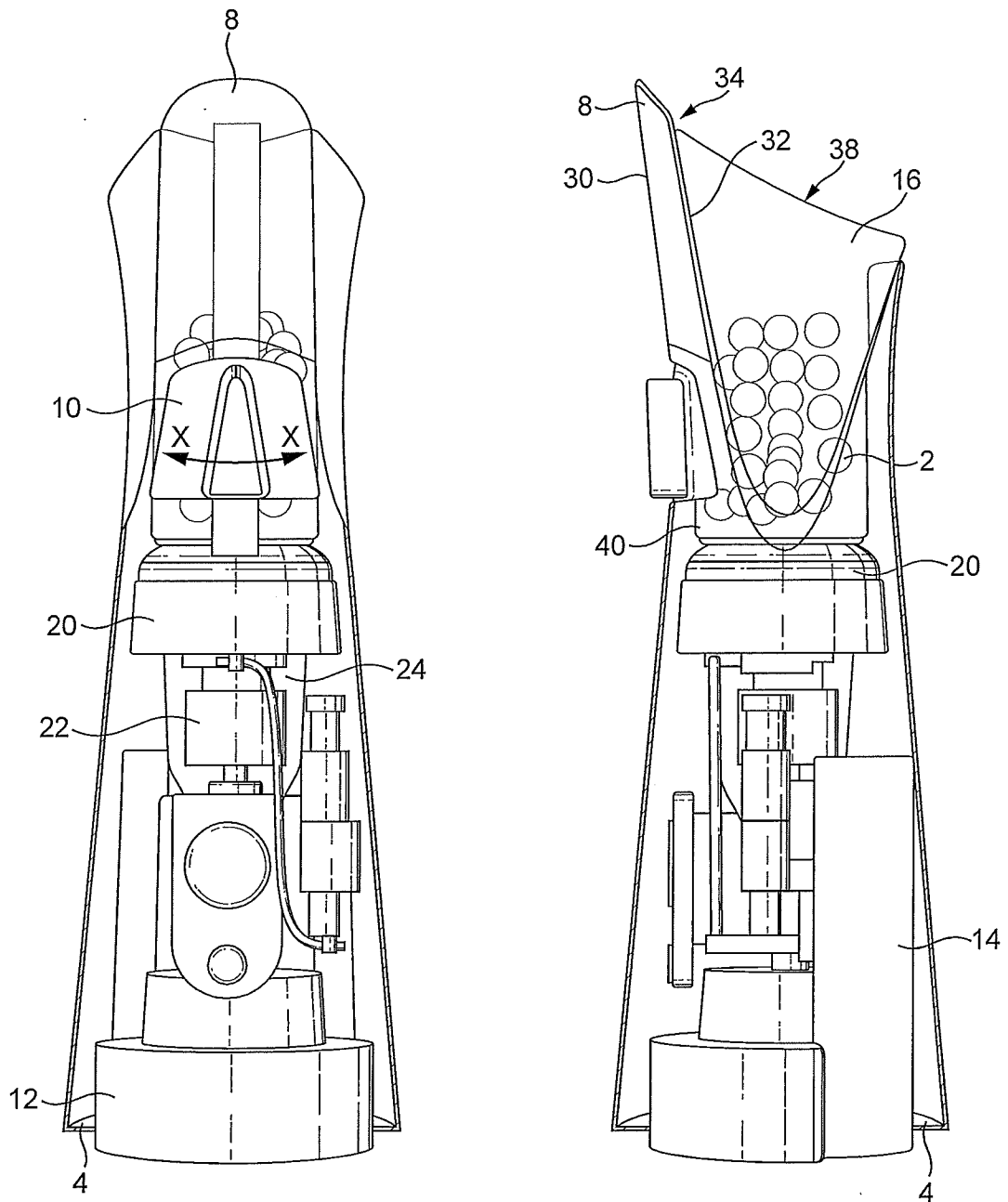


FIG. 2

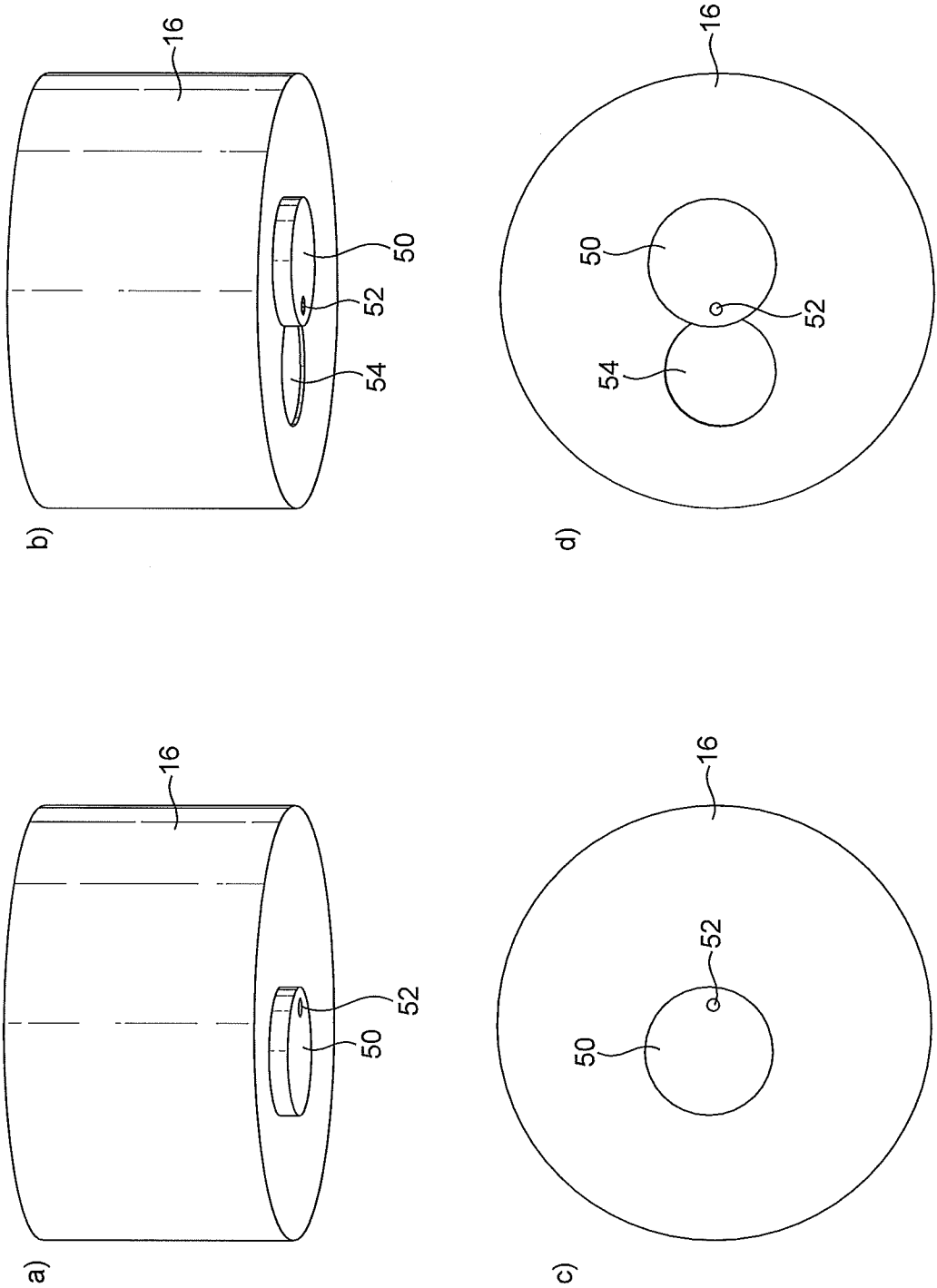


FIG. 3

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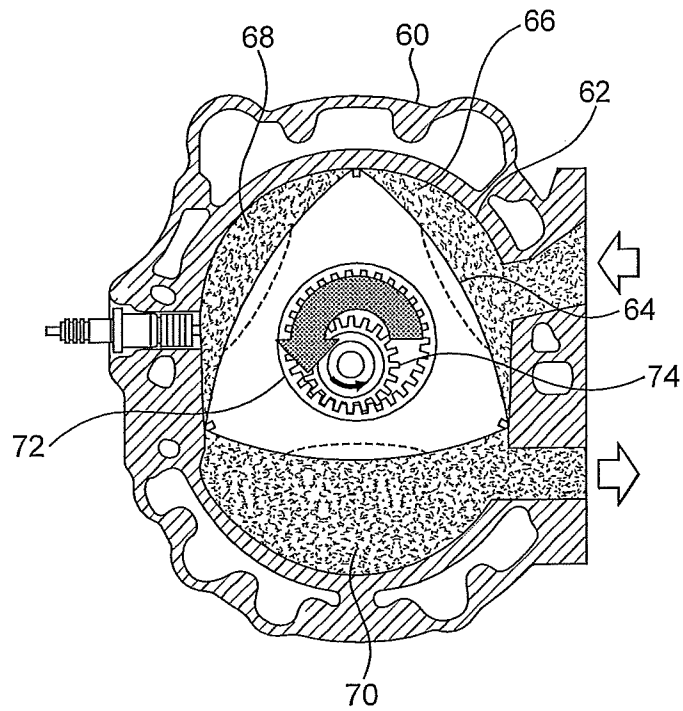


FIG. 4

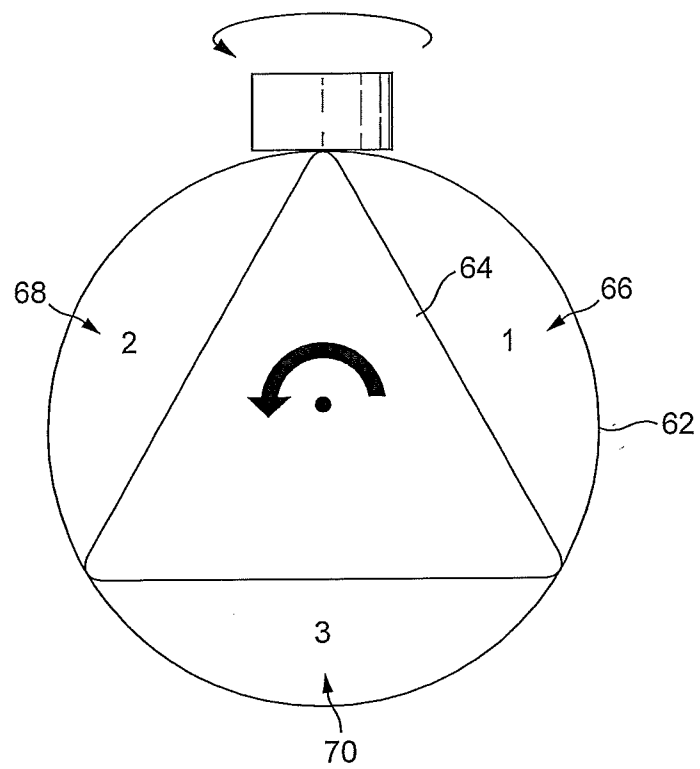


FIG. 5

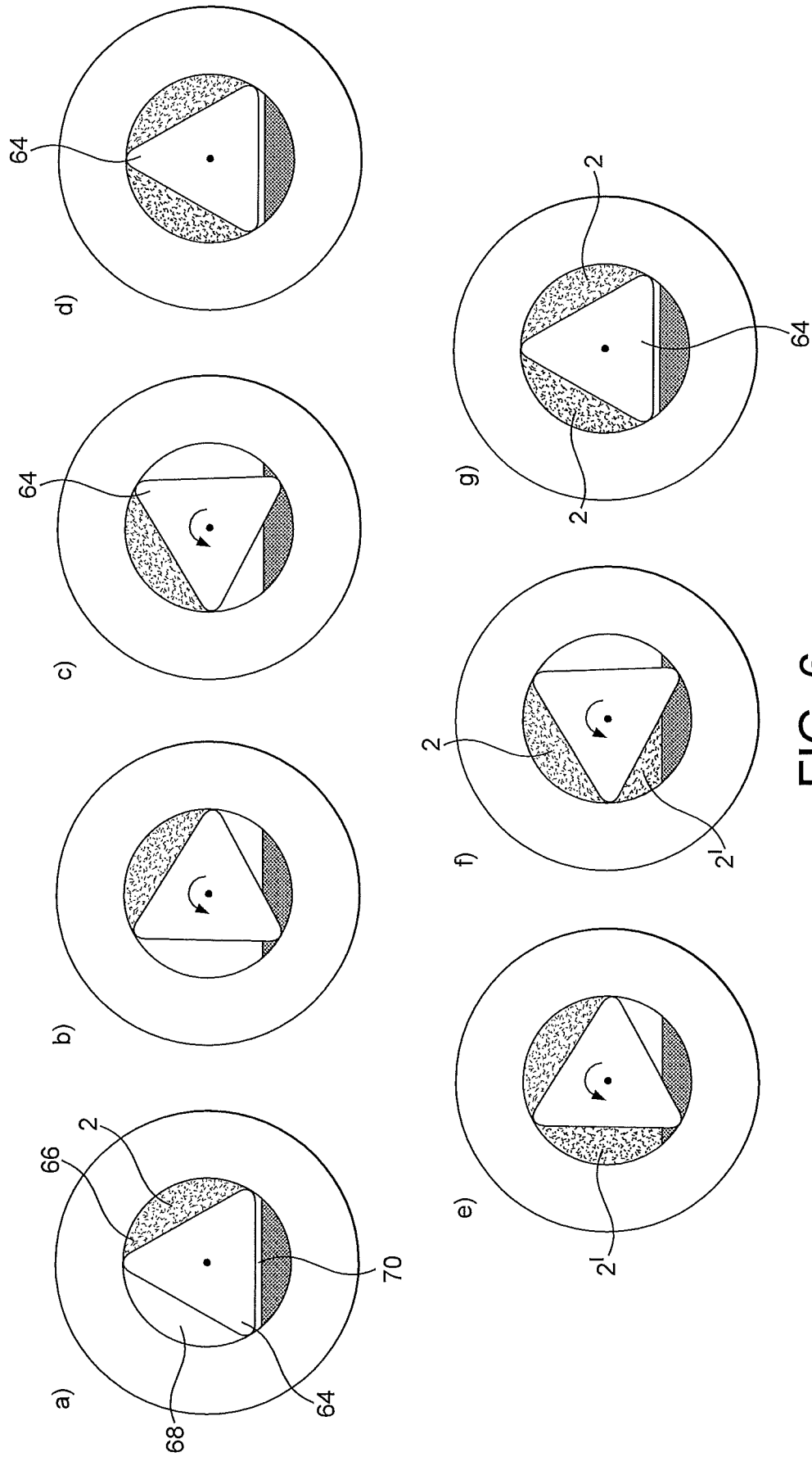


FIG. 6

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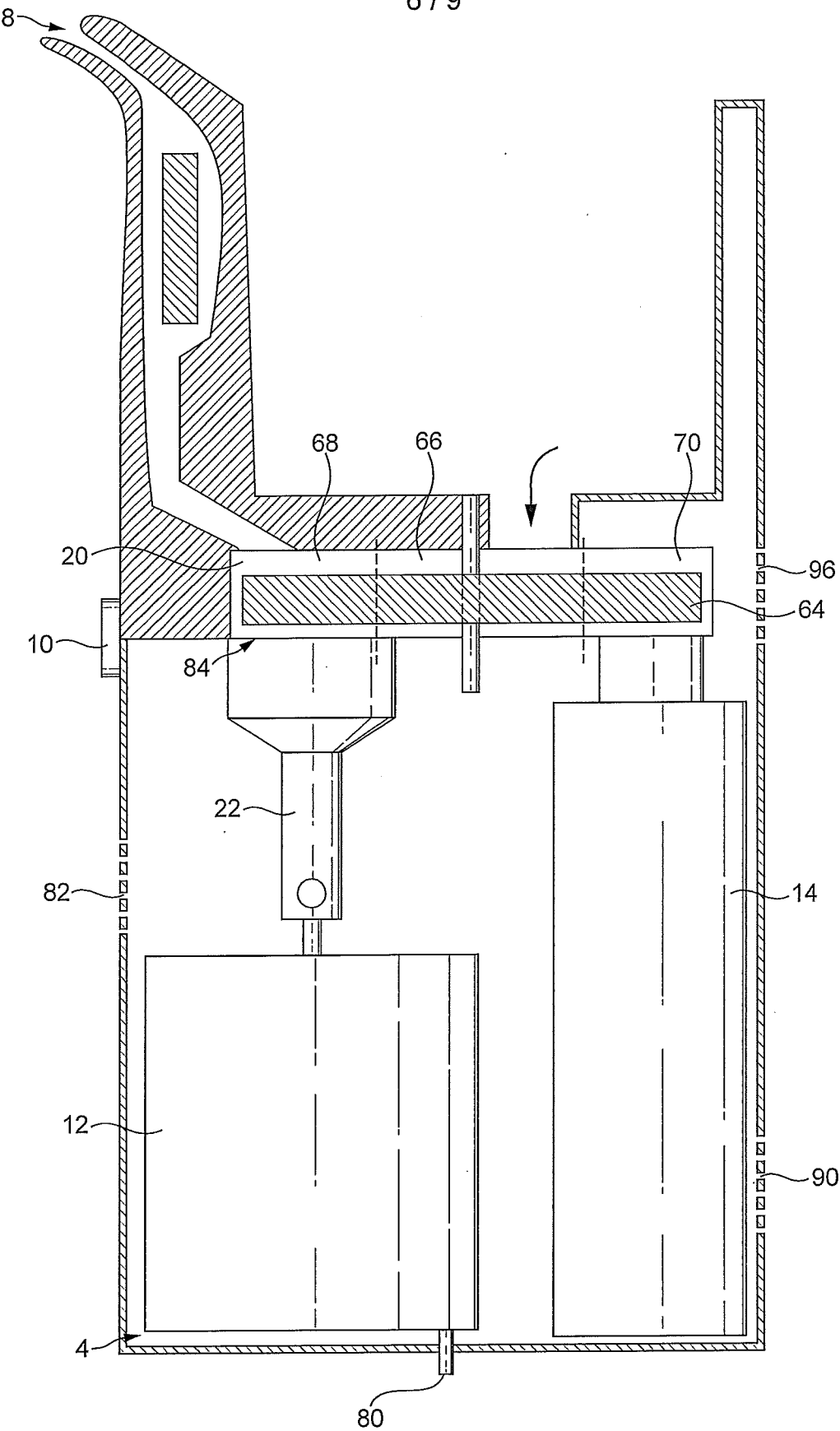


FIG. 7

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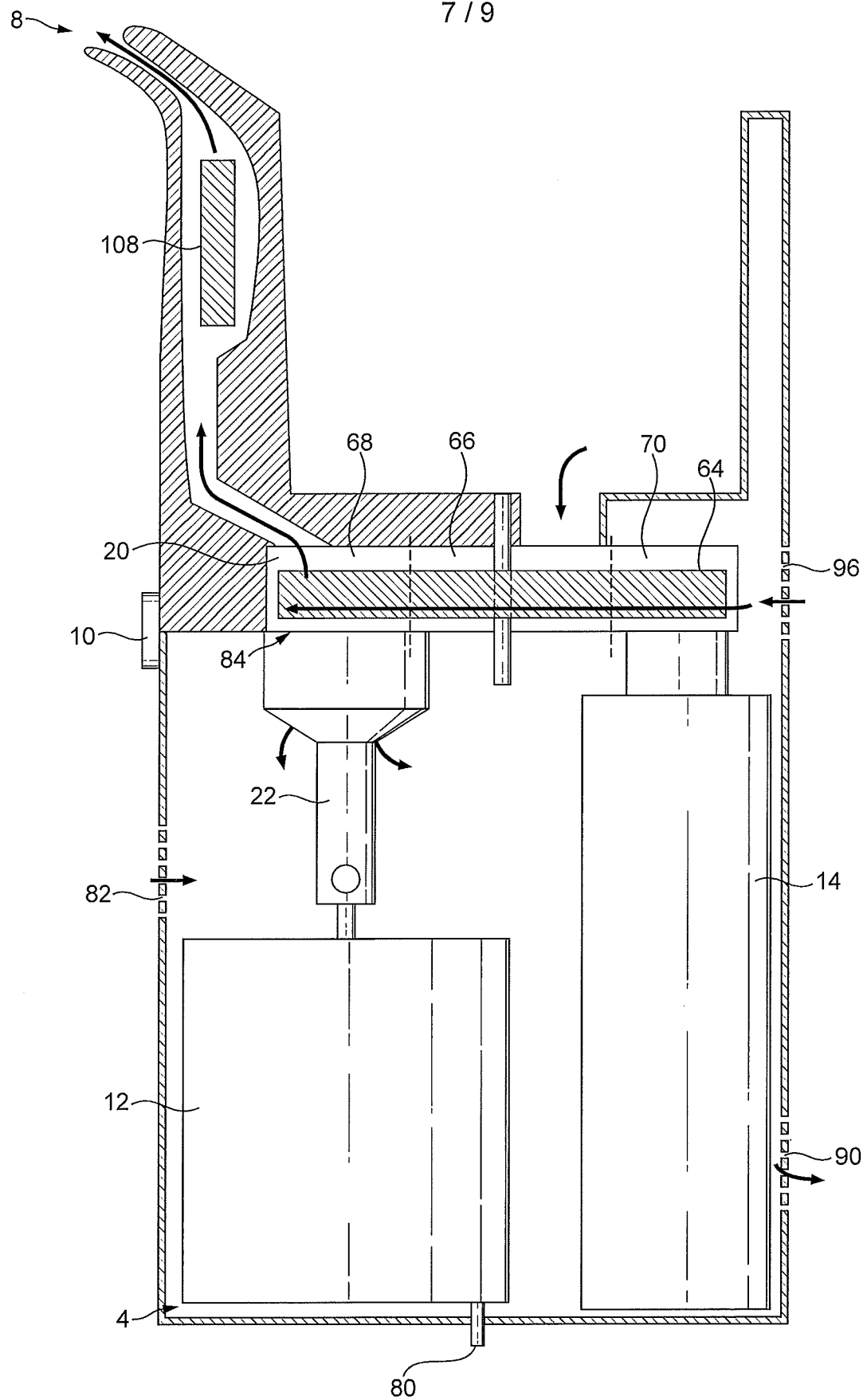


FIG. 8

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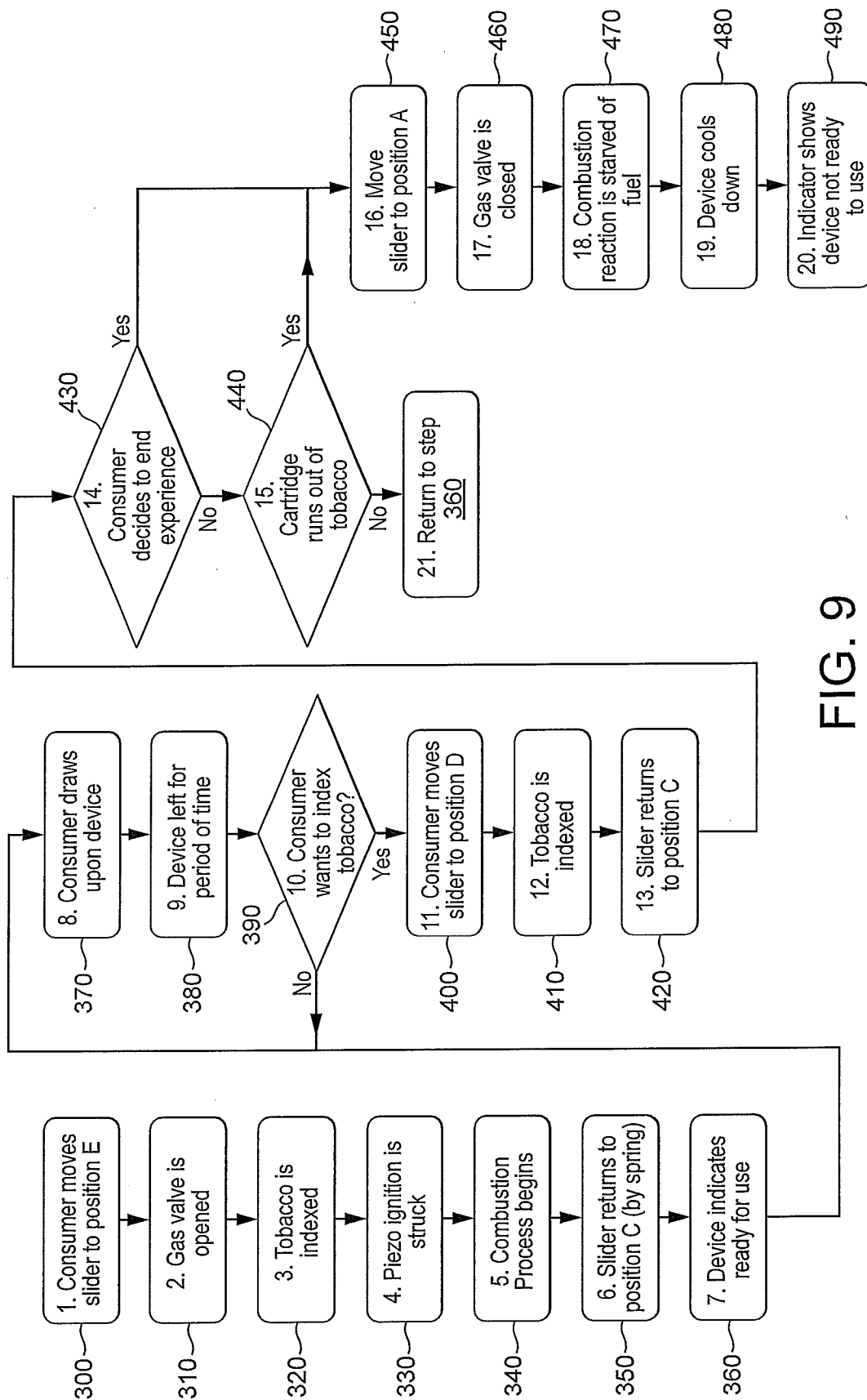


FIG. 9

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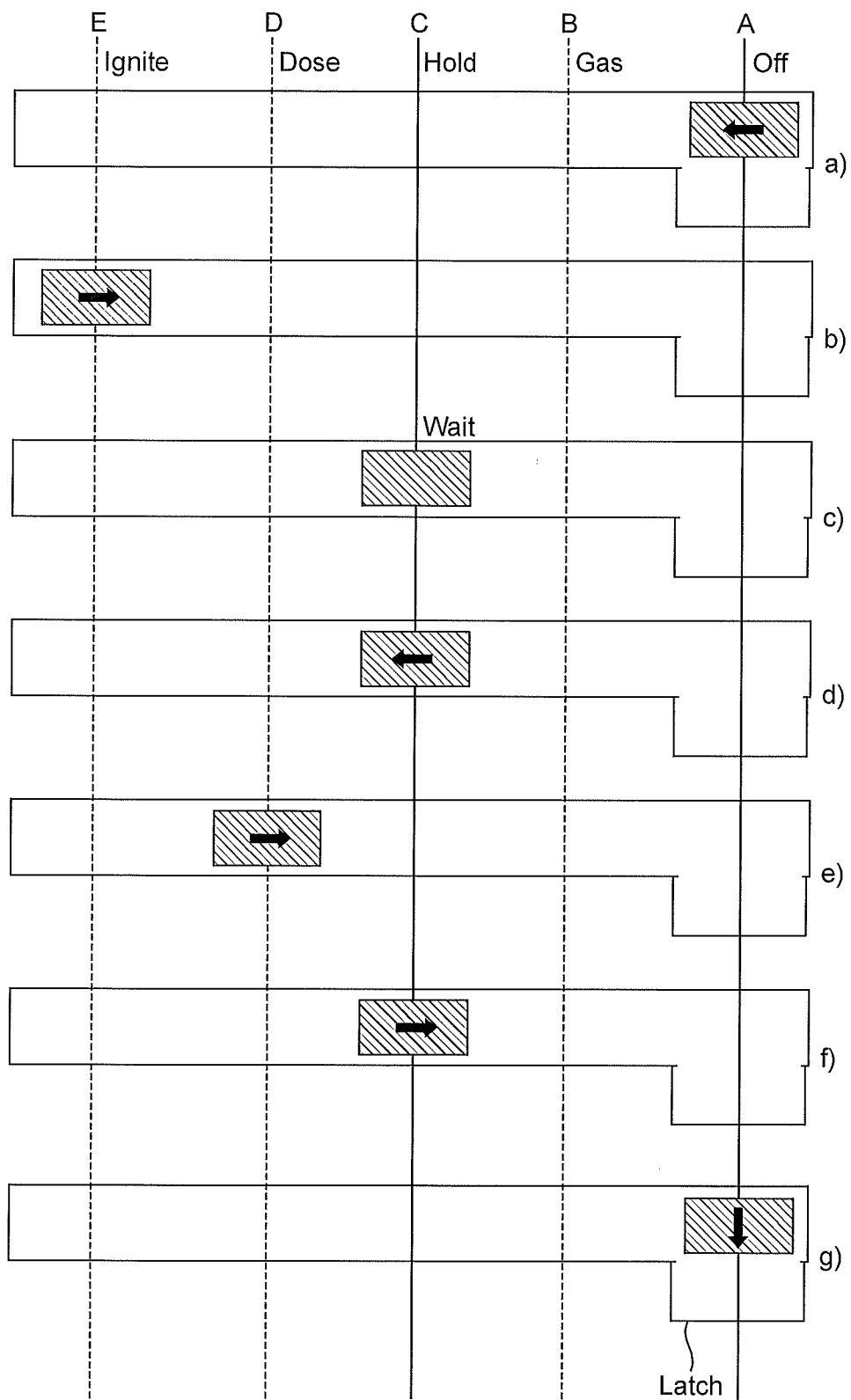


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/060278

A. CLASSIFICATION OF SUBJECT MATTER
INV. A24F47/00
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)
A24F A61M

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, WPI Data

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Further documents are listed in the continuation of Box C.



See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search

25 September 2012

Date of mailing of the international search report

08/10/2012

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Authorized officer

Marzano Monterosso

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/060278

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Information on patent family members

International application No

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