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(54) **AUTO-DOSING DEVICE AND CONTAINER**

AUTOMATISCHE DOSIERVORRICHTUNG UND BEHÄLTER

DISPOSITIF DE DOSAGE AUTOMATIQUE ET RÉCIPIENT

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(56) References cited:

EP-A1- 3 261 943 EP-A2- 0 268 451

US-A1- 2007 267 100 US-B1- 6 167 921

US-B1- 7 658 213

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Description

[0001] The invention relates to an auto-dosing device, a container for use with the auto-dosing device and an auto-dosing system of the device and the container. The invention further relates to a substrate treatment machine incorporating the auto-dosing device or the system.

[0002] At present, with respect to most household and shared washing machines, laundry composition such as detergents needs to be manually dosed. The amount of detergent dosed depends on different users and is very casual, which easily results in dosing too much or too less. Too much detergent will lead to incomplete rinsing with residue and affect the appearance of laundries, while too less will not make the laundries clean. Another disadvantage is that the detergent will remain in a cartridge of the washing machine or split over it during dosing, which may leave stains and negatively affect the user experience.

[0003] Usually in school or at public laundry, users have to carry detergent by themselves due to no smart dosing and this would be a burden and very inconvenient.

[0004] EP0268451 A2 discloses a liquid dispensing system for coupling a liquid filled container to a duct with a valve coupling which co-operates with the duct to enable connection of the container to the duct, and subsequent disconnection, while the valve coupling is lowermost and therefore below the liquid level, without spillage.

[0005] GB2306457 A discloses a dispensing system for use with a cleaning machine, e.g. an industrial dishwasher, comprises a container containing cleaning liquid and a receptacle which removably supports the container in an inverted orientation.

[0006] KR101676493 B1 discloses a beverage dispenser to prevent cooling water in a water tank from making contact with external air and prevent hot beverage in a hot water tank from flowing back to a source, such as the water tank, a container or a water pipe.

[0007] US3974863 A discloses a combination sealing, venting, mounting and filter element which is positioned between a replaceable inverted water bottle and a water reservoir from which the water is dispensed.

[0008] US2007/267100 A1 discloses a cap for sealing a liquid container such as a water bottle. The cap may include a cap body with an outer annular wall engaging the bottle neck, and an inner annular wall with a plug gripping formulation engaging a cap gripping formulation on a cap plug.

[0009] US7658213 B1 discloses a discharge valve for a bottle or other container associated with a fluid dispensing system that substantially prevents spillage of fluid composition from the container when it is withdrawn from the dispensing system is provided according to the invention.

[0010] However, there is a need for developing auto-dosing device through which the replacement of substrate treatment composition is easy to operate, and

leakage can be avoided when replacing the substrate treatment composition. Therefore, the present inventors developed an auto-dosing device, a container for use with the auto-dosing device to meet such needs.

[0011] According to one aspect, the present invention provides an auto-dosing device (1) for substrate treatment composition applicable to a substrate treatment machine, e.g., a washing machine, the auto-dosing device (1) comprising: a) a main body (3), b) a base (4), attached to the main body (3), configured to support a container (2) of the substrate treatment composition in an inverted position, wherein the base (4) comprises: i) a receiving body (24) extending in a longitudinal direction to receive the neck (12) of the container (2) and having an open end (30) with an annular rim (25) for supporting the container (2), and a closed bottom end (31) opposite to the open end (30) in the longitudinal direction and having outlets (32) through which the substrate treatment composition can flow; ii) a penetrating member (21) arranged in the receiving body (24) for opening the container (2); and iii) a ventilation feature configured to fluidly communicate an interior of the container (2) with outside air through the main body (3) when the container (2) is supported on the base (4) for air to flow into the container (2) from outside so that the substrate treatment composition in the container (2) can flow out, wherein the main body (3) comprises: (I) a reservoir (5) supporting and fluidly connected with the base (4) to receive the substrate treatment composition from the container (2) via the base (4); and

(II) a delivering assembly (6) configured to controllably deliver the substrate treatment composition from the reservoir (5) to a substrate treatment machine;

wherein the penetrating member (21) is hollow with a basal end (34) opened to the interior of the reservoir (5) through a bottom surface (26) at the bottom end (31) of the receiving body (24) and a closed distal end (35), and at least one venting aperture (38) is defined in a side wall (36) of the penetrating member (21) as part of the ventilation feature, and the venting aperture (38) is closer to the open end (30) of the receiving body (24) than the outlets (32) in the longitudinal direction.

[0012] According to another aspect, the present invention provides a container (2) of substrate treatment composition for use with the auto-dosing device (1) of the present invention, the container (2) comprising a substrate treatment composition inside of the container, a neck (12) and a cap (13), wherein the cap comprises a penetrating passage (17) and a plug (18) wherein the plug (18) is removably inserted into the penetrating passage (17) and capable of being released inwardly.

[0013] According to a further aspect, the present invention provides a system for auto-dosing substrate treatment composition comprising the auto-dosing de-

vice and the container as defined above.

[0014] According to a further aspect yet, the present invention provides a substrate treatment machine, e.g., a washing machine, incorporating the auto-dosing device or the system as defined above.

[0015] With such a device, the container of substrate treatment composition may be mounted directly to the auto-dosing device which is to be connected to the substrate treatment machine to dose substrate treatment composition automatically. It eliminates the need of manual dosing of existing machines and saves time and efforts for users. What's more, such auto-dosing with the base addresses any inaccuracy incurred by manual dosing and avoids spilling of substrate treatment composition. The replacement of substrate treatment composition is easy to operate, and leakage can be avoided when replacing the substrate treatment composition.

[0016] Preferably, the auto-dosing device comprises a control circuit board configured to communicate with the treatment machine and control the delivering. Preferably, the auto-dosing device comprises a module configured to send and/or receive data or signals to and/or from a remote sever.

[0017] The receiving body may be in any suitable shape to receive the neck of the container but it is preferably that the receiving body is a cylindrical body.

[0018] Preferably, the penetrating member is arranged at a bottom surface at the bottom end of the receiving body and extends in the longitudinal direction therefrom. The penetrating member is hollow with a basal end opened to the interior of the reservoir through the bottom surface and a closed distal end, and at least one venting aperture is defined in a side wall of the penetrating member as part of the ventilation feature. The venting aperture is closer to the open end of the receiving body than the outlets in the longitudinal direction. A pair of opposed elongate venting apertures may be defined in the side wall in the longitudinal direction. The outlets may be defined in a bottom surface and/or a side surface of the receiving body. The penetrating member may be shaped as a frustum at a distal end.

[0019] The annular rim may define at least one air inlet as part of the ventilation feature for fluidly communicating the interior of the reservoir with outside air. The annular rim may taper in the longitudinal direction at a side of the bottom end and extend radially outward at a side of the open end. The annular rim may be provided with a limit structure mated with a complementary limit structure arranged in the reservoir to restrict the base from separating therefrom. The receiving body and the penetrating member may be formed into a single piece.

[0020] The reservoir may take any form with an inner volume to receive the substrate treatment composition, but it is preferably cylindrical in shape.

[0021] To restrict the base from falling off when the container is removed, the reservoir is preferably provided with a complementary limit feature at its open end to mate with the limit feature of the base. Preferably, the interior of

the reservoir is configured to be in fluid communication with the air inlets of the base to allow air to flow in, more preferably without any intermediate connections.

[0022] Preferably, a discharging port is defined at the bottom of the reservoir to be connected to the dosing pipe of the auto-dosing device.

[0023] Preferably, a sensor is provided in the reservoir for sensing a level of substrate treatment composition. More preferably, the level is below a predetermined value, the sensor is capable of transmitting a signal to the control circuit to control the replenish of the substrate treatment composition.

[0024] Preferably the delivering assembly comprises a water inlet pipe to be connected with a tap. Preferably, the delivering assembly comprises pump, more preferably a metering pump, even more preferably a double path piston pump, and most preferably one single double path piston pump. More preferably the delivering assembly comprises a water inlet pipe to be connected with a tap, a flow meter and a normally open solenoid valve arranged at the water inlet pipe, a dosing pipe connected to the reservoir at one end and to the water inlet pipe downstream the solenoid valve at the other end, pump for pumping substrate treatment composition into the dosing pipe, and a liquid outlet pipe to be connected with the substrate treatment machine for supplying the mixed water and substrate treatment composition thereto.

[0025] The container may take any form, but preferably it comprises a bottle body having a neck closed by a cap 13. Preferably, the bottle body is made by rigid plastics. The plastic may comprise polyethylene terephthalate (PET), polyethylene e.g. linear low density polyethylene (LLDPE), low density polyethylene (LDPE), high density polyethylene (HDPE), polypropylene, polyetherimide (PEI), polyoxymethylene (POM), polyamide (PA), ABS, nylon, acetal, and/or polyphenylene sulphide. Preferably the plastic comprises polyethylene terephthalate (PET), polypropylene, and/or polyethylene. More preferably the plastic is polyethylene terephthalate (PET).

[0026] The volume of the container may be very large to reduce the frequency of replacement. Preferably, the volume of the container 100 ml to 30 L, more preferably 0.5 to 10 L and most preferably 2 to 5 L.

[0027] Preferably, the container comprises an identification information, for example QR code and/or barcode.

[0028] Preferably, the penetrating passage is formed to be penetrated by the penetrating member to release the plug inside of the cap when the container is inverted and mounted to the auto-dosing device.

[0029] More preferably, the plug is fastened to an annular portion, in which the penetrating passage is formed, by a fastening loop via a flexible tether, and further preferably the plug is inward from a surface of the cap in the case of being inserted into the penetrating passage.

[0030] In the context, the treatment may include washing, treating with rinse additives, conditioning, softening, cleaning, stain removal, scrubbing, refreshment, fresh-

ening, bleaching, disinfecting, anti-malodour etc.

[0031] Objects to be treated by the substrate treatment machine may be any suitable type, including substrate, substrate articles, garments, bedding, towels etc., and dishes, where "dishes" is used herein in a generic sense, and encompasses essentially any items which may be found in a dishwashing load, including crockery china-ware, glassware, plasticware, hollowware and cutlery, including silverware.

[0032] The substrate treatment composition may comprise any compositions or formulations of a liquid or gel form that are designed for cleaning soiled material. Such composition may include, but are not limited to laundry cleaning composition, fabric softening composition, fabric enhancing composition, fabric freshening composition, laundry prewashing composition, laundry pre-treating composition, laundry additives (e.g., rinse additives, wash additives, etc.), post-rinse fabric substrate treatment composition, dry cleaning composition, ironing aid, dish washing composition, hard surface cleaning composition, and other suitable composition that may be apparent to one skilled in the art in view of the teachings herein. The substrate treatment composition may also be in the form of flowable solid such as particulates, powders, grains etc. Preferably, the composition comprises laundry cleaning composition, fabric softening composition, fabric enhancing composition, fabric freshening composition, laundry disinfecting composition or a mixture thereof.

[0033] Preferably the substrate treatment composition is a liquid or gel. Preferably substrate treatment composition has a viscosity of at least 50 mPa·s, when measured at 20 degrees C at a relatively high shear rate of about 20 s⁻¹. This prevents the substrate treatment liquid being excessively thin/runny. Preferably the high shear viscosity does not exceed 15000 mPa·s when measured at 20 degrees C at a relatively high shear rate of about 20 s⁻¹ as this could compromise the ability of any pumps to function. More preferably the high-shear viscosity is in the range 100 to 1000, even more preferably 150 to 500, and most preferably 150 to 300 mPa·s when measured at 20 degrees C at a relatively high shear rate of about 20 s⁻¹.

[0034] Preferably, the auto-dosing system comprises at least two containers. More preferably, the auto-dosing system comprises at least two container and the substrate treatment composition in each container is different.

[0035] Embodiments of the present invention will now be described by way of example and with reference to the accompanying drawings in which:

Figure 1 is a schematic front view of an auto-dosing system for substrate treatment composition applicable to a substrate treatment machine;

Figure 2 is a schematic sectional view of the auto-dosing system of figure 1;

Figure 3 is a schematic perspective view of a contain-

er of the auto-dosing system;

Figure 4 is a schematic perspective view of a cap of the container;

Figure 5 is a schematic enlarged sectional view of the cap of figure 4;

Figure 6 is a schematic perspective view of a base of the auto-dosing system;

Figure 7 is a schematic sectional view of the base of figure 6;

Figure 8 is a schematic perspective view of the base with the cap arranged inside showing a closure of the cap being pushed open; and

Figure 9 is a schematic sectional view of the base and the cap of figure 8.

[0036] With reference to figs. 1 and 2, the auto-dosing system for substrate treatment composition comprises an auto-dosing device 1 and two containers of substrate treatment composition 2 mounted thereto. It can be envisaged that the auto-dosing system may be designed to have one or more containers. However, it is preferred that the auto-dosing system comprises at least two containers. The auto-dosing device 1 is configured to be connected to a substrate treatment machine (not shown), e.g., a washing machine, to deliver substrate treatment composition stored in the containers 2 in a treatment process.

[0037] As can be best seen in fig. 2, the auto-dosing device 1 comprises a main body 3, a base 4 attached to the main body 3 to receive the container 2 in an inverted position, a reservoir 5 housed in the main body 3 and connected with the base 4 to receive substrate treatment composition from the container 2 via the base 4, a delivering assembly 6 configured to deliver the substrate treatment composition from the reservoir 5 to the substrate treatment machine. Preferably, the auto-dosing device comprises a control circuit board (not shown) configured to communicate with the substrate treatment machine and control the delivering.

[0038] The delivering assembly 6 is schematically shown in fig. 2, which includes a water inlet pipe 7 to be connected with a tap, a flow meter 8 and a normally open solenoid valve 9 arranged at the water inlet pipe 7, a dosing pipe 10 connected to the reservoir 5 at one end and to the water inlet pipe 7 downstream the solenoid valve 9 at the other end, pumps 11 for pumping substrate treatment composition into the dosing pipe 10, and a liquid outlet pipe 42 to be connected with the substrate treatment machine for supplying the mixed water and substrate treatment composition thereto.

[0039] When a washing mode is selected by a user, the substrate treatment machine is initiated and a water inlet valve (not shown) is opened to fill in water. Once the flow meter 8 detects the water filling, the solenoid valve 9 is switched off to block water flow and the delivering assembly 6 starts to work. The pumps 11 pumps the substrate treatment composition from the reservoir 5 into the water inlet pipe 7 via the dosing pipe 10 and then the

solenoid valve 9 is switched on so that the substrate treatment composition are mixed with water and supplied to the substrate treatment machine to improve washing performance. A check valve (not shown) is arranged in the dosing pipe 10 to prevent water from flowing into the dosing pipe 10 and the reservoir 5.

[0040] Besides communicating with the substrate treatment machine, the auto-dosing device 1 may send data or signals to a remote server through communication devices such as those of Internet of Things. With such a configuration, users or operators may control the treatment process remotely.

[0041] The container 2, the base 4 and the reservoir 5 of the auto-dosing system will be described in further details below.

Container

[0042] Figs. 3 to 5 show the container 2 schematically. It is removably and fluidly connectable with the auto-dosing device 1 applicable to the substrate treatment machine.

[0043] The container 2 is designed for storing substrate treatment composition. It may be provided with identification information such as a QR code or a barcode on its body to show what kind of substrate treatment composition it contains. Such information may be read or scanned and sent to the substrate treatment machine or the server.

[0044] The container 2 may take any form, but preferably it comprises a bottle body having a neck 12 closed by a cap 13 as shown in fig. 3.

[0045] The cap 13 of the container 2 may be a screwing type as shown in fig. 4. Fig. 5 is a sectional view of the cap 13 which shows it has a central hole 14 in its flat surface 15. An annular portion 16 is erected inward of the cap 13 from a periphery of the central hole 14 so that a penetrating passage 17 is formed inside the annular portion 16. To prevent substrate treatment composition from flowing out of the container 2 during storage, shipment or replacing the container 2 with a new one, a plug 18 is configured to be removably received in the penetrating passage 17 to seal it. In addition, the central hole 14 may be covered with a thin seal, which is not shown, from outside to restrict the plug 18 from being pushed open due to an unintentional force applied externally. When the container 2 is intended to be mounted on the auto-dosing device 1, the thin seal may be peeled off easily.

[0046] With reference to fig. 5, the plug 18 may be in the form of a plug which can be inserted into the penetrating passage 17 of the cap 13. The plug 18 is preferably formed of a bottomed receiving body 19 and is configured to be pushed at the bottom 20 by a penetrating member 21 of the base 4 which will be described later to leave the penetrating passage 17. The plug 18 may be of any other shapes such as an H-shape or a solid one as long as it has a surface to be pushed by the penetrating member 21. To prevent from floating randomly in the container 2 after

being pushed off, the plug 18 may be connected with a fastening loop 22 via a flexible tether 23. The fastening loop 22 is configured to fit over the annular portion 16 of the cap 13 tightly. When the plug 18 is pushed away from the penetrating passage 17, the fastening loop 22 is still kept fastened to the annular portion 16 of the cap 13 so that the plug 18 will not move at random.

Base

[0047] Returning now to fig. 2, the base 4 is configured to be seated on the reservoir 5 to support the container of substrate treatment composition 2 in an inverted position. When the container 2 is inverted and mounted on the base 4, the cap 13 is opened by the penetrating member 21 of the base 4 so that the substrate treatment composition flow from the container 2 to the base 4 and then into the reservoir 5 by gravity.

[0048] As shown in figs. 6 and 7, the base 4 comprises a bottomed receiving body 24 extending in a longitudinal direction and the penetrating member 21 arranged in the receiving body 24.

[0049] The receiving body 24 has an annular rim 25 at its open end 30 for supporting the container 2 thereon in an inverted position. The annular rim 25 preferably tapers in the longitudinal direction at a side of the bottom end 31, i.e., tapers toward the bottom end 31 of the receiving body 24, to adapt to containers of different sizes. Optionally, the annular rim 25 extends radially outward at a side of the open end 30, i.e., a side opposite from the bottom end 31 of the receiving body 24, and is formed into a flange 27. The form of flange 27 is preferred only and not necessary.

[0050] Fig. 6 shows that the annular rim 25 defines air inlets 28 through which air may enter the reservoir 5 when the base 4 is mounted thereon. Although there are four air inlets 28 as shown, the number is not limited thereto and may be more or less. Similarly, the shape, size and position of the air inlets 28 are not limited as long as the air may flow through them into the reservoir 5. The air inlets 28 constitute part of a ventilation structure which allows air to flow into the container 2 from outside so that the substrate treatment composition in the container 2 may flow out into the reservoir 5.

[0051] Preferably the annular rim 25 is provided with a limit feature 29 at its bottom side as shown in fig. 7. The limit feature 29 is intended for fastening the base 4 to the reservoir 5 so that the base 4 will not separate from the reservoir 5 when the container 2 is removed or exchanged with a new one. The limit feature 29 may be in the form of a protrusion, which may mate with a complementary recess of the reservoir 5 after the base 4 is rotated in a clockwise or an anti-clockwise direction as indicated by a block arrow 33 shown in fig. 6 so that the base 4 is locked with respect to the reservoir. To unlock the base 4, it can be just rotated in an opposite direction. Preferably, two protrusions are diagonally arranged at the bottom side of the annular rim 25, but it is known to

one skilled in the art that the number and position thereof are not limited thereto. It can also be envisaged that the limit feature 29 may be a recess which may mate with a complementary protrusion of the reservoir 5. Other limit structures such as snap-in and wedging in ones are also feasible as long as the base 4 can be restricted from falling off the reservoir 5.

[0052] The receiving body 24 of the base 4 has a closed bottom end 31 which is opposite from the open end 30 in the longitudinal direction. A bottom surface 26 which is perpendicular to the longitudinal direction is defined at the bottom end 31. At least one outlet 32 is provided at the bottom end 31 through which the substrate treatment composition may flow out. In the example shown in fig. 6, two circular and two rectangular outlets 32 (one not shown) are arranged in the bottom surface 26 in a manner of 90 degrees apart in the circumferential direction. However, more or less outlets 32 with different shapes such as oval, square, triangle or the like may be arranged, and the outlets 32 may be arranged in a different way or at a location other than the bottom surface 26, for example, a side surface of the receiving body 24.

[0053] Referring now to fig. 6, the penetrating member 21 is shown located in the receiving body 24, and preferably provided centrally at the bottom surface 26 thereof. The penetrating member 21 is configured to open the container 2 when received by the base 4, and therefore it is not limited to be located as shown but may be at the side surface as long as it can be inserted into the container 2 to open it.

[0054] As shown in fig. 7, the penetrating member 21 is provided to the bottom surface 26 of the receiving body 24 at a basal end 34 and extends from the basal end 34 in the longitudinal direction to a distal end 35 which is configured to engage the penetrating passage 17 of the container 2 to release the plug 18. Between the basal end 34 and the distal end 35 is a side wall 36 of the penetrating member 21. The penetrating member 21 is hollow to allow air to flow through. At the basal end 34, the penetrating member 21 is opened outside the base 4 through the bottom surface 26 to draw air in. At least one venting aperture 38 is defined in the side wall 36 to let the air out into the container 2 when mounted. In the example shown in figs. 6 and 7, a pair of opposed elongated venting apertures 38 are formed in the side wall 36. Thereby the penetrating member 21 is formed with an air passage to let outside air in so as to make substrate treatment composition flow out of the container 2. The penetrating member 21 is preferably closed at the distal end 34 and formed into a frustum such as a truncated cone so as to make a better engagement with the penetrating passage 17 of the container 2.

[0055] According to the invention, the venting apertures 38 are closer to the open end 30 of the receiving body 24 than the outlets 32 located at the bottom end 31 in the longitudinal direction. That's to say, there is a difference between the heights of the venting apertures 38 and the outlets 32 and therefore when the container 2

is mounted on the base 4 more air may go into the container 2 to discharge more substrate treatment composition in comparison with the case in which the venting apertures 38 are at the same or lower level than the outlets 32. Such a design may allow most or all substrate treatment composition to flow out and avoid waste due to residue. It is further preferred that the venting apertures 38 start from a position at or near the bottom surface 26 and extend all along the side surface 36 in the longitudinal direction till the distal end 35 so as to increase its surface area and the height difference. Although two venting apertures 38 are shown symmetrical with respect to the longitudinal direction in the figures, the number and position thereof is not limited thereto.

[0056] The air passage is formed inside the hollow penetrating member 21 to improve ventilation. According to an embodiment that does not form part of the present invention, it can also be contemplated that the penetrating member 21 is formed as an elongated rod with the air passage formed around the rod to allow air to pass through. The passage may be formed by a space between adjacent ribs extending along the rod.

[0057] Preferably, the receiving body 24 and the penetrating member 21 are integrally formed into a single piece, e.g., by injection moulding.

[0058] Figs. 8 and 9 show the cap 13 of the container 2 and the base 4 in a state of mating with each other with the plug 18 being pushed away by the penetrating member 21. As is best seen in fig. 9, after the plug 18 is released by the penetrating member 21, it is still connected to the cap 13 by the fastening loop 22 via the tether 23 and will not move into the container 2 to hinder flow of substrate treatment composition.

Reservoir

[0059] Returning now to fig. 2, the reservoir 5 is configured to support the base 4 and the container 2 at its open end to receive the substrate treatment composition flowing from the container 2 through the base 4.

[0060] The reservoir 5 may take any form with an inner volume to receive the substrate treatment composition, although it is shown in fig. 2 as cylindrical.

[0061] To restrict the base 4 from falling off when the container 2 is removed, the reservoir 5 is provided with a complementary limit feature (not shown) at its open end to mate with the limit feature 29 of the base 4. For example, in case the limit feature 29 of the base 4 is a protrusion, the complementary limit feature of the reservoir 5 is a recess to receive the protrusion after the base 4 is rotated into position, and vice versa. Other features such as snap-in or wedging in structures are also adoptable.

[0062] The interior of the reservoir 5 is configured to be in fluid communication with the air inlets 28 of the base 4 to allow air to flow in. Preferably, the air inlets 28 of the base 4 face the interior of the reservoir 5 directly without any intermediate connections. However, it is known to

one skilled in the art that intermediate connections such as pipes may also be used.

[0063] In the reservoir 5 is arranged a sensor 39 for sensing the level of substrate treatment composition. If the level is below a predetermined value, the sensor 39 transmits a signal indicating it's time to replenish the substrate treatment composition to the control circuit board of the auto-dosing device 1.

[0064] A discharging port 40 is defined at the bottom of the reservoir 5 to be connected to the dosing pipe 10 of the auto-dosing device 1. In operation, the substrate treatment composition flow through the discharging port 40 into the dosing pipe 10.

[0065] The three components of the container 2, the base 4 and the reservoir 5 operate as follows.

[0066] With reference to figs. 2 and 9, before the substrate treatment machine works, the containers 2 are inverted and mounted to the auto-dosing device 1, more exactly to the base 4 of the auto-dosing device 1, in a state that the base 4 has been locked with respect to the reservoir 5. When the containers 2 are seated on the base 4, the penetrating member 21 penetrates into the cap 13 and forces the plug 18 upward to keep clear of the penetrating passage 17. With the ventilation feature of the base 4 and the reservoir 5, air flows from outside into the container 2 through the air inlets 28, the interior of the reservoir 5, and the air passage in the penetrating member 21 in this order. With balance of air pressure inside and outside the container 2, the substrate treatment composition therein flow into the receiving body 24 of the base 4 through a gap 41 (shown in fig. 9) between the penetrating member 21 and the annular portion 16 of the cap 13 by gravity, and then go into the reservoir 5 through the outlets 32 of the base 4 so that they are dosed automatically for subsequent treatment.

[0067] Other embodiments are intentionally within the scope of the accompanying claims.

Claims

1. An auto-dosing device (1) for substrate treatment composition applicable to a substrate treatment machine, e.g., a washing machine, the auto-dosing device (1) comprising:

- a) a main body (3),
- b) a base (4), attached to the main body (3), configured to support a container (2) of the substrate treatment composition in an inverted position,

wherein the base (4) comprises:

- i) a receiving body (24) extending in a longitudinal direction to receive the neck (12) of the container (2) and having an open end (30) with an annular rim (25) for supporting the container

(2), and a closed bottom end (31) opposite to the open end (30) in the longitudinal direction and having outlets (32) through which the substrate treatment composition can flow;

- ii) a penetrating member (21) arranged in the receiving body (24) for opening the container (2); and

- iii) a ventilation feature configured to fluidly communicate an interior of the container (2) with outside air through the main body (3) when the container (2) is supported on the base (4) for air to flow into the container (2) from outside so that the substrate treatment composition in the container (2) can flow out, and

wherein the main body (3) comprises:

- (I) a reservoir (5) supporting and fluidly connected with the base (4) to receive the substrate treatment composition from the container (2) via the base (4); and

- (II) a delivering assembly (6) configured to controllably deliver the substrate treatment composition from the reservoir (5) to a substrate treatment machine;

wherein the penetrating member (21) is hollow with a basal end (34) opened to the interior of the reservoir (5) through a bottom surface (26) at the bottom end (31) of the receiving body (24) and a closed distal end (35), and at least one venting aperture (38) is defined in a side wall (36) of the penetrating member (21) as part of the ventilation feature, and the venting aperture (38) is closer to the open end (30) of the receiving body (24) than the outlets (32) in the longitudinal direction;

characterised in that, with the ventilation feature of the base (4) and the reservoir (5), air flows from outside into the container (2) through air inlets 28, the interior of the reservoir (5), and an air passage in the penetrating member (21) in this order; and

wherein, with balance of air pressure inside and outside the container (2), the substrate treatment composition therein flows into the receiving body (24) of the base (4) through a gap (41) between the penetrating member (21) and an annular portion (16) of a cap (13) by gravity, and then goes into the reservoir (5) through the outlets (32) of the base (4).

2. The auto-dosing device (1) according to claim 1, wherein the penetrating member (21) is arranged at the bottom surface (26) which is perpendicular to the longitudinal direction at the bottom end (31) of the receiving (24) and extends in the longitudinal direction therefrom.

3. The auto-dosing device (1) according to claim 1 or claim 2, wherein a pair of opposed elongate venting apertures (38) are defined in the side wall (36) in the longitudinal direction, and/or the outlets (32) are defined in a bottom surface (26) and/or a side surface of the receiving body (24). 5
4. The auto-dosing device (1) according to any one of claims 1 to 3, wherein the penetrating member (21) is shaped as a frustum at a distal end (35). 10
5. The auto-dosing device (1) according to any one of claims 1 to 4, wherein the annular rim (25) defines at least one air inlet (28) as part of the ventilation feature for fluidly communicating the interior of the reservoir (5) with outside air. 15
6. The auto-dosing device (1) according to any one of claims 1 to 5, wherein the annular rim (25) tapers in the longitudinal direction at a side of the bottom end (31) and extends radially outward at a side of the open end (30). 20
7. The auto-dosing device (1) according to any one of claims 1 to 6, wherein the annular rim (25) is provided with a limit structure (29) mated with a complementary limit structure arranged in the reservoir (5) to restrict the base (4) from separating therefrom. 25
8. The auto-dosing device (1) according to any one of claims 1 to 7, wherein a sensor (39) is provided in the reservoir (5) for sensing a level of substrate treatment composition therein. 30
9. A container (2) of substrate treatment composition for use with the auto-dosing device (1) according to any one of claims 1 to 8, the container (2) comprising a substrate treatment composition inside of the container, a neck (12) and a cap (13), wherein the cap comprises a penetrating passage (17) and a plug (18) wherein the plug (18) is removably inserted into the penetrating passage (17) and capable of being released inwardly, wherein the container (2) is configured to be opened by a penetrating member (21) of the auto-dosing device (1) when received by a base (4) of the auto-dosing device (1), wherein, with a ventilation feature of the base (4) and a reservoir (5) of the auto-dosing device (1), air flows from outside into the container (2) through air inlets (28) of the auto-dosing device (1), the interior of the reservoir (5), and an air passage in the penetrating member (21) in this order, wherein, with balance of air pressure inside and outside the container (2), the substrate treatment composition therein flows into a receiving body (24) of the base (4) through a gap (41) between the penetrating member (21) and an annular portion (16) of the cap (13) by gravity, and then goes into the reservoir (5) through outlets (32) of 35 40 45 50 55

the base (4).

10. The container according to claim 9 wherein the penetrating passage (17) is formed to be penetrated by the penetrating member (21) to release the plug (18) inside of the cap (13) when the container (2) is inverted and mounted to the auto-dosing device (1).
11. The container according to claim 9 or 10 wherein the plug (18) is fastened to the annular portion (16), in which the penetrating passage (17) is formed, by a fastening loop (22) via a flexible tether (23), and further preferably the plug (18) is inward from a surface (15) of the cap (13) in the case of being inserted into the penetrating passage (17).
12. A system for auto-dosing substrate treatment composition comprising the auto-dosing device (1) according to any one of claims 1 to 8 and the container (2) according to any one of claims 9 to 11.
13. A substrate treatment machine, e.g., a washing machine, incorporating the auto-dosing device (1) according to any one of claims 1 to 8 or the system according to claim 12.

Patentansprüche

1. Automatische Dosiervorrichtung (1) für eine Substratbehandlungszusammensetzung, die für eine Substratbehandlungsmaschine, z. B. eine Waschmaschine, geeignet ist, wobei die automatische Dosiervorrichtung (1) Folgendes umfasst:

- a) einen Hauptkörper,
- b) eine Basis (4), die an dem Hauptkörper (3) befestigt ist und konfiguriert ist, einen Behälter (2) der Substratbehandlungszusammensetzung in einer umgedrehten Position zu tragen,

wobei die Basis (4) Folgendes umfasst:

- i) einen Aufnahmekörper (24), der sich in einer Längsrichtung erstreckt, um den Hals (12) des Behälters (2) aufzunehmen, und ein offenes Ende (30) mit einem ringförmigen Rand (25) zum Tragen des Behälters (2) und ein geschlossenes unteres Ende (31) aufweist, das dem offenen Ende in der Längsrichtung gegenüberliegt und Auslässe (32) aufweist, durch die die Substratbehandlungszusammensetzung fließen kann;
- ii) ein Eindringelement (21), das in dem Aufnahmekörper (24) angeordnet ist, um den Behälter (2) zu öffnen; und
- iii) ein Belüftungsmerkmal, das konfiguriert ist, einen Innenraum des Behälters (2) durch den

Hauptkörper (3) mit Außenluft fluidtechnisch zu verbinden, wenn der Behälter (2) auf der Basis (4) getragen wird, damit Luft von außen in den Behälter (2) strömt, sodass die Substratbehandlungszusammensetzung in dem Behälter (2) herausfließen kann,

wobei der Hauptkörper (3) Folgendes umfasst:

- (I) ein Reservoir (5), das die Basis (4) trägt und mit dieser fluidtechnisch verbunden ist, um die Substratbehandlungszusammensetzung aus dem Behälter (2) über die Basis (4) zu empfangen; und
- (II) eine Abgabeeinrichtung (6), die konfiguriert ist, die Substratbehandlungszusammensetzung aus dem Reservoir (5) an eine Substratbehandlungsmaschine steuerbar abzugeben; wobei das Eindringelement (21) hohl ist und ein basales Ende (34), das durch eine Bodenfläche (26) an dem unteren Ende des Aufnahmekörpers (24) zu dem Innenraum des Reservoirs (5) geöffnet ist, und ein geschlossenes distales Ende (35) aufweist und mindestens eine Entlüftungsöffnung (38) in einer Seitenwand (36) des Eindringelements (21) als Teil des Belüftungsmerkmals definiert ist und die Entlüftungsöffnung (38) sich in der Längsrichtung näher bei dem offenen Ende (30) des Aufnahmekörpers (25) befindet als die Auslässe (32);
- dadurch gekennzeichnet, dass** mit dem Belüftungsmerkmal der Basis (4) und dem Reservoir (5) Luft von außen durch Lufteinlässe (28), den Innenraum des Reservoirs (5) und einen Luftdurchgang in dem Eindringelement (21) in dieser Reihenfolge in den Behälter (2) fließt; und wobei bei Luftdruckausgleich innerhalb und außerhalb des Behälters (2) die darin befindliche Substratbehandlungszusammensetzung durch einen Spalt (41) zwischen dem Eindringelement (21) und einem ringförmigen Abschnitt (16) eines Deckels (13) durch Schwerkraft in den Aufnahmekörper (24) der Basis (4) fließt und anschließend durch die Auslässe (32) der Basis (4) in das Reservoir (5) übergeht.
2. Automatische Dosiervorrichtung (1) nach Anspruch 1, wobei das Eindringelement (21) an der Bodenfläche (26), die senkrecht zu der Längsrichtung ist, an dem unteren Ende (31) des Aufnahmekörpers (24) angeordnet ist und sich von dort aus in Längsrichtung erstreckt.
 3. Automatische Dosiervorrichtung (1) nach Anspruch 1 oder 2, wobei ein Paar gegenüberliegender längerlicher Entlüftungsöffnungen (38) in der Seitenwand (36) in Längsrichtung definiert sind und/oder die Auslässe (32) in einer Bodenfläche (26) und/oder

einer Seitenfläche des Aufnahmekörpers (24) definiert sind.

4. Automatische Dosiervorrichtung (1) nach einem der Ansprüche 1 bis 3, wobei das Eindringelement (21) an einem distalen Ende (35) als ein Kegelstumpf geformt ist.
5. Automatische Dosiervorrichtung (1) nach einem der Ansprüche 1 bis 4, wobei der ringförmige Rand (25) mindestens einen Lufteinlass (28) als Teil des Belüftungsmerkmals definiert, um den Innenraum des Reservoirs (5) mit der Außenluft fluidtechnisch zu verbinden.
6. Automatische Dosiervorrichtung (1) nach einem der Ansprüche 1 bis 5, wobei sich der ringförmige Rand (25) in der Längsrichtung an einer Seite des unteren Endes (31) verjüngt und sich an einer Seite des offenen Endes (30) radial nach außen erstreckt.
7. Automatische Dosiervorrichtung (1) nach einem der Ansprüche 1 bis 6, wobei der ringförmige Rand (25) mit einer Begrenzungsstruktur (29) versehen ist, die mit einer komplementären Begrenzungsstruktur, die in dem Reservoir (5) angeordnet ist, zusammenpasst, um zu verhindern, dass sich die Basis (4) davon trennt.
8. Automatische Dosiervorrichtung (1) nach einem der Ansprüche 1 bis 7, wobei in dem Reservoir (5) ein Sensor (39) vorgesehen ist, um einen Füllstand der Substratbehandlungszusammensetzung darin zu erfassen.
9. Behälter (2) für eine Substratbehandlungszusammensetzung zur Verwendung mit der automatischen Dosiervorrichtung (1) nach einem der Ansprüche 1 bis 8, wobei der Behälter (2) eine Substratbehandlungszusammensetzung im Inneren des Behälters, einen Hals (12) und einen Deckel (13) umfasst, wobei der Deckel einen Durchdringungsdurchgang (17) und eine Verschlusskappe (18) umfasst, wobei die Verschlusskappe (18) in den Durchdringungsdurchgang (17) entnehmbar eingesetzt ist und nach innen gelöst werden kann, wobei der Behälter (2) konfiguriert ist, durch ein Eindringelement (21) der automatischen Dosiervorrichtung (1) geöffnet zu werden, wenn er durch eine Basis (4) der automatischen Dosiervorrichtung (1) aufgenommen wird, wobei mit einem Belüftungsmerkmal der Basis (4) und einem Reservoir (5) der automatischen Dosiervorrichtung (1) Luft von außen durch Lufteinlässe (28) der automatischen Dosiervorrichtung (1), den Innenraum des Reservoirs (5) und einen Luftdurchgang in dem Eindringelement (21) in dieser Reihenfolge in den Behälter (2) strömt, wobei bei einem Luftdruckausgleich innerhalb und außerhalb des

Behälters (2) die darin befindliche Substratbehandlungszusammensetzung durch einen Spalt (41) zwischen dem Eindringelement (21) und einem ringförmigen Abschnitt (16) des Deckels (13) durch Schwerkraft in einen Aufnahmekörper (24) der Basis (4) fließt und anschließend durch Auslässe (32) der Basis (4) in das Reservoir (5) übergeht.

10. Behälter nach Anspruch 9, wobei der Durchdringungsdurchgang (17) gebildet ist, um von dem Eindringelement (21) durchdrungen zu werden, um die Verschlusskappe (18) in dem Deckel (13) zu lösen, wenn der Behälter (2) umgedreht und an der automatischen Dosiervorrichtung (1) montiert wird.
11. Behälter nach Anspruch 9 oder 10, wobei die Verschlusskappe (18) an dem ringförmigen Abschnitt (16), in dem der Durchdringungsdurchgang (17) gebildet ist, durch eine Befestigungsschleife (22) über ein flexibles Halteband (23) befestigt ist und ferner die Verschlusskappe (18) vorzugsweise von einer Oberfläche (15) des Deckels (13) nach innen gerichtet ist, wenn sie in den Durchdringungsdurchgang (17) eingesetzt ist.
12. System zur automatischen Dosierung einer Substratbehandlungszusammensetzung, das die automatische Dosiervorrichtung (1) nach einem der Ansprüche 1 bis 8 und den Behälter (2) nach einem der Ansprüche 9 bis 11 umfasst.
13. Substratbehandlungsmaschine, z. B. eine Waschmaschine, die die automatische Dosiervorrichtung (1) nach einem der Ansprüche 1 bis 8 oder das System nach Anspruch 12 enthält.

Revendications

1. Dispositif de dosage automatique (1) pour composition de traitement de substrat applicable à une machine de traitement de substrat, par exemple une machine à laver, le dispositif de dosage automatique (1) comprenant :
 - a) un corps principal (3),
 - b) une base (4) fixée au corps principal (3), configurée pour supporter un récipient (2) de la composition de traitement de substrat dans une position inversée,
 dans lequel la base (4) comprend :
 - i) un corps de réception (24) s'étendant dans une direction longitudinale pour recevoir le goulot (12) du récipient (2) et ayant une extrémité (30) ouverte avec un rebord annulaire (25) pour supporter le récipient (2) et une extrémité infé-

rieure (31) fermée opposée à l'extrémité (30) ouverte dans la direction longitudinale et ayant des sorties (32) à travers lesquelles la composition de traitement de substrat peut s'écouler ;
 ii) un élément de pénétration (21) agencé dans le corps de réception (24) pour ouvrir le récipient (2) ; et
 iii) une caractéristique de ventilation configurée pour faire communiquer, de manière fluïdique, un intérieur du récipient (1) avec l'air extérieur à travers le corps principal (3), lorsque le récipient (2) est supporté sur la base (4) pour que l'air s'écoule dans le récipient (2) depuis l'extérieur de sorte que la composition de traitement de substrat dans le récipient (2) peut s'écouler, et

dans lequel le corps principal (3) comprend :

- (I) un réservoir (5) supportant et raccordé de manière fluïdique à la base (4) pour recevoir la composition de traitement de substrat du récipient (2) via la base (4) ; et
- (II) un ensemble de distribution (6) configuré pour distribuer, de manière contrôlable, la composition de traitement de substrat du réservoir (5) à une machine de traitement de substrat ;

dans lequel :

l'élément de pénétration (21) est creux avec une extrémité de base (34) ouverte sur l'intérieur du réservoir (5) par une surface inférieure (26) à l'extrémité inférieure (31) du corps de réception (24) et une extrémité distale (35) fermée, et au moins une ouverture d'évent (38) est définie dans une paroi latérale (36) de l'élément de pénétration (21) comme faisant partie de la caractéristique de ventilation, et l'ouverture d'évent (38) est plus proche de l'extrémité (30) ouverte du corps de réception (24) que les sorties (32) dans la direction longitudinale ;
caractérisé en ce que, avec la caractéristique de ventilation de la base (4) et le réservoir (5), l'air s'écoule de l'extérieur dans le récipient (2) par les entrées d'air (28), l'intérieur du réservoir (5) et un passage d'air dans l'élément de pénétration (21), dans cet ordre ;
 et dans lequel, avec l'équilibre de la pression d'air à l'intérieur et à l'extérieur du récipient (2), la composition de traitement de substrat à l'intérieur s'écoule dans le corps de réception (24) de la base (4) par un interstice (41) entre l'élément de pénétration (21) et une partie annulaire (16) d'un capuchon (13) par gravité, et ensuite va dans le réservoir (5) par les sorties (32) de la base (4).

2. Dispositif de dosage automatique (1) selon la reven-

- dication 1, dans lequel l'élément de pénétration (21) est agencé sur la surface inférieure (26) qui est perpendiculaire à la direction longitudinale au niveau de l'extrémité inférieure (31) du corps de réception (24) et s'étend dans la direction longitudinale à partir de cette dernière.
3. Dispositif de dosage automatique (1) selon la revendication 1 ou la revendication 2, dans lequel une paire d'ouvertures d'évent (38) allongées opposées est définie dans la paroi latérale (36) dans la direction longitudinale, et/ou les sorties (32) sont définies dans une surface inférieure (26) et/ou une surface latérale du corps de réception (24).
 4. Dispositif de dosage automatique (1) selon l'une quelconque des revendications 1 à 3, dans lequel l'élément de pénétration (21) est en forme de tronc à une extrémité distale (35).
 5. Dispositif de dosage automatique (1) selon l'une quelconque des revendications 1 à 4, dans lequel le rebord annulaire (25) définit au moins une entrée d'air (28) comme faisant partie de la caractéristique de ventilation pour faire communiquer, de manière fluïdique, l'intérieur du réservoir (5) avec l'air extérieur.
 6. Dispositif de dosage automatique (1) selon l'une quelconque des revendications 1 à 5, dans lequel le rebord annulaire (25) se rétrécit progressivement dans la direction longitudinale d'un côté de l'extrémité inférieure (31) et s'étend radialement vers l'extérieur d'un côté de l'extrémité (30) ouverte.
 7. Dispositif de dosage automatique (1) selon l'une quelconque des revendications 1 à 6, dans lequel le rebord annulaire (25) est prévu avec une structure de limite (29) couplée avec une structure de limite complémentaire agencée dans le réservoir (5) pour empêcher la séparation de la base (4).
 8. Dispositif de dosage automatique (1) selon l'une quelconque des revendications 1 à 7, dans lequel un capteur (39) est prévu dans le réservoir (5) pour détecter un niveau de la composition de traitement de substrat à l'intérieur.
 9. Récipient (2) de composition de traitement de substrat destiné à être utilisé avec le dispositif de dosage automatique (1) selon l'une quelconque des revendications 1 à 8, le récipient (2) comprenant une composition de traitement de substrat à l'intérieur du récipient, un goulot (12) et un capuchon (13), dans lequel le capuchon comprend un passage de pénétration (17) et un bouchon (18), dans lequel le bouchon (18) est inséré, de manière amovible, dans le passage de pénétration (17) et pouvant être libéré vers l'intérieur, dans lequel le récipient (2) est configuré pour être ouvert par un élément de pénétration (21) du dispositif de dosage automatique (1) lorsqu'il est reçu par une base (4) du dispositif de dosage automatique (1), dans lequel avec une caractéristique de ventilation de la base (4) et un réservoir (5) du dispositif de dosage automatique (1), l'air s'écoule depuis l'extérieur dans le récipient (2) par les entrées d'air (28) du dispositif de dosage automatique (1), l'intérieur du réservoir (5) et un passage d'air dans l'élément de pénétration (21), dans cet ordre, dans lequel avec l'équilibre de pression d'air à l'intérieur et à l'extérieur du récipient (2), la composition de traitement de substrat à l'intérieur s'écoule dans un corps de réception (24) de la base (4) par un interstice (41) entre l'élément de pénétration (21) et une partie annulaire (16) du capuchon (13) par gravité, et va ensuite dans le réservoir (5) par des sorties (32) de la base (4).
 10. Récipient selon la revendication 9, dans lequel le passage de pénétration (17) est formé pour être pénétré par l'élément de pénétration (21) pour libérer le bouchon (18) à l'intérieur du capuchon (13) lorsque le récipient (2) est inversé et monté sur le dispositif de dosage automatique (1).
 11. Récipient selon la revendication 9 ou 10, dans lequel le bouchon (18) est fixé à la partie annulaire (16), dans laquelle le passage de pénétration (17) est formé, par une boucle de fixation (22) via une attache flexible (23) et en outre de préférence le bouchon (18) est vers l'intérieur à partir d'une surface (15) du capuchon (13) dans le cas de l'insertion dans le passage de pénétration (17).
 12. Système pour composition de traitement de substrat de dosage automatique comprenant le dispositif de dosage automatique (1) selon l'une quelconque des revendications 1 à 8 et le récipient (2) selon l'une quelconque des revendications 9 à 11.
 13. Machine de traitement de substrat, par exemple une machine à laver, comprenant le dispositif de dosage automatique (1) selon l'une quelconque des revendications 1 à 8 ou le système selon la revendication 12.

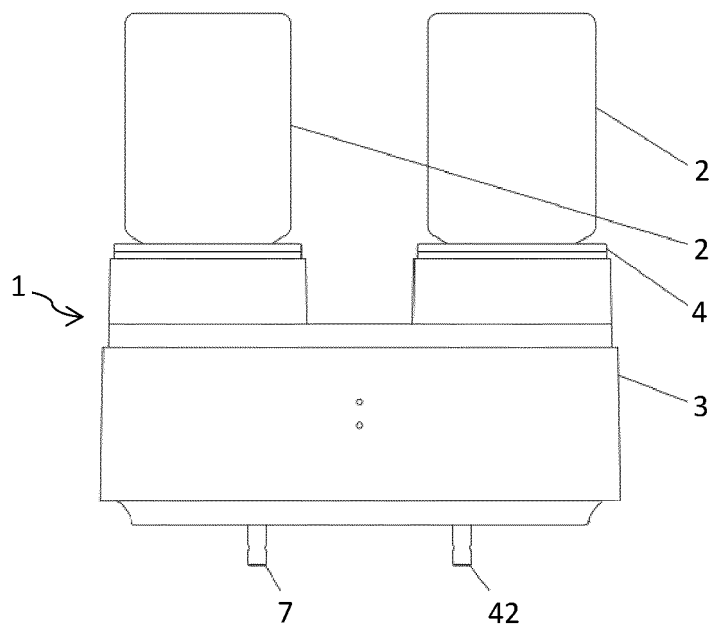


Fig. 1

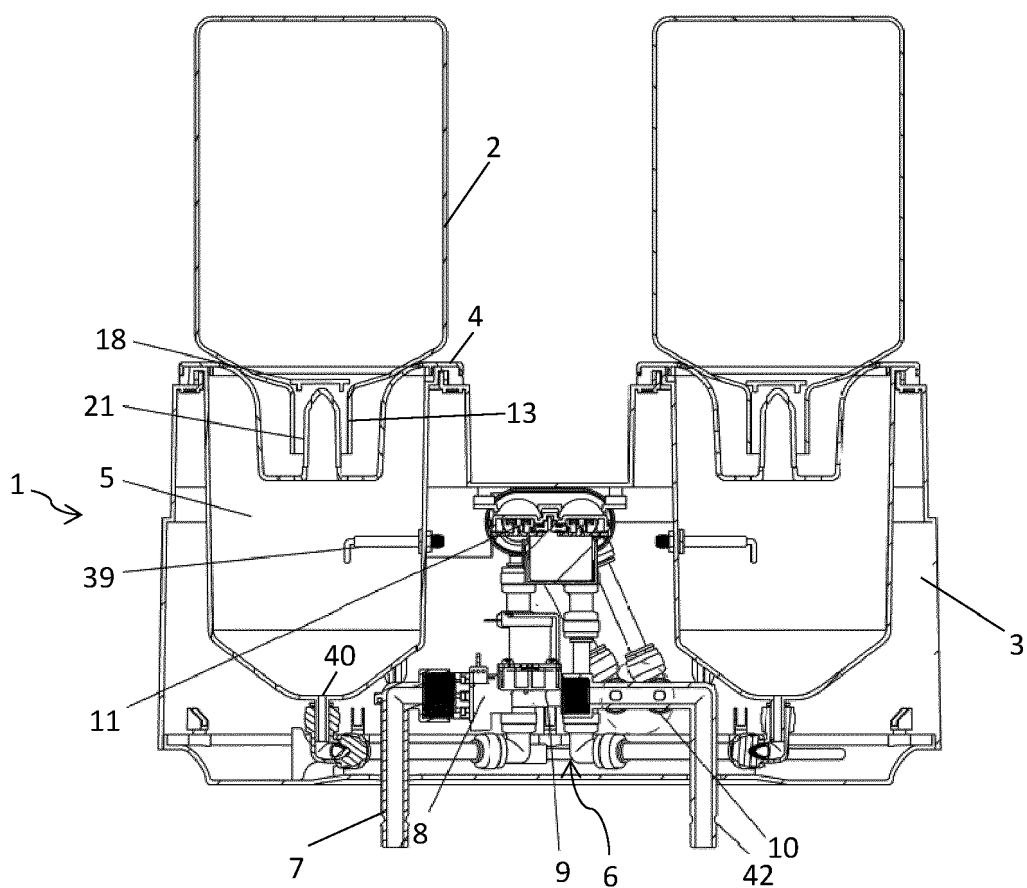


Fig. 2

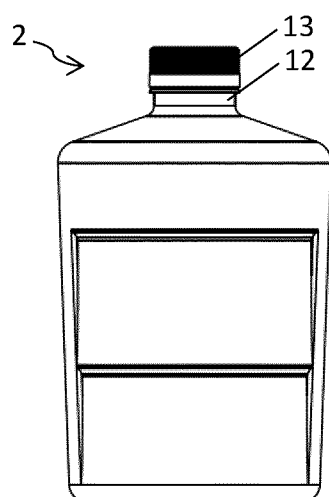


Fig. 3

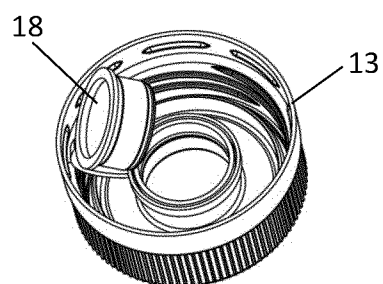


Fig. 4

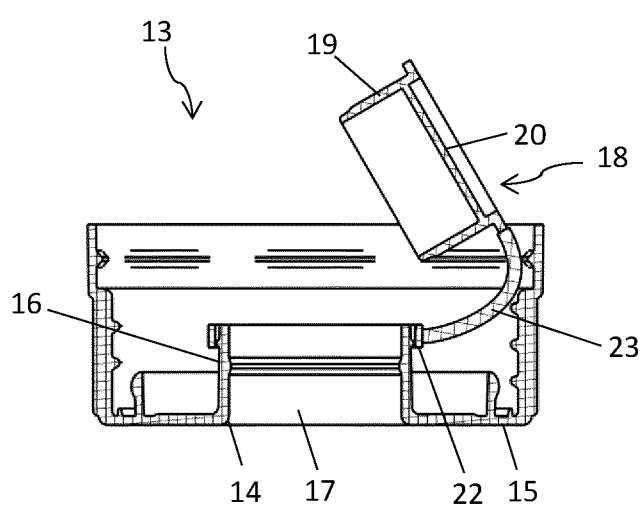


Fig. 5

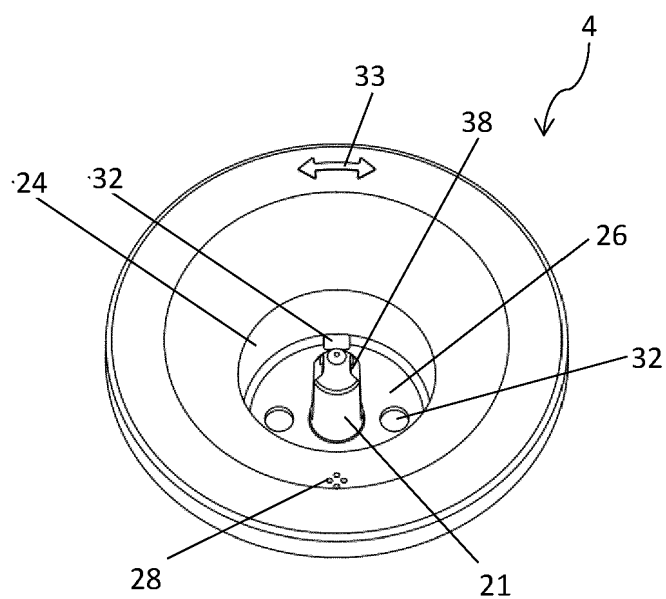


Fig. 6

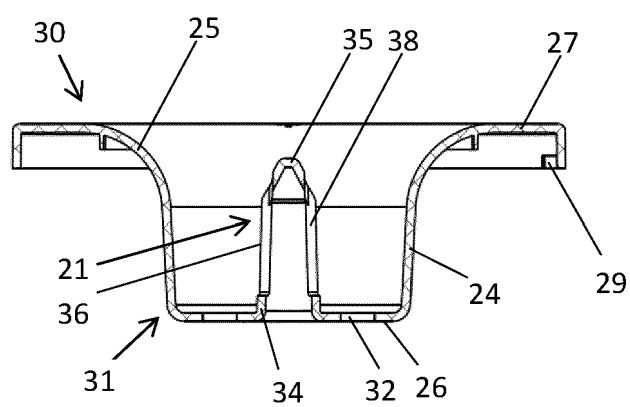


Fig. 7

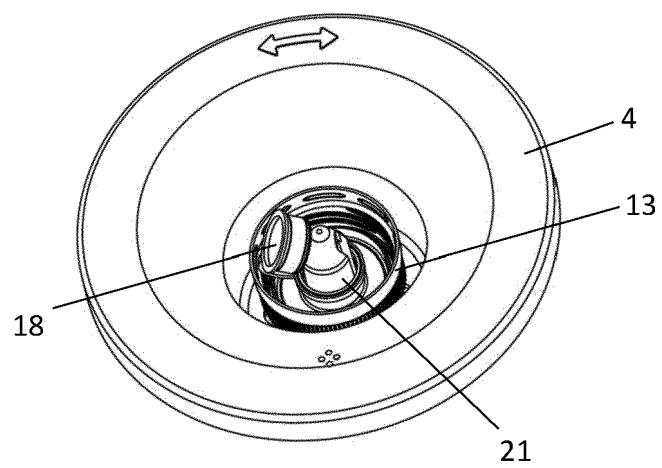


Fig. 8

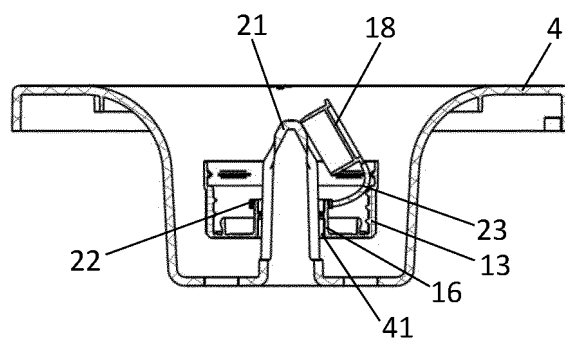


Fig. 9

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0268451 A2 [0004]
- GB 2306457 A [0005]
- KR 101676493 B1 [0006]
- US 3974863 A [0007]
- US 2007267100 A1 [0008]
- US 7658213 B1 [0009]