(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 4 467 233 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.11.2024 Bulletin 2024/48

(21) Application number: **23175219.7**

(22) Date of filing: **25.05.2023**

(51) International Patent Classification (IPC):
B01F 25/00 *(2022.01)* ***B01F 33/501*** *(2022.01)*
B01F 35/32 *(2022.01)* ***B01F 35/00*** *(2022.01)*
B01F 35/71 *(2022.01)* ***B01F 35/22*** *(2022.01)*

(52) Cooperative Patent Classification (CPC):
B01F 25/12; B01F 25/14; B01F 33/50112; B01F 35/2207; B01F 35/32025; B01F 35/561; B01F 35/71755; B01F 35/717611; B01F 35/717612; B01F 35/717613; B05B 7/2464; B05B 7/2472; B05B 12/06; B05B 12/1418;
A45D 34/00; (Cont.)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(71) Applicant: **Sensile Medical AG**
4600 Olten (CH)

(72) Inventors:
- **Wyss, Thomas**
4528 Zuchwil (CH)
- **Huber, Christian**
3006 Bern (CH)
- **Lecchini, Stefano**
8032 Zürich (CH)

(74) Representative: **Schmid, Nils T.F.**
SKM-IP PartGmbB
Oberanger 45
80331 München (DE)

(54) **FLUID DISPENSER**

(57) A dispenser (1) suitable for dispensing a fluid composition dose (70) to an outside of the dispenser is disclosed. The composition dose includes a fluid carrier (31) dose and a fluid agent (21) dose. The dispenser comprises a housing (10) and a cartridge (90). The cartridge is detachably mountable to the housing. The cartridge is configured to accommodate any component of the dispenser that comes into contact with the agent. Further, a corresponding method for dispensing a fluid composition dose is disclosed. Moreover, a method for detachably mounting a cartridge to a housing of a dispenser is disclosed.

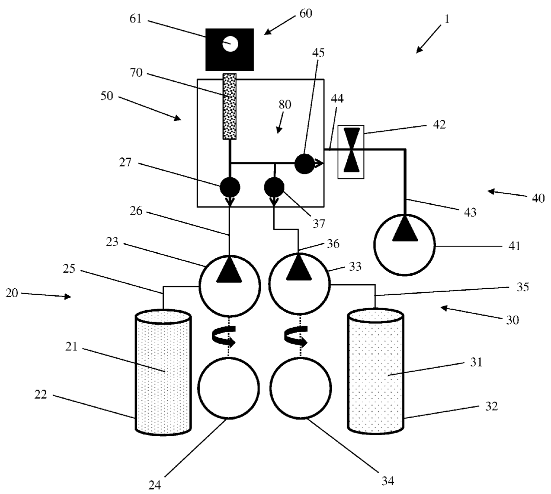


Fig. 1

EP 4 467 233 A1

(52) Cooperative Patent Classification (CPC): (Cont.)
A45D 2034/005; A45D 2200/058; B01F 2101/21;
B01F 2101/22; B01F 2101/2305; B05B 7/0408;
B05B 7/0425; B05B 7/0483; B05B 7/2418;
B05B 7/2424; B05B 7/2443; B05B 12/1409

Description

[0001] The present disclosure relates to a dispenser for fluids.

[0002] In particular, the dispenser is suitable for dispensing a fluid composition dose including at least two fluids.

[0003] In the fields of fluid (liquid or gaseous) cosmetics (such as fragrances or perfumes) or drugs (compositions for medical use), it might be necessary to mix the components of a fluid composition dose, which is to be dispensed to an outside of the dispenser within one discharging cycle, directly before dispensing the dose. In other words, it might be undesirable that a fluid composition dose, which is ready to be dispensed, is stored for a long time (i.e., for time periods exceeding several seconds or at least several minutes). One reason for avoiding long-term storage of the fluid composition dose might be that the characteristics of the components or ingredients of the dose might change or deteriorate over time due to interaction of the components of the dose. Another reason might be that a fluid composition which is an emulsion might undergo an undesired process of de-mixing before being discharged.

[0004] Therefore, it can be generally desirable to store the components of a composition separately within the dispenser and to mix the components directly before dispensing the composition dose.

[0005] The components of a composition are typically an agent that provides the main characteristics or effects of the composition, and a carrier for enabling the handling or the transport of the agent. In the field of cosmetics, the agent would normally be a perfume oil (e.g., fragrant essential oil or aroma compounds). In the field of drugs, the agent would normally be an active agent or ingredient (e.g, an antibiotic).

[0006] One exemplary case, in which the separate storage of the components is desirable, is in the field of cosmetics.

[0007] Conventionally, a fragrance dose, which is an example of a fluid composition dose, mainly comprises a carrier fluid (carrier) and a perfume oil (oil) being the agent. In most cases, the carrier fluid is an alcohol-based fluid, particularly an ethanol-based fluid. The reason being that alcohol-based carriers are good solvents for oils. Further, they have less impact on the characteristics on the oils than other carriers have. However, alcohol-based carriers have several disadvantages as well. One disadvantage being that the production and transportation of alcohols requires a lot of resources and effort, and cause higher costs. Further, alcohol-based carriers might irritate the user's skin. Additionally, alcohol-based carriers might cause air pollution when being discharged from the dispenser. Moreover, some users might have objections to alcohol-based carriers, e.g., for environmental reasons. Finally, alcohol-based carriers might not be desirable for specific user groups, such as children typically having a sensitive skin, or for users from specific cultures, in which the use of alcohol might be prohibited (e.g., in the Islamic culture).

[0008] To overcome the drawbacks of alcohol-based carriers, water-based carriers or water as the carrier can be used in the field of cosmetics. However, oils are barely solvable in water. Therefore, storing a composition of a water-based carrier and oil (i.e., an emulsion) for a long time before use is not desirable. During long-term storage, the emulsion would decompose or de-mix into its components.

[0009] Accordingly, to be able to use water-based compositions, the separate storage of the components and mixing directly before the discharging is desirable. However, the mixing of the water-based carrier and the oil (agent) into the composition dose to be discharged is challenging in view the duration of the whole dispensing process, the dosage of the components, the handling by the user, and the quality of the composition (e.g., the mixing pattern of the components). In the fields of cosmetics and drugs, these parameters are of particular importance.

[0010] The present invention has been made in order to overcome at least some of the above-mentioned disadvantages.

[0011] A dispenser and a method according to the present invention are set out in the independent claims. Further advantageous developments of the present invention are set out in the dependent claims.

[0012] According to the present invention, a dispenser is provided that is suitable for dispensing a fluid composition dose to an outside of the dispenser in one discharging cycle.

[0013] According to the present disclosure, one discharging cycle includes the activation of the dispenser (or the start of the dispensing process) by the user, providing the components or ingredients of the composition dose to a mixing area, providing the composition dose by mixing the components in the mixing area, and discharging the composition dose to the outside of the dispenser. Once the composition dose has been discharged, the discharging cycle ends. When the user activates the dispenser or starts the dispensing process again, a new discharging cycle begins.

[0014] According to the present disclosure, a composition dose is the amount of a composition, which is discharged during one discharging cycle.

[0015] According to the present invention, the composition dose includes at least a fluid carrier dose and a fluid agent dose.

[0016] According to the present disclosure, a carrier dose is the amount of a carrier, which is provided for one composition dose. Similarly, an agent dose is the amount of an agent, which is provided for one composition dose.

[0017] According to the present disclosure, the dispenser comprises a carrier supply system, an agent supply system, a mixing area, and a dispenser head.

[0018] Preferably, the carrier supply system is configured to supply the carrier separately from the agent to the mixing area of the dispenser. The agent supply system is configured to supply the agent separately from the carrier to the mixing area of the dispenser. That is, the carrier supply system and the agent supply system are independent from each other. In other words, each of the systems has all the components which are necessary to provide the respective fluid dose to the mixing area without having to rely on the components of the other system. This means that the systems are fluidically or hydraulically separated from each other. That is, the systems are not in fluid communication with each other, except for the mixing area on the systems' most downstream ends in the flow direction of the fluids (i.e., the carrier and the agent). Accordingly, the carrier and the agent cannot come into contact or mix until they reach the mixing area.

[0019] Preferably, the agent supply system comprises an agent reservoir and agent supply means. The agent reservoir might be a tank that is configured to store the agent. The agent supply means can be configured to supply the agent dose in one continuous flow from the agent reservoir to the mixing area during one discharging cycle. That is, one dose of the agent for one discharging cycle can be provided from the tank to the mixing area in a flow that has no interruptions or pulses. The agent supply means may include, for example, a pump and conduits connecting the tank, the pump, and the mixing area (or an interface to the mixing area, preferably a valve).

[0020] Preferably, the volume of the agent reservoir is 0.5 to 10 milliliters, more preferably 5 to 7 milliliters. Preferably, the agent reservoir might be a collapsible reservoir.

[0021] Preferably, the carrier supply system comprises a carrier reservoir and carrier supply means. The carrier reservoir might be a tank that is configured to store the carrier. The carrier supply means can configured to supply the carrier dose in discrete pulses from the carrier reservoir to the mixing area during one discharging cycle. That is, one dose of the carrier for one discharging cycle can be provided from the tank to the mixing area in a pulsed, discontinuous flow that has interruptions. The carrier supply means may include, for example, a pump and conduits connecting the tank, the pump, and the mixing area (or an interface to the mixing area preferably being a valve).

[0022] Preferably, the volume of the carrier reservoir is 20 to 100 milliliters, more preferably 30 to 70 milliliters. It might additionally have an air vent for pressure equalization. Alternatively, if the carrier reservoir needs to be hermetically sealed (e.g. to prevent degradation of the carrier over time), the carrier reservoir might be included in a cartridge comprising a plunger or a pouch (collapsible reservoir).

[0023] Preferably, at least one of the agent supply means and the carrier supply means have/has a high accuracy output in the microliter range.

[0024] Preferably, at least one of the agent supply means and the carrier supply means is/are a micropump. More preferably, the micropump is a mechanical micropump. Even more preferably, the mechanical micropump is a piezoelectric micropump, a peristaltic micropump, or a piston micropump.

[0025] Preferably, at least one of the agent supply means and the carrier supply means is/are a micropump. More preferably, the micropump is a non-mechanical micropump. Even more preferably, the non-mechanical micropump is a valveless micropump, a capillary micropump, and a chemically powered micropump.

[0026] Preferably, the micropumps have a high performance at their inlets/outlets. Additionally or alternatively, the pumps have free-flow prevention means against back-pressure on their upstream and/or downstream ends.

[0027] Generally, the micropumps have a high accuracy of dosing and have a high performance (i.e., are configured to supply large and exactly dosed volumes of fluid in a short time).

[0028] Preferably, the micropump for the agent might have a rotational speed in the range of 1 to 5 Hz. It might have a speed sensor. Further, it might have a metered volume increment of 1 to 30 microliters, more preferably 10 microliters. The flowrate of the micropump might be in the range of 1 to 30 microliters (more preferably 10 microliters) per second (at a speed of 1Hz) to 5 to 150 microliters (more preferably 40 microliters) per second (at a speed of 5Hz). The dosing accuracy might be +/- 10%.

[0029] Preferably, the micropump for the carrier might have a rotational speed in the range of 1 to 15 Hz. It might have a speed sensor. Further, it might have a metered volume increment of 1 to 30 microliters, more preferably 10 microliters. The flowrate of the micropump might be in the range of 1 to 30 microliters (more preferably 10 microliters) per second (at a speed of 1Hz) to 15 to 450 microliters (more preferably 150 microliters) per second (at a speed of 15Hz). The dosing accuracy might be +/- 5%.

[0030] In the carrier and the agent supply systems, different types of pumps might be used that are adapted to the different fluid characteristics.

[0031] Generally, the micropumps might correspond to the micropumps disclosed in WO 2005/039674 A1, WO 2007/074363 A2, and WO 2019/115276 A1, the content of which is included herein by reference.

[0032] Preferably, the carrier and agent supply means (particularly, the pumps) are synchronized such that, during one discharging cycle, the continuous flow of the agent dose is disrupted by the pulses of the carrier dose in the mixing area. The disruption means that the pulses of the carrier are intermittently ejected towards the agent to interrupt the continuous flow of the agent. The resulting pattern of the agent and the carrier within the mixing area resembles the pattern of zebra stripes or stacked layers of fluid. In other words, layers of the carrier are jetted or slid in between the agent. By disrupting the agent dose with the pulses of the carrier dose, a composition dose is generated in which the pulses of the carrier and the discontinuous/disrupted agent are alternately distributed within the mixing area for being discharged via the dispenser head to the outside of the dispenser.

[0033] This mixing pattern is particularly advantageous for compositions that would form emulsions (as the composition doses) when mixed conventionally, which conventional emulsions have components/ingredients that do not mix well or at all with each other.

[0034] The striped pattern of the agent dose and the carrier dose is formed due to the poor miscibility of the agent and the carrier. If the agent dose and the carrier dose supplied to the mixing area would remain too long in the mixing area, one could observe that the particular portions of the agent would recompose.

[0035] The striped pattern of the agent dose and the carrier dose is configured such that there is substantially no material exchange between the distinct layers of the agent dose which are separated by layers of the carrier. Conversely, there is substantially no material exchange between the distinct layers of the carrier dose which are separated by layers of the agent. Due to the dynamics of the mixing and discharging process of the carrier and agent (and the composition) doses, the carrier and the agent will not mix to form an emulsion in which the agent is dispersed in the carrier and is statistically distributed in the carrier.

[0036] According to the present disclosure, the mixing area is arranged downstream of the carrier supply system and the agent supply system. The mixing area is configured such that the independently supplied fluid doses are mixed to form the composition dose having the stripped pattern of the agent and the carrier.

[0037] According to the present disclosure, "downstream" and "upstream" refer to the flow directions of the respective fluids during a normal discharging cycle.

[0038] According to the present disclosure, downstream of the mixing area, the dispenser head is arranged. The dispenser head is in fluid connection with the mixing area, such that the fluid composition dose, which has been mixed in the mixing area using the carrier dose and the agent dose, can flow from the mixing area to the dispenser head and can be discharged (jetted) to the outside of the dispenser by a (spraying) nozzle of the dispenser head.

[0039] Generally, the generation and the dispensing of a fluid composition dose can be described in four steps, the first step being the ingredients intake step (aspiration or input step), the second step being the ingredients dosing step (dispensing or output step), the third step being the mixing or loading step, and the fourth step being the discharging or spraying step.

[0040] In the first step, predetermined amounts (in the range of microliters) of at least two different fluids (for example, the carrier and the agent) are sucked from the separate reservoirs by separate micropumps (aspiration). The micropumps are operated independently from each other. In other words, the sucking (aspiration or input) of the fluids by the pumps may be conducted with different flow rates, flow velocities, and flow amounts. The flow rate is dependent on the dimensions of the micropumps as well as the operation parameters (rotational speed, total number of revolutions) that are set for the pumps. The function of the micropumps is described below.

[0041] The charge size of the aspiration is defined by the dimension of the micropump (internal pump chamber). In one preferred embodiment, the volume of the pump chamber is substantially 1-30 microliters, more preferably 10 microliters. The accuracy of the aspiration by the micropump, i.e., of the volume of the fluid dose that is sucked by the micropump, depends on the characteristics/design of the micropump, the viscosity of the fluid, physical/hydraulic parameters (flow resistance, elasticity) of the fluid input side (upstream of the pump), and the speed of the aspiration.

[0042] If the fluid is perfume oil, the aspiration is restricted due to the oil's higher viscosity as compared to the carrier. The oil's viscosity may be in a range of 10 mPas (millipascal seconds) to 100mPas. If the micropump is operated at high rotational speeds, the high viscosity results in a high pressure load of more than 2 bar of the system. The rotational speed of the micropump is thus limited. Therefore, the range of the rotational speed of the micropump that is used in the agent supply system is 1 Hz to 5 Hz.

[0043] The density of the perfume oil is less than 997 kilograms per cubic meter.

[0044] In contrast, there are no such limitations for the micropump that is used in the carrier supply system. This is due to the lower viscosity of water-based carriers or water as compared to the oil. The range of the rotational speed of the micropump that is used in the carrier supply system is 2 Hz to 15 Hz.

[0045] In the second step (ingredients dosing step, dispensing or output step), the fluid doses (the amounts of the fluids aspirated in the first step by the micropumps) are separately provided towards the mixing area through independent fluid output paths. The amounts and flow velocities of the fluids (pulsed flow rate) is dependent on the operation modes of the corresponding micropumps. The exact dosage of the amount of fluid is defined by the output (dispensing) step, and by the preceding input (aspiration) step of the micropump. The accuracy of the dosage of the amount of fluid is in the range of +/-5% due to manufacturing tolerances of the micropumps.

[0046] The accuracy of the dispensing by the micropumps, i.e., of the volume of the fluid dose that is output by the micropump, depends on the characteristics/design of the micropump, the viscosity of the fluid, physical/hydraulic parameters (flow resistance, elasticity) of the fluid output side (downstream of the pump), and the speed of the dispensing.

[0047] The flow rate related behavior of the micropump is dependent on the repeatedly performed aspiration/dispensing by the micropump, the duration of the aspiration/dispensing, and the time intervals between the aspiration/dispensing. Due to the characteristics and the operation modes of the micropumps, the flow rate related behavior may be fluctuating (pulsed output of the doses). The flow rate of the micropump can be varied by the rotation speed of the micropump. The rotation speed of the micropump can be in the range up to 20 Hz when considering the restriction that particular desired accuracy of the dosing/flow rate has to be met.

[0048] If the fluid is perfume oil, the dispensing is restricted due to the oil's higher viscosity as compared to the carrier, as explained above. The rotational speed of the micropump is thus limited to the range of 1 Hz to 5 Hz is such cases. The range of the rotational speed of the micropump that is used in the water-based carrier supply system is 2 Hz to 15 Hz.

[0049] In one preferred embodiment, the input and the output of the micropumps (the aspiration and the dispersion, i.e., the first and the second steps) are combined into one pump cycle. More preferably, each of the input, the output, and the two transitions therebetween (i.e., the transition from the aspiration to the dispersion and the transition from the dispersion to the aspiration) take 1/3 of the pump cycle. This is advantageous insofar as only the time for the pump output of the agent dose has to be considered before the third (mixing) step. In this case, the input of the agent dose to be output in a pump cycle has been performed in the previous pump cycle.

[0050] In another preferred embodiment, the input and the output of the micropumps can be performed separately, i.e., within separate pump cycles (this is also referred to as split pump cycle). If the input and output of the micropump are separated, the suction of the fluid can be conducted in a preparing step. As soon as the generation of the fluid composition dose is requested by the user, only the output of the fluid has to be performed. Therefore, the duration of the whole dispensing process can be shortened.

[0051] The split pump cycle is particularly advantageous for perfume oil as the fluid due to the restrictions of the rotational speed of the micropump, i.e., the restrictions of the intake step duration. In this case, assuming that the volume of the oil dose (i.e., the amount of oil that is output for one fluid composition dose) is 1 to 30 microliters (preferably 10 microliters) and that the output of the oil dose is normally 1/3 of the pump cycle (360 degrees of rotation), the (overall) dispensing process duration can be reduced to a range of 60 milliseconds to 400 milliseconds.

[0052] The split pump cycle may be performed by the oil pump while the carrier pump performs the combined cycle in which the aspiration and the dispersion are combined into one pump cycle.

[0053] Generally, the adjustment of the flow rates, the fluid amounts and the flow velocity of the fluids may be achieved by varying operational parameters of the micropumps, such as the rotational speed and the total number of revolutions per pump cycle. They are also influenced by the size and the design of the micropump.

[0054] Generally, the pumps might include output valves. The output valves can prevent that the simultaneous operation of the micropumps for dispensing the fluids results in a situation that the pumps mutually hydraulically affect each other (reduction of flow rate and free flow as well as prevention of undesired backflow or inaccuracies of the dosing of the fluids). In other words, due to the output valves, the micropumps are configured to correctly dose the fluids and provide correct flow rates.

[0055] Generally, short pressure loads (pressure peaks) up to 3 bar in the hydraulic system downstream of the micropumps are acceptable. The normal pressure in the downstream part of the system is up to 2 bar.

[0056] Generally, short pressure loads (pressure peaks) down to -0.4 bar in the hydraulic system upstream of the micropumps are acceptable. The normal pressure in the upstream part of the system is down to -0.2 bar.

[0057] In the third step (the mixing or loading step), the fluids are mixed in the mixing area (mixing chamber) into the alternating pattern with a predetermined mixing ratio. The mixing of the fluids directly depends on the preceding ingredients dosing step (second step), and indirectly depends on the ingredients intake step (first step).

[0058] To achieve a specific mixing ratio of the two fluids in combination with a specific mixing amount, and a specific mixing pattern (the generation of alternating layers of the two fluids), the micropumps are preferably operated in predetermined and synchronized operation modes.

[0059] For the mixing of the fluids, other parameters than the behavior and the characteristics of the micropumps might be relevant as well. For example, the hydraulic characteristics of the fluid paths (e.g., dead volume, the useful volume, hydraulic resistances, etc.) and the size/design of the mixing chamber (mixing area) can be relevant. The maximum dead volume of the fluid path downstream the carrier pump up to the mixing area might be less than 10 microliters.

[0060] In the filling or loading of the mixing chamber (mixing area) with the at least two fluids, there are restrictions in view of time and amount. For the mixing of one fluid composition dose (i.e. the filling of the mixing area for one discharging cycle of one fluid composition dose), generally, mixing volumes in the range of 10 microliters to 500 microliters are provided. For cosmetic compositions, the range is preferably 40 microliters to 200 microliters, more preferably from 40 microliters to 150 microliters.

[0061] In the field of cosmetics, i.e., when one fluid is perfume oil and the other fluid this a water-based carrier (or water as the carrier), mixing ratios of oil/carrier in the range of 1/3 to 1/15 are possible. A preferred mixing ratio of oil/carrier is 1/6. Preferably, the amount of oil in one perfume dose (fluid composition dose) is 1 to 30 microliters, preferably 10 microliters. The ratio of the flowrate of the oil and the carrier is proportional to the preset mixing ratio of the oil/carrier. This means that, for example, if the mixing ratio of oil/carrier is set to be 1/6, the flowrate and the amount of the carrier is 6 times larger than the flowrate and the amount of the oil. The one perfume dose is provided within a time range of 60 microseconds to 400microseconds. The one oil dose of 10 microliters is combined with the amount of the carrier being in a range of 30 microliters to 140 microliters (the increment of the dose is +/- 10 microliters).

[0062] Alternatively, in a case where an extended oil dose is used, mixing ratios of oil/carrier in the range of 1/2 to 1/10 are possible. A preferred mixing ratio of oil/carrier is 1/4. Preferably, the amount of oil in one perfume dose (fluid composition dose) is 20 microliters (extended dose), if the amount of oil of a standard dose is 10 microliters. Generally, an extended dose of oil in one perfume dose may be the double amount of a standard dose. The one extended oil dose is provided within a time range of 260microseconds to 1400 microseconds. The one extended oil dose of 20 microliters is combined with the amount of the carrier being in a range of 20 microliters to 130 microliters (the increment of the dose is +/- 10 microliters).

[0063] The mixing is performed using the FIFO (first in, first out) principle.

[0064] Preferably, the dispenser comprises a fluid booster supply system. The fluid booster supply system comprises booster supply means. The booster supply system is configured to supply a pressurized fluid booster to the mixing area to discharge the composition dose from the mixing area to the outside via the dispenser head. The booster supply system is configured to supply the booster from a booster reservoir configured to store the booster. Alternatively, the booster supply system is configured to suck ambient air from the outside into the dispenser as the booster.

[0065] Preferably, the dispenser comprises a mixing adapter. The mixing adapter is configured to control the inflow of the fluids (e.g., the agent and the carrier, and preferably the booster) into the mixing area.

[0066] More preferably, the mixing adapter is a valve. Even more preferably, the valve is a 3/2-way valve having three ports and two positions. The three ports include two inflow ports and one outflow port.

[0067] In one preferred embodiment, a valve is provided in the most upstream part of the mixing area. The valve is used to introduce the fluids into the mixing area. The valve can additionally be used to introduce a fluid booster (pressurized fluid) into the mixing area for discharging the fluid composition dose towards the dispenser head after mixing.

[0068] Once the mixing step has been performed, a mixture of oil/carrier in a microliter range (volume in the range between 40 to 150 microliters) is provided. The mixture preferably consists of oil/carrier with the above-mentioned mixing ratio which are arranged in the above-mentioned alternating (striped) pattern. The mixture is provided in the mixing area. In other words, the fluid doses collide and are divided (disrupted or split) in partial doses that are arranged alternately in the mixing area. This mixture is now ready to be discharged via the dispenser head, preferably by using the pressurized air.

[0069] In the fourth step (the discharging or spraying step), the mixture of the fluids (e.g. the oil and the carrier) that has been provided in the mixing area in the third step, is transferred towards a spray nozzle of the discharge head, preferably using a fluid booster (e.g. pressurized air). The spray nozzle is preferably arranged on the downstream end of the mixing area. Alternatively, the spray nozzle is connected with the mixing area via a fluid path. The fluid composition dose (preferably including the fluid booster) is discharged via the spray nozzle. In other words, the mixture provided in the mixing area, preferably together with the fluid booster, is jetted to the outside via the spray nozzle (hydraulic resistance). The mixture is atomized. Single droplets are generated from the mixture and are transported to the outside of the dispenser in a predetermined spraying or discharging direction.

[0070] The time range between providing the mixture in the mixing area and the start of the discharging or spraying step is preferably in a range of less than 100 microseconds. Due to this short time range, no significant de-mixing processes of a mixture can take place.

[0071] Preferably, a pressurized fluid such as air is led to the mixing area via an additional, separate fluid path, which is arranged at the upstream portion of the mixing area.

[0072] In one preferred embodiment, compressed air is fed to the mixture of fluids, such as oil and water-based carrier, in the mixing area using a pressure in the range of 1.2 to 2.6 bar within less than 100 microseconds. The flow rate of the air might be in a range of 1 to 15 liters per minute, more preferably 2 to 8 liters per minute.

[0073] If pressurized air is used as the fluid booster, four different booster modes A to D can be provided (see Table 1).

Mode	Summary	Description/Characteristics	Mixing step	Discharging step	Purging step	Shutdown
A	Air pressure is ON at the start of the discharging step	Air pump operation	ON	ON	ON	OFF
		Air valve operation	CLOSED	OPEN	OPEN	OPEN
B	Air pressure is turned ON at the start of the mixing step but is turned OFF before start of the discharging step	Air pump operation	ON	OFF	OFF	OFF
		Air valve operation	CLOSED	OPEN	OPEN	OPEN
C	Air pressure is turned ON at the start of the discharging step	Air pump operation	OFF	ON	ON	OFF
		Air valve operation	CLOSED	OPEN	OPEN	OPEN
D	Air pressure is turned ON/OFF via pulse modulation by an on/off air valve and by an air pump (adaptive behavior)	Air pump operation	ON/OFF	ON/OFF	ON/OFF	OFF
		Air valve operation	CLOSED	OPEN/ CLOSED	OPEN	OPEN

Table 1: Air booster modes overview

[0074] Table 2 summarizes the advantages and the disadvantages of the four booster modes A to D.

Table 2: Advantages and disadvantages of the air booster modes

Mode	Advantages	Disadvantages
A	- Strong air boost at the beginning of the discharging step - Very strong atomization of the fluid composition dose - very good generation of a composition cloud - forming of rather small droplets on the target (e.g. on the skin)	- variable discharging behavior - large ratio of air in the discharged composition - large energy consumption, since the air pump is operated for at least 2 seconds
B	- low energy consumption, since the air pump is operated for approximately 0.5 seconds - damped discharge once the discharging step has started	- potential generation of droplets rather at the end of the dispensing step - weak atomization
C	- damped air boost at the start of the discharging step - optimized energy consumption , since the air pump is operated for 1 to 2 seconds	- the damping of the air boost might be too strong
D	- adaptive behavior of the discharging step is possible depending on the air pressure and/or the set parameters - optimized air boos at the start, during formation of the cloud, and at the end of the discharging step (cloud-end and purging step)	- complex operation via pulse width modulation operation of the air valve

[0075] In the following, the booster modes A to C are described in more details.

[0076] During a first phase of mode A (phase A.1), the air pump is started simultaneously to the mixing step of the fluids. The pressure between the air pump and an air switching valve increases (the air volume is approximately 1 to 4 milliliters). The pressure levels out at 2 bar. In an embodiment using an air pump, the pressure reaches 2.2 bar. The duration of phase A.1 is approximately 1 second.

[0077] A second phase of mode A (phase A.2) is divided into three sub-phases (A.2a to A.2c). In phase A.2a, the mixing process is completed. The air switching valve is opened (the air pump keeps operating) and the air volume flows into the mixing area. The air volume facilitates the mixing of the oil and the carrier towards the spray nozzle. By discharging the perfume composition, the pressure in the air flow path is reduced and levels out at a predetermined pressure together with the air generated by the air pump, and with the flow resistance that is generated at the spray nozzle by the discharging of the perfume to the outside (transient oscillation behavior). The duration of phase A.2a is approximately 120 milliseconds.

[0078] In phase A.2b, the dispensing behavior (the behavior during the flow of the composition dose through the spray nozzle) starts to level out (decrease of pressure in the system) until the perfume composition generates no flow resistance any more. At the air pump, a minimum air volume flow is generated by the spray nozzle resistance (approximately 1.1 bar). The duration of phase A.2b is approximately 250 milliseconds.

[0079] In phase A.2c, a minimum air volume flow is generated at the air pump by the spray nozzle resistance (approximately 1.1 bar). Single "squirts" are still sprayed out (purging). The duration of phase A.2c is approximately 1 second.

[0080] In phase A.3, the air pump is shut off while the air switching valve is still opened. The pressure in the system decreases (ventilation). The duration of the ventilation is approximately 500 milliseconds. The duration of phase A.3 is approximately 1 second.

[0081] During a first phase of mode B (phase B. 1), the air pump is started simultaneously with the dosing and mixing steps of the fluids. The pressure between the air pump and the air switching valve increases (the air volume is approximately 1 to 4 milliliters). The pressure levels out at 2 bar. In the embodiment using the air pump, the pressure reaches 2.2 bar. The duration of phase B.1 is approximately 1 second.

[0082] A second phase of mode B (phase B.2) is divided into two sub-phases (B.2a and B.2b). In phase B.2a, the dosing and the mixing processes are completed. The air pump is stopped, the air switching valve is opened, and the air volume flows into the mixing area. The air volume conveys the perfume composition (approximately 120 milliliters) towards the spraying nozzle. By the dispensing, the pressure in the air flow path is decreased. The duration of phase B.2a is approximately 250 milliseconds.

[0083] In phase B.2b, the system is completely ventilated.

[0084] During a first phase of mode C (phase C. 1), the perfume dose is dosed, mixed, and provided in the mixing area for discharge. The air pump is not switched on yet. The duration of phase C.1 is approximately 0.5 to 1 milliseconds.

[0085] A second phase of mode C (phase C.2) is divided into three sub-phases (C.2a to C.2c). In phase C.2a, the air valve is opened and the air pump is switched on. The air pressure increase begins until the maximum pressure has leveled out in the system (approximately 1.5 bar). The leveling out depends on the hydraulic resistance due to the spray nozzle, the perfume composition amount, and the viscosity of the perfume composition. The duration of phase C.2a is approximately 30 milliseconds.

[0086] In phase C.2b, the second part of the pressure adjustment begins. During this phase, the perfume composition (approximately 40 to 150 microliters, depending on the set amount) flows through the spray nozzle. The pressure in the system slightly decreases (approximately by 0.1 bar). The duration of phase C.2b is approximately 50 milliseconds.

[0087] In phase C.2c, the air pump is switched off and the pressure in the system starts to decrease. The discharge of the residual perfume composition through the spray nozzle, and the purging of the fluid flow paths with air follows.

[0088] The air booster mode C is preferred for perfume applications. Using the air booster mode C allows optimizing the dispenser in view of function (feasibility, usability, and quality), design (mechanics, hydraulics, pneumatics, and structure of the dispenser), operational behavior (energy consumption), and costs (reduction of complexity and components).

[0089] Generally, using the air pump allows generating the necessary airflow (air volume) having the necessary air pressure within a short time (less than 100 microseconds), which airflow can be used as the fluid booster.

[0090] The atomization or the distribution of the composition dose into single droplets is dependent on the type of spray nozzle mechanics, the pressurized air (flow rate of the air, pressure generation), the amount of the composition dose, the mixing ratio, and the physical/fluidic characteristics of the single fluids. Preferably, the type of atomization is adapted to the predetermined use of the dispenser. For perfume applications, the adaptation of the atomization effect for the evaporation of the oil/carrier with regard to the olfactometry is an important factor.

[0091] The generation of droplets by atomization should be as homogeneous as possible. The largest part of the droplets dimension (diameter of a droplet) should be in a range of 0.05 to 0.5 millimeters.

[0092] A discharging cycle duration is approximately 1 second (+/- 0.5 seconds). However, the generated cloud that exits the dispenser lasts longer (due to the atomization and the evaporation processes).

[0093] According to the present invention, the dispenser has a modular structure.

[0094] According to the present invention, the dispenser comprises a housing and a (first) cartridge detachably mountable to the housing. The cartridge is configured to accommodate any component of the dispenser that comes into contact with the agent. In other words, the cartridge accommodates all the components of the dispenser that contact the agent.

[0095] The modular structure allows changing the agent within the cartridge without having to change the whole dispenser. Therefore, costs and space can be saved. Further, this is advantageous in view of environmental protection.

[0096] Preferably, the cartridge is configured to accommodate the agent supply system, the mixing area, and dispenser head of the dispenser.

[0097] If a valve is used at the interface of the fluid supply systems and the mixing area, the valve may be also included in the cartridge.

[0098] Furthermore, if a fluid booster is used and a valve is used at the interface of the fluid booster supply system and the mixing area, the valve may be also included in the cartridge.

[0099] According to the present invention, the cartridge is configured to accommodate any component of the dispenser that comes into contact with the agent. In other words, when the cartridge is not attached or mounted to the housing, the housing does not include any component that comes into contact with the agent during normal use. Such a modular dispenser has the advantage that it does not have to be purged, once the user changes the fragrance or the drug, for example. Therefore, the change is easier and the desired quality of the new fragrance or drug is instantly available, since it does not mix with the old fragrance or drug during the first discharging cycle(s) after the exchange.

[0100] In the modular structure of the dispenser, the cartridge(s) might be disposable. This modular structure is favorable in view of the easy and convenient handling for the user. For environmental reasons, the cartridge(s) might be reusable (e.g., refillable or reloadable) or recyclable. Additionally or alternatively, some cartridge(s) might be semi-disposable. This means that if a cartridge includes more than one component (e.g., a reservoir and the corresponding supply means), at least one of the components is disposable and replaceable by another component (e.g., the reservoir), and at least one of the other components (e.g., the supply means) is reusable. Additionally or alternatively, some cartridge(s) might be refillable. In other words, a cartridge including a reservoir might be configured such that the reservoir can be refilled and the cartridge can thus be reused.

[0101] In one of the modular structures, the housing is configured to accommodate drive units for the carrier and agent supply means, a power source for the dispenser, which is preferably a rechargeable power source, and a controller for the dispenser. Preferably, the housing is also configured to accommodate the carrier supply means. Additionally or alternatively, the housing may also be configured to accommodate sensors for controlling and monitoring the supply of the carrier and/or the agent.

[0102] The power source of the dispenser is preferably a rechargeable power source.

[0103] The controller might be configured to perform all the method steps described herein. It might further be configured to process all data from sensors such as speed sensors, fill-level detection sensors of liquids, composition/components identification sensors for tracking and traceability or pressure sensors. The tracking and traceability is important in view of counterfeited and imitated cartridges that can be excluded from being used in the dispenser. For example, the controller might prohibit the use of the dispenser (e.g., might electronically or mechanically block it) if the tracking and traceability sensors detect a non-original cartridge attached to the dispenser. The controller might be further configured to control the communication between the dispenser and the user and/or between the dispenser and other devices (e.g., mobile devices such as smartphones or tablets).

[0104] In one of the modular structures, the dispenser comprises a second cartridge that is detachably mountable to the housing and/or to the first cartridge. The second cartridge is configured to accommodate the carrier reservoir. Preferably, the second cartridge is configured to also accommodate the carrier supply means. Additionally, a third cartridge could be provided that is detachably mountable to the housing, to the first cartridge, and/or to the second cartridge. The third cartridge is configured to accommodate the agent reservoir. Preferably the third cartridge consists of (only) the agent reservoir (i.e., is the agent reservoir or includes only the agent reservoir that is in a housing) and of a mechanical (and preferably an electronic) interface to the other parts of the dispenser.

[0105] There are four types of modular structures of the dispenser which are particularly preferred, the types being A1, A2, B1, and B2. However, other types of modular structures are also possible and are not excluded from the present invention.

[0106] In type A1, the drive units for the agent and the carrier supply means, preferably (if provided) the booster (more preferably air) supply means, the controller of the dispenser, and preferably (if provided) the micro valve for the booster (more preferably air) system are provided in the housing. Most preferably, the housing is reusable. The other components of the dispenser are provided in the first cartridge that is removably mountable to the housing. Preferably, the first cartridge is disposable. Alternatively, not all of the other components are provided in the first cartridge, but the carrier reservoir and the carrier supply means are provided in a second cartridge. The second cartridge is removably mountable to the first cartridge. Preferably, the second cartridge is also disposable.

[0107] In type A2, the housing includes the same components as in type A1, and additionally includes the carrier supply means. The first cartridge (preferably in combination with the second cartridge that is mounted to the first cartridge) includes the other components of the dispenser. Type A2 is the most preferred type of a modular structure of the dispenser.

[0108] In types A1 and A2, the carrier reservoir is included in the first or the second cartridges. In types B1 and B2, the carrier reservoir is included in the housing (or in the second cartridge that is mounted to the housing).

[0109] Type B1 corresponds to type A2 but additionally includes the carrier reservoir in the housing (or in the second cartridge that is mounted to the housing).

[0110] Type B2 corresponds to type A1 but additionally includes the carrier reservoir in the housing (or in the second cartridge that is mounted to the housing).

[0111] In one preferred embodiment, the housing is configured to further accommodate the booster supply system, and more preferably sensors for controlling and monitoring the supply of the booster.

[0112] Preferably, the cartridge is disposable and the housing is reusable. More preferably, the second cartridge is refillable with the carrier and/or the booster.

[0113] For example, if the modular structure of the dispenser is used for perfumes, the lifetime of the housing might be between 3 to 5 years, more preferably more than 5 years. The lifetime of the first cartridge might be up to 1 year or even more.

[0114] Preferably, the first cartridge is configured to accommodate the mixing adapter.

[0115] The present invention also relates to a method of dispensing a fluid composition dose to an outside of a dispenser. The composition dose corresponds to the composition dose described above and includes at least a fluid carrier dose and a fluid agent dose.

[0116] The method comprises the following steps to be performed during normal use (i.e., not during manufacturing or repairing the dispenser) by the (end) user: detachably mounting to the dispenser all components of the dispenser that come into contact with the agent by mounting the cartridge to the housing, and starting the dispensing of the fluid composition dose.

[0117] Preferably, the method comprises the demounting from the dispenser all components of the dispenser that come into contact with the agent after the dispensing of the fluid composition dose is completed by demounting the cartridge from the housing.

[0118] Preferably, the method comprises detachably mounting the second cartridge to the housing or to the first cartridge before starting the dispensing of the fluid composition dose.

[0119] More preferably, the method comprises the demounting of the second cartridge from the housing or from the first cartridge after the dispensing of the fluid composition dose is completed.

[0120] According to the present invention, a method for detachably mounting a cartridge to a housing of a dispenser comprises detachably mounting to the dispenser all components of the dispenser that come into contact with the agent by mounting the cartridge to the housing. The method preferably comprises the demounting from the dispenser all components of the dispenser that come into contact with the agent by demounting the cartridge from the housing after use of the dispenser.

[0121] The method according to the present disclosure comprises the following sequential steps: a supply step, a mixing step and a discharging step.

[0122] The supply step might correspond to a combination of the first and second steps as described above. In other words, the supply step might be a combination of the first step being the ingredients intake step (aspiration or input step) and the second step being the ingredients dosing step (dispensing or output step).

[0123] According to the present disclosure, the supply step comprises supplying the carrier dose and the agent dose independently from each other to a mixing area of a dispenser for mixing.

[0124] The mixing step might correspond to the above-described third step being the mixing or loading step.

[0125] According to the present disclosure, the mixing step comprises mixing the independently supplied carrier and agent doses to obtain the composition dose for discharging

[0126] The discharging step might correspond to the above-described fourth step being the discharging or spraying step.

[0127] According to the present disclosure, the discharging step comprises discharging the composition dose to the outside of the dispenser.

[0128] According to the present disclosure, in the mixing step, the agent dose is supplied to the mixing area in one continuous flow, and the carrier dose is supplied to the mixing area in discrete (noncontinuous) pulses. The supply of the carrier and the supply of the agent are synchronized in the supply step such that, in the one discharging cycle, the continuous flow of the agent dose is disrupted by the pulses of the carrier dose in the mixing step (as described above), thus obtaining the composition dose in which the pulses of the carrier and the discontinuous agent are alternately distributed (as also described above) and are then discharged in the discharging step.

[0129] Preferably, the agent and/or the carrier are/is supplied to a mixing area with a high accuracy in the microliter range in the supply step. More preferably, supplying the fluids with the high accuracy is performed using one of the aforementioned micropumps.

[0130] Preferably, the supply step and/or the discharging step further comprises pressurizing a fluid booster and supplying the booster to the mixing area. The fluid booster might be the aforementioned fluid booster. The four booster modes A to D might be used (and might be part of the discharging step). The booster might be supplied from a booster reservoir storing the booster. Alternatively, the booster might be ambient air from the outside of the dispenser which is sucked into the dispenser and pressurized. When using the fluid booster, the discharging step further comprises discharging the composition dose using the pressurized booster as driving means for the discharge.

[0131] Preferably, the method comprises further steps that are performed prior to the supply step. One such step might be a preparation step comprising detachably mounting a cartridge to a housing of the dispenser. The cartridge might be one of the aforementioned cartridges of a modular dispenser. Additionally or alternatively, the housing might be one of the aforementioned housings of the modular dispenser.

[0132] Preferably, the preparation step further comprises detachably mounting a second cartridge to the housing or to the first cartridge of the dispenser (the first and second cartridges correspond to the cartridges as described above in connection with the four types A1, A2, B1, B2 of the modular structures). The first cartridge is preferably for accommodating all the components coming into contact with the agent. More preferably, the preparation step further comprises detachably mounting a third cartridge to the housing or to the first cartridge, or to the second cartridge of the dispenser (the first and second cartridges correspond to the cartridges as described above in connection with the four types A1, A2, B1, B2 of the modular structures).

[0133] If pressurized fluid is used as a fluid booster for discharging the composition dose from the dispenser, and the fluid booster is not sucked from outside the dispenser but is stored in a reservoir (preferably in a pressurized reservoir), the reservoir can be preferably accommodated in the first or in the second cartridge.

[0134] Generally, in one discharging cycle of the aforementioned dispenser or method, the one agent dose is mixed with 2 to 15 pulses, preferably with 4 to 8 pulses, and more preferably with 6 pulses of the carrier.

[0135] Generally, if the volume of the pump chamber is 10 microliters and/or the dose of the agent output from the pump is 10 microliters, in the aforementioned dispenser or method, the agent/carrier volume ratio supplied to the mixing area is in the range from 30/40 to 10/150. Preferably, the range is from 20/80 to 10/90. More preferably, the range is 10/60.

[0136] Generally, in the aforementioned dispenser or method, the composition is a cosmetic or a medical composition. The carrier might be a substance which is biocompatible. Additionally or alternatively, the carrier might be a substance which is environmentally friendly. However, the carrier may impair the stability of the agent over time. In other words, the carrier might affect the composition and/or characteristics of the agent over time. Therefore, separate storage of the carrier and the agent might be desirable.

[0137] Generally, in the aforementioned dispenser or method, the carrier may be a water-based carrier. More preferably, the carrier might be water.

[0138] All of the aforementioned features of the dispenser for and the method of dispensing a fluid composition dose can be combined as long as the combinations are technically feasible.

[0139] In the following, preferred embodiments of the present invention will be described in detail. The present invention, however, is not limited to these exemplary embodiments but is defined by the appended claims.

Fig. 1 is a schematic diagram of the components and the fluid paths of a preferred dispenser according to the present invention.

Fig. 2 is a schematic diagram of the components and the fluid paths of a preferred dispenser according to the present invention.

Fig. 3 is a partial view of the dispenser of Fig. 2.

Fig. 4 is a partial view of the dispenser of Fig. 2.

Fig. 5 is a diagram schematically showing one discharging cycle of the dispenser.

Fig. 6 is a time diagram showing one discharging cycle of the dispenser.

Fig. 7 is a photo of a distribution of a fluid composition dose on a glass plate, wherein the dose has been discharged from a dispenser according to the present invention in one discharging cycle.

Fig. 8 is a schematic diagram of the type A1 modular structure of the dispenser according to the present invention.

Fig. 9 is a schematic diagram of the type A2 modular structure of the dispenser according to the present invention.

Fig. 10 is a schematic diagram of the type B 1 modular structure of the dispenser according to the present invention.

Fig. 11 is a schematic diagram of the type B2 modular structure of the dispenser according to the present invention.

[0140] In the following, preferred embodiments of the present invention will be described with reference to Figs. 1 to 7. The preferred embodiments relate to a modular dispenser for dispensing fluid compositions doses such as cosmetics. However, the fluid composition doses might also be for a medical use or any other compositions of at least two fluids.

[0141] Fig. 1 shows a dispenser 1 having an agent supply system 20, a carrier supply system 30, a mixing area 50 and a dispenser head 60.

[0142] As depicted in Fig. 1, the agent supply system 20 and the carrier supply system 30 are independent from each other.

[0143] The agent supply system 20 has an agent reservoir (oil reservoir) 22 for storing the agent 21 being perfume oil in the present embodiment. The oil reservoir 22 is connected via a first fluid path 25 with an input (upstream end) of a first micropump 23 (corresponding to an agent supply means in the present embodiment). The first micropump 23 is driven by a first drive unit 24 (e.g., an electric motor). An output (downstream end) of the first micropump 23 is connected via a second fluid path 26 with an input (upstream end) of a mixing chamber 50 (corresponding to a mixing area in the present embodiment).

[0144] Preferably, a first check valve (non-return valve) 27 is provided at an interface of the second fluid path 26 and the mixing chamber 50.

[0145] The carrier supply system 30 has a carrier reservoir (water reservoir) 32 for storing the carrier 31 being water in the present embodiment. The water reservoir 32 is connected via a third fluid path 35 with an input (upstream end) of a second micropump 33 (corresponding to a carrier supply means in the present embodiment). The second micropump 33 is driven by a second drive unit 34 (e.g., an electric motor). An output (downstream end) of the second micropump 33 is connected via a fourth fluid path 36 with the input of the mixing chamber 50.

[0146] Preferably, a second check valve (non-return valve) 37 is provided at the interface of the fourth fluid path 36 and the mixing chamber 50.

[0147] The preferred embodiment further comprises an optional fluid booster supply system 40. The fluid booster supply system 40 is a system for supplying pressurized air as a discharge booster to the mixing chamber 50. The fluid booster supply system 40 (air supply system) has an air pump 41 (corresponding to the booster supply means in the present embodiment). Preferably, the air supply system 40 has a micro valve 42 for accurately controlling the airflow into the mixing chamber 50. A downstream end of the air pump 41 is connected with an upstream end of the micro valve 42 via a fifth fluid path 43. A downstream end of the micro valve 42 is connected via a sixth fluid path 44 with the input of the mixing chamber 50.

[0148] Preferably, a third check valve (non-return valve) 45 is provided at the interface of the sixth fluid path 44 and the mixing chamber 50.

[0149] The air supply system 40 sucks the air by the air pump 41 either from an air reservoir (not shown) or from the outside of the dispenser 1.

[0150] The three upstream ends of the second fluid path 26, the fourth fluid path 36, and the sixth fluid path 44 may be connected to an upstream end of a mixing junction interface 80, preferably by the first to third check valves 27, 37, and 45. The mixing junction interface 80 might be or comprise a valve, preferably including the first to third check valves 27, 37, and 45. A downstream end of the mixing junction interface 80 might be connected to the mixing chamber 50. The mixing junction interface 80 might be a part of the mixing area or mixing chamber 50.

[0151] In the mixing chamber 50, the oil 21 and the water 31 are mixed into striped patterns (Fig. 5) to become the composition dose (perfume dose) 70 which is to be discharged to the outside (e.g., towards the user's skin).

[0152] The mixing chamber 50 is connected directly or via a further fluid path to the dispenser head 60 downstream the mixing chamber 50. The perfume dose 70 flows through the dispenser head 60 and is discharged to the outside of the dispenser 1 via a spray nozzle 61 of the dispenser head 60.

[0153] Fig. 2 shows another preferred embodiment having a mixing junction interface 80 including a 3/2-way valve 81. The valve 81 is connected on its upstream end (input ports) with the fourth fluid path 36 of the carrier supply system 30, and with the sixth fluid path 44 of the air supply system 40. The downstream end (output port) of the valve 81 is connected with the second fluid path 26 of the oil supply system 20.

[0154] Fig. 3 is an partial enlarged view of the of the dispenser 1 of Fig. 2 showing the valve 81 in a first position, in which the fourth fluid path 36 is fluidly connected with the second fluid path 26 of the oil supply system 20 for mixing the oil 21 and the water 31 into the perfume dose 70.

[0155] Fig. 4 is an partial enlarged view of the of the dispenser 1 of Fig. 2 showing the valve 81 in a second position, in which the sixth fluid path 44 is fluidly connected with the second fluid path 26 (or the upstream end of the mixing chamber 50 in which the perfume dose 70 is ready for discharge of the perfume dose 70 towards the outside of the dispenser 1 via the dispenser head 60).

[0156] The use of a switch valve corresponding to the valve 81 is particularly advantageous for the booster modes A and B (for the booster modes C and D, no such valve is needed). This kind of valve enables the release of the air. If the switch valve is integrated into the mixing junction interface 80, the switching valve can be switched between the first/second step (loading and mixing of the oil and the water) and the discharging step of the perfume 70.

[0157] The advantages of using the switch valve 81 are that the pressurized air for the boost can be provided already during the mixing of the oil 21 and the water 31. This shortens the time that is required for the air boost. Further, the air is at the desired or set pressure level directly at the beginning of the discharging step of the perfume composition 70. Thus, the spraying of the perfume composition 70 can be improved. Additionally, the switch valve 81 prevents the oil 21 and the water 31 from entering the fluid booster supply system 40. Finally, the switch valve 81 allows optimizing the dead volume of the oil/water (fluids) and the air paths.

[0158] The drawbacks of using a switch valve are that the system becomes more complex and expensive as well as larger than a system without the valve. Further, the valve increases the energy consumption of the dispenser.

[0159] Fig. 5 schematically shows the preferred discharging cycle of the dispenser 1. The oil 21 and the water 31 are sucked by the respective pumps 23, 33 in the first step (ingredients intake step, aspiration or input step). The doses of the oil 21 and the water 31 sucked into the pumps 23, 33 in the first step are then discharged to the mixing chamber 50 in the second step (ingredients dosing step, dispensing or output step). Fig. 5 shows the continuous flow of the oil 21 and the pulsed flow of the water 31. In the third step (mixing or loading step), the doses of the continuous oil 21 and the pulsed water 31 are mixed in the mixing chamber 50 to form the striped pattern as depicted in Fig. 5. The different hatchings show the layers of the oil 21 and water 31 in the perfume composition 70 which are stacked in the flowing direction (i.e., in the direction from the upstream end of the mixing chamber 50 to the downstream end of the mixing chamber 50).

[0160] At the bottom of Fig. 5, the step of providing a fluid booster is shown. Air is sucked by the air pump 41 and is pressurized by the air pump 41 (as indicated by the rising pressure in the depicted diagram). The pressurized air is then released towards the mixing chamber 50 to start the fourth step (the discharging or spraying step of the perfume dose 70).

[0161] Fig. 6 is a time diagram showing the preferred discharging cycle of the dispenser 1.

[0162] In the uppermost line of Fig. 6, the user action is shown. The user merely has to perform the step of starting the dispensing process (the discharging cycle), for example, by pushing a button on the dispenser 1 or on another device such as a smartphone or a tablet.

[0163] In the next line of Fig. 6 (second line from the top), the operation of the water micropump 33 is shown, which is performed at 1 to 15 Hz rotational speed of the pump. The operation of the water micropump 33 including the aspiration and the dispensing steps of the water starts after the user has started the dispensing process.

[0164] In the next line of Fig. 6 (third line from the top), the operation of the oil micropump 23 is shown, which is performed at 1 to 5 Hz rotational speed of the pump. The operation of the oil micropump 23 including the dispensing and the aspiration steps of the oil starts after the user has started the dispensing process and starts simultaneously with the aspiration of the water 31. However, according to the preferred embodiment shown in Fig. 6, the oil micropump 23 first dispenses oil that has being aspirated in a preceding discharging cycle and has been accommodated (stored) in a pump chamber of the oil micropump 23. After the dispensing (or starting parallel to the dispensing) of the oil 21, a new dose of the oil 21 is aspired for a next discharging cycle. The aspiration step in preparation for the next discharging cycle of the dispenser 1 is shown by the hatched part of the oil micropump 23 operation diagram.

[0165] In the next line of Fig. 6 (fourth line from the top), the operation of the air pump 41 is shown. In the shown embodiment, the operation of the air pump 41 is started after the dispensing steps of the oil 21 and the water 31 have been fully completed. However, the operation of the air pump 41 can be started earlier, as explained above.

[0166] In the lowermost line of Fig. 6, the discharging step of the perfume composition is shown, which is driven by the pressurized air from the air pump 41.

[0167] The duration of the processes shown in Fig. 6 is in the range of 60 to 400 milliseconds for the dosing (aspiration and dispensing) and the mixing steps (or 260 to 1400 milliseconds if an extended dose of the oil is used which is twice as large as a single dose of the oil). For the spraying step of the perfume dose, the duration is in a range of 500 microseconds to 1.5 seconds.

[0168] Fig. 7 shows the result of one discharging cycle of the dispenser 1. The perfume dose has been sprayed on a glass plate. The photo has been made less than 15 seconds after the end of the discharging step of the perfume dose 70. The distance of the spray nozzle 61 to the glass plate was 15 centimeters. The mixing ratio of the oil and the carrier was 1/3. The volume of the perfume dose was 40 microliters. Fig. 7 shows three exemplary diameters [1] to [3] of the generated droplets, each being less than 0.3 millimeters. In the lower right part of Fig. 7, a scale in millimeters is provided.

[0169] Turning now to the modular structure of the dispenser. Figs. 8 to 11 show four preferred types of a modular structure of the dispenser 1 according to the present invention. Fig. 8 shows type A1, Fig. 9 shows type A2, Fig. 10 shows type B1, and Fig. 11 shows type B2. In each of the Figs. 8 to 11, the housing 10 and the first cartridge 90 are schematically shown by two dotted-and-dashed lines. The lower line defines the housing 10 of the dispenser 1 and the upper line defines the first cartridge 90 of the dispenser 1 in each of the Figs. 8 to 11. The optional second cartridge 95 is shown by a dotted line in each of the Figs. 8 to 11. In each of the Figs. 8 to 11, the other depicted parts of the dispenser 1 correspond to the parts of the dispenser 1 as depicted in the preceding Figs. Therefore, the reference numbers for some of the depicted parts have been omitted for the sake of lucidity.

[0170] As shown in Fig. 8, in the type A1, the first and second drive units 24, 34 for the oil micropump 23 and the water micropump 33, the preferably provided air pump 41, the controller (not shown) of the dispenser 1, and the preferably provided micro valve 42 are provided in the housing 10. The housing 10 does not include components of the dispenser 1 that come into contact with the oil 21.

[0171] The oil reservoir 22, the first micropump 23, the first check valve 27, the second check valve 37, the third check valve 45, the mixing junction interface 80 (preferably including the valve 81), the mixing chamber 50, and the dispenser head 60 are provided in the first cartridge 90. The water reservoir 32 and the second micropump 33 are also provided in the first cartridge 90. Alternatively, the water reservoir 32 and the second micropump 33 can be provided in the second cartridge 95 that is detachably mountable to the first cartridge 90. Accordingly, the first and second cartridges 90, 95 can form a cartridge unit that is detachably mountable to the housing 10.

[0172] As shown in Fig. 9, type A2 of the modular dispenser 1 differs from type A1 in that the second micropump 33 is accommodated by the housing 10. In all other respects, the modular dispenser 1 of the type A2 corresponds to that of the type A1. The type A2 is a particularly preferred modular structure of the dispenser 1 according to the present invention.

[0173] In types A1 and A2 shown in Figs. 8 and 9, the water reservoir 32 is included directly in the first cartridge 90 or alternatively in the second cartridge 95 that is mountable to the first cartridge 90.

[0174] As shown in Fig. 10, type B1 differs from type A2 in that the water reservoir 32 is accommodated directly in the housing 10 or in the optional second cartridge 95 that is removably mountable to the housing 10. In all other respects, the modular dispenser 1 of the type B 1 corresponds to that of the type A2.

[0175] As shown in Fig. 11, type B2 differs from type A1 in that the water reservoir 32 is accommodated directly in in the housing 10 or in the optional second cartridge 95 that is removably mountable to the housing 10. In all other respects, the modular dispenser 1 of the type B2 corresponds to that of the type A1.

[0176] In types B1 and B2, the water reservoir 32 is included in the housing 10 or in the second cartridge 95 that is mountable to the housing 10.

[0177] The second cartridge 95 can be mountable to the first cartridge 90 and to the housing 10. In types A1 and A2, the second cartridge 95 is first detachably mounted to the first cartridge 90 (or the other way round) and then both cartridges 90, 95 are mounted to the housing 10. Alternatively, only one of the two cartridges 90, 95 is directly mounted to the housing 10 while the other cartridge 95, 90 is mounted to the cartridge 90, 95 that is mounted to the housing 10.

[0178] In types B1 and B2, the two cartridges 90, 95 can be independently mounted to the housing 10. They can be mounted to each other while being mounted to the housing 10.

[0179] Additionally, in all of the types A1, A2, B1, and B2, a third cartridge (not shown) can be provided that is detachably mountable to the housing 10, to the first cartridge 90, and/or to the second cartridge 95. The third cartridge is configured to accommodate the oil reservoir 22. Preferably the third cartridge consists of (only) the oil reservoir 22 (i.e., is the carrier reservoir or includes only the carrier reservoir that is in a housing) and of a mechanical (and preferably an electronic) interface to the other parts of the dispenser, i.e., to the housing 10, to the first cartridge 90, and/or to the second cartridge 95.

Claims

1. Dispenser (1) suitable for dispensing a fluid composition dose (70) to an outside of the dispenser (1), the composition dose (70) including a fluid carrier (31) dose and a fluid agent (21) dose, the dispenser (1) comprising:

    a housing (10); and
    a cartridge (90) detachably mountable to the housing (10); wherein
    the cartridge (90) is configured to accommodate any component of the dispenser (1) that comes into contact with the agent (21).

2. Dispenser (1) according to claim 1, further comprising:

    a carrier supply system (30) configured to supply the carrier (31) to a mixing area, the carrier supply system (30) comprising a carrier reservoir (32) configured to store the carrier (31) and a carrier supply means (33) configured to supply the carrier (31) dose from the carrier reservoir (32) to the mixing area (50);
    an agent supply system (20) configured to supply the agent (21), the agent supply system (20) being independent from the carrier supply system (30), and comprising an agent reservoir (22) configured to store the agent (21) and an agent supply means (23) configured to supply the agent (21) dose from the agent reservoir (22) to the mixing area (50);
    the mixing area (50) arranged downstream of the carrier and agent supply systems (20, 30) in flow directions of the carrier (31) and the agent (21), the mixing area (50) being configured to mix the independently supplied carrier (31) and agent (21) doses to form the composition dose (70); and
    a dispenser head (60) configured to discharge the composition dose (70) to the outside, the dispenser head (60) being in fluid connection with the mixing area (50); wherein
    the cartridge (90) is configured to accommodate the agent supply system (20), the mixing area (50), and dispenser head (60).

3. Dispenser (1) according to claim 1 or 2, wherein

    the housing (10) is configured to accommodate
    drive units (24, 34) for the carrier and agent supply means (23, 33),
    a power source for the dispenser (1), which is preferably a rechargeable power source, and
    a controller for the dispenser (1); and preferably
    the carrier supply means (33); and/or
    sensors for controlling and monitoring the supply of the carrier (31) and/or the agent (21).

4. Dispenser (1) according to any of the preceding claims, further comprising
a second cartridge (95) detachably mountable to the cartridge (90) or to the housing (10), the second cartridge (95) being configured to accommodate the carrier reservoir (32), and preferably the carrier supply means (33).

5. Dispenser (1) according to any of the preceding claims, further comprising

    a fluid booster supply system (40) comprising a booster supply means (41); wherein
    the booster supply system (40) is configured to supply a pressurized fluid booster to the mixing area (50) to discharge the composition dose (70) from the mixing area (50) to the outside via the dispenser head (60); and wherein
    the booster supply system (40) is configured to

        supply the booster from a booster reservoir configured to store the booster, or
        suck ambient air from the outside into the dispenser (1) as the booster; and/or

    the booster supply system (40) is accommodated in the housing (10).

6. Dispenser (1) according to claim 5, wherein

the housing (10) is configured to further accommodate the booster supply system (40), and preferably sensors for controlling and monitoring the supply of the booster; or
a second cartridge (95) detachably mountable to the housing (10) or to the cartridge (90) is configured to accommodate the carrier reservoir (32), preferably also the carrier supply means (33), and more preferably also the booster reservoir and/or the booster supply means (41).

7. Dispenser (1) according to any of the preceding claims, wherein
the cartridge (90) is disposable, semi-disposable, or refillable, and the housing (10) is reusable, and wherein, preferably, the second cartridge (95) is refillable with the carrier (31) and/or the booster.

8. Dispenser (1) according to any of the preceding claims, further comprising

a mixing adapter (80) being configured to control the inflow of the agent (21) and the carrier (31), and preferably the booster, to the mixing area (50); wherein
the mixing adapter (80) is preferably a valve, more preferably a 3/2-way valve having three ports and two positions, the three ports being two inlet ports and one outlet port.

9. Dispenser (1) according to claim 8, wherein the cartridge (90) is configured to accommodate the mixing adapter (80).

10. Method for detachably mounting a cartridge (90) to a housing (10) of a dispenser (1), the dispenser (1) being suitable for dispensing a fluid composition dose (70) to an outside of the dispenser (1), the composition dose (70) including a fluid carrier (31) dose and a fluid agent (21) dose,

the dispenser (1) comprising

the housing (10), and
the cartridge (90) detachably mountable to the housing (10); wherein

the method comprises

detachably mounting to the dispenser (1) all components of the dispenser (1) that come into contact with the agent (21) by mounting the cartridge (90) to the housing (10), and
demounting from the dispenser (1) all components of the dispenser (1) that come into contact with the agent (21) by demounting the cartridge (90) from the housing (10).

11. Method for dispensing a fluid composition dose (70) to an outside of the dispenser (1) according to any of claims 1 to 9, the method comprising the following steps to be performed during normal use by the user

detachably mounting to the dispenser (1) all components of the dispenser (1) that come into contact with the agent (21) by mounting the cartridge (90) to the housing (10), and
starting the dispensing of the fluid composition dose (70).

12. Method according to claim 11, further comprising
demounting from the dispenser (1) all components of the dispenser (1) that come into contact with the agent (21) after the dispensing of the fluid composition dose (70) is completed by demounting the cartridge (90) from the housing (10).

13. Method according to any of claims 10 to 12, further comprising
detachably mounting a second cartridge (95) to the cartridge (90) or to the housing (10) before starting the dispensing of the fluid composition dose (70).

14. Method according to claim 13, further comprising
demounting the second cartridge (95) from the cartridge (90) or from the housing (10) after the dispensing of the fluid composition dose (70) is completed.

15. Method according to claim 13 or 14, wherein

the second cartridge (95) accommodates
the booster reservoir and preferably the booster supply means (41); and/or

the carrier reservoir (32) and preferably the carrier supply means (33).

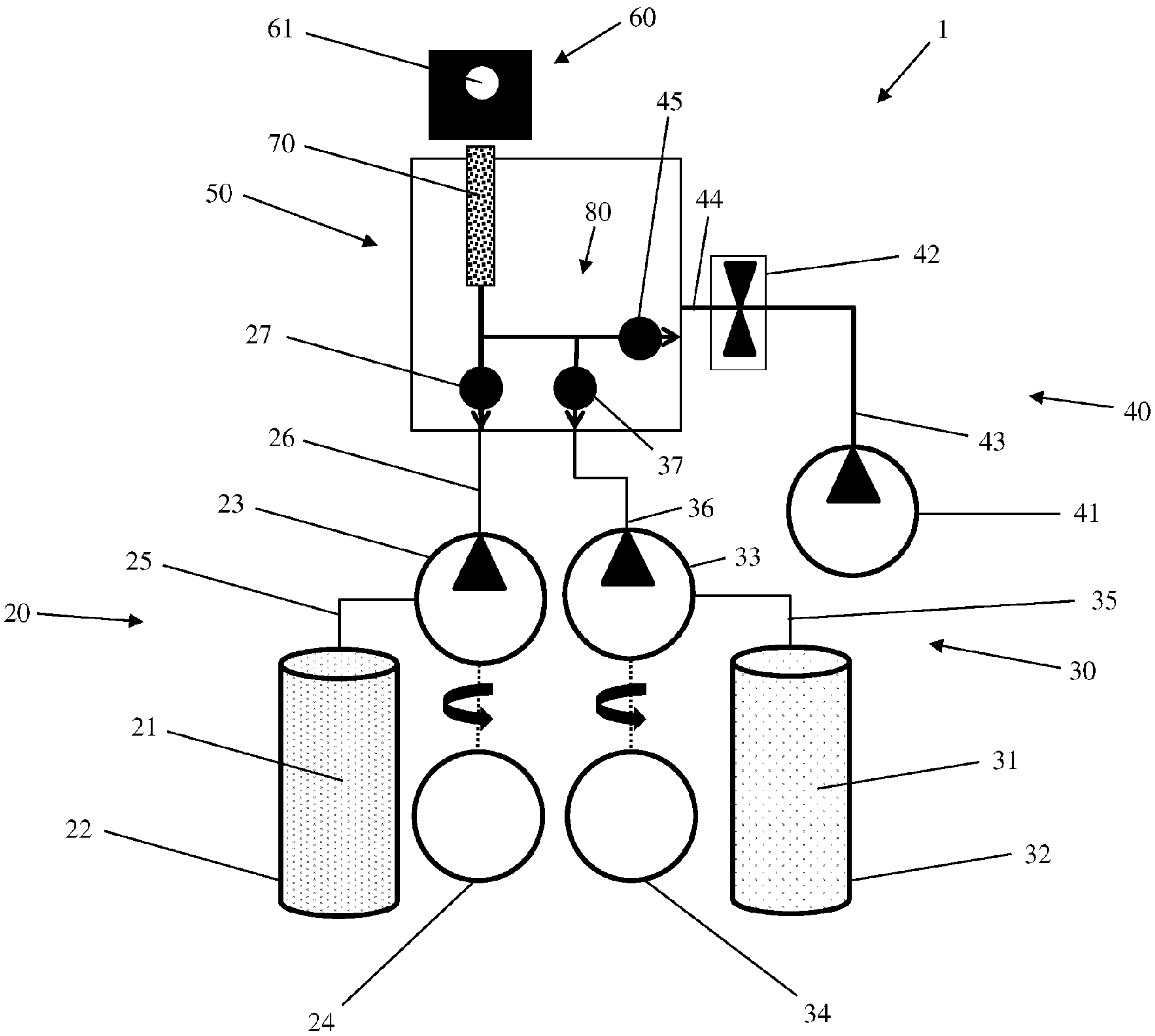

61
60
1
45
70
80
44
50
42
27
40
26
43
37
36
41
23
33
25
35
20
30
21
31
22
32
24
34

Fig. 1

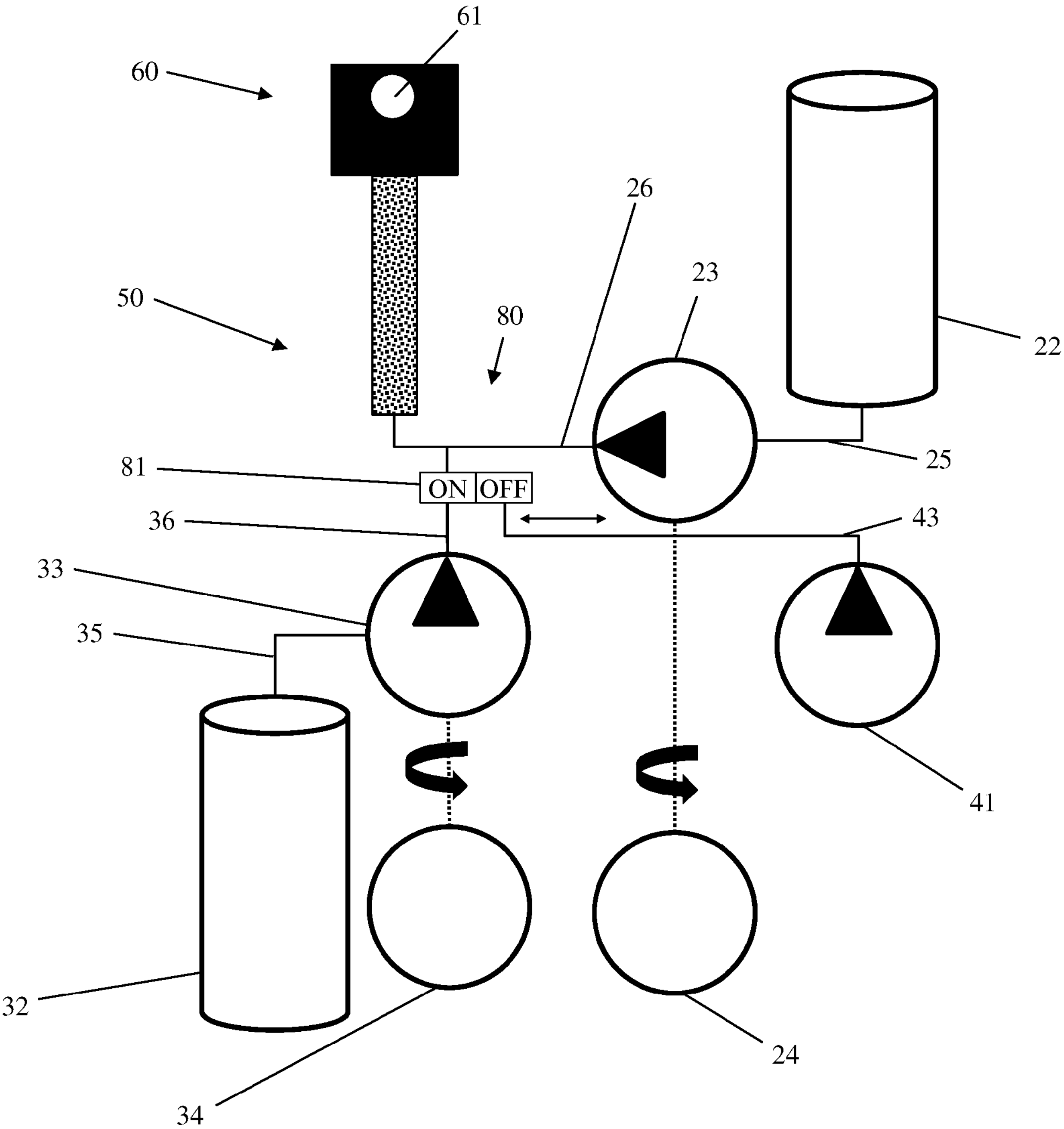


Fig. 2

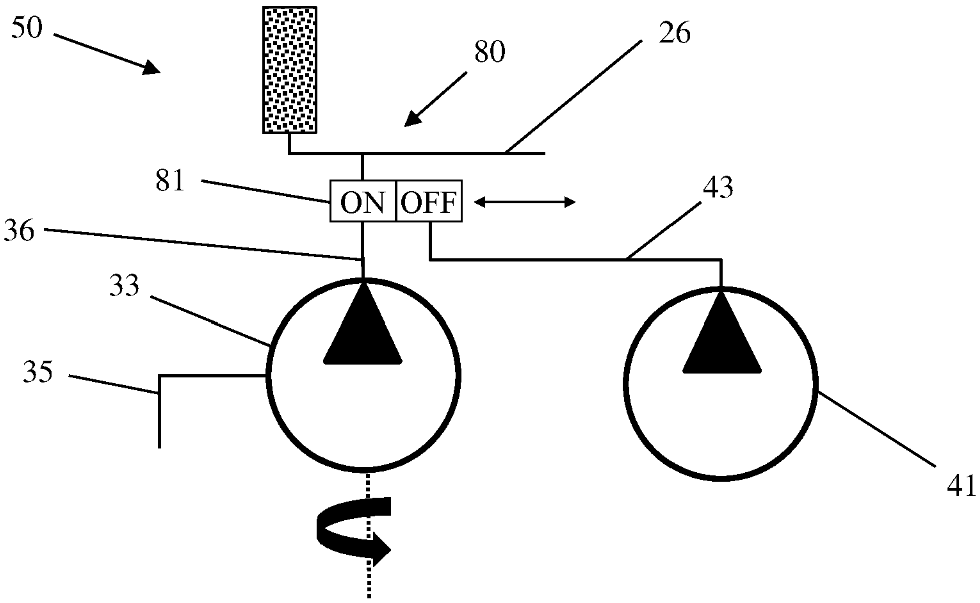


Fig. 3

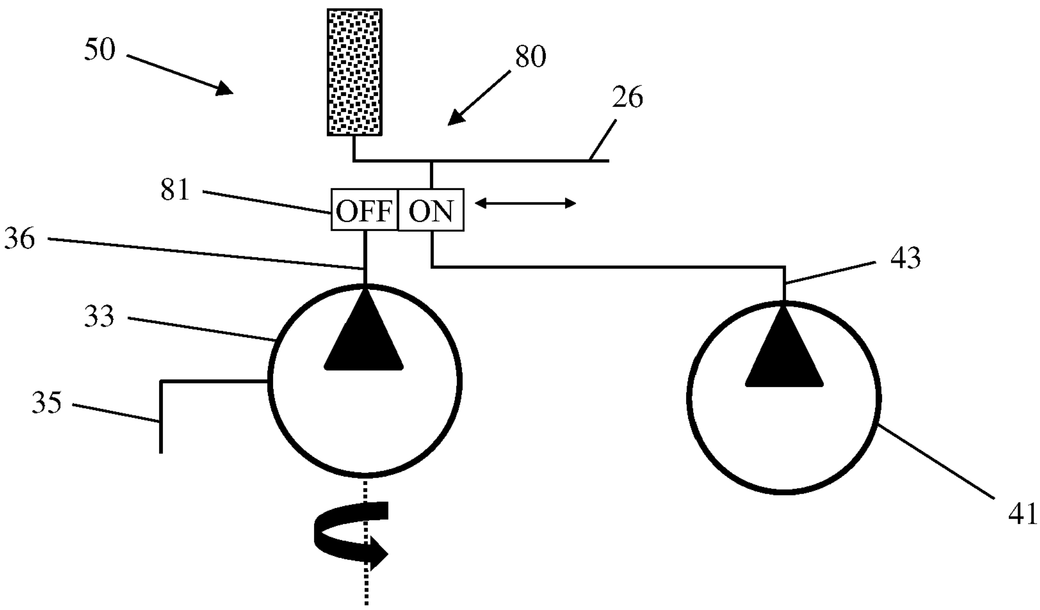


Fig. 4

Fig. 5

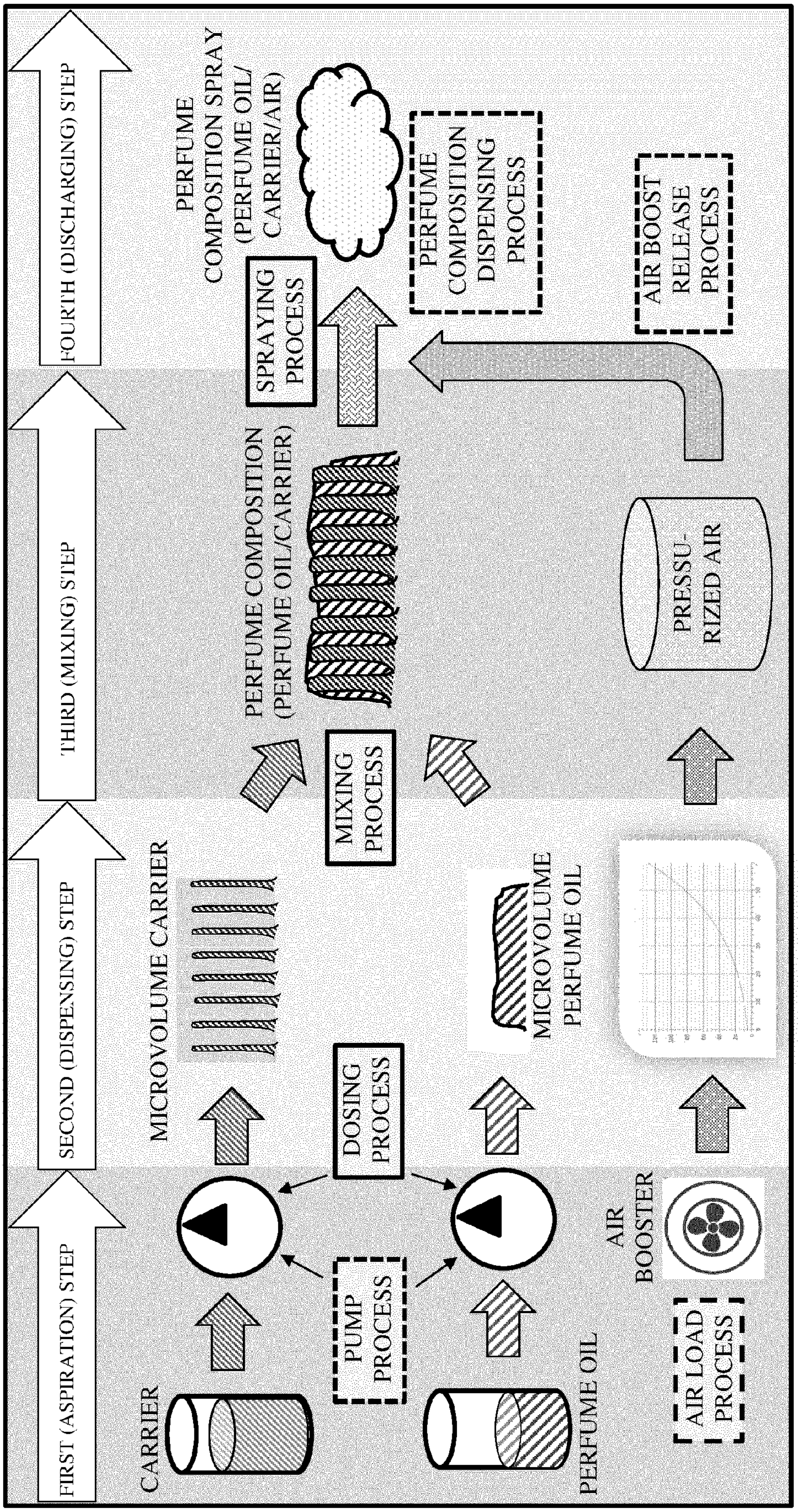
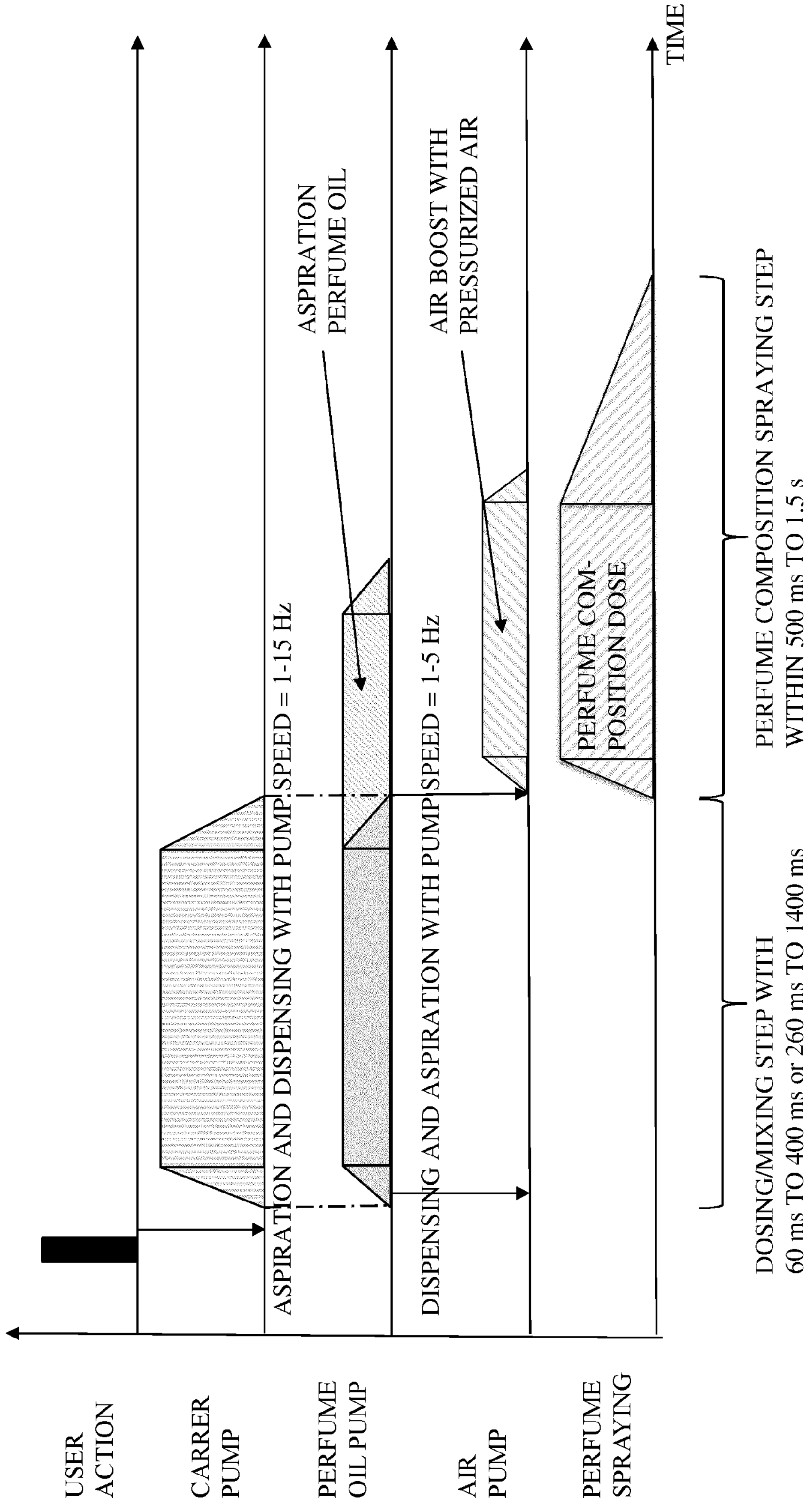

FIRST (ASPIRATION) STEP
SECOND (DISPENSING) STEP
THIRD (MIXING) STEP
FOURTH (DISCHARGING) STEP
CARRIER
PERFUME OIL
PUMP PROCESS
DOSING PROCESS
AIR BOOSTER
AIR LOAD PROCESS
MICROVOLUME CARRIER
MICROVOLUME PERFUME OIL
MIXING PROCESS
PERFUME COMPOSITION (PERFUME OIL/CARRIER)
PRESSU-RIZED AIR
SPRAYING PROCESS
PERFUME COMPOSITION SPRAY (PERFUME OIL/ CARRIER/AIR)
PERFUME COMPOSITION DISPENSING PROCESS
AIR BOOST RELEASE PROCESS

Fig. 6


USER ACTION
CARRER PUMP
PERFUME OIL PUMP
AIR PUMP
PERFUME SPRAYING
TIME
ASPIRATION AND DISPENSING WITH PUMP SPEED = 1-15 Hz
ASPIRATION PERFUME OIL
DISPENSING AND ASPIRATION WITH PUMP SPEED = 1-5 Hz
AIR BOOST WITH PRESSURIZED AIR
PERFUME COM-POSITION DOSE
DOSING/MIXING STEP WITH 60 ms TO 400 ms or 260 ms TO 1400 ms
PERFUME COMPOSITION SPRAYING STEP WITHIN 500 ms TO 1.5 s

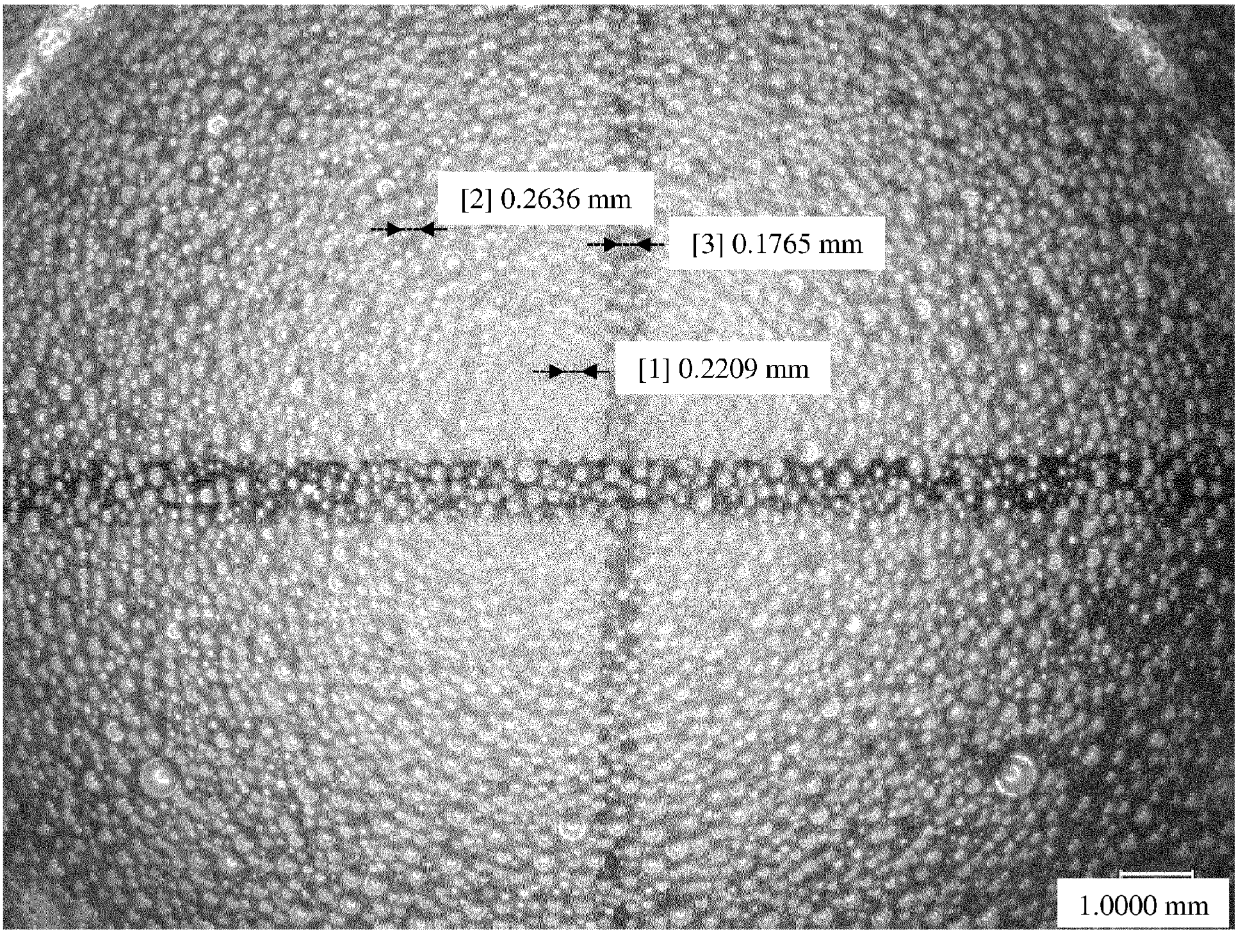


Fig. 7

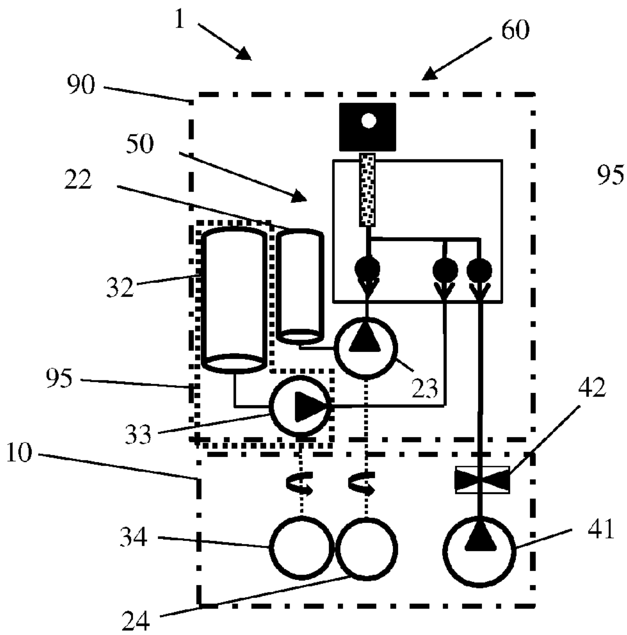


Fig. 8

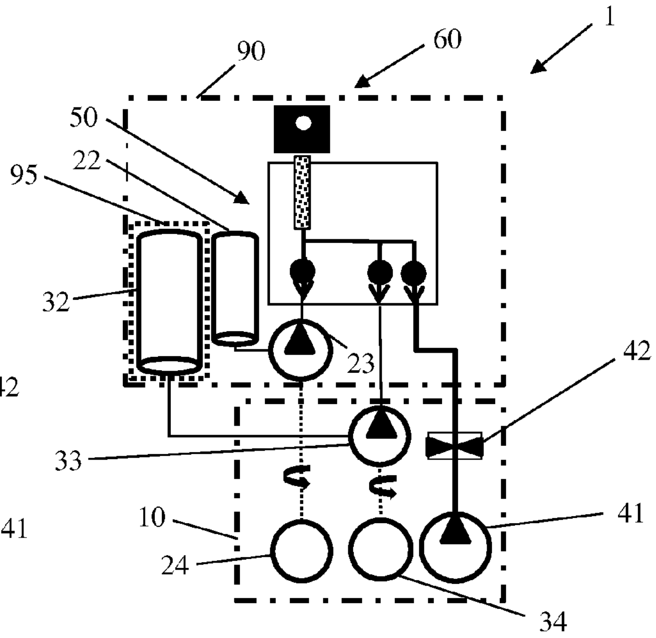


Fig. 9

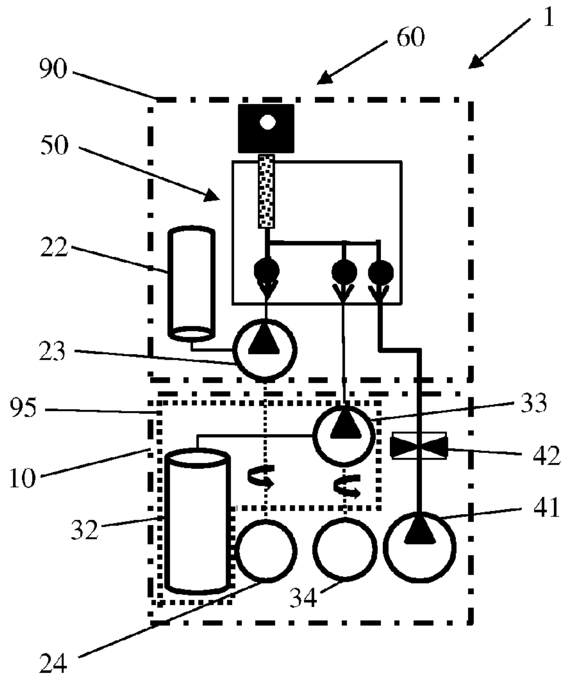


Fig. 10

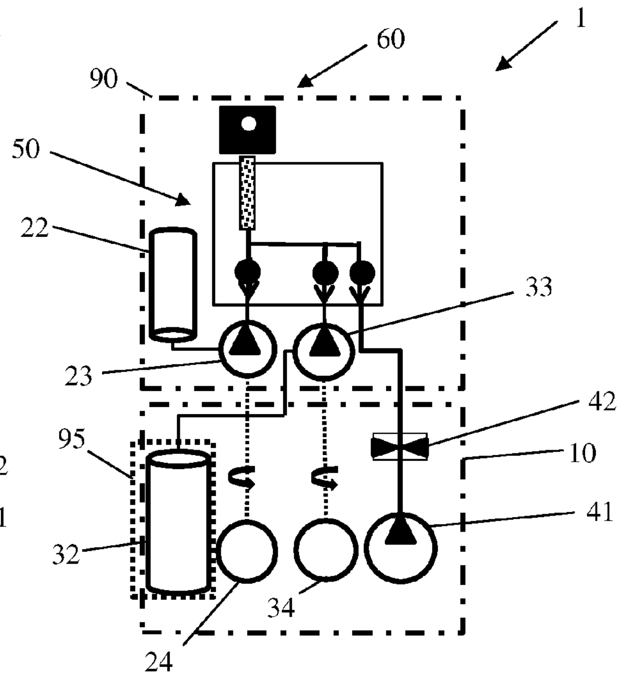


Fig. 11

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 23 17 5219

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	WO 2012/082138 A1 (COLGATE PALMOLIVE CO [US]; FALLAT II PETER J [US] ET AL.) 21 June 2012 (2012-06-21) * paragraph [0001] * * paragraph [0004] * * paragraph [0006] - paragraph [0008] * * paragraph [0069] - paragraph [0076] * * figures * -----	1-4,7-15 5,6	INV. B01F25/00 B01F33/501 B01F35/32 B01F35/00 B01F35/71 B01F35/22
X A	EP 3 666 687 A1 (SHISEIDO CO LTD [JP]) 17 June 2020 (2020-06-17) * paragraph [0001] * * paragraph [0010] - paragraph [0011] * * paragraph [0097] * * paragraph [0125] - paragraph [0136] * * figures * -----	1-4,7-15 5,6	
X A	US 2020/164323 A1 (MÜLLER GERHARD [DE] ET AL) 28 May 2020 (2020-05-28) * paragraph [0001] - paragraph [0002] * * paragraph [0014] - paragraph [0015] * * paragraph [0115] - paragraph [0116] * * paragraph [0148] - paragraph [0164] * * figures * -----	1-4,7-15 5,6	TECHNICAL FIELDS SEARCHED (IPC) B01F B05B

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	8 November 2023	Real Cabrera, Rafael

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 23 17 5219

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

08-11-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2012082138 A1	21-06-2012	AR 084348 A1	08-05-2013
		AU 2010365395 A1	02-05-2013
		BR 112013015211 A2	11-10-2016
		CA 2820188 A1	21-06-2012
		CN 103249339 A	14-08-2013
		EP 2651275 A1	23-10-2013
		JP 2013544282 A	12-12-2013
		RU 2013132973 A	10-02-2015
		SG 190858 A1	31-07-2013
		TW 201238544 A	01-10-2012
		US 2013264358 A1	10-10-2013
		WO 2012082138 A1	21-06-2012
EP 3666687 A1	17-06-2020	CN 110997519 A	10-04-2020
		EP 3666687 A1	17-06-2020
		JP 7200112 B2	06-01-2023
		JP WO2019031358 A1	13-08-2020
		KR 20200039668 A	16-04-2020
		TW 201910231 A	16-03-2019
		US 2020207538 A1	02-07-2020
		WO 2019031358 A1	14-02-2019
US 2020164323 A1	28-05-2020	DE 102017112440 A1	06-12-2018
		DE 102018118957 A1	12-12-2019
		EP 3634614 A2	15-04-2020
		EP 3801856 A1	14-04-2021
		JP 7316944 B2	28-07-2023
		JP 2020528386 A	24-09-2020
		JP 2021525649 A	27-09-2021
		US 2020164323 A1	28-05-2020
		US 2021245119 A1	12-08-2021
		WO 2018224570 A2	13-12-2018
		WO 2019234083 A1	12-12-2019

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2005039674 A1 **[0031]**
- WO 2007074363 A2 **[0031]**
- WO 2019115276 A1 **[0031]**