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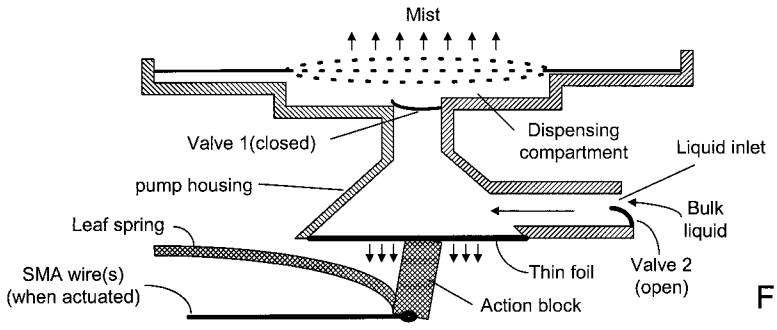

FIG. 15(b)

(57) Abstract: A scent dispenser is integratable into a portable device, such as a mobile handset. The scent dispenser has a vibrating element configured to vibrate in an ultrasound frequency range for dispensing a scent material. Scent dispensing can be in response to an incoming signal received by a mobile handset, but scent dispensing can also be controlled by a user. The scent material is stored in a compartment having a channel with a valve and the vibrating element can be used to open the valve for replenishing the scent material when the vibration is in a low frequency range such as 1-10Hz. The vibrating element can also be used to produce audio signals. Thus, the scent dispenser can also be integrated with a sound producing unit in a mobile electronic device.

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METHOD AND APPARATUS FOR SCENT DISPENSING

Field of the Invention

The present invention relates generally to a scent dispenser and, more particularly, to a scent dispenser which can be attached to or integrated into a mobile electronic device, such as a mobile handset.

Background of the Invention

It would be desirable to have a mobile electronic device, such as a mobile handset, that dispenses a scent when it is used. Some of the existing mobile handsets have, for example, a scent dispenser wherein the fragrant material must be heated in order to generate sufficient amount of scent. Heating a fragrant or perfumed material can create a somewhat long-term scent. The scent, however, may become unnoticeable to the phone user because olfactory adaptation to a scent often occurs shortly after exposure. Furthermore, heating a perfume may eventually cause the material to be rancid.

It would be advantageous to provide a scent generation unit in a mobile handset without the need of heating the fragrant material.

Summary of the Invention

The present invention provides a method and apparatus for emitting scent. In particular, the present invention provides a scent dispenser that can be integrated into a mobile electronic device, such as a mobile handset. The scent dispenser has a vibrating element to dispense a perfume or scent when the vibrating element vibrates in a high frequency range such as the ultrasound frequencies. When the vibrating element vibrates in a low frequency, such as between 1 to 10Hz, it can be used to open a valve, for example. As such, when the scent dispenser is coupled to a source unit through a channel having such a valve, the scent material in the scent dispenser can be replenished by moving part of the scent material in the source unit into the scent dispenser through the channel. Furthermore, the scent dispenser can be integrated into a sound producing unit, such as a speaker or a buzzer. As such, the vibrating element can be used to produce an audio signal when vibrating in a frequency range substantially between 20Hz to 2kHz.

Thus, the first aspect of the present invention is a method for scent dispensing, the method comprising:

vibrating a vibrateable element in a first frequency range for dispensing at least a part of a scent material stored in a compartment; and

vibrating the vibrateable element in a second frequency range lower than the first frequency range for moving the scent material into the compartment.

According to one embodiment of the present invention, the scent material is stored adjacent to the vibrateable element.

According to one embodiment of the present invention, apertures are provided on the vibrating element so that the scent material is dispersed through at least some of the apertures.

According to another embodiment of the present invention, the method further comprises:

coupling a second vibrateable element to the vibrateable element, wherein the scent material is stored adjacent to the second vibrateable element, and wherein when the vibrateable element vibrates in the first frequency range, the second vibrateable element vibrates for dispersing the scent material.

According to one embodiment of the present invention, apertures are provided on the second vibrating element so that the scent material is dispersed through at least some of the apertures.

According to one embodiment of the present invention, the method further comprises:

providing a channel between the compartment and a source unit also having the scent material; and

providing a valve at the channel, the valve configured to open in response to vibrations in the second frequency range for moving a part of the scent material in the source unit into the compartment through the channel.

According to one embodiment of the present invention, the vibrateable element is coupled to a processor in a mobile handset configured to receive an incoming signal, wherein the vibrateable element is configured to vibrate in the first frequency range in response to the incoming signal.

The second aspect of the present invention is a device, comprising:

a compartment for storing a scent material; and

a vibrateable element configured to vibrate in a first frequency range for dispensing the scent material, and to vibrate in a second lower frequency range for replenishing the scent material in the compartment.

According to one embodiment of the present invention, the vibrateable element is located in the compartment and the scent material is stored adjacent to the vibrateable element.

According to one embodiment of the present invention, the vibrateable element has a plurality of apertures in at least a part of the vibrateable element, wherein the apertures are sized to move at least some of the scent material therethrough when the vibrateable element vibrates in the first frequency range.

According to another embodiment of the present invention, the device further comprises:

a second vibrateable element coupled to the vibrateable element, the second vibrateable element located in the compartment, wherein the scent material is stored adjacent to the second vibrateable element, and the second vibrateable element is configured to vibrate for dispensing the scent material when the vibrateable element vibrates in the first frequency range.

According to one embodiment of the present invention, the second vibrateable element has a plurality of apertures in at least a part of the second vibrateable element, wherein the apertures are sized to move at least some of the scent material therethrough when the vibrateable element vibrates in the first frequency range.

According to one embodiment of the present invention, the compartment has a channel configured for linking the compartment to a scent source, said device further comprising:

a valve located at the channel of the compartment, wherein the valve is configured to open in response to vibrations in the second frequency range for moving the scent material from a scent source into the compartment through the channel.

According to one embodiment of the present invention, the compartment has a surface spaced from the vibrateable element by a distance sufficiently small such that a capillary effect is produced for retaining the scent material located between the surface and the vibrateable element.

According to one embodiment of the present invention, the vibrateable element is coupled to a mobile electronic device configured to receive an incoming signal, and wherein the vibrateable element is configured to vibrate in the first frequency range in response to an incoming signal received in mobile electronic device.

The third aspect of the present invention is an apparatus, comprising:

a compartment for storing a scent material;

a vibrateable element located in relationship to the compartment; and

a driving unit coupled to the vibrateable element, wherein the driving unit is configured to vibrate the vibrateable element in a first frequency range for dispensing at least a part of the scent material in the compartment, and to vibrate the vibrateable element in a second lower frequency range for replenishing the scent material in compartment.

According to one embodiment of the present invention, the driving unit is also configured to vibrate the vibrateable element in a third frequency range between the first and second frequency ranges for producing an audio signal. The first frequency range is substantially between 50kHz and 300kHz; the second frequency range is substantially between 1Hz and 10Hz; and the third frequency range is substantially between 20Hz and 2kHz, for example.

According to one embodiment of the present invention, the apparatus further comprises a receiver for receiving incoming signals, the receiver coupled to the driving unit, wherein the driver is configured to vibrate the vibrateable element in the first frequency range in response to the incoming signals.

According to one embodiment of the present invention, the compartment comprises a plurality of sub-compartments, each sub-compartment having a valve, and wherein the scent material comprises a plurality of different scents stored in said different sub-compartments, said apparatus further comprising:

a controller coupled to the receiver, wherein the controller is configured to open the valve of a different one of the sub-compartments in response to a selected one of the incoming signals.

According to one embodiment of the present invention, the compartment has a channel configured for linking to a scent source also having the scent material, and a valve located at the channel, wherein the valve is configured to open in response to vibrations in the second frequency for moving at least part of the scent material in the scent source into the compartment through the channel.

The apparatus can be a mobile electronic device, such as mobile handset.

The fourth aspect of the present invention is an apparatus, comprising:

means for storing a scent material;

means for vibrating; and

means, coupled to said vibrating means, for driving said vibrating means to vibrate in the first frequency range for dispensing the scent material, and to vibrate in a second lower frequency for moving the scent material into said storing means.

According to one embodiment of the present invention, the apparatus further comprises:

means for receiving a signal, coupled to the driving means, wherein the driving means is configured to vibrate the vibrating means in the first frequency range in response to the signal.

According to one embodiment of the present invention, the signal comprises an incoming signal received in a mobile terminal, and wherein said receiving means is coupled to a transceiver in the mobile terminal to receive the incoming signal.

The present invention will become apparent upon reading the description taken in conjunction with Figures 1 to 16b.

Brief Description of the Drawings

Figure 1 shows a mobile handset having a scent dispenser, according to one embodiment of the present invention.

Figure 2 shows a scent dispensing unit having a perforated vibrating element for dispensing a perfumed material, according to one embodiment of the present invention.

Figure 3 shows a scent dispensing unit having a perforated vibrating element for dispensing a perfumed material, according to another embodiment of the present invention.

Figure 4 shows a scent dispensing unit having a perforated membrane for dispensing a perfumed material, according to yet another embodiment of the present invention.

Figure 5 shows a scent dispensing unit having a vibrating element linking to a perforated element for dispensing a perfumed material, according to one embodiment of the present invention.

Figure 6 shows a scent dispensing unit having a passive perforated element for allowing a perfumed material to dispense therethrough, according to one embodiment of the present invention.

Figure 7 shows a scent dispensing unit having an attached vibrating element for dispensing a perfumed material through a passive perforated element, according to one embodiment of the present invention.

Figure 8 shows a scent dispenser having a valve to intake liquid perfume from a bulk liquid perfume source, according to one embodiment of the present invention.

Figure 9 shows a scent dispenser having a valve to intake liquid perfume from a bulk liquid perfume source, according to another embodiment of the present invention.

Figure 10 shows a scent dispenser having a valve to intake liquid perfume from a bulk liquid perfume source, according to yet another embodiment of the present invention.

Figure 11 shows a scent dispenser having a valve to intake liquid perfume from a bulk liquid perfume source, according to a different embodiment of the present invention.

Figure 12a to Figure 12d show a scent dispenser having two scent compartments and two valves for controlling the intake of the scent material, wherein the scent dispenser has a stationary perforated plate.

Figure 13a to Figure 13d show a scent dispenser having two scent compartments and two valves for controlling the intake of the scent material, wherein the scent dispenser has a vibrating perforated plate.

Figure 14 shows a scent dispenser having a plurality of liquid perfume containers for storing different liquid perfumes so that a perfume can be released according to a particular caller.

Figure 15a shows a scent dispenser wherein a flexible foil is used to prevent leakage through the replenishing channel.

Figure 15b shows the scent dispenser of Figure 15a where the flexible foil is moved to a different position to intake liquid perfume for replenishment.

Figure 16a shows a collapsible bag containing bulk liquid perfume attached to a scent dispenser as shown in Figure 15b.

Figure 16b shows a collapsible bag containing bulk liquid perfume attached to a scent dispenser as shown in Figures 13b.

Detailed Description of the Invention

The scent dispenser, according to various embodiments of the present invention, can be integrated into a mobile electronic device, such as a mobile handset. The scent dispenser has a vibrating element which is configured to vibrate at various frequencies. Thus, according to some embodiments of the present invention, the actuator solution for

producing sound is also used for scent dispensing. The actuator can be a vibrating element for producing sound in a speaker or a buzzer in a mobile phone. When the vibrating element is used for producing an audio sound, the vibrating frequency is substantially within the range of 20Hz to 2kHz. When the same vibrating element is used for dispensing a perfumed material, the vibrating frequency can be increased to 50kHz to 300kHz, for example. Furthermore, in some embodiments of the present invention, a valve is used as a pump to provide the liquid perfume to the scent material chamber, the valve is responsive to the vibrating frequency in the 1-10Hz range, for example, so that the scent material can be replenished from a larger storage compartment.

The scent dispenser, according to the present invention, can be integrated into a mobile electronic device, as shown in Figure 1. The scent dispenser can be a stand-alone unit or integrated with a speaker or a buzzer in the mobile electronic device.

According to various embodiments of the present invention, the scent is dispensed as a liquid spray through a plurality of micron-sized holes, for example. Figure 2 shows one embodiment of the present invention, where a liquid perfume container is attached to a vibrating element. Where the vibrating element is linked to the liquid perfume container, a number of small holes are made on the vibrating element so as to allow the liquid to pass through when the vibrating element is vibrating in the 50kHz to 300kHz range. The vibrating element can be a ring-shaped (annular) piezoelectric element having a perforated area substantially in the middle for scent dispensing. The perforated area functions like a micro-pump to pump the liquid through the micron-sized hole only at the ultrasound frequencies, for example. Thus, when the piezoelectric element vibrates in the audio frequency range, no significant amount of scent is dispensed. When the piezoelectric element is vibrating in the 50kHz to 300kHz range, sufficient amount of scent is dispensed while no audio sound is produced.

The scent dispenser or the sound producing unit can be a Helmholtz-typed device where a number of orifices are made on a plate covering an air chamber, as shown in Figure 3. In this embodiment, sound waves are generated through the orifices when the vibrating element is vibrating in the audio frequency range and the liquid mist is delivered through the orifices when the vibrating element is vibrating in the ultrasound frequency range, for example.

In a different embodiment of the present invention, a perforated membrane is used as a cover of a liquid perfume chamber, as shown in Figure 4. The perforated membrane has a plurality of micron-sized holes within a certain area and is used to deliver a mist of

liquid perfume when it vibrates in the ultrasound frequency range, for example. The same membrane can also be used to produce audio sound. The perforated membrane can be a part of an annular piezoelectric element, for example.

In another embodiment of the present invention, the perforated element is only used to dispense the liquid perfume, but not to produce sound. As shown in Figure 5, the perforated element is coupled to a sound producing membrane disposed in a separate compartment. When the sound producing membrane vibrates, it causes the perforated element to vibrate accordingly. When the sound producing membrane vibrates in the ultrasound frequency range, the perforated element also vibrates in a high frequency range to generate a mist of perfume.

Figures 6 and 7 show two different embodiments of the present invention wherein the perforated element remains stationary or passive when the scent is dispensed. As shown in Figure 6, the perforated element is disposed separately from the vibrating membrane or element. The perforated element can be sufficiently rigid and has a plurality of holes or openings large enough to allow sound waves and the perfume mist to pass through. The vibrating element is programmed to vibrate in the audio frequency range to produce audio sound and to vibrate in a higher frequency to generate a mist through the openings.

In the embodiment as shown in Figure 7, the mist-generating element is coupled to a vibrating membrane disposed in a separate compartment. When the vibrating membrane vibrates, it causes the mist-generating element to vibrate accordingly. When the vibrating membrane vibrates in the ultrasound frequency range, the mist-generating element also vibrates in a high frequency range to generate a mist of perfume through the passive perforated element.

When a mobile handset is oriented such that the scent dispenser is oriented vertically, for example, the liquid perfume may be pulled away from the perforated membrane or the mist-generating element by gravity. As such, the amount of mist dispensed from the scent dispenser may be significantly reduced. In a variety of embodiments of the present invention, the compartment that is used to store the liquid perfume can be made very thin so that the liquid perfume can be substantially retained by the compartment walls due to the liquid-solid surface tension and the capillary effect (capillarity). For example, the distance between the vibrating membrane or element and compartment base is only a fraction of a millimeter. As such, the liquid perfume is almost in contact with a large part of the vibrating membrane or element, regardless of the

orientation of the mobile handset. In order to replenish the liquid perfume in the scent dispenser compartment, bulk liquid is provided to the scent dispenser compartment through a valve or a diffusing element. According to the present invention, the valve or diffusing element can be caused to open by acoustic pressure when the vibrating element vibrates in the 1-20Hz range, for example. A few examples of orientation-independent scent dispenser units are shown in Figures 8 to 13d.

Figure 8 shows a valve or diffuser element disposed in a scent dispenser unit similar to that illustrated in Figure 4. In Figure 8, the distance d between the vibrating membrane and the compartment base is only a fraction of a millimeter in order to produce the capillary effect, whereas the scent dispenser as shown in Figure 4 can be made thickness to store more liquid perfume therein. The valve can be made of a flexible material such that it responds more efficiently to an acoustic wave in a low frequency range. For example, the valve vibrates more efficiently in the Hz range than in the audio frequency range. Thus, the scent dispenser unit is configured to vibrate in three different frequency ranges. When the scent dispenser unit is used as a speaker or buzzer, the vibrating membrane is caused to vibrate in the audio frequency range. When the scent dispenser unit is used to generate a mist of perfume, the vibrating membrane is caused to vibrate in the ultrasound frequency range. When it is time to replenish the liquid perfume in the scent dispenser compartment, the vibrating membrane is caused to vibrate in a frequency lower than the audio frequency range.

Figure 9 shows a valve or diffuser element disposed in a scent dispenser unit similar to that illustrated in Figure 5. In Figure 9, the distance d between the vibrating membrane and the compartment base is only a fraction of a millimeter in order to produce the capillary effect, whereas the scent dispenser as shown in Figure 5 can be made to have a sufficient thickness to store more liquid perfume therein.

Figure 10 shows a valve disposed in a scent dispenser unit similar to that illustrated in Figure 6. In Figure 10, the distance d between the vibrating membrane and the compartment base is only a fraction of a millimeter in order to produce the capillary effect, whereas the scent dispenser as shown in Figure 6 can be made at a thickness to store more liquid perfume therein.

Figure 11 shows a valve disposed in a scent dispenser unit similar to that illustrated in Figure 7. In Figure 11, the distance d between the vibrating membrane and the compartment base is only a fraction of a millimeter in order to produce the capillary effect,

whereas the scent dispenser as shown in Figure 7 can be made at a thickness to store more liquid perfume therein.

Figure 12a to Figure 12d show a scent dispenser having two scent compartments and two valves for controlling the intake of the scent material, wherein the scent dispenser has a stationary perforated plate. Figure 12a shows the various components of the scent dispenser. As shown, the scent dispenser has two compartments: a scent dispensing compartment defined by a stationary or passive perforated plate and a vibrating element, and a scent storage compartment on the other side of the vibrating element. The scent dispenser has a first valve for controlling the scent intake into the storage compartment from a scent source (not shown), and a second valve for controlling the scent flow into the dispensing compartment from the storage compartment.

Figure 12b shows the scent dispenser in the scent dispensing mode. As shown in Figure 12b, the vibrating element vibrates in a high frequency range to produce a mist of scent through the perforated plate. The first and second valves are configured such that they are not significantly responsive to high frequency vibrations. As such, both of the valves remain closed through the scent dispensing period.

Figures 12c and 12d shows the scent dispenser in the pumping mode. In this mode, the vibrating element vibrates at a low frequency range. As shown in Figure 12c, when the vibrating element is in the upward flexing period, it pulls up the first valve to cause the scent material from a source to flow into the storage compartment. As shown in Figure 12d, when the vibrating element is in the downward flexing period, it causes the first valve to close but pushes open the second valve in order to replenish the scent material in the scent dispensing compartment.

Figure 13a to Figure 13d show a scent dispenser having two scent compartments and two valves for controlling the intake of the scent material, wherein the scent dispenser has an active perforated element. Figure 13a shows the various components of the scent dispenser. As shown, the scent dispenser has two compartments: a scent dispensing compartment defined by an active or vibrateable perforated element and a pumping membrane, and a scent storage compartment on the other side of the pumping membrane. The scent dispenser has a first valve for controlling the scent intake into the storage compartment from a scent source, and a second valve for controlling the scent flow into the dispensing compartment from the storage compartment.

Figure 13b shows the scent dispenser in the scent dispensing mode. As shown in Figure 13b, the perforated element vibrates in a high frequency range to produce a mist of

scent through the perforated element. The pumping membrane is configured such that it is not significantly responsive to high frequency vibrations. As such, the pumping membrane does not create a pressure on the first and second valves. Thus, the valves remain closed through the scent dispensing period.

Figures 13c and 13d shows the scent dispenser in the pumping mode. In this mode, the perforated element vibrates at a low frequency range. As shown in Figure 13c, when the perforated element is in the upward flexing period, it creates a negative pressure to pull up the pumping membrane. At the same time, the first valve is open to allow the scent material from a source to flow into the storage compartment. As shown in Figure 13d, when the vibrating element is the downward flexing period, it creates a downward pressure to push down the pumping membrane. As such, the first valve is closed but the second valve is open in order to replenish the scent material in the scent dispensing compartment. It should be noted that the pumping membrane is not necessary for the scent dispense to function. Nevertheless, it would be advantageous to have two scent compartments wherein each of the compartments is made thin enough to create the capillary effect in order to retain the liquid material in place regardless of the orientation of the scent dispenser. The capillary effect is particularly useful when it is used in a mobile electronic device, such as a mobile handset.

In sum, the present invention provides a method of scent dispensing in an electronic device, such as a mobile handset. The scent dispensing unit can be a stand-alone unit, or it can be integrated with a sound producing unit that has a vibrating element which is configured to vibrate in different frequency ranges. When the sound producing unit is used to produce an audio sound or used as a speaker, the vibrating element is caused to vibrate in an audio frequency range. When the sound producing unit is used for scent dispensing, the vibrating element is caused to vibrate in a higher frequency range, such as the ultrasound frequency range. The vibrating element can be disposed adjacent to a perforated element for generating a mist of perfume through the perforated element. Alternatively, the vibrating element can have a plurality of openings to allow a mist of liquid perfume to pass therethrough when the vibrating element vibrates in the higher frequency range. In a different embodiment, the vibrating element is coupled to a mist-generating element disposed in a separate compartment so that the vibrating element causes the mist-generating element to vibrate accordingly. The vibrating element can be configured to vibrate in a frequency range lower than the audio frequency range to actuate

a valve or diffusing element in order to replenish the liquid perfume in the scent dispenser unit.

The present invention provides a variety of embodiments of the scent dispenser unit that can be integrated with a speaker or buzzer in a device, such as a mobile terminal. But any one of the embodiments can be a stand-alone scent dispenser. The stand-alone scent dispenser can be designed as an add-on to a mobile electronic device. The electronic device for driving the piezoelectric element can be integrated into the stand-alone dispenser. Alternatively, the driving signal applied to the piezoelectric element is a part of the mobile electronic device. Likewise, the scent dispenser can have its own battery or it can use the electrical power of the mobile electronic device. Also, a control bottom can be provided on the scent dispenser or on the mobile electronic device so as to allow the user to dispense the scent at anytime, without waiting for an incoming signal.

When the user attaches a scent dispensing module to a phone, for example, the user may be asked whether he or she would want to be part of a mailing list, to receive background graphic to the phone, etc. In this way, the phone can be personalized.

The scent dispensers come with a variety of scents so as to allow a user to choose the desirable ones. The scent dispensers can be attached or detached in an easy way so as to allow a user to change the scents to the user's liking. The scent dispenser unit has a mist-generating element for dispensing a scent when a user is using the mobile terminal. For example, a scent is dispensed when the mobile terminal receives an incoming call/message signal. The scent or perfume can be customized by adding a selected scent unit. Accordingly to a different embodiment of the present invention, the scent dispenser unit has a number of separate liquid perfume containers, each of which stores a different perfume, as illustrated in Figure 14. A plurality of valves can be coupled to a value controller so that a certain liquid perfume container will be opened in response to a certain ring-tone or call number. As such, scents can be used as an information delivery channel to provide a method for personalized call identification from a distance, with no physical contact with the device. Adding a movement/touch sensor to a phone to initiate scent dispensing ensures that the information is delivered to the user immediately after entering the surroundings of the phone.

The present invention provides an actuator solution for producing both audio as a speaker and a scent mist-generating device with independent driving solutions based on intelligent actuator structure and different operating frequency ranges of applications.

In some embodiments, the modified Helmholtz-type resonator used in speaker solutions is used for scent generation, where liquid from an exchangeable or refillable container is delivered on one side of the vibrating plate. The actuator can be a perforated or mesh plate containing hundreds or thousands of micron sized holes through which a liquid perfume is able to penetrate only when the mesh is vibrating. The liquid from the container can be dispensed using e.g. a small pump or a wick (based on capillarity). Usable frequency range is at far ultrasonic range between 100-300 kHz, for example.

The Helmholtz-type resonator can have a ring-shaped piezoelectric element with a a perforated plate in the middle of piezoelectric element. A piezoelectric actuator has an especially large dynamic frequency range to cover both the audio range and the far ultrasonic range required for scent dispensing. Thus, the scent dispenser unit uses a shared piezoelectric element to produce both sound and scent. When vibrated without exposure to the liquid perfume, the device works as a normal speaker or buzzer. With exposure to the liquid perfume, the vibration of the perforated plate works as a micro-pump pumping the liquid through the micron sized holes on the plate and creating a mist of perfume. It is understood that the piezoelectric or vibrating element, as shown in Figures 2 to 11, is coupled to a driving unit similar to the one illustrated in Figure 12. The driving unit is also coupled to a controller configured to control the vibration frequencies and the vibration timing.

The actuator should be fixed so that its mechanical resonance frequency is set to scent dispensing frequency, i.e. ultrasonic. This enables efficient scent dispensing and avoids difficult resonances in the audio frequency range. For ensuring fully separate functionality between scent dispensing and audio sound producing, additional shutter (not shown) between the perfume liquid and the actuator can be used. For example, the shutter is on (closed) when audio is produced, and off (open) when scent is dispensed.

The present invention improves the space utilization in a mobile phone by combining two functions requiring a piezoelectric element. The scent-generating speed or amount can be adjusted by the user by choosing from several predetermined options, such as vibrating frequencies.

The scent dispensing function, according to the present invention, can be implemented by using either active or passive mesh technology.

In an active mesh technology an annular piezoelectric element is used to vibrate a diaphragm in which the middle part is perforated. The tapered holes on the mesh are micron-sized with the larger ends facing towards the liquid perfume chamber, for

example. In a passive mesh technology, a piezoelectric element that is used to vibrate a diaphragm or membrane is disposed adjacent to a perforated plate.

In some embodiments of the present invention, a micro-pump or valve is also integrated into the scent dispenser unit so that the same piezoelectric element can be used to pump the liquid perfume into the liquid perfume chamber while vibrating in a low frequency, such as in 1 to 10Hz range. The vibration of the piezoelectric element in the Hz range causes the diaphragm or membrane to move up and down, thereby producing a pumping action. While the air in the liquid perfume compartment can escape the compartment through the mesh, the liquid accumulated in the compartment is substantially retained as the surface tension and other fluid specific properties prevent it from exiting through the holes on the perforated plate. When the liquid perfume chamber is full, i.e. it has the required perfume dose, the vibration frequency of the piezoelectric element is changed to a higher frequency so that the pumping stops and the atomization starts.

To make the operation of the system orientation independent, the atomizer construction is implemented so that the liquid perfume chamber is so thin that the liquid is in contact with the atomizing surface at all times, regardless of the orientation of the atomizer. Other parts of the orientation dependency and the free positioning of the liquid in the container that it is being stored therein can be solved by integrating a collapsible bag into the fluid container. As the liquid in the collapsible bag is being pulled into the chamber by the pump, the suction force creates a vacuum, thus collapsing the bag and keeping the fluid at the container outlet for providing the liquid perfume to the pump in all orientations.

Due to the fluid specific properties of some liquids, the holes on the mesh plate might have to be very small. These small holes may prevent the air in the liquid perfume compartment from exiting through them. In this case, an overflow pipe controlled by a micro check valve can be used to remove the air. The valve is open during the pumping mode, and closed during scent dispensing.

Normally when a phone rings in response to an incoming call, the caller may not be identified without seeing names on the mobile device display. Scent technologies connected to caller name(s) can be used such that spraying a mist of perfume in the room is carried out when a priorized person/caller is calling. In a loud and heavy traffic environment, a scent in response to a call could be a complementary to a ring-tone or the phone body vibration. Sense of smell can replace some of the impaired senses like hearing or touch.

Adding a scent unit to a mobile device is a way to customize the device. Similar to adding customized display graphics (such as adding a brand name visible to the display, www-pages etc..), memory data information can be integrated to the scent added on package.

The scent dispensing unit, including control electronics, liquid container, dispensing system with micro pump and atomizing unit/spraying head, can be integrated into the sound producing device in a device, such as a mobile phone. Alternatively, the scent dispensing unit can be a separate add-on module to the device to allow the perfume container to be refilled or replaced by a user.

The liquid perfume container can be refillable or interchangeable. The fixation of the interchangeable container to the mobile handset can be done by using quick-release couplings, for example. The container can also be a part of a larger entity, such as an exchangeable unit, which can possibly comprise some other functional packages. In this case the whole module is interchanged. The use of the container is secured by using an RFID (radio frequency identification device) or some other securing method. The liquid in the container is stored in a collapsible bag, to enable the liquid delivery to the container outlet in all orientations.

As shown in Figures 8, 9, 10, 11 and 12a – 13d, a single valve is used to seal off the liquid perfume chamber from the inlet through which bulk liquid in provided for replenishment purposes. The bulk liquid can be stored in a collapsible bag, for example. The valve can be opened by vibrating the vibrating element in a low frequency range so as to allow bulk liquid in the collapsible bag to enter into the liquid perfume chamber through the inlet, for example. In order to prevent leakage of the liquid perfume in the liquid perfume chamber through the valve and the inlet, the present invention further provides a pump located between the valve and the liquid perfume inlet. The pump can serve a number of functions, which include: 1) to move the bulk liquid into the pump housing and then to the perfume chamber; 2) to prevent liquid in the atomization chamber from returning to the perfume chamber (the returned liquid possibly brings along dirt, air etc.) and 3) to prevent the liquid in the perfume chamber from flowing into the atomizer thus causing leakage through the mesh in some positions (if a large amount of liquid is above the atomizer this increases the pressure thus pushing the liquid through the holes on the mesh).

As shown in Figures 15a and 15b, the pump comprises a pump housing between the dispensing compartment and the liquid perfume inlet. The pump housing has a narrow

end a wide end. The narrow end is connected to the dispensing compartment through a small tube, such as a capillary tube. The wide end is sealed by a membrane or a flexible thin-foil. The pump housing is also coupled to a liquid inlet through the side-wall of the pump housing. A first one-way valve (Valve 1) is located at the end of the capillary tube to allow liquid from the pump housing to enter into the dispensing compartment when the valve is open (see Figure 15a). A second one-way valve (Valve 2), located at one end of the liquid inlet, is used to allow bulk liquid to enter into the pump housing through the liquid inlet when it is open (Figure 15b). The membrane or thin foil, coupled to an action block, is used as a pump piston. When the thin foil is pulled away from the dispensing compartment, it causes Valve 1 to close and causes Valve 2 to open (Figure 15b). When the thin foil is pushed toward the dispensing compartment, it pushes the liquid perfume in the pump housing through Valve 1, and, at the same time, the movement of the thin foil causes Valve 2 to close. When the thin foil is pushed to a seal-off position, the thin foil is pushed against the inner wall of the capillary tube for preventing the liquid perfume from flowing back into the pump housing. At the same time, part of the thin foil also block off the liquid inlet (see Figure 15a).

The movement of the thin foil can be achieved by the movement of the action block toward or away from the dispensing compartment. The movement of the action block can be achieved by a shape-memory-alloy (SMA) wire coupled to one end of the action block, for example. An SMA wire contracts when it is heated above its transient temperature and returns to its original length when it is cooled below its transient temperature. The heating of the SMA wire can be carried out by applying an electrical current through the wire, for example. The heated SMA can be cooled by ambient air, for example. The heating and cooling cycle can be in the Hz frequency range. As shown in Figure 15b, when the SMA contracts, it pulls the action block away from the dispensing compartment. When the SMA wire is cooled, a leap spring or the like is used to help pushing the thin foil against the inner wall of the capillary tube (Figure 15a).

Figures 15a and 15b illustrate one embodiment of the present invention, wherein a SMA actuated valve is used for flow blockage. By having two one-way valves (Valve 1 and Valve 2) on both sides of the SMA actuated valve, the valve system acts as a pump. The pumping force can be made greater than the acoustic pressure by the vibrating element in the low frequency range (Figures 8, 9, 10, 11 and 12a – 13d), rendering it possible to draw liquid perfume from a liquid storage unit even when the storage unit is not in the vicinity of the dispensing compartment. With such a pump or valve system, it is

possible to use the scent dispensing unit in all orientations. When the SMA actuated valve is in its normal stage, the leaf spring helps push the seal against the inner wall of the capillary tube. The flow of the liquid through the capillary tube can be effectively blocked. The blockage prevents not only the liquid in the dispensing compartment from coming out from through the capillary tube, but also unwanted liquid from entering the dispensing compartment. Furthermore, at this stage, part of the thin foil is also used to block the flow of the liquid through the liquid inlet. As such, the leakage of liquid through the liquid inlet is also prevented.

The SMA actuated system, along with the leaf spring, can be made as a small-sized system. Thus, the SMA actuated pump can be used in a device with very limited space. The spring that is used to push the thin-foil against the inner wall of the capillary tube can be a helical shaped-spring or a disk-shaped spring. The SMA wire is chosen such that when it is heated, it is strong enough to overcome the force of the spring in order to move the thin-foil away from the capillary tube and to open the liquid inlet as shown in Figure 15b. The control of the SMA actuated pump can be time based on/off control.

The scent dispensing functionality can be related to caller identification. Certain callers could have their personalized "smell-tones" to notify when they are calling. If the mobile phone user is not in the same environment with the phone at the time of the call, the phone could use a proximity sensor or something similar to detect when the user enters the environment, and then release the scent again. Using scents as an information delivery channel provides a method for personalized caller identification from a distance, with no physical contact with the device. Adding a movement / touch sensor to the phone to initiate spraying ensures that the information is delivered to the user immediately after entering the surroundings of the phone. Using exchangeable scent unit provides the user with many personalization opportunities limited by the number of existing scent units. Easily exchangeable scent units can be interchanged by the user so as to allow the user to choose a particular scent. As such, the particular scent is dispensed when a special someone has called, or when the phone has received a call from an unknown number.

It is understood that, in many embodiments of the present invention, it is possible that the scent dispensing function is controlled by the user. The user can push one or more keys on the keypad on a mobile handset, for example, to cause the scent dispensing. According to various embodiments of the present invention, a collapsible bag can be used to store bulk liquid perfume, as shown in Figure 16a and 16b. The collapsible bag can also be kept within a more rigid container or the like.

Thus, although the present invention has been described with respect to one or more embodiments thereof, it will be understood by those skilled in the art that the foregoing and various other changes, omissions and deviations in the form and detail thereof may be made without departing from the scope of this invention.

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What is claimed is:

1. A method, comprising:

vibrating a vibrateable element in a first frequency range for dispensing at least a part of a scent material stored in a compartment; and

vibrating the vibrateable element in a second frequency range lower than the first frequency range for moving the scent material into the compartment.

2. The method of claim 1, wherein the scent material is stored adjacent to the vibrateable element.

3. The method of claim 1, further comprising:

coupling a second vibrateable element to the vibrateable element, wherein the scent material is stored adjacent to the second vibrateable element, and wherein when the vibrateable element vibrates in the first frequency range, the second vibrateable element vibrates for dispersing the scent material.

4. The method of claim 1, further comprising:

providing a plurality of apertures in the vibrating element so that the scent material is dispersed through at least some of the apertures.

5. The method of claim 3, further comprising:

providing a plurality of apertures in the second vibrating element so that the scent material is dispersed through at least some of the apertures.

6. The method of claim 1, further comprising:

providing a channel between the compartment and a source unit also having the scent material; and

providing a valve at the channel, the valve configured to open in response to vibrations in the second frequency range for moving a part of the scent material in the source unit into the compartment through the channel.

7. The method of claim 1, further comprising:

coupling the vibrateable element to a processor in a mobile handset configured to receive an incoming signal, wherein the vibrateable element is configured to vibrate in the first frequency range in response to the incoming signal.

8. A device, comprising:

a compartment for storing a scent material, the compartment having an outlet section and an inlet section;

a vibrateable element, coupled to the outlet section, for dispensing the scent material; and

a valve, coupled to the inlet section, for replenishing the scent material in the compartment.

9. The device of claim 8, wherein the vibrateable element is configured to vibrate in a first frequency range for dispensing the scent material, and a second lower frequency range for replenishing the scent material in the component through the valve.

10. The device of claim 9, further comprising:

a second vibrateable element coupled to the vibrateable element, the second vibrateable element located in the compartment, wherein the scent material is stored adjacent to the second vibrateable element, and the second vibrateable element is configured to vibrate for dispensing the scent material when the vibrateable element vibrates in the first frequency range.

11. The device of claim 9, wherein the vibrateable element has a plurality of apertures in at least a part of the vibrateable element, wherein the apertures are sized to move at least some of the scent material therethrough when the vibrateable element vibrates in the first frequency range.

12. The device of claim 10, wherein the second vibrateable element has a plurality of apertures in at least a part of the second vibrateable element, wherein the apertures are sized to move at least some of the scent material therethrough when the vibrateable element vibrates in the first frequency range.

13. The device of claim 9, wherein the compartment further comprises a channel at the inlet section, the channel configured for linking the compartment to a scent source, and wherein the valve is configured to open in response to vibrations in the second frequency range for moving the scent material from a scent source into the compartment through the channel.

14. The device of claim 13, wherein the compartment has a surface spaced from the vibrateable element by a distance sufficiently small such that a capillary effect is produced for retaining the scent material located between the surface and the vibrateable element.

15. The device of claim 9, wherein the vibrateable element is coupled to a mobile electronic device configured to receive an incoming signal, and wherein the vibrateable element is configured to vibrate in the first frequency range in response to an incoming signal received in mobile electronic device.

16. The device of claim 8, wherein the compartment further comprises a channel having a first channel end and a second channel end, wherein the valve is located at the first channel end, said device further comprising:

a pump having a first pump end and a second pump end, the first pump end configured to linking to the second channel end, wherein the second pump end having a pump inlet configured for moving the scent material from a scent source into the pump.

17. The device of claim 16, wherein the pump further comprises

a pump housing having a first housing end and a second housing end, the first housing end located at the first pump end for connecting to the second channel end, and

a flexible member coupled to second housing end, wherein the flexible member is operable between a first position and a second position, wherein

when the flexible member is operated in the first position, the flexible member is pushed against the second channel end, preventing the scent material in the compartment from moving into the pump housing through the channel, and

when the flexible member is operated in the second position, at least part of the flexible member is spaced from the second channel end to permit a flow of the scent material between the pump housing and the channel.

18. The device of claim 17, wherein when the flexible member is operated in the first position, the flexible member is configured to block off the pump inlet.

19. The device of claim 17, wherein the pump further comprises an actuating member coupled to the flexible member for causing the flexible member to operate between the first and second position.

20. The device of claim 18, wherein when the actuating member has a temperature lower than a predetermined temperature, the actuating member has a first length, and when the actuating member has a temperature equal to or higher than the predetermined temperature, the actuating member has a second length smaller than the first length so as to cause the flexible member to move away from the first position toward the second position.

21. The device of claim 20, wherein the pump further comprises a spring member, coupled to the flexible member, and wherein when the temperature of the actuating member is lower than the predetermined temperature, the spring member is configured to provide a force for urging the flexible member to return to the first position.

22. The device of claim 20, wherein the actuating member is made of a shape-memory alloy and the predetermined temperature is a transient temperature characteristic of the shape-memory alloy.

23. The device of claim 13, wherein the scent source comprises a collapsible bag for storing the scent material.

24. An apparatus, comprising:

a compartment for storing a scent material;

a vibrateable element located in relationship to the compartment; and

a driving unit coupled to the vibrateable element, wherein the driving unit is configured to vibrate the vibrateable element in a first frequency range for dispensing at least a part of the scent material in the compartment, and to vibrate the vibrateable element in a second lower frequency range for replenishing the scent material in compartment.

25. The apparatus of claim 24, wherein the driving unit is also configured to vibrate the vibrateable element in a third frequency range between the first and second frequency ranges for producing an audio signal.

26. The apparatus of claim 24, further comprising:

a receiver for receiving incoming signals, the receiver is coupled to the driving unit, wherein the driver is configured to vibrate the vibrateable element in the first frequency range in response to the incoming signals.

27. The apparatus of claim 26, wherein the compartment comprises a plurality of sub-compartments, each sub-compartment having a valve, and wherein the scent material comprises a plurality of different scents stored in said different sub-compartments, said apparatus further comprising:

a controller coupled to the receiver, wherein the controller is configured to open the valve of a different one of the sub-compartments in response to a selected one of the incoming signals.

28. The apparatus of claim 24, wherein the compartment has a channel configured for linking to a scent source also having the scent material, and a valve located at the channel, wherein the valve is configured to open in response to vibrations in the second frequency for moving at least part of the scent material in the scent source into the compartment through the channel.

29. The apparatus of claim 24, comprising a mobile electronic device.

30. The apparatus of claim 24, comprising a mobile handset.

31. An apparatus, comprising:

means for storing a scent material;

means for vibrating; and

means, coupled to said vibrating means, for driving said vibrating means to vibrate in the first frequency range for dispensing the scent material, and to vibrate in a second lower frequency for moving the scent material into said storing means.

32. The apparatus of claim 31, further comprising:

means for receiving a signal, coupled to the driving means, wherein the driving means is configured to vibrate the vibrating means in the first frequency range in response to the signal.

33. The apparatus of claim 32, wherein said signal comprises an incoming signal received in a mobile terminal, and wherein said receiving means is coupled to a tranceiver in the mobile terminal to receive the incoming signal.

34. A device, comprising:

a compartment for storing a scent material, the compartment comprising an outlet section, and an inlet section having a channel;

a vibrateable element, coupled to the outlet section, for dispensing the scent material; and

a pump configured for linking to the channel for moving the scent material into the compartment.

35. The device of claim 34, wherein the pump comprises:

a pump housing having a first housing end and a second housing end, the first housing end connected to the channel, and

a flexible member coupled to second housing end, the flexible member operable between a first position and a second position, such that

when the flexible member is operated in the first position, the flexible member is pushed against the second housing end, preventing the scent material in the compartment from moving into the pump housing through the channel, and

when the flexible member is operated in the second position, at least part of the flexible member is spaced from the second channel end to permit a flow of the scent material between the pump housing and the channel.

36. The device of claim 35, wherein the second housing end having a pump inlet configured for moving the scent material from a scent source into the pump, and wherein when the flexible member is operated in the first position, the flexible member is configured to block off the pump inlet.

37. The device of claim 35, wherein the pump further comprises an actuating member coupled to the flexible member for causing the flexible member to operate between the first and second position.

38. The device of claim 36, wherein when the actuating member has a temperature lower than a predetermined temperature, the actuating member has a first length, and when the actuating member has a temperature equal to or higher than the predetermined temperature, the actuating member has a second length smaller than the first length so as to cause the flexible member to move away from the first position toward the second position.

39. The device of claim 38, wherein the pump further comprises a spring member, coupled to the flexible member, and wherein when the temperature of the actuating member is lower than the predetermined temperature, the spring member is configured to provide a force for urging the flexible member to return to the first position.

40. The device of claim 38, wherein the actuating member is made of a shape-memory alloy and the predetermined temperature is a transient temperature characteristic of the shape-memory alloy.

41. A method, comprising:

vibrating a vibrateable element in for dispensing at least a part of a scent material stored in a compartment through an outlet section of the compartment, the compartment further comprising an inlet section; and

moving the scent material into the compartment through the inlet section.

42. The method of claim 41, wherein the inlet section is connected to a pump housing having a first housing end and a second housing end, the first housing end connected to the channel, said method comprising:

providing a flexible member at second housing end, the flexible member operable between a first position and a second position, such that

when the flexible member is operated in the first position, the flexible member is pushed against the second housing end, preventing the scent material in the compartment from moving into the pump housing through the channel, and

when the flexible member is operated in the second position, at least part of the flexible member is spaced from the second channel end, permitting a flow of the scent material between the pump housing and the channel so as to allow the scent material to move from the channel into the compartment through the inlet section..

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FIG. 1

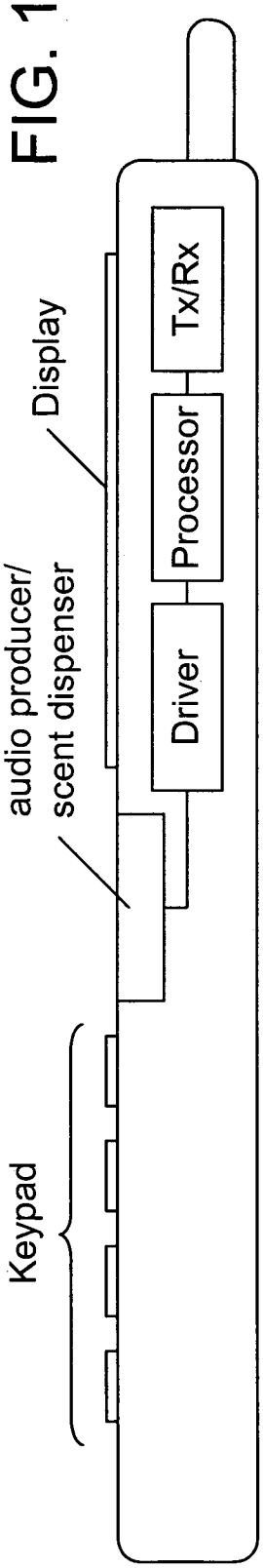


FIG.2

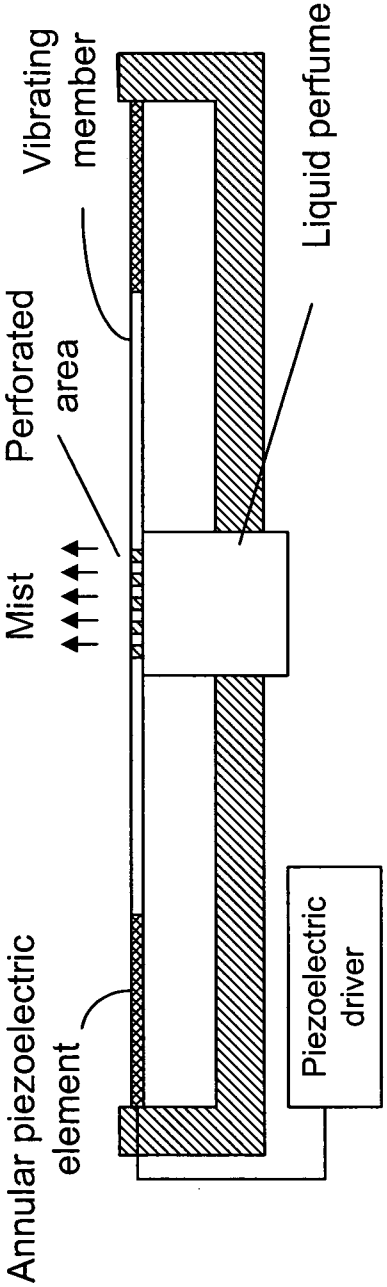


FIG.3

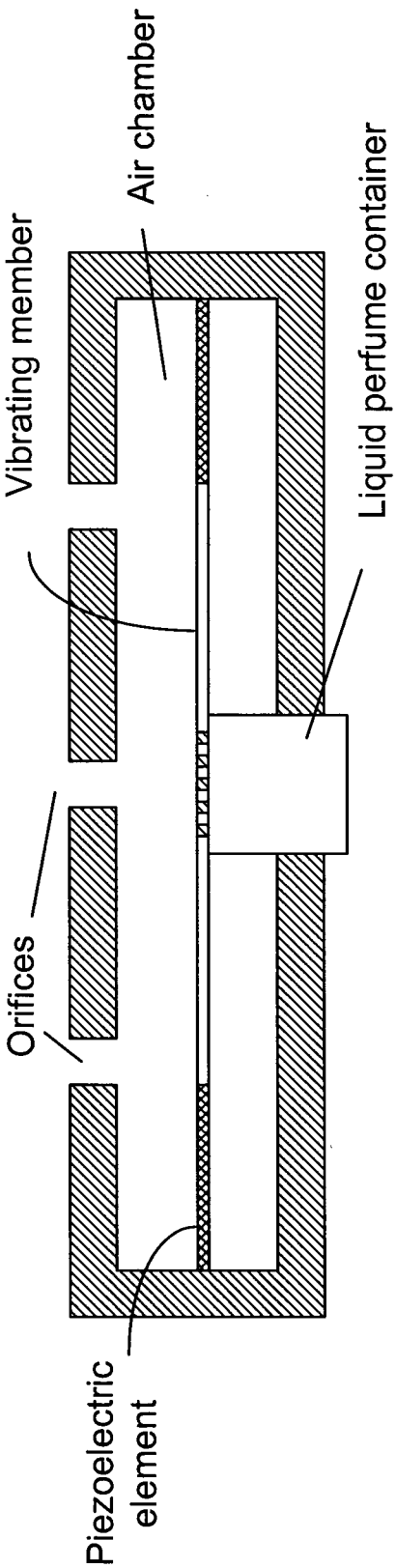


FIG. 4

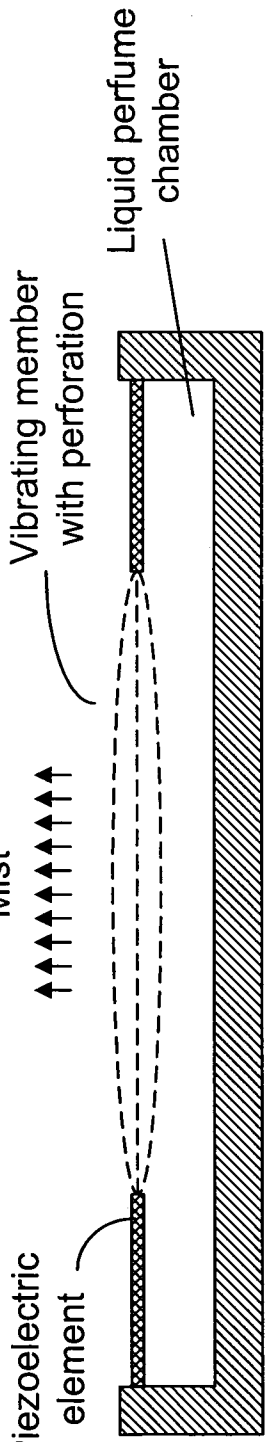


FIG. 5

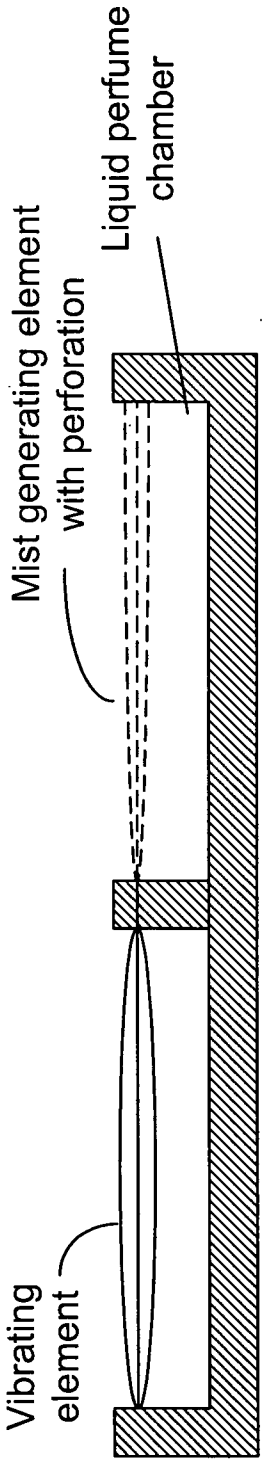
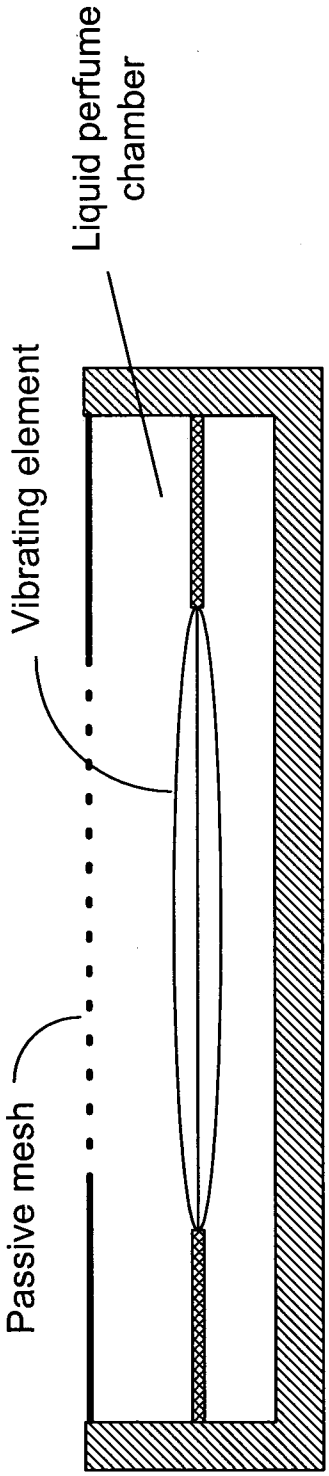


FIG. 6



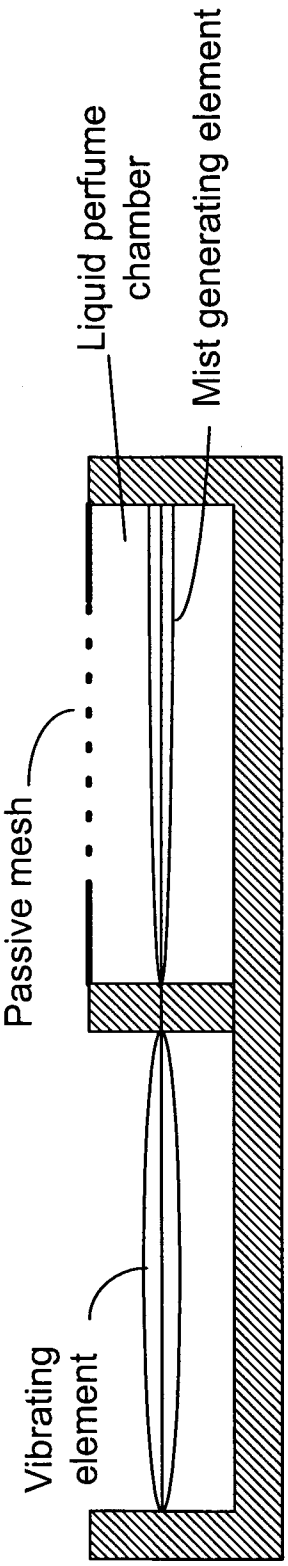

Liquid perfume chamber
Mist generating element
Passive mesh
Vibrating element

FIG. 7

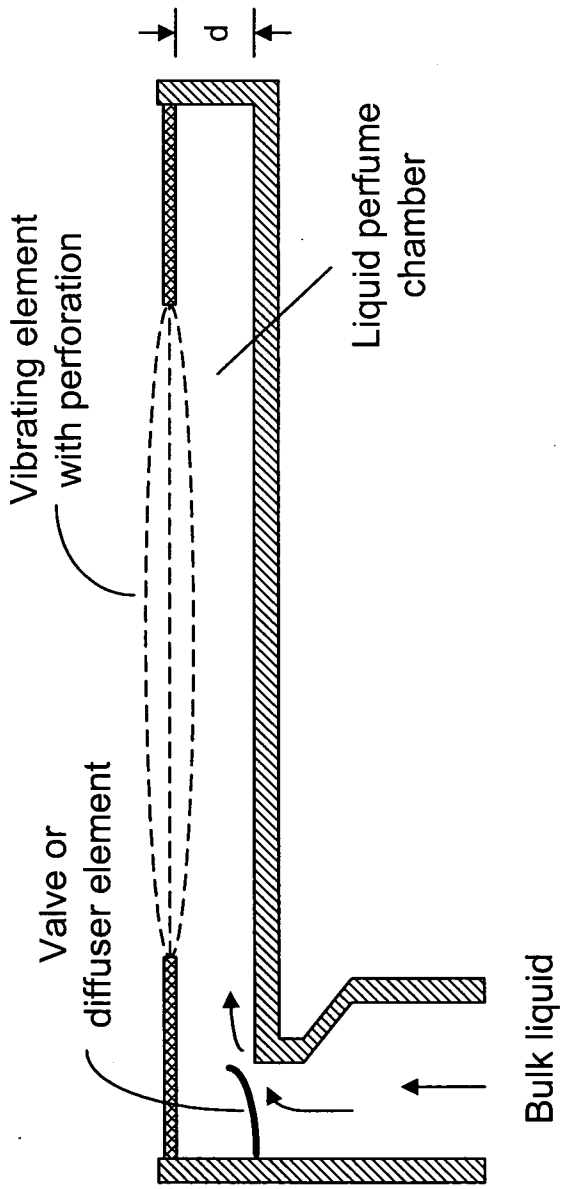

d
Vibrating element with perforation
Liquid perfume chamber
Valve or diffuser element
Bulk liquid

FIG. 8

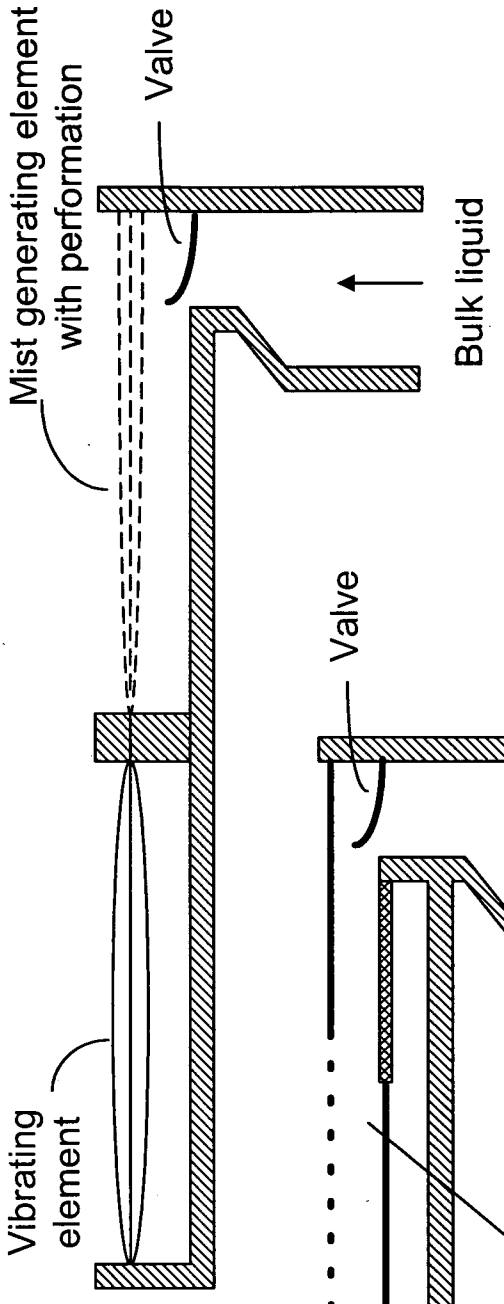


FIG. 9

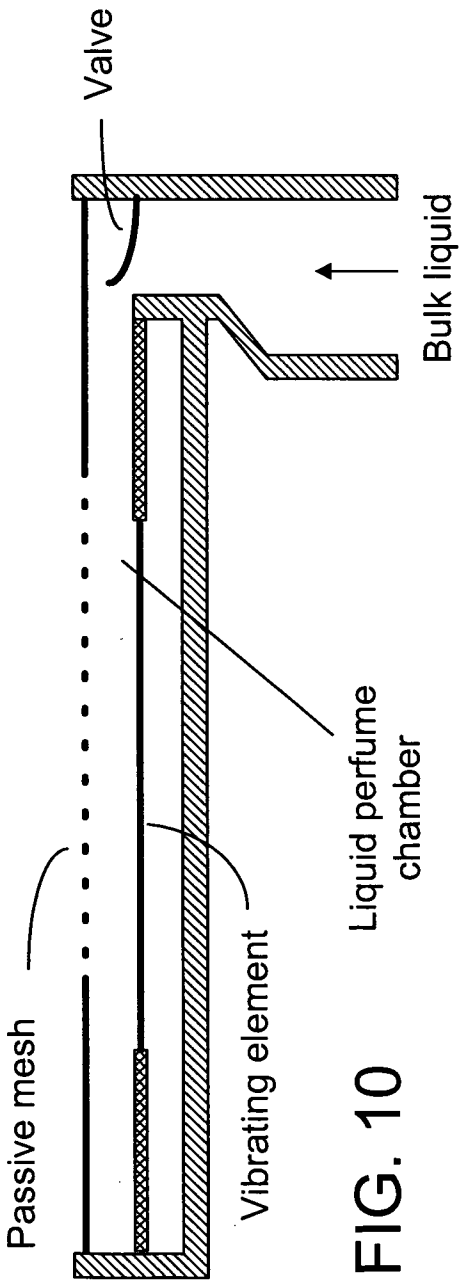


FIG. 10

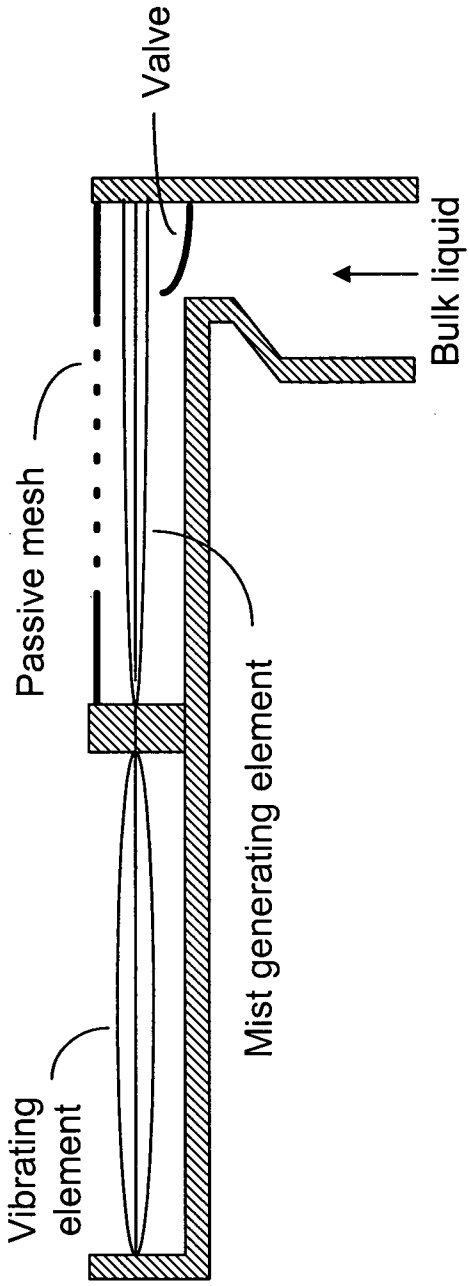


FIG. 11

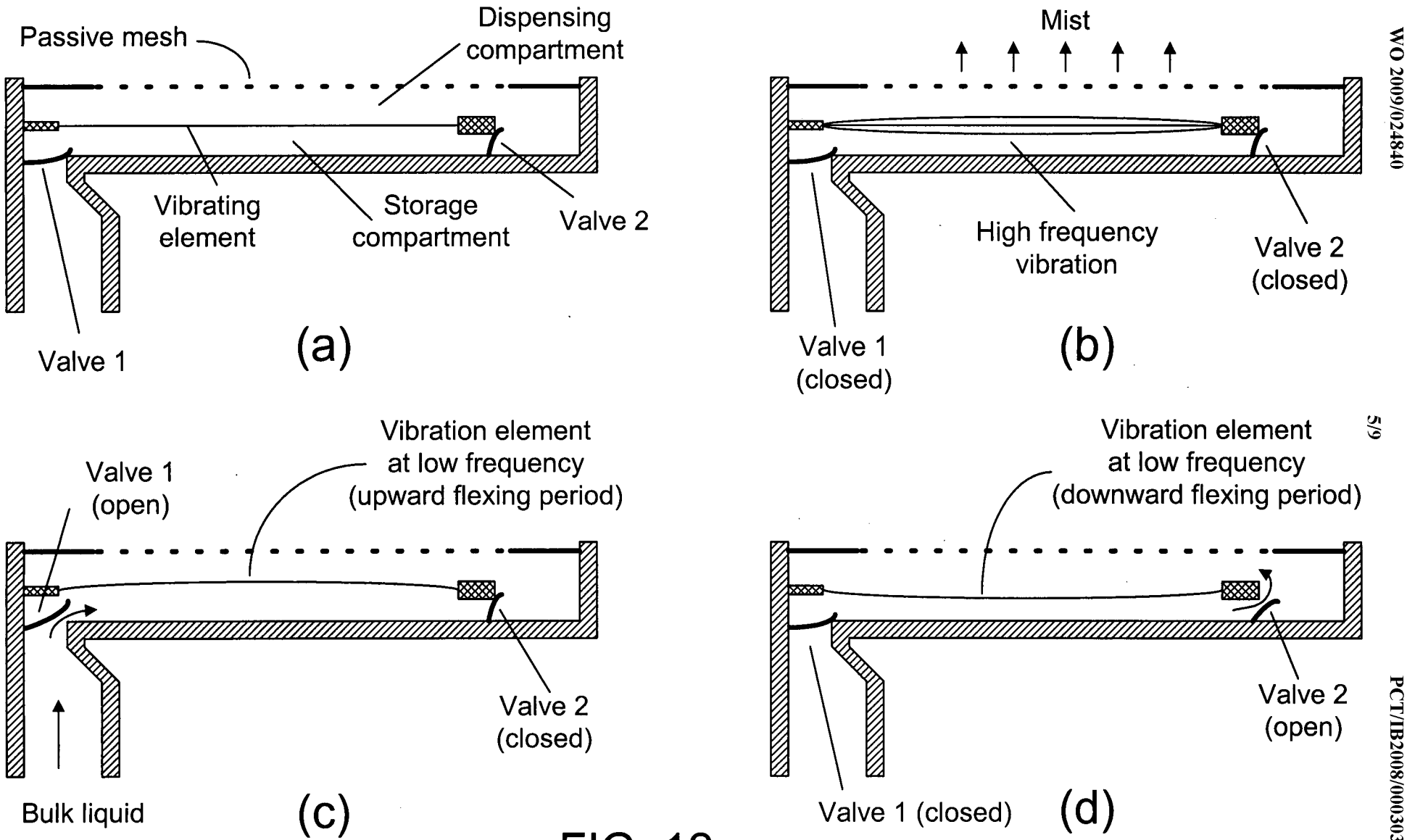

Passive mesh
Dispensing compartment
Vibrating element
Storage compartment
Valve 2
Valve 1
(a)
Mist
High frequency vibration
Valve 2 (closed)
Valve 1 (closed)
(b)
Valve 1 (open)
Vibration element at low frequency (upward flexing period)
Valve 2 (closed)
Bulk liquid
(c)
Vibration element at low frequency (downward flexing period)
Valve 2 (open)
Valve 1 (closed)
(d)

FIG. 12

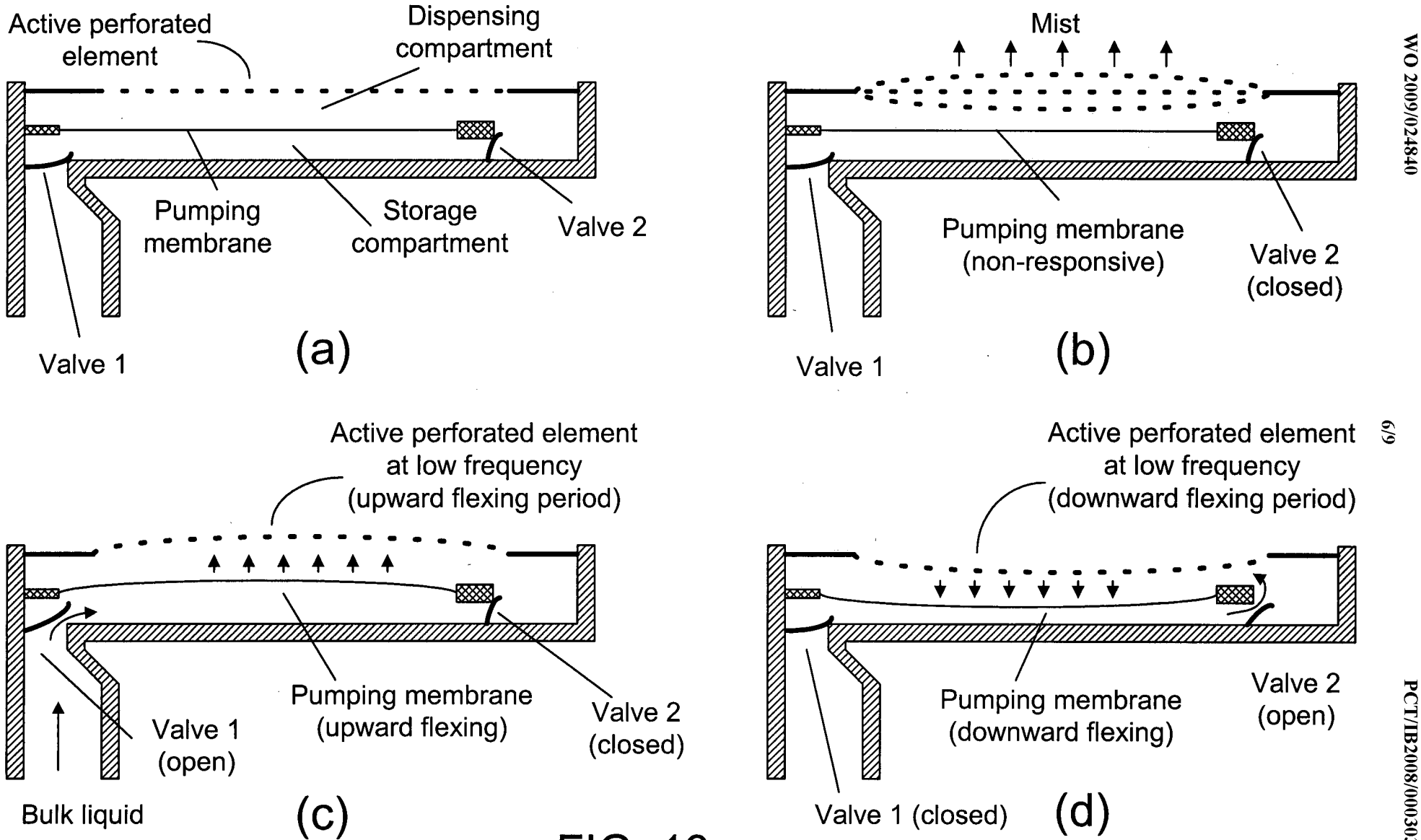

Active perforated element
Dispensing compartment
Pumping membrane
Storage compartment
Valve 2
Valve 1
(a)
Mist
Pumping membrane (non-responsive)
Valve 2 (closed)
Valve 1
(b)
Active perforated element at low frequency (upward flexing period)
Pumping membrane (upward flexing)
Valve 2 (closed)
Valve 1 (open)
Bulk liquid
(c)
Active perforated element at low frequency (downward flexing period)
Pumping membrane (downward flexing)
Valve 2 (open)
Valve 1 (closed)
(d)

FIG. 13

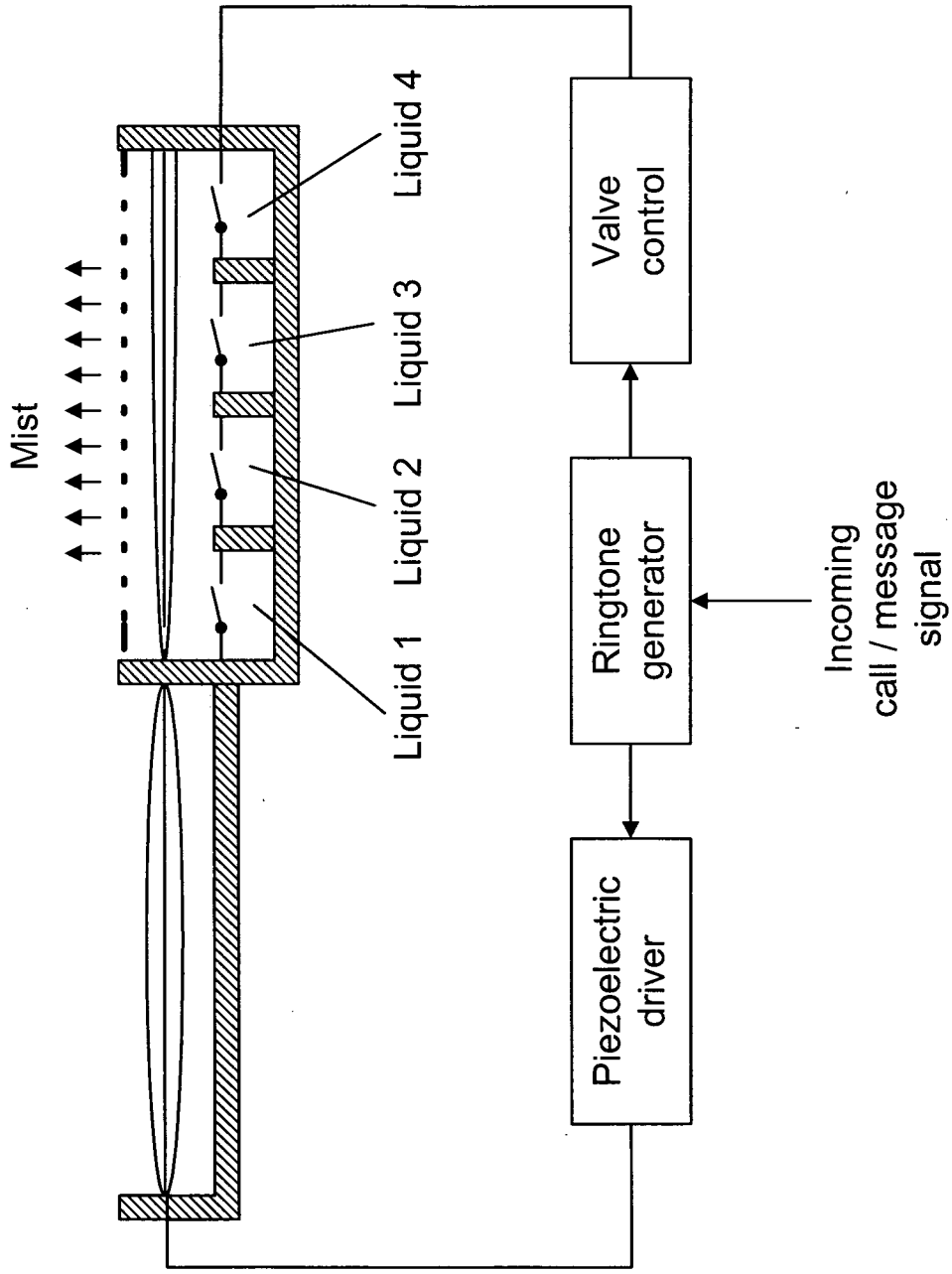

Mist
Liquid 1
Liquid 2
Liquid 3
Liquid 4
Valve control
Ringtone generator
Piezoelectric driver
Incoming call / message signal

FIG. 14

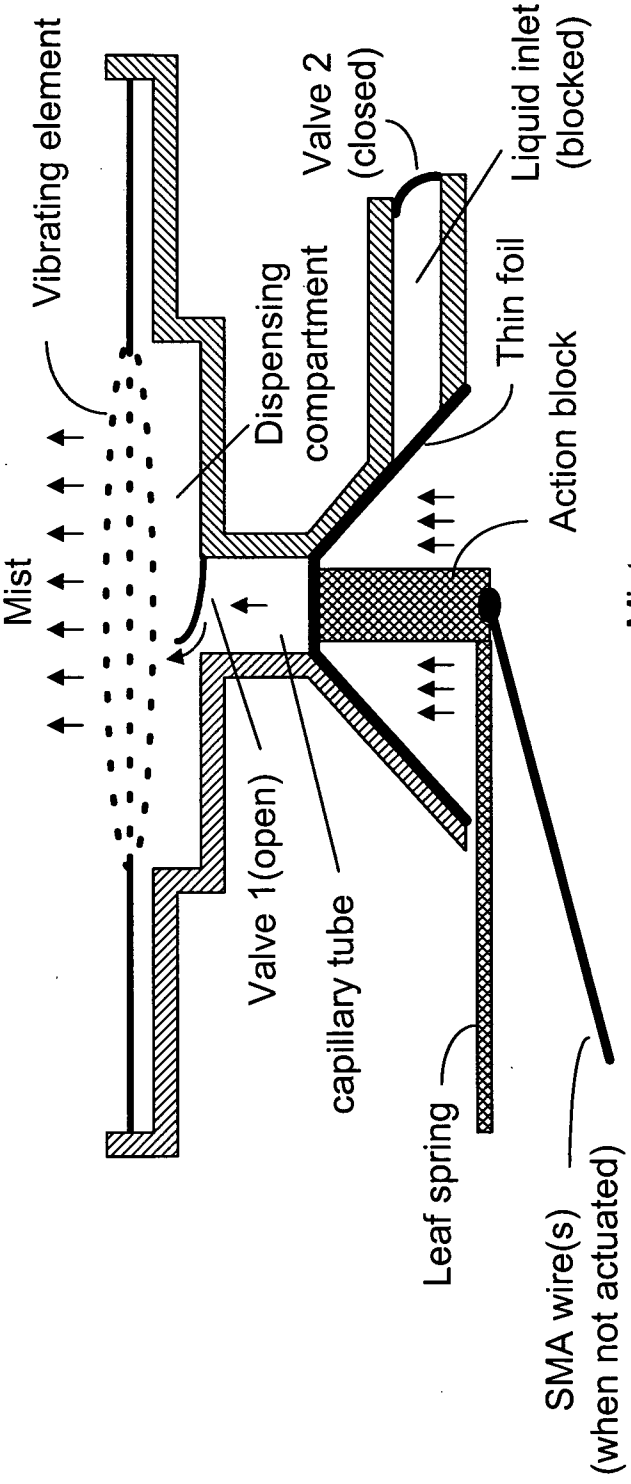


FIG. 15(a)

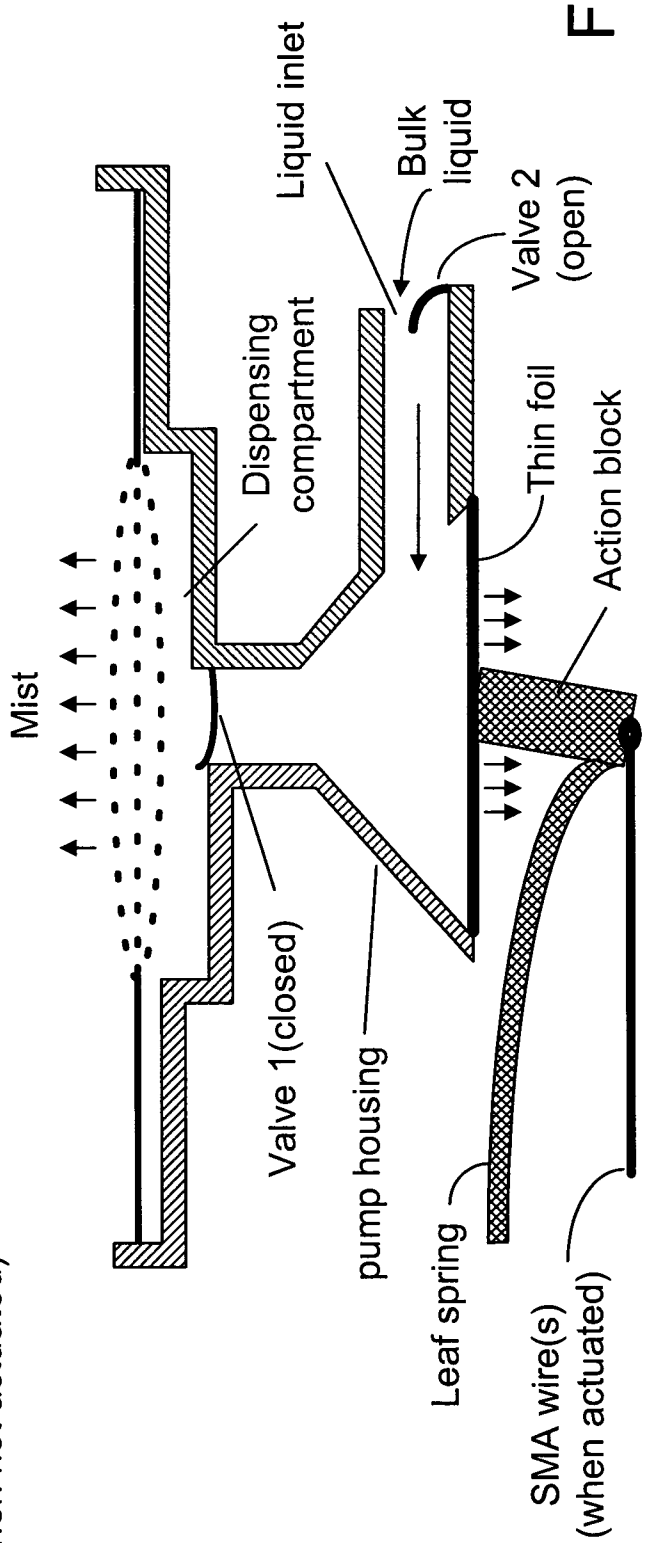


FIG. 15(b)

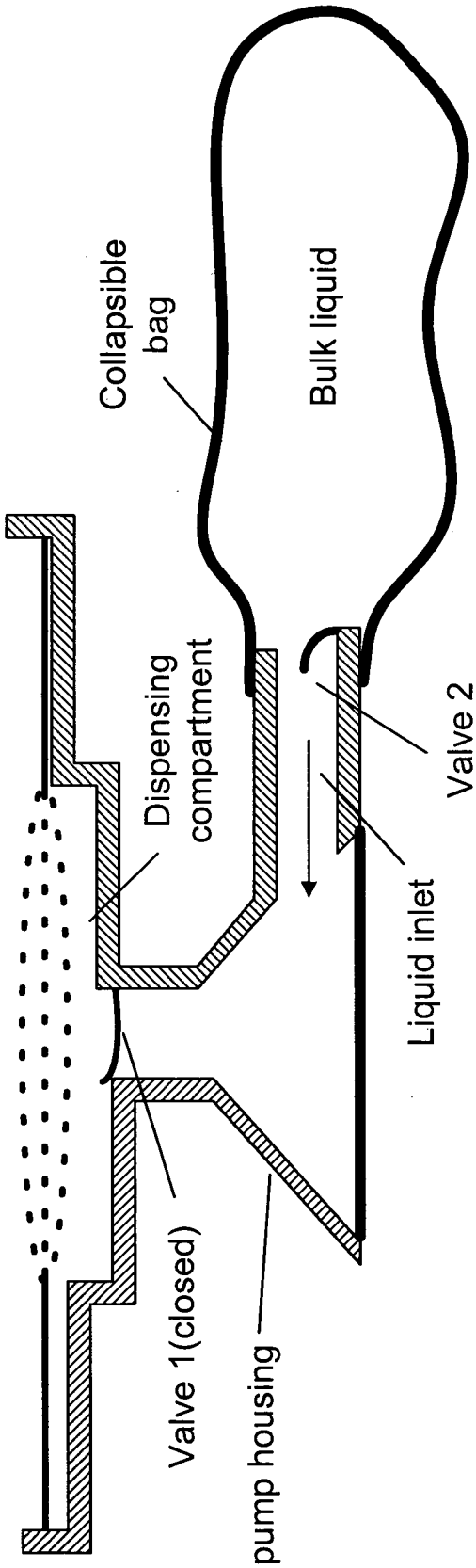


Fig. 16(a)

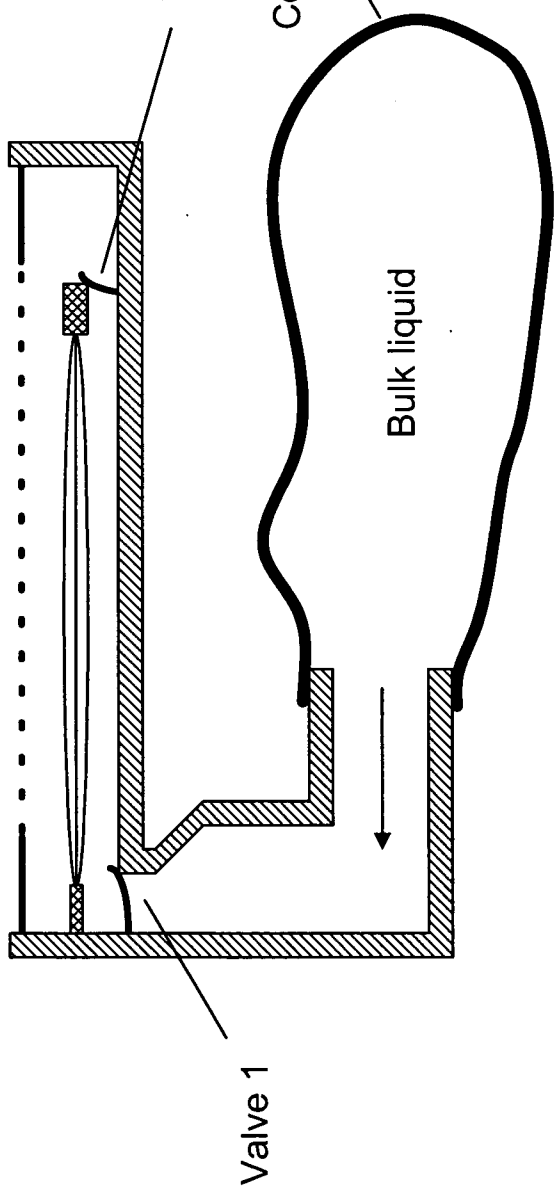


Fig. 16(b)

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2008/000303

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61L9/14 H04M1/21 A61L9/12

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)
A61L H04M

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	EP 0 923 957 A (MICROFLOW ENG SA [CH]) 23 June 1999 (1999-06-23) paragraphs [0020], [0022], [0026], [0027] -----	8,9,16, 34,41 1,2,6, 24,31,32
X A	US 4 702 418 A (CARTER ROBERT E [US] ET AL) 27 October 1987 (1987-10-27) column 3, line 57 - column 4, line 28 column 5, line 47 - column 7, line 20; figures 2,4 ----- -/--	8,9,24, 34,41 1,2,4,6, 11, 16-19, 28, 35-37,42

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 November 2008	04/12/2008

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

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2008/000303

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/062408 A1 (CHO WOO-JONG [KR] ET AL) 23 March 2006 (2006-03-23)	41
A	paragraphs [0021], [0022], [0024], [0025], [0027], [0028], [0031]	1,6-8, 15,16, 24,26, 31-34
X	JP 2004 254026 A (KYOCERA CORP) 9 September 2004 (2004-09-09)	41
A	the whole document	1,6-8, 24,26, 29-33
A	US 2004/235430 A1 (MA KUO-TONG [TW] ET AL) 25 November 2004 (2004-11-25) paragraphs [0034] - [0036], [0043] - [0046], [0051], [0055], [0061], [0062]	1,2,6-8, 41

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2008/000303

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. claims: 1-42

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1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers allsearchable claims.

2. ☒ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search reportcovers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-42

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2008/000303

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EP 0923957 A	23-06-1999	DK 1129741 T3	07-08-2006
		EP 1129741 A2	05-09-2001
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US 2004235430 A1	25-11-2004	TW 583003 B	11-04-2004