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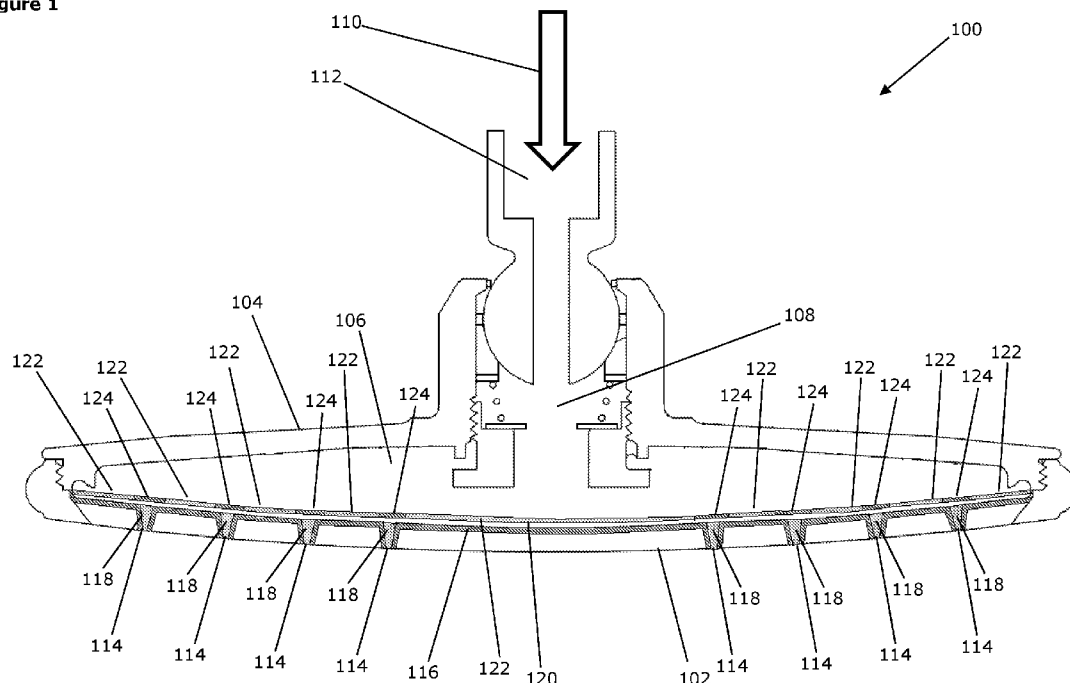
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(54) Title: SPRAY HEAD

Figure 1



(57) Abstract: A spray head comprising: a spray plate including at least one aperture; and at least one restrictor in a substantially fixed spaced apart configuration with the spray plate; wherein a spacing between the spray plate and the at least one restrictor, in a vicinity of the at least one aperture, is configured such that, below a predetermined fluid pressure, a fluid is prevented from flowing through the spacing due to its surface tension, whilst above the predetermined fluid pressure the fluid is able to flow through the spacing and pass through the at least one aperture.

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SPRAY HEAD

The present disclosure relates to a spray head, in particular for an ablutionary appliance or fitting. More particularly, it relates to a spray head having a non-drip mechanism and to a shower system employing the spray head. Whilst the disclosure is particularly suited to use in a shower head, it need not be limited to such use.

Known shower spray heads are prone to dripping after the shower system has been turned off, due to residual water within the shower spray head and in the connecting hose and/or pipes. In addition to any irritation caused by the sight and sound of dripping water, this can lead to bathroom surfaces remaining wet and slippery for longer, so increasing the chance of accidents. Slowly dripping water may also lead to damp problems within the bathroom or shower room.

Some or all of the residual water within the shower spray head and in the connecting hose and/or pipes may drip from the shower spray head some time, e.g. several minutes or even hours, after the shower system has been turned off. This may be unexpected and/or disturbing. Further, it may lead to user complaints concerning the components, e.g. valves, within the shower system, which may in fact be perfectly fine. In attending to such user complaints, potentially unnecessary inspection, maintenance and/or replacement of valves and other components within the shower system may be carried out. Various factors may cause the delayed dripping of the residual water within the shower spray head and in the connecting hose and/or pipes, including for example changes in temperature, air pressure or air flow in the room.

25

According to a first aspect, there is provided a spray head, comprising:

a spray plate including at least one aperture; and

at least one restrictor in a substantially fixed spaced apart configuration with the spray plate;

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wherein a spacing between the spray plate and the at least one restrictor, in a vicinity of the at least one aperture, is configured such that, below a predetermined fluid pressure, a fluid is prevented from flowing through the spacing due to its surface tension, whilst above the predetermined fluid pressure the fluid is able to flow through the spacing and pass through the at least one aperture.

35

The spacing provided by the restrictor therefore prevents or limits the passage of fluid when the pressure drops below a predetermined fluid pressure by action of the surface tension of the fluid interacting with the surfaces bounding the spacing.

- 5 The spacing may be up to or at least 0.1 cm, up to or at least 0.2 cm, up to or at least 0.3 cm and/or up to or at least 0.5 cm.

The spray head may further comprise a nozzle mat that provides a nozzle within the at least one aperture, the nozzle mat being interposed between the spray plate and the at
10 least one restrictor. The nozzle mat may act to improve the fluid jets formed by the spray head.

The spacing may be provided between the at least one restrictor and the nozzle mat.

- 15 The at least one restrictor may be positioned upstream of the spray plate. The “upstream” direction may be determined by the direction of flow of fluid, in use.

The spray head may further comprise a spacing element within the spacing, the spacing element being configured to set a height of the spacing. By setting a height of
20 the spacing using a spacing element, the spacing can be prevented or limited from changing, in use.

The spacing element may be interposed between the spray plate and the restrictor, the spray plate and the nozzle mat, or the nozzle mat and the restrictor.

25

The at least one restrictor may restrict the passage of fluid about an entire circumference of the at least one aperture.

The at least one restrictor may be provided on or by a plate spaced apart from the
30 spray plate. Providing the at least one restrictor on or by a plate may make manufacture simpler and/or provide enhanced alignment of the restrictor(s). The restrictor(s) may be integrally formed with the plate.

The plate may be formed with a plurality of passages configured to allow fluid to flow through the plate to the apertures. The passages may be formed as apertures through the plate. The apertures through the plate may surround each restrictor.

- 5 All of the restrictors may be provided on or by a single plate.

The predetermined fluid pressure may be substantially equal to ambient air pressure.

The fluid may be water.

10

The fluid may have a temperature of at least 0°C, up to or at least 5°C, up to or at least 15°C, up to or at least 45°C and/or up to or at least 65°C.

15

The fluid may have a surface tension of up to or at least 60 mN.m⁻¹, up to or at least 65 mN.m⁻¹, up to or at least 75 mN.m⁻¹ and/or up to or at least 80 mN.m⁻¹. The spray head may therefore be configured such that fluid with a surface tension within a disclosed range will be prevented from passing through the at least one aperture when the pressure drops below the predetermined fluid pressure.

20

The or each restrictor may include a protrusion that extends towards the spray plate, e.g. towards and/or into the at least one aperture. The protrusion may therefore extend a given restriction down into a nozzle, assisting with the prevention of fluid flow when pressure is removed. The protrusion may extend through a plane defined by an upper surface of the spray plate. The protrusion may extend through a plane defined by an upper surface of the nozzle mat and may or may not protrude through a plane defined by an upper surface of the spray plate.

25

The spray plate may include any number of apertures. For example, the spray plate may include up to or at least 10 apertures, up to or at least 50 apertures, up to or at least 100 apertures and/or up to or at least 200 apertures, or may include any other number of apertures.

30

The restrictors may be provided in a 1:1 ratio with the apertures. Each restrictor may be associated with a corresponding aperture. The spray head may comprise the same number of restrictors as apertures.

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The spray head may comprise a fixed shower head or may comprise a handheld shower head. The spray head may alternatively comprise a tap or other fluid, e.g. water, fitting, for use either indoors or outdoors in a domestic, industrial or commercial setting.

A second aspect provides a fluid delivery system comprising a spray head according to the first aspect, the spray head being in fluid communication with a water supply.

The fluid delivery system may comprise a shower system. The spray head may comprise a fixed shower head or may comprise a handheld shower head.

A third aspect provides a kit of parts arranged to form a spray head according to the first aspect or a fluid delivery system according to the second aspect.

The skilled person will appreciate that except where mutually exclusive, a feature or parameter described in relation to any one of the above aspects may be applied to any other aspect. Furthermore, except where mutually exclusive, any feature or parameter described herein may be applied to any aspect and/or combined with any other feature or parameter described herein.

A non-limiting example of the present invention will now be described with reference to the accompanying drawings, in which:

Figure 1 shows an example embodiment of a spray head;

Figure 2 is an enlarged view of a nozzle of the spray head of Figure 1;

Figure 3 is an enlarged view of a portion of a restrictor and nozzle of another embodiment of a spray head, showing a spacing element; and

Figure 4 is an ablutionary system including the spray head of Figure 1.

Referring to Figure 1, there is shown a spray head 100 comprising a face plate 102 and a back plate 104 that are engaged together to form a chamber 106. The face plate 102 and back plate 104 are both formed of plastics, but other materials may also be suitable, these being known to the skilled person. The spray head 100 of this embodiment is configured for use as a shower head, but other uses may also be known to the skilled person and this is not intended to be limiting to the scope of the disclosure. An opening 108 is formed in the back plate 104 for the receipt of fluid, for example water, from a fluid source 110. In the present embodiment, the opening 108 is attached to a joint – in this case a ball joint 112 – which allows the back plate 104 to pivot relative to the ball joint 112 and connected inlet 112. This pivoting allows for directing of the spray from the face plate 102. For ease, the term “water” will be used from hereon in, but this is not intended to be limiting and other fluids may be used.

The face plate 102 includes a plurality of apertures 114 through which water may pass, under pressure. Adjacent to the face plate 102 is a nozzle mat 116 that is shaped so as to form nozzles 118 within the apertures 114, for the passage of water. The nozzle mat 116 is, in this embodiment, formed of a resilient material, which may comprise a rubber or polymer.

Above the nozzle mat 116 and within the chamber 106 is positioned a support plate 120. The support plate 120 includes a series of passages 122 through which water can pass in order to travel to the nozzles 118. Importantly, the support plate 120 also includes cover portions, hereafter referred to as restrictors 124, which are positioned directly above each nozzle 118 in order to restrict the passage of water to the nozzles 118 once it has passed through the passages 122 in the support plate 120. Each restrictor 124 is set at a predetermined distance above its respective nozzle 118 in order to provide the desired spacing or restriction.

As can be seen in Figure 2 – an enlarged view of a single restrictor 124 – in the present embodiment, the restrictor 124 includes a protrusion 128 that extends into the nozzle 118 created by the nozzle mat 116. This protrusion 128 extends the restriction downwards into the nozzle, creating a longer restricted passageway for the emission of water that passes through the support plate 120.

In use, water will enter the chamber 106 through the inlet 112 and opening 108. The water admitted to the chamber 106 will be pressurised, for example by mains water pressure, either directly or through a boiler or an instantaneous water heater, water tank pressure, or by pumping, and will therefore be forced through the chamber 106, through the support plate 120, through the spacing or restriction provided by the restrictors 124, and out of the nozzle 118. This nozzle flow will appear as a spray to a user of the spray head 100.

When water is stopped from flowing into the spray head 100, through removal of water pressure by the closing of a valve or other flow prevention mechanism, there is no longer any motive force on the water in the chamber 106. The spacing or restriction provided by each restrictor 124 then acts to prevent any further water flow from the chamber 106 to the nozzles 118. This prevention is provided due to the combination of the surface tension of the water and the size of the spacing or restriction formed between the restrictor 124 and the nozzle mat 116.

As is well-known, fluid flow is prevented through apertures smaller than a predetermined radius dependent upon the surface tension of the fluid in question. For a circular aperture, the maximum radius of an aperture that allows zero water flow is given by:

$$r = \frac{2\gamma}{\rho gh}$$

where:

- r is the minimum radius of aperture required to prevent fluid flow;
- γ is the surface tension of the fluid;
- ρ is the density of the fluid;
- g is the acceleration due to gravity; and
- h is the depth of water above the aperture.

The skilled person will be able to utilise this information and their technical expertise to identify, without any undue burden, the required spacing of the restrictors 124 from the nozzles 118 in order to prevent fluid flow when external (supply) pressure is removed from the fluid held within the chamber 106. Of course, this may depend on the depth of the chamber 106 and the characteristics of the fluid being used. It is

considered that any restriction of the disclosure on the basis of specific measurements of any of the features of the spray head 100 would be overly restrictive, in view of the many possible variations in fluid and geometry. Moreover, it is considered that the skilled person would be able to identify, without undue burden, whether a spray head
5 100 prevents or does not prevent a fluid such as water from passing through the restrictions once pressure is removed.

In another embodiment, illustrated in part in Figure 3, a spacing element 126 can be provided that ensures a specific separation between each restrictor 124 and the nozzle
10 mat 116. The spacing element 126 may be provided by any means that allows the spacing or restriction to be maintained at a set distance. In the example shown in Figure 3, the spacing element 126 is provided as a small pip that is seated between the restrictor 124 and the nozzle mat 116. The spacing element 126 will, of course, allow flow through the restriction around the spacing element 126, when the external fluid
15 pressure is high enough to overcome the effects of surface tension. Any number, e.g. a plurality, of spacing elements may be employed. Each spacing element may comprise a discrete pip. Alternatively, the spacing element(s) may be provided on or by the nozzle mat and/or the support plate. The spacing element(s) may be integrally formed with the nozzle mat or the support plate.

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Where allowed by design requirements, the nozzle mat 116 may be omitted, the nozzles being formed directly by the face plate of the spray head. In this case, the restrictors may form a restriction directly between each restrictor and its respective nozzle in the face plate. Moreover, where spacing elements are provided, these will
25 also be provided between the restrictor and the spray head. In embodiments in which the nozzle mat is omitted, the spacing element(s) may each comprise a discrete pip. Alternatively, the spacing element(s) may be provided on or by the face plate and/or the support plate. The spacing element(s) may be integrally formed with the face plate or the support plate.

30

For convenience, the preceding examples have been discussed primarily in relation to spray heads for showers. The skilled person will appreciate that other applications of the anti-drip mechanism are possible, such as in spray heads for use in the kitchen or on hosepipes, taps or pressurised drink dispensers. Similarly, the example

embodiments are primarily discussed in terms of using water, but the skilled person will understand that the disclosure would equally apply to other fluids.

Figure 4 shows the spray head 100 of Figure 1 as part of an ablutionary system 1000.

5 The spray head 100 is attached to a valve 1002 and a water source, which in this case is a water tank 1004. The water tank feeds a water pump 1006 which pressurises water to pass it through the valve 1002 to the spray head 100. The valve 1002 can be rotated to selectively allow or disallow flow to the spray head 100.

10 It will be understood that the invention is not limited to the embodiments above-described and various modifications and improvements can be made without departing from the concepts described herein. Except where mutually exclusive, any of the features may be employed separately or in combination with any other features and the disclosure extends to and includes all combinations and sub-combinations of one
15 or more features described herein.

CLAIMS

1. A spray head, comprising:
a spray plate including at least one aperture; and
5 at least one restrictor in a substantially fixed spaced apart configuration with the spray plate;
wherein a spacing between the spray plate and the at least one restrictor, in a vicinity of the at least one aperture, is configured such that, below a predetermined fluid pressure, a fluid is prevented from flowing through the spacing due to its surface
10 tension, whilst above the predetermined fluid pressure the fluid is able to flow through the spacing and pass through the at least one aperture.
2. A spray head according to claim 1, further comprising a nozzle mat that provides a nozzle within the at least one aperture, the nozzle mat being interposed
15 between the spray plate and the at least one restrictor.
3. A spray head according to claim 2, wherein the spacing is provided between the at least one restrictor and the nozzle mat.
- 20 4. A spray head according to any one of the preceding claims, further comprising a spacing element within the spacing, the spacing element being configured to set a height of the spacing.
5. A spray head according to any one of the preceding claims, wherein the at least
25 one restrictor restricts the passage of fluid about an entire circumference of the at least one aperture.
6. A spray head according to any one of the preceding claims, wherein the at least one restrictor is formed as a single plate spaced apart from the spray plate.
30
7. A spray head according to any one of the preceding claims, wherein the spacing is up to or at least 0.1 cm and/or up to or at least 0.5 cm.
8. A spray head according to any one of the preceding claims, wherein the or
35 each restrictor includes a protrusion that extends towards the spray plate.

9. A spray head according to any one of the preceding claims comprising the same number of restrictors as apertures in the spray plate.
- 5 10. A spray head according to any one of preceding claims, wherein the at least one restrictor is provided on or by a plate spaced apart from the spray plate.
11. A spray head according to any one of the preceding claims, wherein the predetermined fluid pressure is substantially equal to ambient air pressure.
- 10 12. A spray head according to any one of the preceding claims, wherein the fluid is water.
13. A spray head according to any one of the preceding claims, wherein the spray
15 head comprises a fixed shower head or a handheld shower head.
14. A fluid delivery system comprising a spray head according to any one of the preceding claims, the spray head being in fluid communication with a water supply.
- 20 15. A fluid delivery system according to claim 13, wherein the fluid delivery system comprises a shower system.
16. A kit of parts arranged to form a spray head according to any one of claims 1 to 13 or a fluid delivery system according to claim 14 or claim 15.

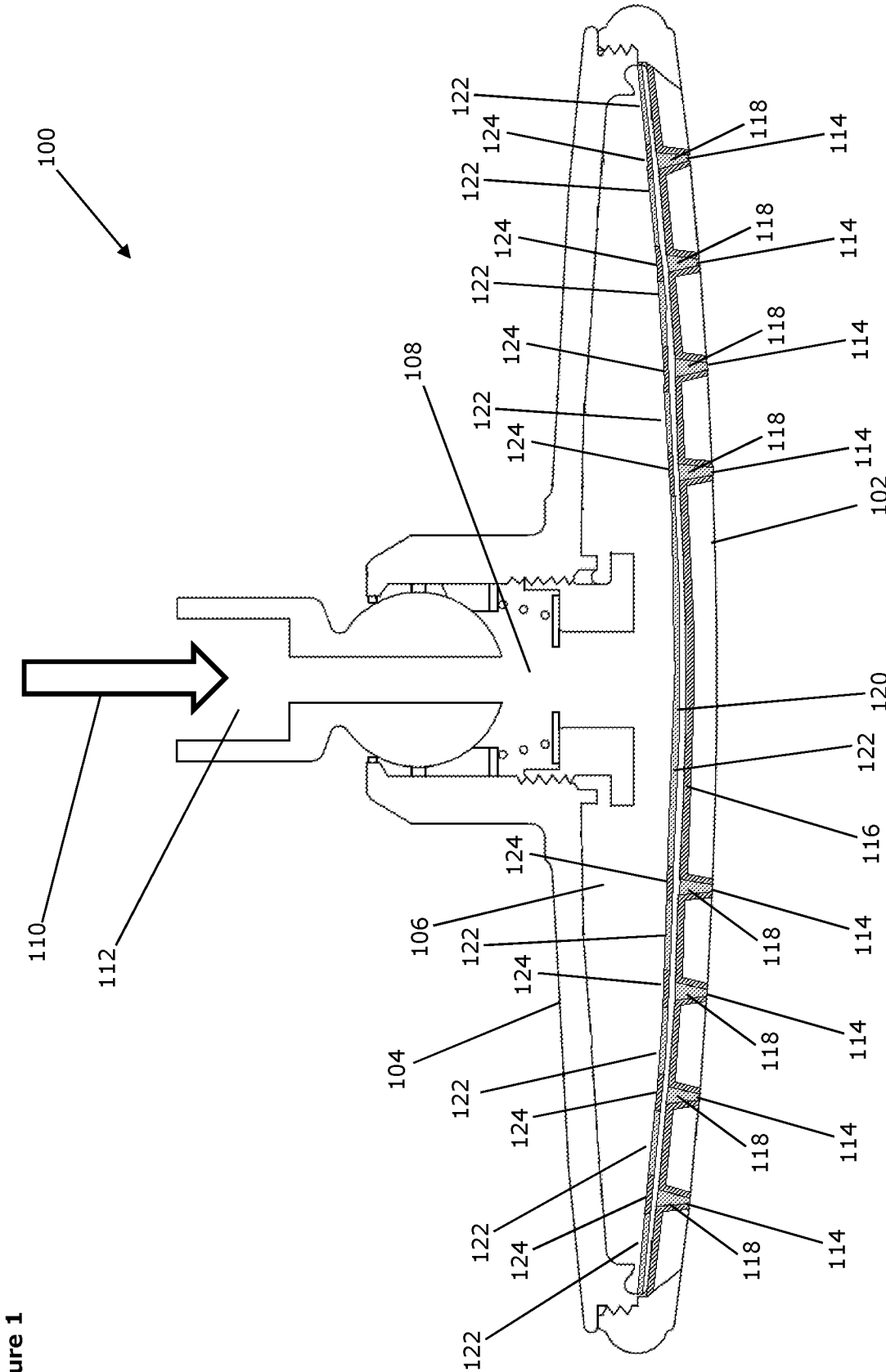


Figure 1

Figure 2

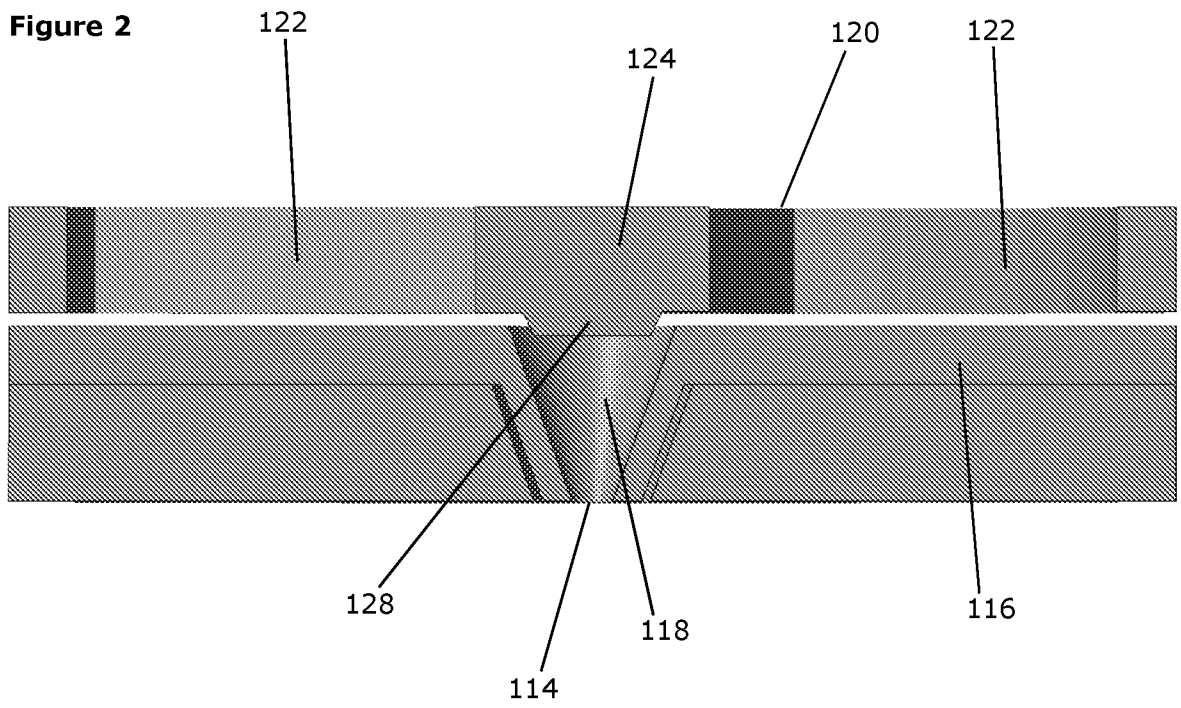
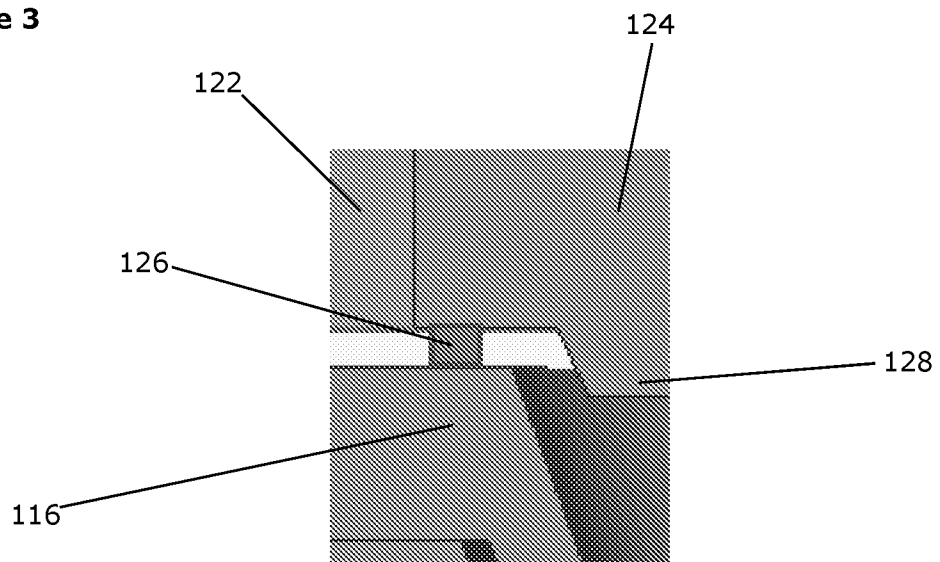


Figure 3



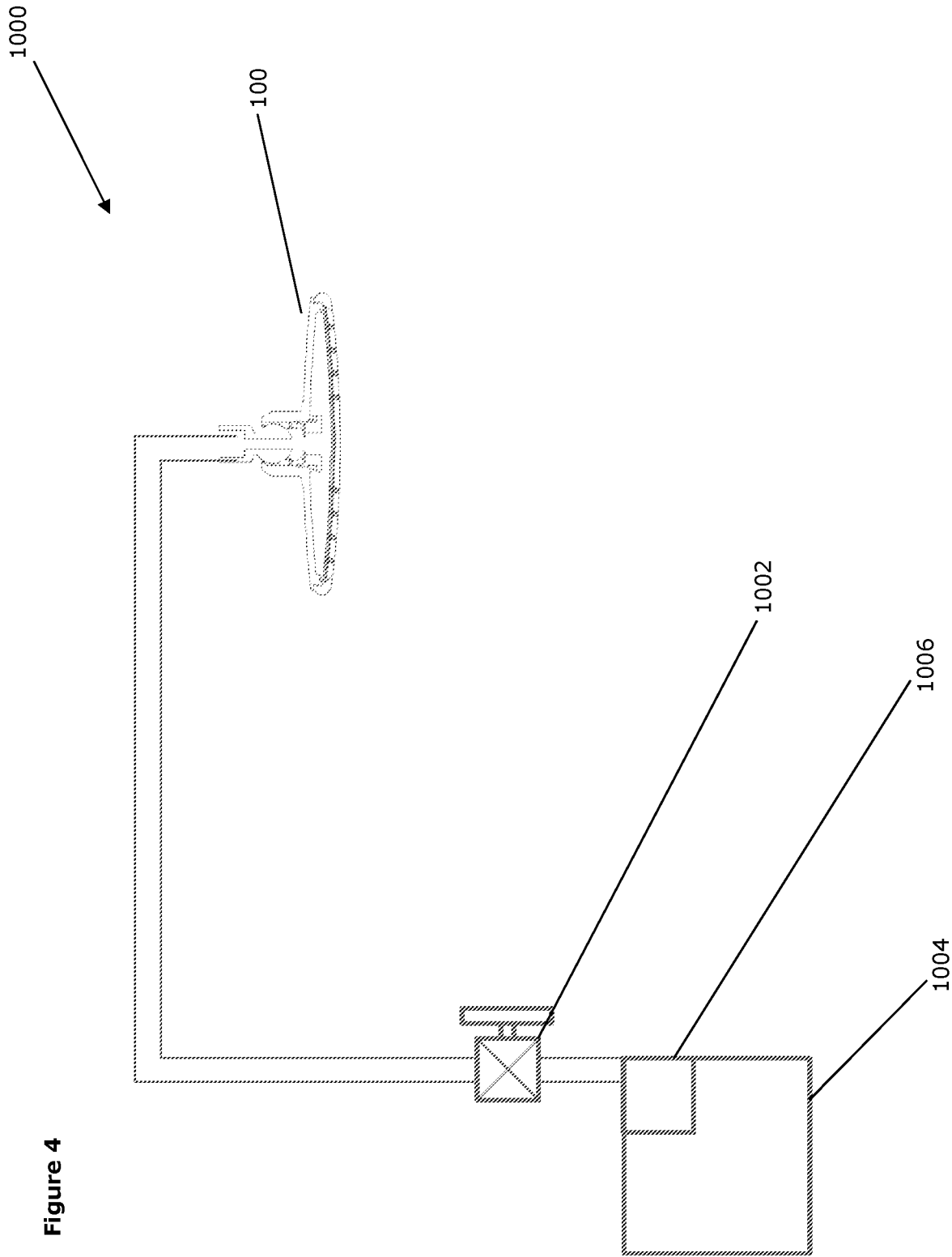


Figure 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2020/050258

A. CLASSIFICATION OF SUBJECT MATTER
INV. B05B1/18 B05B1/28
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B05B

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2003 038379 A (TOTO LTD) 12 February 2003 (2003-02-12) abstract; figures 1-11 paragraph [0061] -----	1-16
X	JP 2004 136242 A (TOTO LTD) 13 May 2004 (2004-05-13) abstract; figures 1-3 paragraph [0015] - paragraph [0016] -----	1-16
X	CN 206 064 655 U (XIAMEN SHUIDA SANITARY WARE CO LTD) 5 April 2017 (2017-04-05) abstract; figures 1-7 -----	1-16



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"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

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2020/050258

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 2003038379	A	12-02-2003	NONE	

JP 2004136242	A	13-05-2004	JP 4217873 B2	04-02-2009
			JP 2004136242 A	13-05-2004

CN 206064655	U	05-04-2017	NONE	
