



(43) International Publication Date
1 September 2016 (01.09.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/135324 A1

(51) International Patent Classification:

A61J 7/00 (2006.01) C02F 1/50 (2006.01)
A47G 21/18 (2006.01) C02F 1/68 (2006.01)

(21) International Application Number:

PCT/EP2016/054150

(22) International Filing Date:

26 February 2016 (26.02.2016)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

1503258.4 26 February 2015 (26.02.2015) GB

(71) Applicant: RATIOPHARM GMBH [DE/DE]; Graf-Arco-Strasse 3, 89079 Ulm (DE).

(72) Inventors: HUBER, Gerald; Neusatz 31, 73655 Plüderhausen (DE). DACHTLER, Markus; Vogelbergstr. 22, 89079 Einsingen (DE). GREINER, Gordon; Einsteinstr. 17/1, 89077 Ulm (DE).

(74) Agent: D YOUNG & CO LLP; 120 Holborn, London EC1N 2DY (GB).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: REHYDRATION AND PURIFICATION DEVICE

(57) Abstract: The present invention is in the field devices for assisting in the provision of rehydration therapy in third world countries. It has been identified that rehydration therapy in third world is being administered using contaminated water thus causing a cycle of disease and ill-health. In order to address this issue a device for dispensing a composition is provided according to the present invention. The device includes a first chamber; and a second chamber located adjacent to the first chamber. Each of the first and second chambers has an outlet. The first and second chambers are separated by a first filter and the first chamber contains a first composition and the second chamber contains a second composition.



WO 2016/135324 A1

Rehydration and Purification Device**Technical Field**

The present invention relates to a device for dispensing a composition. In particular the present invention is concerned with a device for dispensing a composition for oral administration.

Background

In locations where access to clean drinking water or other such fluids is difficult, water purification methods are typically used. For example, sterilisation by heating, or by chemical disinfectants are well-known. However, neither of these methods is convenient, especially in situations where small volumes of drinkable fluids (e.g. 1-2 litres or less) are required, or where access to suitable vessels and/or equipment for heating or chemical sterilization, as well as to large volumes of liquid to be treated, is limited, such as, for example, in remote areas or in the developing countries. For example, water purification using a disinfectant powder is typically used in the developing countries in order to render water potable. However, this method typically involves mixing a disinfectant composition with large quantities (e.g. 10 litres) of water, and, after allowing the disinfectant to take effect, the mixture must be filtered into a second, clean vessel before it can be safely used.

In the developing countries, a significant cause of death is due to dehydration caused by diarrhoea and vomiting. Often the cause of the diarrhoea and vomiting in such situations are gastrointestinal infections arising from consumption of contaminated water. In such locations, potable water is either non-existent or in very short supply. It is therefore essential that access to drinkable liquid compositions, such as oral rehydration liquids, is readily available without the need to use heating equipment and without the need to treat and store large quantities of sterilised water.

Further, in other situations, access to such large volumes of liquid and to suitable vessels for heating is likely to be limited. For example, in remote areas, hikers and mountaineers are likely to require portable quantities of consumable liquids, such as water, oral rehydration or isotonic liquids, and energy (e.g. glucose-based) drinks. Treatment of large volumes of unclean or contaminated fluid, including but not limited to water, is likely to be impractical in

such situations. For example, during hiking or camping trips, an individual may become dehydrated through physical activity but whilst a supply of water from streams or rivers may be found, there is a risk that this may be contaminated and therefore unsuitable for drinking. Isotonic drinks containing similar concentrations of salt and sugar to the human body are known to assist in rehydration after exercise and physical activity. However, carrying a sufficient amount of these drinks when hiking and/or camping is undesirable due to the excess weight that must be transported and the waste from the containers containing these drinks which has to be safely disposed of by carrying to a suitable disposal point or may be abandoned and pollute the environment.

Thus, there is a need for an easily accessible and convenient means of dispensing a composition, especially where the composition is for oral administration. In particular there is a need for a small, lightweight, easily transportable and easy to use device which creates low volumes of waste. There is a further need for such a device to keep several potentially incompatible components separate during storage and/or transport of the device despite its handiness.

As discussed above, the inventors have identified a number of different scenarios where the provision of such a means would be advantageous.

Summary

The present invention thus relates to a means for providing point-of-use purification of liquid compositions, especially compositions for oral administration. In particular the present invention relates to a device for purifying and consuming a fluid. In particular, the device can be used to assist in the consumption of a liquid composition for oral administration. More particularly, the device is provided with a means for purification of a fluid and a composition.

Particular aspects and embodiments are set out in the accompanying claims.

Thus, according to a first aspect a device for administration of a composition is provided. According to a first aspect there is provided a device for oral administration of a composition. The device includes a first chamber containing a first solid composition; and a second chamber located adjacent to the first chamber wherein the second chamber contains a second

solid composition each of the first and second chambers comprising an outlet; wherein the first and second chambers are separated by at least one filter. The filter has a permeability to allow the passage of a fluid from the first chamber to the second chamber such that the fluid may flow into the first chamber via the outlet in the first chamber, through the filter into the second chamber and out of the device via the outlet in the second chamber. The outlet in the first chamber is arranged to receive a fluid and wherein the outlet in the second chamber is arranged for oral application of suction to the device.

Thus a device is provided that advantageously assists with dispensing and/or administering two different compositions. Those compositions might be incompatible, e.g. they might influence each other during storage and/or transport and thus their concentration and/or activity might be lowered or their integrity (e.g. chemical and/or physical structure) changed. The device prevents the two different compositions from reacting with one another by separating them by means of a filter. In this manner each composition can be separately dispensed or administered. In this example a first composition is dispensed from the device by pouring it out of the chamber via the outlet. In most examples the first composition is poured into a fluid. The second composition can then be administered by orally applying suction to the other outlet thus the user can suck the fluid containing the first composition and the second composition up through the device thereby administering both compositions to the user. In an alternative example the second composition may be dispensed by pouring it out of the device into a container of fluid which is then consumed by the user.

The filter is configured to allow passage of fluid through the device. Thus fluid containing a composition in a container can be administered by orally applying suction to the device. Whilst also keeping the two compositions apart when not in use, the filter also advantageously retains any precipitate contained in the fluid in the device thereby removing debris from the fluid.

A pre-filter may be located adjacent to the filter. This allows for staged filtering of precipitate or debris from the device.

In an alternative example a pre-filter may be separated from the filter by a predetermined distance thereby forming a third chamber between the pre-filter and the filter. This allows for staged filtering of precipitate or debris whilst also providing a third chamber that is separate from the first and second chambers if a third composition required.

The pre-filter may have a higher porosity than the filter. In this disclosure porosity is used to define the size of the holes in the filter and thus the size of debris that can be filtered out. In this example fluid being dispensed passes through the pre-filter which filters out large debris or precipitate and then passes through a filter that filters out small debris or precipitate. Thus
5 an efficient filter of the fluid can be achieved.

At least one of the pre-filter and the filter may be coated with silver. The silver coating provides purification means thus all fluid that is dispensed through the filter is further purified. This provides significant advantages in countries where clean drinking water is in short supply. Either the filter or the pre-filter may be coated with silver or silver ions.
10 However it will be appreciated that if only one filter is to be coated the last filter the fluid is to pass through i.e. the filter will be preferable since at this stage most debris will have been filtered out thereby leading to more efficient purification of the liquid.

The cross sectional area of the pre-filter and/or filter may substantially correspond to the inner cross-sectional area of the device. Thus the filter and/or the pre-filter completely separates
15 the different chambers formed in the device.

In some examples at least one of the pre-filter and the filter may be arranged to move axially by a predetermined amount within the device. In these examples upon application of suction to the device the filter is able to move from a lower position to an upper position within the device. This can be a useful indicator as to whether a composition has been completely
20 dispensed.

A portion of the device may be provided with a reduced cross-sectional area in order to limit movement of the pre-filter or filter. In some examples the portion of the device is tapered, in other examples the portion of the device comprises a ridge arranged around the inner circumference of the device so as to limit movement of the pre-filter or filter. In a still further
25 example the portion of the device comprises a plurality of protrusions arranged around the inner circumference of the device so as to limit movement of the pre-filter or filter. Advantageously the reduced cross sectional area prevents the filter from being sucked out of the device upon application of suction to the device and thus the risk of swallowing or choking on the filter is removed.

Each of the outlets may include a removable seal associated with that outlet wherein the seal is arranged to prevent contamination of the device. One or both of the seals may include a cap and/or a membrane. In another example each of the seals may include a cap and membrane extending across the outlet. Prior to use it is important that the device is kept clean and sterile to reduce the possibility of any external contamination. The provision of a seal in the form of a cap and/or membrane at each of the outlets assists in maintaining the sterility of the device and also retains the compositions in the device. A membrane is provided to prevent contamination of the device whilst a cap may be provided in order to protect the membrane. The membrane may be for example a foil or plastic seal covering the relevant outlet. Alternatively a cap itself may be sufficient to prevent contamination of the device. The cap may be a plastic cap or may be formed of any other suitable material.

In some examples the device includes a detachable chamber located adjacent to one of the seals. Detachable chamber means that at least part of the chamber could be detached (.i.e either the entire chamber could be detached or a part of it could be detached while a portion of the chamber is still associated with the remaining device). The detachable chamber may be attached to the device via a frangible portion or alternatively a perforated or grooved portion. The detachable chamber may include an outlet and further may include a seal associated with the outlet. A composition may be provided in the detachable chamber. Advantageously a further option for an additional chamber is provided that allows for an additional composition to be provided in the device whilst being kept separate from the other compositions. This may have particular advantages where a drug needs to be administered in addition to oral rehydration therapy.

The device and the detachable chamber may be in the form of a tube. In this manner a device in the form of a drinking straw may be provided. Thus a device that is a convenient size and is easy to use is provided.

A plurality of holes may be provided in one of the first and second chambers adjacent to one of the outlets. This assists in allowing fluid to enter the relevant chamber and be administered through the device. Additionally if one of the outlet or the holes becomes blocked by debris, the fluid can still enter the device and thus the device is still usable.

The device may be formed of glass, metal, ceramic, carbon fibre, laminated cardboard e.g. plastic coated cardboard or plastic. The device may be formed of a transparent or translucent material thus allowing the user to see whether the composition has been dispensed or not.

One of the first and second compositions may include a sterilizing agent (disinfectant) alone,
5 or a sterilizing agent (disinfectant) in combination with one or more of: a flocculant or another sterilization or purification agent, or a combination thereof. In this manner contaminated fluid can be treated to render it potable before it is administered to the user.

The other of the first and second compositions may include: oral rehydration therapy components, one or more medicaments for treating gastrointestinal infections, isotonic drink
10 components or energy drink components, dietary supplements such as vitamins, minerals, probiotics and/or prebiotics, or a sterilization or purification agent. Thus oral rehydration therapy can be administered to the user whilst minimising the risk of infection due to contaminated water. This provides significant advantages in the developing countries where frequently the only water available is not suitable for consumption.

15

The first composition may include a sterilizing agent (disinfectant) in combination with a flocculant and the second composition may include an oral rehydration therapy component. The oral rehydration component may include at least one of a carbohydrate and/or at least one electrolyte and optionally one or more pharmaceutically acceptable excipients.

20

The oral rehydration component may be water-soluble at ambient temperature. In this disclosure ambient temperature is defined as between 15 and 30 degrees centigrade. By providing an oral rehydration component that is water soluble at ambient temperature, the oral rehydration component may advantageously dissolve in the fluid as the fluid is sucked through the device or may be poured into the fluid for dissolution therein. Thus
25 administration of the oral rehydration component is facilitated.

The oral rehydration component may include sodium chloride and glucose and optionally in combination with one or more selected from the group consisting of: sodium bicarbonate, potassium bicarbonate, and trisodium citrate dihydrate.

30

One of the compositions may be in the form of a tablet. In alternative examples one of the compositions may be in the form of granules or powder. Thus the composition is

conveniently provided in a form that is suitable for dissolution or dispersion in aqueous liquid or fluid. Preferably the fluid is an aqueous liquid substantially comprising water.

According to a further example there is provided a device for orally administering a composition including: a tube; a cap associated with each end of the tube wherein each cap is arranged to seal that end of the tube; and a filter located across the interior of the tube. A composition is provided in the tube between the filter and one end of the tube and a second composition is provided in the tube between the filter and the opposing end of the tube.

According to a further example there is provided an oral medicament delivery device including an elongate body having an inlet at a first end and an outlet at a second opposing end, the elongate body containing at least one internally located filter separating the inside of the body into a first chamber associated with the inlet and a second chamber associated with the outlet, and wherein a composition comprising a disinfectant is contained in said first chamber and a composition comprising a medicament is contained in said second chamber and isolated from said first chamber by the at least one filter.

Description of Drawings

The present teachings will now be described by way of example only with reference to the following figures in which like parts are depicted by like reference numerals:

Figure 1 illustrates a cross sectional view of a device according to a first embodiment;

Figures 2A-2C illustrate the device illustrated in Figure 1 in use;

Figure 3 illustrates a second embodiment;

Figure 4 illustrates a third embodiment;

Figures 5A-D illustrate the device illustrated in Figure 4 in use;

Figure 6 illustrates a fourth embodiment;

Figures 7A-7D illustrate the device illustrated in Figure 6 in use;

Figure 8 illustrates a modification of before-mentioned embodiments with movable filter.

While the invention is susceptible to various modifications and alternative forms, specific embodiments are shown by way of example in the drawings and are herein described in detail.

- 5 It should be understood, however, that the drawings and detailed description of the specific embodiments are not intended to limit the invention to the particular forms disclosed. On the contrary, the invention is covering all modifications, equivalents and alternatives falling within the spirit and the scope of the present invention as defined by the appended claims.

10 Detailed Description

Figure 1 illustrates a device (1) for dispensing a composition. The device (1) is particularly intended for use in dispensing purified rehydration therapy.

- 15 The device (1) is in the form of a hollow cylinder or tube (2). Each end of the tube (2) has a cap (3A, 3B) covering the end thereby preventing ingress of contaminants to the device (1). The tube (2) has a filter (4) located inside it thereby separating the tube (2) into first (5) and second (6) chambers. A first composition (7) is provided in the first chamber (5) and a second composition (8) is provided in the second chamber (6). In one example the first
20 composition (7) includes a disinfectant and a flocculent and the second composition (8) includes an oral rehydration component.

- In a preferred embodiment the device (1) is the approximate size and shape of a drinking straw and configured for oral administration of a composition. Thus the size of the device is
25 determined by the final use of the device. The device is therefore configured to be used in conjunction with relatively small volumes of fluid. In some examples the amount of each composition (7, 8) included in the device (1) is sufficient for use with 100ml-1000ml of fluid. In some examples a range of devices may be provided each containing the amount of composition (7, 8) required for use with a certain volume of fluid. For example a device for
30 use with 250ml of fluid may be provided. In an alternative example a device may be provided for use with 500ml of fluid. In each device the amount of each composition is the exact amount required for use with the particular volume of fluid. In this manner no excess

composition is provided and there is no risk of a shortfall in composition leading to some fluid being untreated.

In any aspect and embodiment of the present invention, the first composition (7) may
5 comprise a sterilization agent (disinfectant) to treat contaminated liquid, rendering it safe for consumption. Examples of suitable disinfectants include calcium hypochlorite, sodium hypochlorite, colloidal silver, silver compounds such as silver sulfate, silver chloride, sodium/silver chloride complex (AgNaCl_2), silver carbonate, silver fluoride, silver benzoate, silver(I) oxide and silver(II) oxide, tetraglycine hydroperiodide, halazone {4-
10 [(dichloroamino)sulfonyl]-benzoic acid}, sodium dichloroisocyanurate. Preferred disinfectants include colloidal silver, silver nitrate, silver sulfate, silver chloride, sodium/silver chloride complex (AgNaCl_2), silver carbonate, silver fluoride, silver benzoate, silver(I) oxide and silver(II) oxide, and preferably wherein the disinfectant is AgNaCl_2 . Particularly hypochlorite salts such as calcium hypochlorite or sodium hypochlorite are
15 selected.

The first composition (7) may further comprise a flocculant to treat contaminated liquids and are used to increase the efficiency of settling, clarification, filtration and centrifugation operations. A flocculant is a substance which causes fine particles suspended in liquids to
20 agglomerate. The agglomerates can then be removed by filtration which would not be possible with the un-agglomerated fine particles. Flocculants consist of various molecular weight anionic, nonionic and cationic polymers. Mainly used are flocculants from three groups, mineral flocculants e.g. activated silica, colloidal clays (for example hydrated aluminium silicate (bentonite PhEur 6.4)), metallic hydroxides, natural flocculants e.g. starch
25 derivatives, polysaccharides, alginates and synthetic flocculants e.g. polyacrylamides, polyethylenes, polyamines, sulfonated compounds. Examples of suitable flocculants include but are not limited to alum, aluminium chlorohydrate, aluminium sulphate, calcium oxide, calcium hydroxide, sodium hydroxide, iron(II) sulphate (ferrous sulphate), iron(III) chloride (ferric chloride), polyacrylamide, polydiallyldimethylammonium chloride (polyDADMAC),
30 sodium aluminate, sodium silicate. Furthermore numerous natural products can be used as flocculants including but not limited to Chitosan, Isinglass, Moringa oleifera seeds (Horseradish Tree), Gelatine, Strychnos potatorum seeds (Nirmali nut tree), Guar gum, Alginates (brown seaweed extracts), natural starches, anionic oxidized starches, amine treated

cationic starches, pregelatinized starch, corn starch, potato starch. Preferably the flocculant is bentonite, ferric sulphate or guar gum, more preferably the flocculant is bentonite or ferric sulphate.

- 5 In a further preferred embodiment the first composition comprises a disinfectant and a flocculant and the second composition comprises an oral rehydration composition, especially the disinfectants, flocculants and oral rehydration composition as described herein.

10 Preferably the first composition comprises one or more disinfectant including but not limited to calcium hypochlorite, sodium hypochlorite or AgNaCl_2 , and one or more flocculant including but not limited to bentonite, starch derivatives, alginates, natural gums, ferric sulphate. Preferably the second composition comprises one or more carbohydrates, one or more electrolytes including but not limited to sodium chloride, sodium bicarbonate or trisodium citrate dihydrate and potassium bicarbonate. More preferably the second
15 composition comprises anhydrous Glucose, sodium chloride, trisodium citrate dihydrate and potassium bicarbonate.

In any aspect and embodiment of the present invention, the second composition (8) may include a medicament (such as components for oral rehydration therapy for treating, e.g.,
20 dehydration due to diarrhoea and/or vomiting, or for treating gastrointestinal infections such as an antibiotic), components of isotonic drinks or energy drinks, dietary supplements such as vitamins, minerals, probiotics and/or prebiotics, or a combination thereof. Thus the device may be used to administer a composition for oral rehydration therapy whilst minimising the risk of reinfection due to contaminated water. This provides significant advantages in the
25 developing countries where frequently the only water available is not suitable for consumption.

Oral rehydration compositions in the form of a reconstitutable solid are known and typically comprise at least one carbohydrate and at least one electrolyte. The carbohydrate of the oral
30 rehydration composition typically comprises at least one sugar, which is preferably selected from the group consisting of: glucose, fructose, sucrose or dextrose and mixtures thereof. The electrolyte component of the oral rehydration composition preferably comprises one or more of: sodium, potassium, chloride and bicarbonate and combinations thereof, and preferably

comprises sodium chloride. Other electrolyte components may be included. For example, the electrolyte may further comprise one or more of calcium, magnesium, and hydrogen carbonate (bicarbonate). Preferably the carbohydrate component comprises glucose and/or sucrose, and more preferably is glucose. In its simplest form, the oral rehydration components of the second composition comprise a carbohydrate, such as a sugar (preferably glucose) and sodium chloride. Oral rehydration compositions comprising glucose, sodium chloride, sodium bicarbonate, and potassium chloride may also be used. Alternatively the oral rehydration composition may comprise sodium chloride, glucose, potassium chloride and trisodium citrate dihydrate. It will be appreciated that any of the oral rehydration compositions described herein may be used in the device of the present invention.

An effective oral rehydration composition is an aqueous mixture that typically comprises from:

- 35 to 90 milliequivalents per litre (meq/l or mmol/l), preferably 60-90 meq/l of sodium
- 1.2 to 3.0 weight percent (wt%) of a carbohydrate,

and having a total osmolarity of from 200-311 meq/l.

In one embodiment the oral rehydration composition consists of the following components as a dry powder, to be used for one litre of aqueous solution:

Component	g
Glucose, anhydrous	20
Sodium chloride	3.5
Sodium bicarbonate	2.5
Potassium chloride	1.5
	27.5

(Table 1)

The following concentrations of the actives (mmol/l) are obtained:

	Glucose	111
	Sodium	90
5	Chloride	80
	Bicarbonate	30
	Potassium	20

In some cases, the sodium bicarbonate may be replaced by 2.9 g of trisodium citrate dihydrate, which improves the shelf life of the composition.

In another embodiment oral rehydration compositions having reduced osmolarity (245-260 mmol/l compared with the osmolarity of normal blood plasma of around 275 to 295 meq/l) due to reduced glucose and sodium chloride concentrations, which avoids the effects of hypertonicity on fluid absorption.

Component	g		mmol/l	
			Reduced osmolarity oral rehydration composition	Standard oral rehydration composition
Sodium chloride	2.6	Sodium	75	90
		Chloride	65	80
Glucose, anhydrous	13.5	Glucose, anhydrous	75	111
Potassium chloride	1.5	Potassium	20	20
Trisodium citrate dihydrate	2.9	Citrate	10	10
Total	20.5		245	311

(Table 2)

Advantageously, according to any embodiment of the present invention, the second composition may further include one or more active agents for treating or ameliorating

diarrhoea or diarrhoea symptoms and/or vomiting, preferably selected from the group consisting of zinc salts (such as zinc sulfate monohydrate, zinc citrate, and zinc oxide), probiotics (for example *Saccharomyces boulardii*), prebiotics (for example inulin, Pelargonium sidoides extract), an antibiotic, an antispasmodic (such as loperamide), an
5 antiemetic (such as metoclopramide), activated charcoal, kaolin, montmorillonite clay, bentonite clay, bismuth subsalicylate, and Crofelemer (Fulyzaq), a GI protective agent (for example, an H₂ receptor antagonist such as cimetidine and ranitidine, a proton pump inhibitor such as omeprazole, esomeprazole and pantoprazole).

10 The second composition may also comprise other components and/or pharmaceutically acceptable excipients, dietary supplements such as vitamin C, or other vitamins, an amino acid, a di-peptide and/or an oligo-peptide. Suitable pharmaceutically acceptable excipients include a buffering agent, a taste-masking agent, a sweetener, a flavouring agent, a colourant, and a preservative.

15

The second composition is soluble in fluid, but could also form a fine suspension or dispersion which passes through the filter(s) of the device. Both the first and second compositions are provided in a form that is suitable for dissolution or dispersion in aqueous liquid or water. Conveniently, the first composition may be in the form of a powder, granule,
20 tablet or a capsule. The second composition may be in the form of a powder or granule. For example, the second composition may be in the form of granules. Thus, when the granules come into contact with fluid, they react to release hydrating nutrients into the water thereby providing a clean rehydration liquid for the treatment of illness.

25 Dissolution or dispersion of the composition may be aided by the inclusion of an effervescent composition, to form an effervescent tablet or effervescent granules. Suitable effervescent systems are well known in pharmaceutical formulations. Typically, the effervescence is provided by the reaction of a pharmaceutically acceptable acid with a pharmaceutically acceptable base. Suitable acids include citric, malic, tartaric and fumaric acids. Citric and
30 malic acids are preferred, with citric acid being particularly preferred. Suitable bases include alkali metal bicarbonates and carbonates – e.g. sodium bicarbonate, potassium bicarbonate, sodium carbonate and potassium carbonate. Sodium or potassium bicarbonate, and particular

sodium bicarbonate are preferred. Citric acid in combination with sodium bicarbonate is a preferred effervescent system.

In the case where the first composition is in the form of a tablet, and particularly with effervescent tablets, the composition may comprise a binder in order to provide acceptable hardness and to enable processing and handling of the tablets. Suitable binders include dextrose, xylitol, lactose, sorbitol, povidone, modified cellulose and natural or modified starch.

The device (1) is predominantly formed of metal, although devices formed of other materials, for example hard or soft plastic (such as PE, PP, PHA, PHD, PET, PBT), ceramic, glass, carbon fibre or natural and/or synthetic fabrics, cardboard coated with wax or a plastic film, are also envisaged. The skilled person will be aware of other suitable materials used for, e.g. manufacture of drinking straws. Other example materials include laminated or plastic coated cardboard such as that commonly used for drinks cartons (e.g. the material marketed under the trade mark Tetra-Pak). The material used may also be clear or tinted if the composition contained in the device is photosensitive.

The filter (4) is typically formed of metal but filters formed of other materials such as hard or soft plastics, ceramic, glass, carbon fibre or natural and/or synthetic fabrics may also be used. For example a charcoal or bentonite filter could be used. In some examples the filter (4) is coated with silver or silver ions.

The size of the filter (4) in the device (1) is selected depending on the intended use of the device (1) and the material to be filtered out of the fluid. For example, to remove natural sediment and particles which may be present in water from, e.g. rivers, filter sizes of from about 5 to about 100 microns, preferably about 5 to about 50 microns and more preferably about 15 to about 25 microns may be used. In other applications, the filter (4) may be used to remove bacteria, and in this case, filter sizes of about 0.2 to about 3 microns, preferably about 0.5 to about 2 microns and more preferably about 0.5 to about 1.5 microns may be used. A 1 micron filter generally can remove most (about 99.9%) bacteria.

Thus, preferably, the filter size may be from 5 to about 100 microns, about 5 to about 50 microns, about 15 to about 25 microns, about 20 microns, about 0.2 to about 3 microns, about 0.5 to about 2 microns, about 0.5 to about 1.5 microns or about 1 micron.

- 5 The caps (3A, 3B) may be made from the same material as the device (1) or alternatively may be made from a different material. In some examples each cap (3A, 3B) is screwed onto the end of the device (1). In other examples each cap (3A, 3B) is simply pressed over the end of the device (1).
- 10 Figures 2A-2B illustrate how the device (1) may be used. In this example it is assumed that the first composition (7) comprises a disinfectant and a flocculent and the second composition (8) comprises an oral rehydration component. Firstly in Figure 2A the cap (3B) is removed from the end of the device (1) containing the disinfectant. The first composition (7) is then poured into contaminated fluid (9). As previously discussed the device is sized to
- 15 accommodate sufficient composition for use with 100-1000ml of contaminated fluid. In certain examples the device is arranged to accommodate the required amount of disinfectant to purify 200ml to 500 ml of contaminated fluid, preferably 200ml, 250ml, 330ml, 375ml or 500ml, more preferably 250ml or 330 ml.
- 20 The fluid is left for a predetermined period of time and optionally agitated by, for example stirring or shaking, to allow the disinfectant to react with the contaminated water to purify it. This reaction produces a precipitate. The time taken for this reaction to occur depends on the amount of contaminants in the contaminated water and the strength and/or type of the disinfectant. For example, disinfection using calcium hypochlorite will take approximately
- 25 20-30 minutes whereas disinfection using silver ions will take significantly longer. Typically the amount of time for the reactions to occur is up to 120 minutes. In other examples the amount of time for the reactions to occur is between 10 and 60 minutes. In some examples the amount of time for the reactions to occur is between 20-30 minutes.
- 30 After the predetermined period of time has elapsed, the open end of the device is inserted into the now disinfected fluid and the other cap (3A) is removed as illustrated in Figure 2B. The user then drinks the fluid by applying oral suction to the end of the device (1) protruding from the contaminated fluid. As fluid is sucked up through the device (1) it is filtered by the filter

(4) thereby removing precipitate from the now disinfected water. Subsequently as the fluid passes through the second chamber (6) of the device (1) the second composition (8) provided in the second chamber (6) dissolves into the fluid thus the fluid that is consumed is not only potable water but also provides rehydration therapy to the user.

5

The second composition is preferably soluble in water at a temperature between 15 and 30 degrees centigrade. In some examples the second composition is soluble at a temperature between 18 and 28 degrees centigrade. In further examples the second composition is soluble at a temperature of 20-25 degrees centigrade. In the present disclosure ambient temperature is considered to be between 15 and 30 degrees centigrade.

10

The device is arranged to contain enough rehydration composition that can be dissolved in the specific amount of fluid that can be rendered potable by the amount of disinfectant contained in the device.

15

In an alternative example illustrated in Figure 2C, once the predetermined period of time has elapsed, the remaining cap (3A) is removed and the second composition (8) is poured out of the second chamber (6) into the now disinfected water. The device (1) is then inserted into the disinfected fluid containing rehydration therapy and the user drinks the fluid by applying suction to the end of the device (1) protruding from the fluid. In this manner the fluid is sucked up through the device (1) and is filtered by the filter (4) before it is consumed by the user.

20

Figure 3 illustrates an alternative embodiment to the device described with reference to Figure 1. In this example a pre-filter (4B) is provided adjacent to the filter (4A) each other i.e. arranged in series. The pre-filter (4B) is located such that when suction is applied to the device, the fluid first passes through the pre-filter (4B) and subsequently the filter (4A). In the present disclosure a pre-filter (4B) is defined as a filter arranged to capture larger particles before they enter the filter (4A). The pre-filter (4B) is used to filter out large debris e.g. sand, mud and the filter (4A) is used to filter out smaller debris e.g. precipitate, microorganisms such as bacteria. Thus, in one example a pre-filter (4B) of about 5 to about 100 microns, preferably about 5 to about 50 microns, more preferably about 15 to about 25 microns and most preferably about 20 microns may be used, and a filter (4A) of about 0.2 to about 3

25

30

microns, preferably about 0.5 to about 2 microns, more preferably about 0.5 to about 1.5 microns, and most preferably about 1 micron may be used. In an alternative example a pre-filter (4B) of approximately 50-100 microns may be used in conjunction with a filter (4A) of approximately 15-25 microns. Alternatively a plurality of filters and pre-filters may be used,
5 each having a successively smaller pore size.

Additionally in this embodiment the device (10) includes a number of small holes (9) arranged around the circumference of the first chamber (5) containing the disinfectant. The holes (9) are covered by the cap (3B) whilst the device (1) is in storage. These additional
10 holes can also be present in other embodiments of the device, for example the embodiments illustrated in Figures 1 and 6.

This alternative embodiment of the device is used in the same manner as described above with respect to Figures 2A and 2B. However in this example the additional holes (9) located in the
15 first chamber (5) of the device (10) assist in allowing fluid to be dispensed through the device (10). As discussed above the reaction of the disinfectant with the contaminated water produces a precipitate which may block the end of the device (10). Whilst the user will be encouraged to place the end of the device (10) in the disinfected fluid above any precipitate or sediment formed, in the event that sediment enters the device (10) and blocks the end of the
20 device (10), the holes (9) arranged around the circumference of the first chamber (5) provide an alternative route of entry for the disinfected fluid. Thus even if the end of the device (10) is blocked by precipitate, fluid can still be dispensed through the device (10).

Alternatively as described with reference to Figure 2C the composition contained in the
25 second chamber (6) may be poured into the fluid and dissolved before the fluid is consumed via the device (10).

Figure 4 illustrates a further alternative embodiment. In this embodiment a third chamber (21) is provided at the base of the device (20) that is at least in part detachable from the rest of
30 the device (20). In the illustrated example the entire chamber is detachable from the rest of the device. However in other examples only a portion of the chamber may be detachable from the rest of the device. In one example only the bottom portion of the third chamber is

detachable from the rest of the device thus leaving the upper portion of the third chamber attached to the rest of the device.

In the illustrated example the third chamber (21) is attached to the rest of the device (20) via a frangible portion. This may be a perforated portion or a groove. Thus the third chamber (21) may be removed from the device (20) by applying a torsional force to the third chamber (21) thereby causing the frangible portion to break completely thereby removing the third chamber (21) from the rest of the device (20). In an alternative example the third chamber may be screwed to the cap by means of a screw thread. In an alternative example the third chamber may be attached to the rest of the device by means of a double ended bung.

A plug or seal (22) is provided at the base of the first chamber (5) in order to retain a composition in the first chamber (5) in the device (20). Thus this embodiment may be used where three different compositions are required. For example a disinfectant (7) may be provided in the third chamber (21), a pharmaceutical or drug (23) may be provided in the first chamber (5) and an oral rehydration component (8) may be provided in the second chamber (6). In an alternative embodiment a separate flocculant to the disinfectant may be required and thus the device may contain in the three chambers: a disinfectant (7), a flocculant (23) and an oral rehydration component (8).

Figures 5A-5D illustrate how the device of Figure 4 is used. In Figure 5A the cap 3B on the third chamber (21) is removed and the composition located in the third chamber (21) is poured into the contaminated fluid. As described with reference to Figure 2A this composition is then left for a predetermined period of time to react with the contaminated fluid. Once the predetermined period of time has elapsed, a torsional force is applied to the third chamber (21) and this is removed as shown in Figure 5B and disposed of to leave the device with only the first (5) and second (6) chambers. The device (20) is then used as described with reference to Figures 2A-2B. The plug or seal (22) covering the end of the first chamber (5) is removed and the composition (23) contained therein is poured into the pre-treated water as shown in Figure 5C. The fluid may need to be left for a further predetermined period of time to allow this composition (23) to react or dissolve into the fluid. This end of the device (20) is then inserted into the fluid and the cap (3A) covering the end of the device (20) extending from the fluid is removed as shown in Figure 5D. The user may

then drink the fluid through the device (20). As the fluid passes through the device (20) the second composition (8) located in the second chamber (6) dissolves into the fluid. Thus the fluid consumed by the user has been in contact with the compositions contained in all three chambers.

5

Alternatively as described with reference to Figure 2C the composition contained in the second chamber (6) may be poured into the fluid and dissolved before the fluid is consumed via the device (20).

10 Figure 6 illustrates a further alternative embodiment. This example is based on the example illustrated in Figure 3. However in the example according to Figure 6, the two filters (4A, 4B) are separated by a predetermined distance thereby forming a third chamber (34). In this example a disinfectant (7) may be provided in the first chamber (5), a further composition e.g. a drug (33) may be provided in the second chamber (6) and an oral rehydration component (8)
15 may be provided in the third chamber (34). Thus a three chamber device is provided as an alternative to the device described with reference to Figure 4.

Figures 7A-7D illustrate the use of the device illustrated in Figure 6. As shown in Figure 7A, firstly the cap (3A) on the first chamber (5) is removed and the disinfectant (7) is poured into
20 the contaminated water and left for a predetermined period of time. In the next step as illustrated in Figure 7B the remaining cap (3B) on the second chamber (6) is removed and as shown in Figure 7C the composition e.g. a drug (33) contained in the second chamber (6) is optionally poured into the now disinfected water. Finally as illustrated in Figure 7D, the device (30) is inserted into the fluid which is consumed by the user via the device (30). As
25 the fluid is passes through the device (30) it is filtered by the pre-filter (4B) before entering the third chamber (34). As the fluid passes through the third chamber (34) the oral rehydration component (8) dissolves into the fluid before it passes out of the third chamber (34) via the filter (4A) and then passes through the rest of the device (30) to the mouth of the user.

30

In the examples described above with reference to Figures 1-7 each of the filters is fixed in position in the device. However in alternative examples the filters are movable within the hollow tube thereby assisting in controlling whether the entire composition has been

dispensed. Such a possibility has been disclosed in WO2004/000264 A1 which is incorporated-by-reference for disclosing the movable filter and any modification of the hollow tube needed therefore. Figure 8 illustrates a movable filter (40) located within the hollow tube (2). The filter is movable in an axial direction of the tube (2) between two locations A and B. In order to retain the filter within this area a circumferential ridge (41) is provided on the inner surface of the hollow tube at each of positions A and B. In an alternative example a plurality of protrusions or lugs are provided at regular intervals around the inner circumference of the hollow tube at positions A and B. In a further alternative example the tube itself is tapered such that the outlet is smaller than the cross sectional area of the filter thereby retaining the filter in the device. Any suitable mean of retaining the filter between the two locations A and B may be used. In preferred examples the retaining means is a means of reducing the inner cross-sectional area of the device at locations A and B.

In use, when suction is applied to one end of the device, the filter moves from position A to position B thereby assisting in transferring the composition in the device through the device. Thus by using this type of filter arrangement it is ensured that the entire composition located in the chamber above the filter is dispensed through the device.

Whilst in the examples described above a cap is used to seal the ends of the device, in alternative examples for all possible embodiments described above a laminate seal may be used to seal the ends of the device. In these examples when the device is ready to be used the seal is peeled away from the device and disposed of.

In the above described examples the second chamber is formed from the same tube as the first chamber and remains attached to the first chamber. However in alternative examples, at least part of the second chamber may be detachable from the first chamber. In some examples only the bottom portion of the second chamber may be detachable from the rest of the device. In other examples the entire second chamber may be detachable from the rest of the device.

In such examples the second chamber may be attached to the rest of the device via a frangible portion in the form of a groove or perforated portion adjacent to the filter. In this manner once the composition has been dispensed from the second chamber, at least part of the second

chamber can be removed by applying a torsional force to the second chamber. A detachable second chamber can be included in any of the embodiments previously described.

Thus a device for assisting in dispensing purified liquid for use in rehydration therapy from contaminated water has been described. Although a number of examples have been described above the invention is not limited to the arrangements illustrated in the Figures and discussed above. Instead the present disclosure is intended to cover all combinations and alternatives that fall within the scope of the appended claims.

The following numbered clauses define various further aspects and features of the present technique:

1. A device for oral administration of a composition, the device comprising:

a first chamber containing a first solid composition; and

a second chamber located adjacent to the first chamber wherein the second

chamber contains a second solid composition, each of the first and second chambers comprising an outlet; wherein the first and second chambers are separated by at least one filter;

wherein the filter has a permeability to allow the passage of a fluid from the first chamber to the second chamber such that the fluid may flow into the first chamber via the outlet in the first chamber, through the filter into the second chamber and out of the device via the outlet in the second chamber;

wherein the outlet in the first chamber is arranged to receive a fluid and wherein the outlet in the second chamber is arranged for oral application of suction to the device and

wherein the first composition comprises a sterilizing agent (disinfectant) and the second composition comprises an oral rehydration therapy component.

2. A device according to clause 1 comprising a pre-filter located adjacent to the filter.

3. A device according to any of clauses 1-2 comprising a pre-filter separated from the filter by a predetermined distance thereby forming a third chamber between the pre-filter and the filter.

4. A device according to clause 2 or clause 3 wherein the pre-filter has a higher porosity than the filter.
5. A device according to any of clauses 2-4 wherein at least one of the pre-filter and the filter is coated with silver.
6. A device according to any of clauses 2-5 where the cross sectional area of the pre-filter and/or filter substantially corresponds to the inner cross-sectional area of the device.
7. A device according to any of clauses 2-6 wherein at least one of the pre-filter and the filter is arranged to move axially by a predetermined amount within the device.
8. A device according to clause 7 wherein a portion of the device is provided with a reduced cross-sectional area in order to limit movement of the pre-filter or filter.
9. A device according to clause 8 wherein a portion of the device is tapered so as to limit movement of the pre-filter or filter.
10. A device according to clause 8 wherein the portion of the device comprises a ridge arranged around the inner circumference of the device so as to limit movement of the pre-filter or filter.
11. A device according to clause 8 where the portion of the device comprises a plurality of protrusions arranged around the inner circumference of the device so as to limit movement of the pre-filter or filter.
12. A device according to any preceding clause wherein each of the outlets comprises a removable seal associated with that outlet wherein the seal is arranged to prevent contamination of the device.
13. A device according to clause 12 wherein one or both of the seals comprises a cap and/or a membrane.
14. A device according to clause 12 or clause 13 wherein each of the seals comprises a cap and membrane extending across the outlet.

15. A device according to any of clauses 12-14 comprising a detachable chamber located adjacent to one of the seals.
- 5 16. A device according to clause 15 wherein the detachable chamber is attached to the device via a frangible portion.
17. A device according to clause 15 or clause 16 wherein the detachable chamber is attached to the device via a perforated portion.
- 10 18. A device according to clause 15 or clause 16 wherein the detachable chamber is attached to the device via a grooved portion.
19. A device according to any one of clauses 15-18 wherein the detachable chamber comprises an outlet.
- 15 20. A device according to clause 19 wherein the detachable chamber comprises a seal associated with the outlet.
21. A device according to any one of clauses 15-20 wherein a composition is provided in the detachable chamber.
- 20 22. A device according to any one of clauses 15-21 wherein the detachable chamber is in the form of a tube.
- 25 23. A device according to any preceding clause wherein the device is in the form of a tube.
24. A device according to any preceding clause wherein a plurality of holes are provided in one of the first and second chambers adjacent to one of the outlets.
- 30 25. A device according to any preceding clause wherein the device is formed of glass, metal, ceramic, carbon fibre, laminated cardboard or plastic.
- 35 26. A device according to any preceding clause wherein one of the first and second compositions comprises a sterilizing agent (disinfectant) alone, or a sterilizing agent

(disinfectant) in combination with one or more of: a flocculant or another sterilization or purification agent, or a combination thereof.

- 5 27. A device according to clause 26 wherein the other of the first and second composition comprises: oral rehydration therapy components, one or more medicaments for treating gastrointestinal infections, isotonic drink components or energy drink components, dietary supplements such as vitamins, minerals, probiotics and/or prebiotics.
- 10 28. A device according to any of clauses 1-25 wherein the first composition comprises a sterilizing agent (disinfectant) in combination with a flocculant and the second composition comprises an oral rehydration therapy component.
- 15 29. A device according to clause 27 or clause 28 wherein the oral rehydration component comprises at least one of a carbohydrate and/or at least one electrolyte, preferably at least one carbohydrate and at least one electrolyte and optionally one or more pharmaceutically acceptable excipients.
- 20 30. A device according to any of clauses 27-29 wherein the oral rehydration component is water-soluble at ambient temperature.
- 25 31. A device according to any of clauses 27-30 wherein the oral rehydration component comprises sodium chloride and glucose and optionally in combination with one or more selected from the group consisting of: sodium bicarbonate, potassium bicarbonate, and trisodium citrate dihydrate.
- 30 32. A device according to any preceding clause wherein the first and/or the second composition is in the form of a tablet.
- 35 33. A device according to any of clauses 1-31 wherein the first and/or second composition is in the form of granules or powder.
34. A device according to any preceding clause wherein at least part of the second chamber is detachable from the device.

35. A device according to clause 34 wherein the second chamber is attached to the device via a frangible portion.

5 36. A device according to clause 35 wherein the second chamber is attached to the device via a perforated or grooved portion.

37. A device for orally administering a composition comprising:

a tube;

10 a cap associated with each end of the tube wherein each cap is arranged to seal that end of the tube; and

a filter located across the interior of the tube

wherein a composition is provided in the tube between the filter and one end of the tube and wherein a second composition is provided in the tube between the filter and the opposing end of the tube.

15

38. An oral medicament delivery device comprising an elongate body having an inlet at a first end and an outlet at a second opposing end, the elongate body containing at least one internally located filter separating the inside of the body into a first chamber associated with the inlet and a second chamber associated with the outlet, and wherein a composition comprising a disinfectant is contained in said first chamber and a composition comprising a medicament is contained in said second chamber and isolated from said first chamber by the at least one filter.

20

25

30

35

26
Claims

1. A device for oral administration of a composition, the device comprising:
a first chamber containing a first solid composition; and
5 a second chamber located adjacent to the first chamber wherein the second chamber contains a second solid composition, each of the first and second chambers comprising an outlet; wherein the first and second chambers are separated by at least one filter;
wherein the filter has a permeability to allow the passage of a fluid from the
10 first chamber to the second chamber such that the fluid may flow into the first chamber via the outlet in the first chamber, through the filter into the second chamber and out of the device via the outlet in the second chamber;
wherein the outlet in the first chamber is arranged to receive a fluid and
wherein the outlet in the second chamber is arranged for oral application of suction to
15 the device and
wherein the first composition comprises a sterilizing agent (disinfectant) and the second composition comprises an oral rehydration therapy component.
2. A device according to claim 1 comprising a pre-filter located adjacent to the filter
20 wherein the pre-filter is optionally separated from the filter by a predetermined distance thereby forming a third chamber between the pre-filter and the filter.
3. A device according to claim 2 wherein the pre-filter has a higher porosity than the
25 filter and optionally wherein at least one of the pre-filter and the filter is coated with silver.
4. A device according to any of claims 2-3 wherein at least one of the pre-filter and the filter is arranged to move axially by a predetermined amount within the device.
- 30 5. A device according to claim 4 wherein a portion of the device is provided with a reduced cross-sectional area in order to limit movement of the pre-filter or filter.
6. A device according to claim 5 wherein a portion of the device is tapered so as to limit movement of the pre-filter or filter and optionally wherein the portion of the device

comprises a ridge or plurality of protrusions arranged around the inner circumference of the device so as to limit movement of the pre-filter or filter.

- 5 7. A device according to any preceding claim wherein each of the outlets comprises a removable seal associated with that outlet wherein the seal is arranged to prevent contamination of the device and optionally wherein one or both of the seals comprises a cap and/or a membrane.
- 10 8. A device according to claim 7 comprising a detachable chamber located adjacent to one of the seals wherein a composition is provided in the detachable chamber and wherein the detachable chamber is optionally attached to the device via a frangible portion, a perforated portion or a grooved portion.
- 15 9. A device according to claim 8 wherein the detachable chamber comprises an outlet and optionally a seal associated with the outlet.
- 20 10. A device according to any preceding claim wherein the first composition comprises a sterilizing agent (disinfectant) in combination with a flocculant and the second composition comprises an oral rehydration therapy component.
- 25 11. A device according to any preceding claim wherein the oral rehydration component comprises at least one of a carbohydrate and/or at least one electrolyte, preferably at least one carbohydrate and at least one electrolyte and optionally one or more pharmaceutically acceptable excipients, and/or wherein the oral rehydration component comprises sodium chloride and glucose and optionally in combination with one or more selected from the group consisting of: sodium bicarbonate, potassium bicarbonate, and trisodium citrate dihydrate.
- 30 12. A device according to any preceding claim wherein the first and/or the second composition is in the form of a tablet, granules or powder.
- 35 13. A device according to any preceding claim wherein the second chamber is at least in part detachable from the device and wherein the second chamber is optionally attached to the device via a frangible portion, a perforated portion or a grooved portion.

14. A device according to claims 1 to 12 wherein a third chamber is provided at the base of the device and wherein the third chamber is optionally attached to the device via a frangible portion, a perforated portion or a grooved portion.
- 5 15. A device according to any preceding claim wherein the device is in the form of a tube, preferably in the form of a drinking straw.

1/6

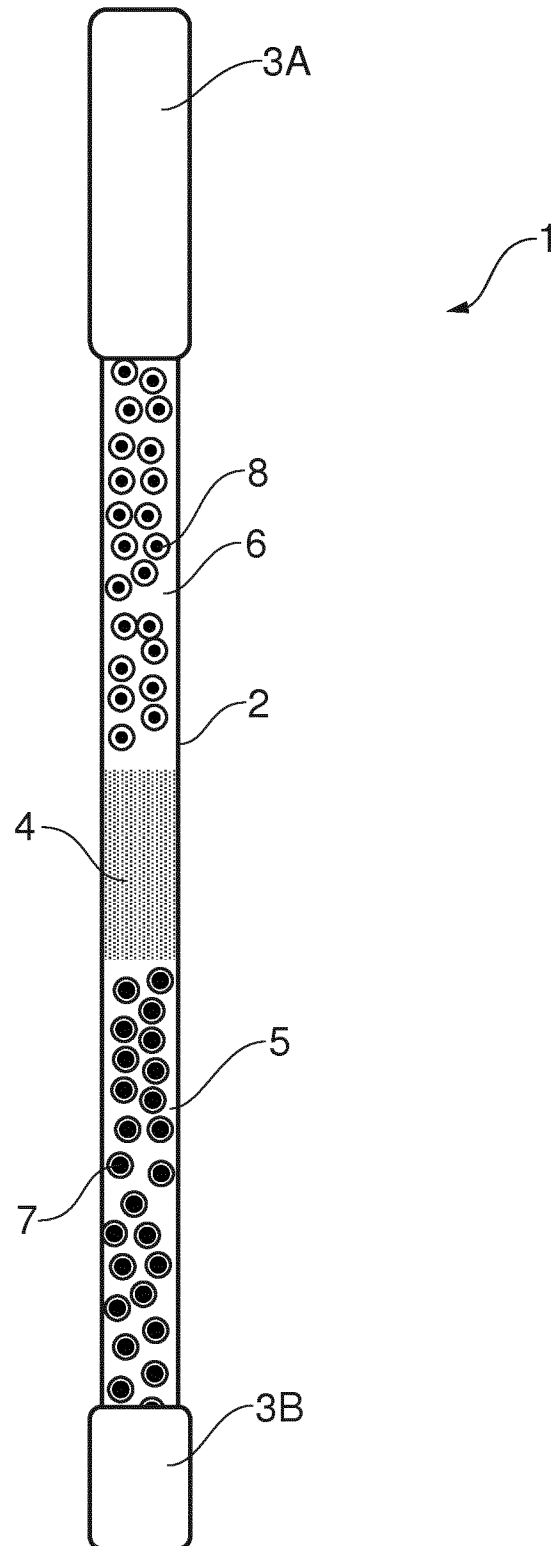


FIG. 1

2/6

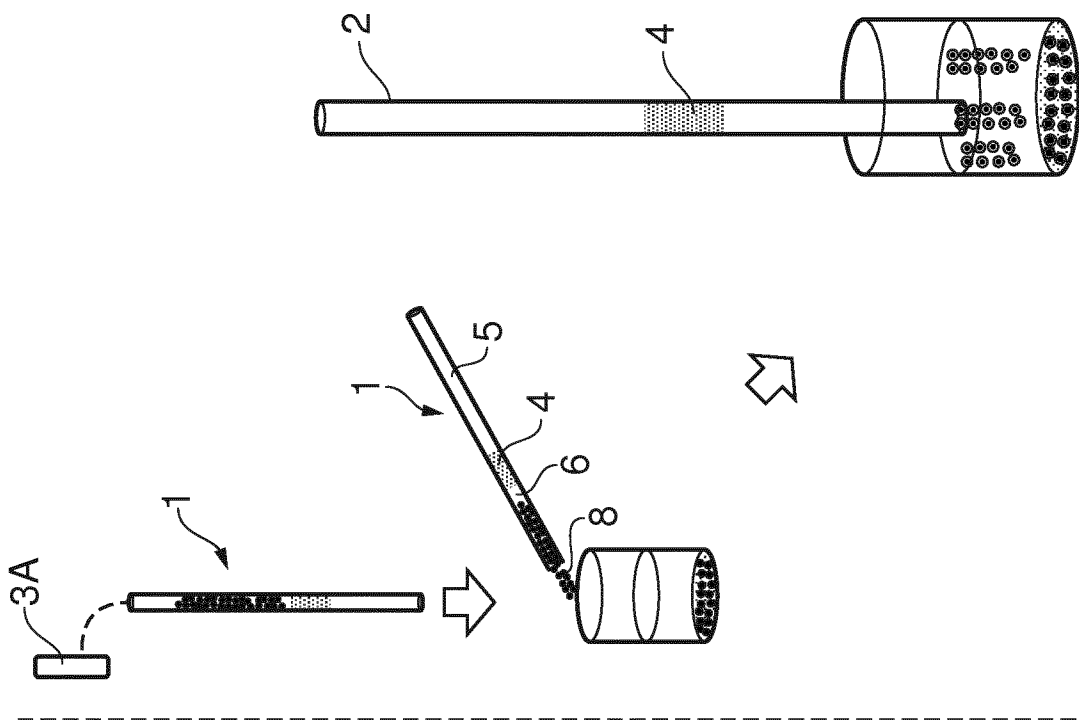


FIG. 2C

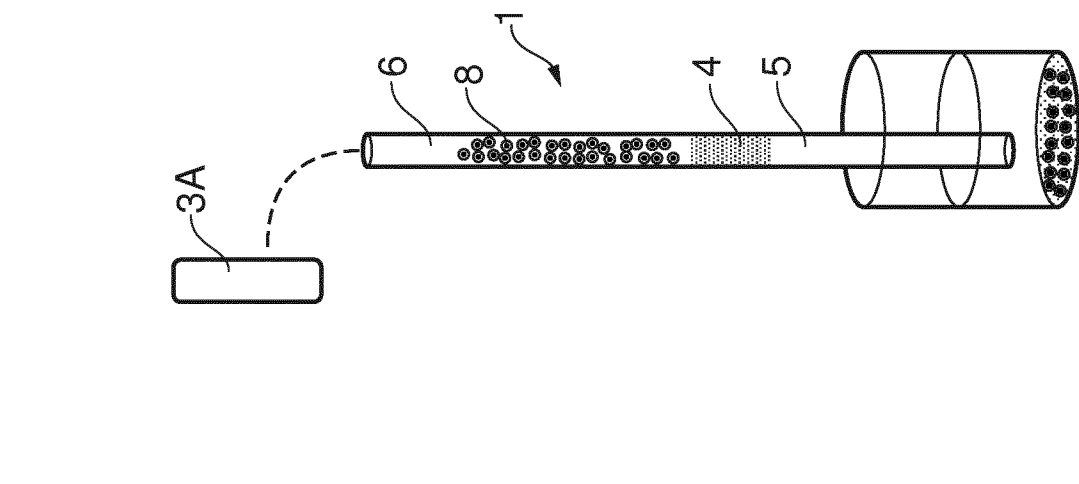


FIG. 2B

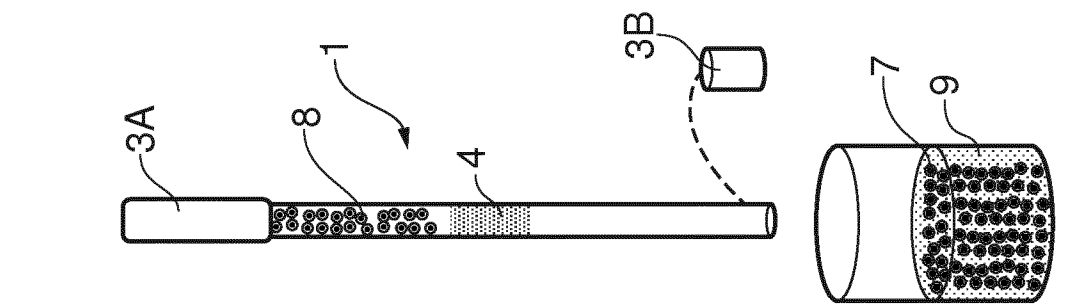


FIG. 2A

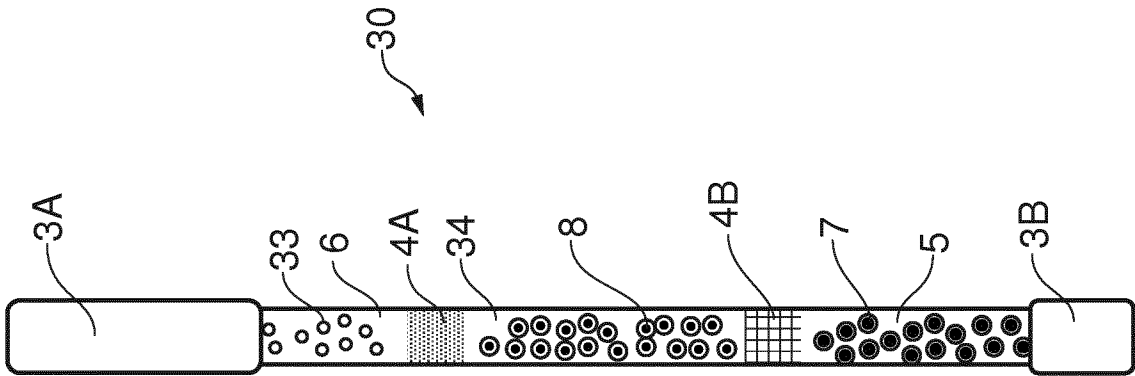


FIG. 6

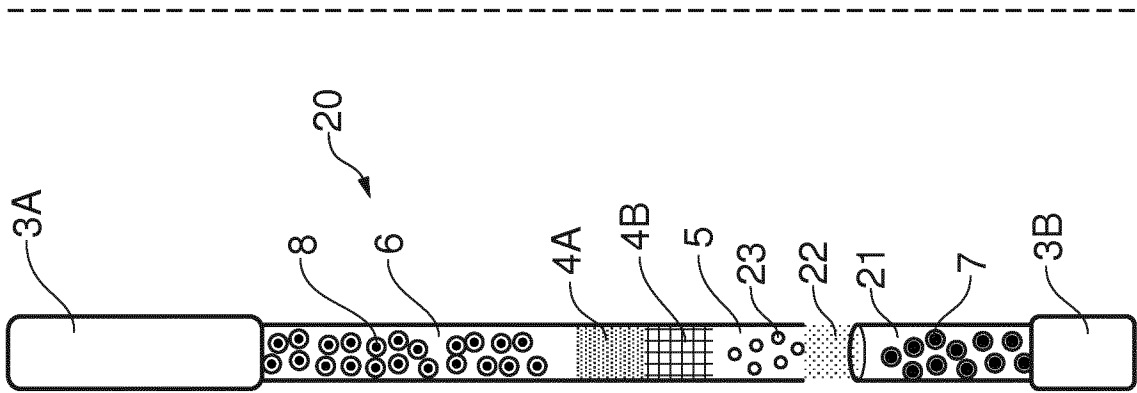


FIG. 4

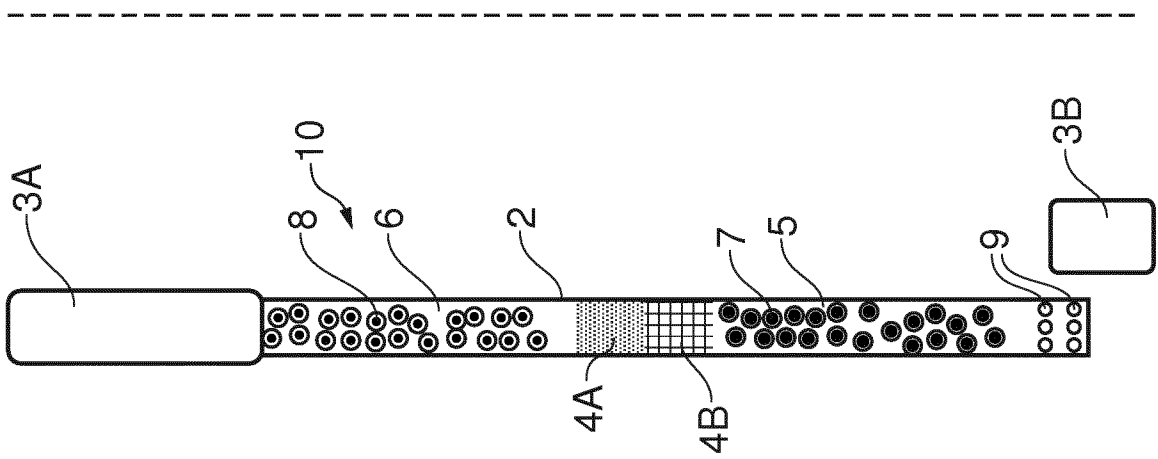
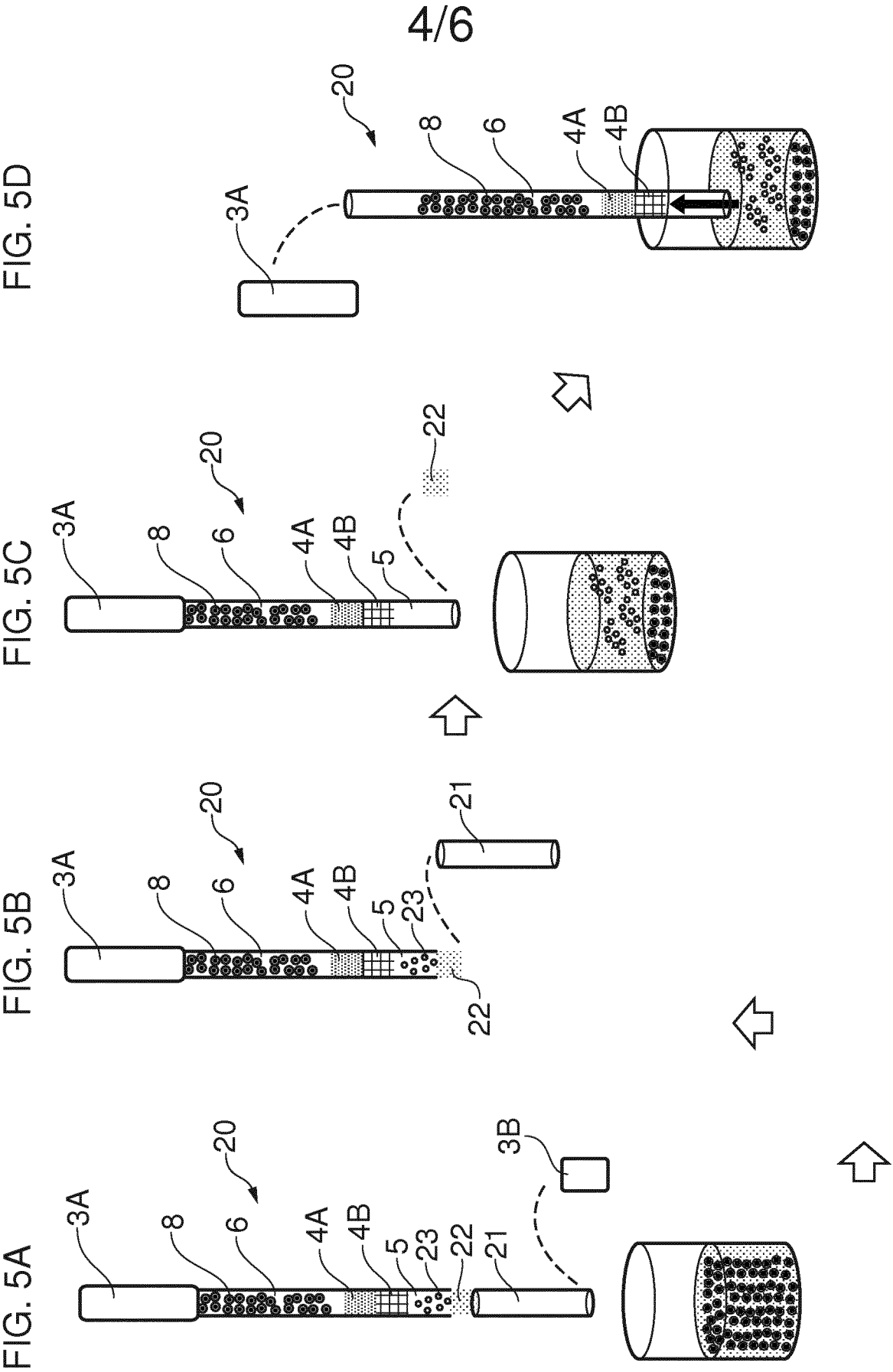


FIG. 3



5/6

FIG. 7D

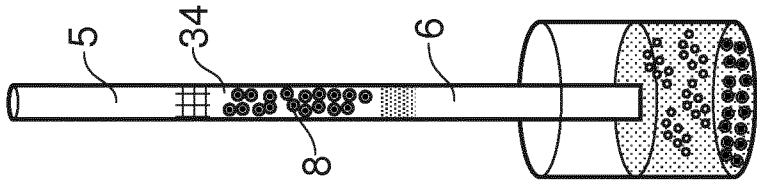


FIG. 7C

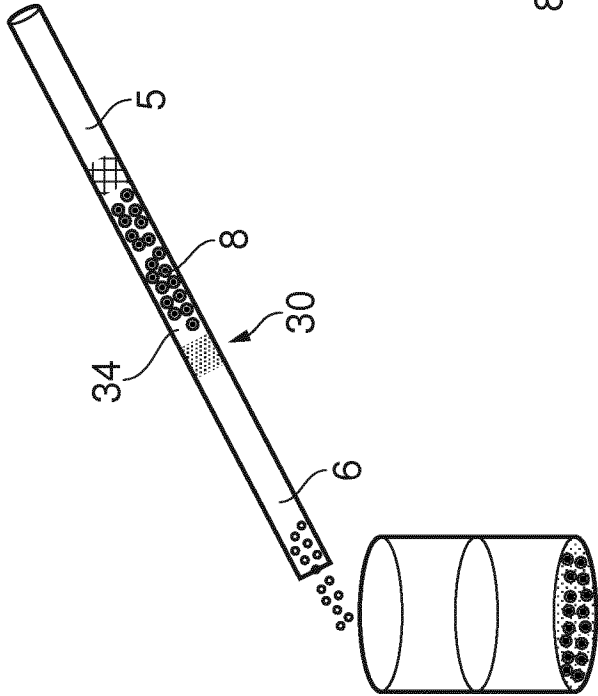


FIG. 7B

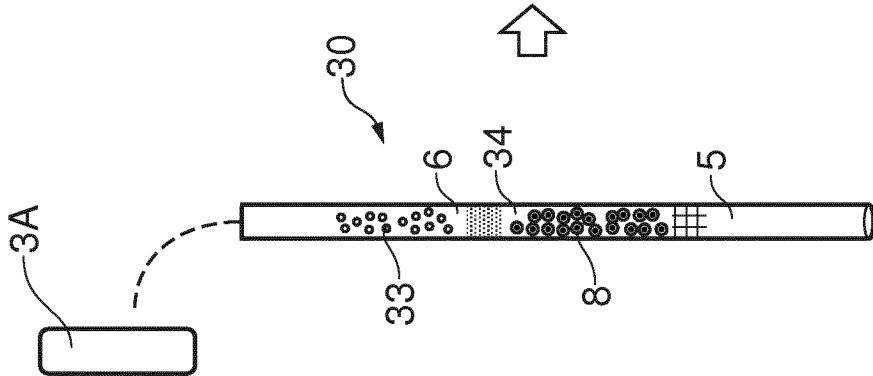
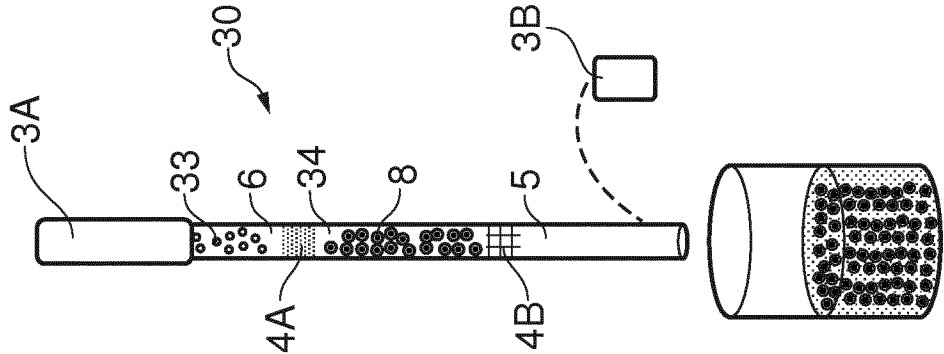


FIG. 7A



6/6

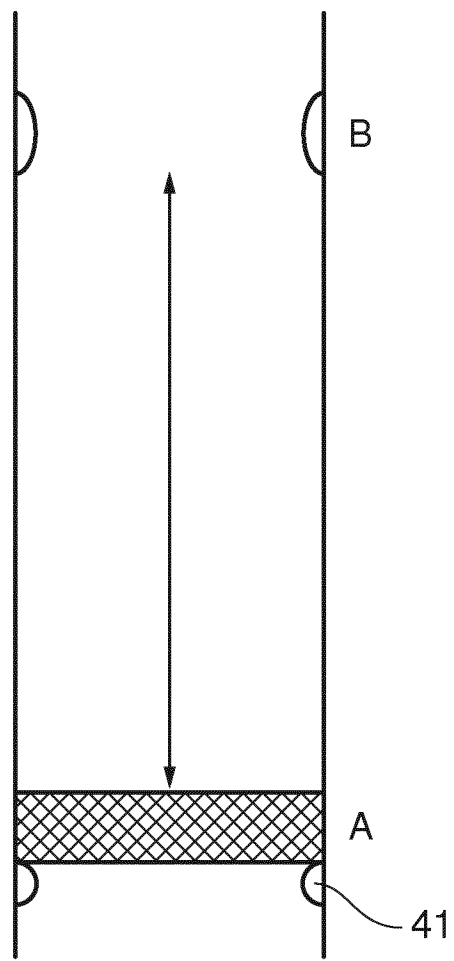


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/054150

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61J7/00 A47G21/18
ADD. C02F1/50 C02F1/68

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C02F A61J A47G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/102002 A1 (O'BRIEN PAUL W [US] ET AL) 29 April 2010 (2010-04-29) paragraphs [0040] - [0046]; claim 4; figure 2	1-15
A	----- CN 2 905 764 Y (DUAN XIAOTONG [CN]) 30 May 2007 (2007-05-30) the whole document	1-15
A	----- AU 2007 229 424 A1 (JOHN SCHEIRS) 15 May 2008 (2008-05-15) the whole document	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search

6 April 2016

Date of mailing of the international search report

15/04/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Liebig, Thomas

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2016/054150

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2010102002	A1	29-04-2010	US 2010102002 A1	29-04-2010
			WO 2010045502 A2	22-04-2010

CN 2905764	Y	30-05-2007	NONE	

AU 2007229424	A1	15-05-2008	NONE	
