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(54) **An air-water mixing shower**

(57) A shower comprises a shower head (1) having a water inlet and outlet holes (12), a connecting assembly (2) connected with the shower head (1) and connectable with a water inlet pipe and adapted to transfer water from the inlet pipe to the water inlet of the shower head (1) and to mix the water with air, the rotatable connecting assembly (2) including a tubular external connector having a first end connected to the water inlet of the shower head (1), an internal expansion chamber (213) and a second end, a ball rod (22) connected with the water inlet pipe and with the expansion chamber (232) and forming a through hole and a first air inlet (224) extending through a side wall of the ball rod (22) into the through hole, a tubular water guide rod (23) arranged inside the through hole of the ball rod (22) and forming a Venturi shaped distribution hole and expansion hole and a second air inlet (234) extending through a side wall of the water guide rod (23) into the expansion hole (232) for sucking air in the water flow in the expansion hole, an annular gap (233) defined between the water guide rod (23) and the ball rod (22), wherein the first air inlet (224) connects the annular gap (233) with the outside and the second air inlet (234) connects the annular gap (233) with the expansion hole (232).

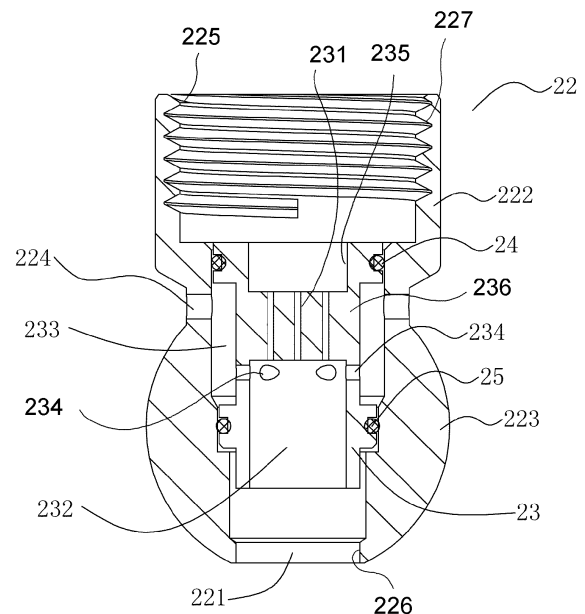


FIG. 7

Description

Technical Field

[0001] The present invention concerns a water spraying device, particularly a water-saving water-air mixing shower of the kind that can be held in a hand or connected to a shower holder in a shower cabin or bathroom or installed in a bathing equipment.

Background Art

[0002] There are known water-saving showers for water spraying, which can be installed in a position above a head position of a bather. The appearance, dimensions, installation and operation of the known water-saving shower are almost the same as that of a traditional shower for the same use, but without water-saving capabilities, except that an air admission and suction structure are added to the base structure of the traditional shower, for transforming water pressure in kinetic force which sucks in air, so that water and air are thoroughly mixed and sprayed at a high speed after puffing. The known water-saving showers have the following advantages:

- low flow rate and large spraying range, which reduces water consumption and saves water efficiently;
- gentle water spraying, which avoids the feel of pain due to strong jetting, improves water comfort and prevents water splash;
- increase in oxygen content in water, which promotes blood circulation, plays a role in health care, and avoids the occurrence of hypoxia in children, aged and infirm persons during shower bathing;
- skin massage and deep skin cleansing when the oxygen-rich water bubbles pop on the skin.

[0003] Generally, in known water-saving showers an air inlet is provided and a sealing sleeve or a rubber cup is installed, which prevents the water from flowing back into the air inlet and from leaking out. At the time of air admission to the flow of water, the air flow pushes the sealing sleeve or rubber cup in an open position and enters the mixing chamber. When the water flows back towards the air inlet, the water flow pushes the sealing sleeve or rubber cup to a closed position in which the air inlet is closed, thereby preventing the water from leaking out. However, this known structure is complex, the manufacturing and assembly process is cumbersome and expensive, the air admittance is not always unobstructed due to the risk of sudden blockage of the sealing sleeve or rubber cup, thus negatively affecting the air-water mixing effect of the known showers. Moreover, the sealing sleeve or rubber cup of the known showers becomes easily worn and loses its elasticity during long-term use, thus negatively affecting the water sealing effect.

Summary of the Invention

[0004] The object of the present invention is to provide a water spraying device, particularly an air-water mixing water-saving shower having features such as to at least partially overcome the deficiencies of the prior art.

[0005] A particular object of the present invention is to provide a water spraying device, particularly an air-water mixing water-saving shower, which has a simplified structure.

[0006] A further particular object of the present invention is to provide a water spraying device, particularly an air-water mixing water-saving shower, having an improved air-water mixing effect.

[0007] A yet further particular object of the present invention is to provide a water spraying device, particularly an air-water mixing water-saving shower, which effectively avoids water leakage.

[0008] These and other objects are achieved by a water spraying device, particularly an air-water mixing water-saving shower, according to claim 1.

[0009] The dependent claims concern advantageous embodiments.

[0010] In accordance with an aspect of the invention, a shower is provided which comprises:

- a shower head having a water inlet and outlet holes,
- a rotatable connecting assembly connected with the shower head and connectable with a water inlet pipe, the connecting assembly being adapted to transfer water from the inlet pipe to the water inlet of the shower head and to mix the water with air, wherein the rotatable connecting assembly includes:
 - a tubular external connector having a first end connected to the water inlet of the shower head, an internal expansion chamber and a second end,
 - a ball rod forming a water inlet end connectable with the water inlet pipe and a ball end rotatably received in the expansion chamber, a through hole extending from the water inlet end to the ball end and a first air inlet extending through a side wall of the ball rod into the through hole in a region between the water inlet end and the ball end,
 - a tubular water guide rod arranged inside the through hole of the ball rod and forming a distribution hole and an expansion hole downstream the distribution hole, as well as a second air inlet extending through a side wall of the water guide rod into the expansion hole, wherein a flow section of the expansion hole is greater than a flow section of the distribution hole for sucking air by Venturi effect through the second air inlet into the expansion hole and mixing the sucked air with the water flow in the expansion hole,
 - an annular gap defined by an internal surface of the ball rod, an external surface of the water guide rod and first and second gaskets arranged between the water guide rod and the ball rod, wherein the first air inlet connects the annular gap with the outside and

the second air inlet connects the annular gap with the expansion hole.

By adopting a structure with dual air inlets and an interposed annular gap, water overflow or water backflow into the air inlets can be prevented without additional elastic sealing components.

The air admission to the expansion hole is unobstructed and the air-water mixing effect is improved. Moreover, the annular gap provides a containing space for a water backflow, thereby preventing undesired leakage through the air inlet. The structure of the shower is simple and reliable, and the manufacturing and assembly process is simplified, thus reducing the production cost.

In accordance with an aspect of the invention, the through hole of the ball rod may be tapered from a larger inlet end to a smaller outlet end and form one or more internal steps on which the water guide rod may rest. In this way a correct relative positioning between the water guide rod and the ball rod is assured and the assembling of the shower simplified. In accordance with an aspect of the invention, the water guide rod forms multiple distribution holes adapted to divide the water flow in multiple smaller flows to further improve mixing with the sucked air.

[0011] In accordance with a further aspect of the invention, the first air inlet opens into the annular gap at a higher level than the opening of the second air inlet into the annular gap, thereby providing a height difference which creates a hydrostatic resistance against a water backflow through the air inlets.

[0012] These and other objects and advantages of the present invention shall be made apparent from the accompanying drawings and the description thereof, which illustrate embodiments of the invention and, together with the general description of the invention given above, and the detailed description of the embodiments given below, serve to explain the principles of the present invention.

Brief Description of Figures

[0013]

- Figure 1 is an exploded view of a shower in accordance with an embodiment;
- Figure 2 is a schematic perspective view of the shower in figure 1;
- Figure 3 is a cross-sectional view of the shower in Figure 2 along the line A-A;
- Figure 4 is a cross-sectional view of the shower in Figure 2 along the line B-B;
- Figure 5 is a schematic perspective view of a ball rod of the shower in accordance with an embodiment;
- Figure 6 is a schematic perspective view of a water guide rod of the shower in accordance with an embodiment;
- Figure 7 is a cross-sectional view of a sub-assembly of a shower containing a ball rod, water guide rod,

upper gasket and lower gasket in accordance with an embodiment.

Detailed Description of Embodiments

[0014] With reference to Figures 1 - 7, an air mixing water-saving shower comprises a shower head 1, a rotatable connecting assembly 2, a tubular external connector 21, a ball rod 22 and a water guide rod 23.

[0015] The shower head 1 is provided with or forms a water inlet 11 and at least one or a plurality of water outlet holes or spout holes 12.

[0016] The rotatable connecting assembly 2 is (preferably removably) connected to the shower head 1 and (preferably removably) connectable with an inlet pipe 30, and configured such that the water conveyed through the inlet pipe 30 is transferred through the connecting assembly 2, inside which the water is mixed with air, to the water inlet 11 of the shower head 1.

[0017] In accordance with an embodiment, the rotatable connecting assembly 2 includes a tubular external connector 21 having a lower or first end 211 fixed on the water inlet 11 of the shower head 1 and an upper or second end 212 which may form a retaining bayonet 214. The external connector 21 forms an internal expansion chamber 214 in flow connection with the water inlet 11 of the shower head 1.

[0018] The rotatable connecting assembly 2 further includes a ball rod 22 defining a through hole 221 which may taper, e.g. in a stepped manner, from a greater first or upper opening 225 at a first or upper end of the ball rod 22 to a smaller second or lower opening 226 at a second or lower end of the ball rod 22, wherein one (preferably the first) end of the ball rod 22 forms a water inlet end 222 which is connected or connectable with the water inlet pipe 30 (e.g. by thread engagement of an internal thread 227 of the water inlet end 22 with an external thread 31 of the water inlet pipe 30), and the other (preferably second) end forms a rotatable ball portion or ball end 223 which is at least partially received, e.g. clamped, in the expansion chamber 213 of the external connector 21.

[0019] The bayonet 214 or other retaining means, e.g. a retaining nut, a retaining collar or a retaining ring or gasket, retains the ball end 223 in rotatable or spherically rotatable engagement with the expansion chamber 213 of the external connector 21 and prevents the ball end 223 from detaching or escaping from the expansion chamber 213. The water inlet end 222 of the ball rod 22 extends from the second or upper end 212 of the external connector 21, e.g. from the retaining means, such as bayonet 214, and connects with the water inlet pipe 30, ensuring a free shower water flow path, while the water inlet end 222 can rotate in a certain rotational range with respect to the external connector 21. The ball rod 22 further forms one or more first air inlets 224, which extend, e.g. radially, through a side wall of the ball rod 22 from its outside into the (preferably stepped) through hole 221,

preferably in a region between the water inlet end 222 and the ball end 223.

[0020] The rotatable connecting assembly 2 further includes a water guide rod 23 arranged in said through hole 221 of the ball rod 22, preferably resting on a step formed in the through hole 221. The water guide rod 23 forms a passage channel and has an inlet end or upper end 235 forming a water inlet opening of the passage channel, and one or more distribution holes 231 formed downstream or below the water inlet opening in the passage channel, e.g. in an internal wall 236. The distribution holes are preferably configured to divide the water flow entering the water inlet opening into multiple smaller flows. Downstream the distribution hole or holes 231 or, in other words, below the internal wall 236, the passage channel forms an expansion hole 232 or expansion space having a flow section (in other words: a cross-sectional area normal to the direction of flow) greater than the flow section or sum of the flow sections of the distribution hole or holes 231. The water guide rod 23 further forms one or more second air inlets 234, which extend, e.g. radially, through a side wall of the water guide rod 23 from its outside into the expansion hole 232.

[0021] Such a Venturi type variation of flow section within the passage channel of the water guide rod 23 makes it possible to suck air through the second air inlet 234 into the expansion hole 232 and mix the sucked air inside the expansion hole 232 with the multiple small water flows coming out of the distribution holes 231.

[0022] A first or upper gasket 24 and a second or lower gasket 25 are arranged between the water guide rod 23 and the ball rod 22 and, possibly, fixed (e.g. received in annular grooves) on corresponding first and second annular projections 237, 238 formed in an external surface of and extending all around the water guide rod 23, such that an internal surface of the through hole 221 of the ball rod 22, the external surface of the water guide rod 23, the first (upper) gasket 24 and the second (lower) gasket 25 form an annular gap 233 around the water guide rod 23, wherein the annular gap 233 is flow-connected through the first air inlet 224 with the outside of the ball rod 22, and through the second air inlet 234 with the expansion hole 232.

[0023] When the shower is turned on, the shower begins spraying water through the spout holes 12. The water flows from the inlet pipe 30 into the distribution holes 231 which divide the water into multiple small water flows. The multiple small water flows flow into the expansion hole 232, thereby generating a Venturi type depression in the expansion hole 232 and sucking air through the first air inlet 224, the annular gap 233 and the second air inlet 234 into the expansion hole 232. After entering the expansion hole 232, the sucked air is mixed with the multiple water flows coming from the distribution holes 231 so as to achieve an excellent and efficient air-water mixing effect.

[0024] In order to ensure a sufficient mechanical strength of the ball rod 22 while at the same time increas-

ing the air flow into the water-air mixture, two opposite first air inlets 224 may be provided in the ball rod 22. In this embodiment, even if the shower head 1 is rotated in a position which may partially obstruct one of the two first air inlets 224, the other one 224 of the first air inlets would still remain unobstructed.

[0025] To achieve a better water-air mixing effect and a greater water-air contact area, multiple second air inlets 234 may be provided, e.g. uniformly circumferentially distributed around the water guide rod 23, so that a greater amount of air can be sucked in from the outside. When water flows from the distribution holes 231 into the expansion hole 232, air and water are well and uniformly mixed within the available space inside the expansion hole 232.

[0026] To prevent undesired leakage of water through the air inlets, an exit of the first air inlet 224 is located in the gap 233 at a level which is higher than the level of an entrance of the second air inlet 234 in the gap 233, so that there is a height difference between the first and second air inlets.

[0027] To improve mixing of water and air, the exit of the second air inlet 234 is located in an upper region, e.g. in an upper fourth or fifth of the height of the expansion hole 232, and an exit axis or exit direction of the second air inlet 234 is at least approximately perpendicular to the outflow direction of the distribution hole 231.

[0028] In order to divide the water flow into multiple small flows, multiple distribution holes 231 may be provided in the water guide rod 23. These distribution holes 231 may be uniformly spaced both radially and circumferentially, so that the divided flows are uniformly spaced and a greater contact surface is provided between the water and the air to facilitate them mixing.

[0029] In accordance with an embodiment, the shower head 1 comprises a front cover 13 with multiple, preferably uniformly arranged, spout holes 12 and a back cover 14 with the water inlet 11. The front cover 13 and the back cover 14 are tightly fitted together to form an outflow chamber. A rubber insert 15 may be arranged in the outflow chamber, which rubber insert 15 forms a system of water guide channels interconnected to the spout holes 12 of the front cover 13.

[0030] For the connection of the external connector 21 to the back cover 14, a threaded tubular internal connector 16 may be installed in the shower head 1. A threaded (upper) end of the internal connector 16 extends through the water inlet 11 of the shower head 1 and may be screwed into or onto the external connector 21. In this specific embodiment, the connecting assembly 2 may include a threaded adapter ring 28 screwed both with the lower end 211 of the external connector 21 and with the internal connector 16, as well as a locking screw or dowel 281 for locking the threaded adapter ring 28 on the external connector 21, so as to fix the straight tubular external connector 21 on the water inlet 11 of the back cover 14.

[0031] In order to make the ball rod 22 rotate more

freely in the expansion chamber 213 of the external connector 21 and avoid water leakage therebetween, the expansion chamber 213 may be provided with a gasket 26 matching the end face of the ball end 223.

[0032] To prevent water leakage at the water inlet 11 of the back cover 14 of the shower head 1, a water inlet gasket 27 may be arranged between the external connector 21 and the back cover 14.

[0033] In an advantageous embodiment, an external connector gasket 29 may be arranged inside the external connector 21 between the threaded adapter ring 28 and the ball end 223 of the ball rod 22.

The water spraying device, in particular the shower, according to the present invention has multiple advantages. The dual air inlets with an interposed annular air chamber make it possible to obviate the need of an elastic sealing component to prevent water leakage. A containing space for a water backflow is provided, thus preventing leakage through the air inlet in case a water level builds up inside the shower. The structure is simplified and more reliable with respect to the prior art air-water mixing showers, and the manufacturing and assembly process is simplified, thus reducing the production costs. Last but not least, an unobstructed air admission is assured and the air-water mixing effect is improved.

[0034] Although preferred embodiments of the invention have been described in detail, it is not the intention of the applicant to limit the scope of the invention to such particular embodiments, but to cover all modifications and alternative constructions falling within the scope of the claims.

Claims

1. An air mixing water-saving shower, comprising:

- a shower head (1) having a water inlet (11) and outlet holes (12),
- a rotatable connecting assembly (2) connected with the shower head (1) and connectable with a water inlet pipe (30), the connecting assembly (2) being adapted to transfer water from the inlet pipe (30) to the water inlet (11) of the shower head (1) and to mix the water with air, wherein the rotatable connecting assembly (2) includes:

- a tubular external connector (21) having a first end (211) connected to the water inlet (11) of the shower head (1), an internal expansion chamber (213) and a second end (212),
- a ball rod (22) forming a water inlet end (222) connectable with the water inlet pipe (30) and a ball end (223) rotatably received in the expansion chamber (213), a through hole (221) extending from the water inlet end (222) to the ball end (223) and a first

air inlet (224) extending through a side wall of the ball rod (22) into the through hole (221) in a region between the water inlet end (222) and the ball end (223),

- a tubular water guide rod (23) arranged inside the through hole (221) of the ball rod (22) and forming a distribution hole (231) and an expansion hole (232) downstream the distribution hole (231), as well as a second air inlet (234) extending through a side wall of the water guide rod (23) into the expansion hole (232), wherein a flow section of the expansion hole (232) is greater than a flow section of the distribution hole (231) for sucking air by Venturi effect through the second air inlet (234) into the expansion hole (232) and mixing the sucked air with the water flow inside the expansion hole (232),
- an annular gap (233) defined by an internal surface of the ball rod (22), an external surface of the water guide rod (23) and first and second gaskets (24, 25) arranged between the water guide rod (22) and the ball rod (22), wherein the first air inlet (224) connects the annular gap (233) with the outside and the second air inlet (234) connects the annular gap with the expansion hole (232).

2. The air mixing water-saving shower of Claim 1, wherein the ball rod (22) forms two opposite first air inlets (224).
3. The air mixing water-saving shower of Claim 1 or 2, wherein the water guide rod (23) forms multiple second air inlets (234) uniformly distributed around a circumference of the water guide rod (23).
4. The air mixing water-saving shower of any one of the preceding claims, wherein an exit of the first air inlet (224) is arranged in the annular gap (233) at a level which is higher than the level of an entrance of the second air inlet (234) in said gap (233), so that there is a height difference between the first and second air inlets.
5. The air mixing water-saving shower of any one of the preceding claims, wherein an exit of the second air inlet (234) is arranged in an upper region of the expansion hole (232), and an exit direction of the second air inlet (234) is approximately perpendicular to an outflow direction of the distribution hole (231).
6. The air mixing water-saving shower of claim 5, wherein the exit of the second air inlet (234) is arranged in an upper fourth, preferably in an upper fifth of the height of the expansion hole (232).
7. The air mixing water-saving shower of any one of

the preceding claims, wherein the water guide rod (23) forms multiple distribution holes (231).

8. The air mixing water-saving shower of any one of the preceding claims, wherein the shower head (1) comprises:
 - a front cover (13) with multiple outlet holes (12) and a back cover (14) forming said water inlet (11), the front cover (13) and the back cover (14) being connected to form an outflow chamber,
 - a rubber insert (15) arranged in the outflow chamber and forming a system of water guide channels connected to the outlet holes (12).
9. The air mixing water-saving shower of any one of the preceding claims, wherein a threaded tubular internal connector (16) is installed in the shower head (1) and a threaded end of the internal connector (16) extends through the water inlet (11) and is screwed on the external connector (21).
10. The air mixing water-saving shower of any one of the preceding claims, wherein the expansion chamber (213) houses a gasket (26) matching the end face of the ball end (223).
11. The air mixing water-saving shower of any one of the preceding claims, wherein a water inlet gasket (27) is arranged between the external connector (21) and the back cover (14).
12. The air mixing water-saving shower of any one of the preceding claims, wherein an external connector gasket (29) is arranged inside the external connector (21) between the threaded adapter ring (28) and the ball end (223) of the ball rod (22).
13. The air mixing water-saving shower of any one of the preceding claims, wherein said through hole (221) tapers in a stepped manner from a greater first opening (225) at the first end of the ball rod (22) to a smaller second opening (226) at the second end of the ball rod (22) and the guide rod (23) rests against a step formed in said through hole (221).

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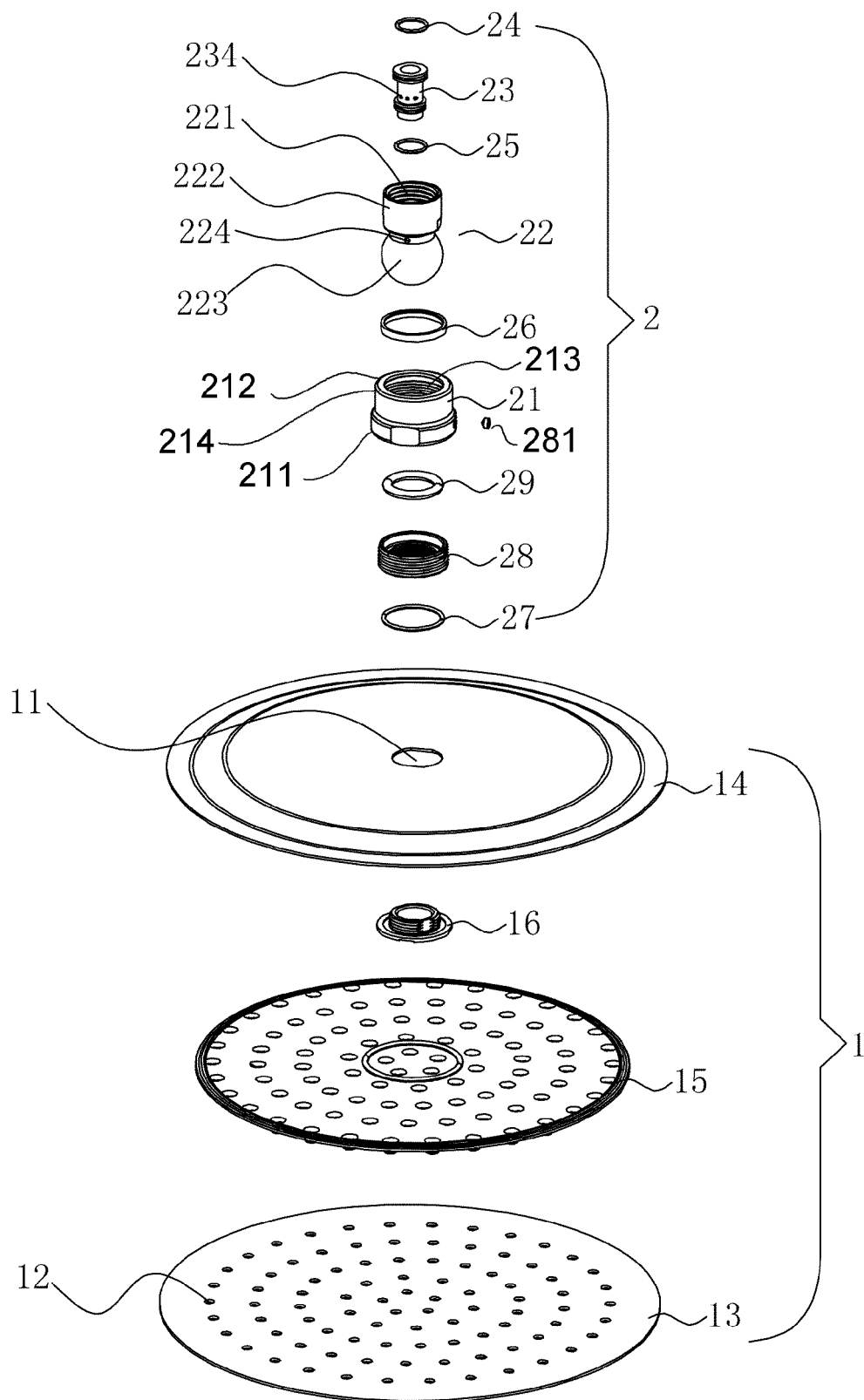


FIG. 1

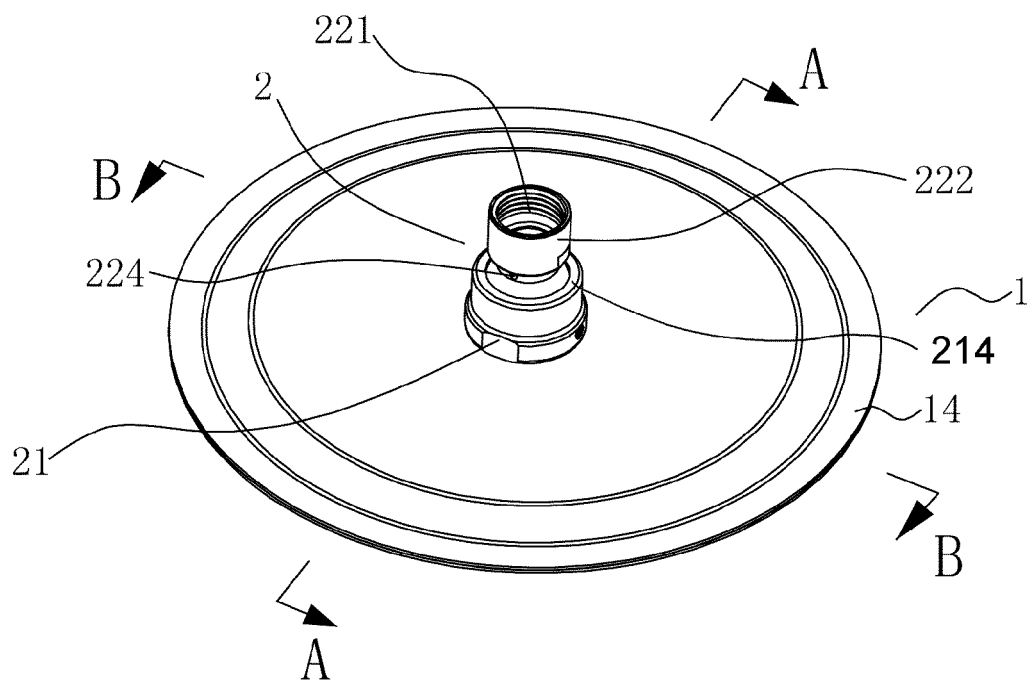


FIG. 2

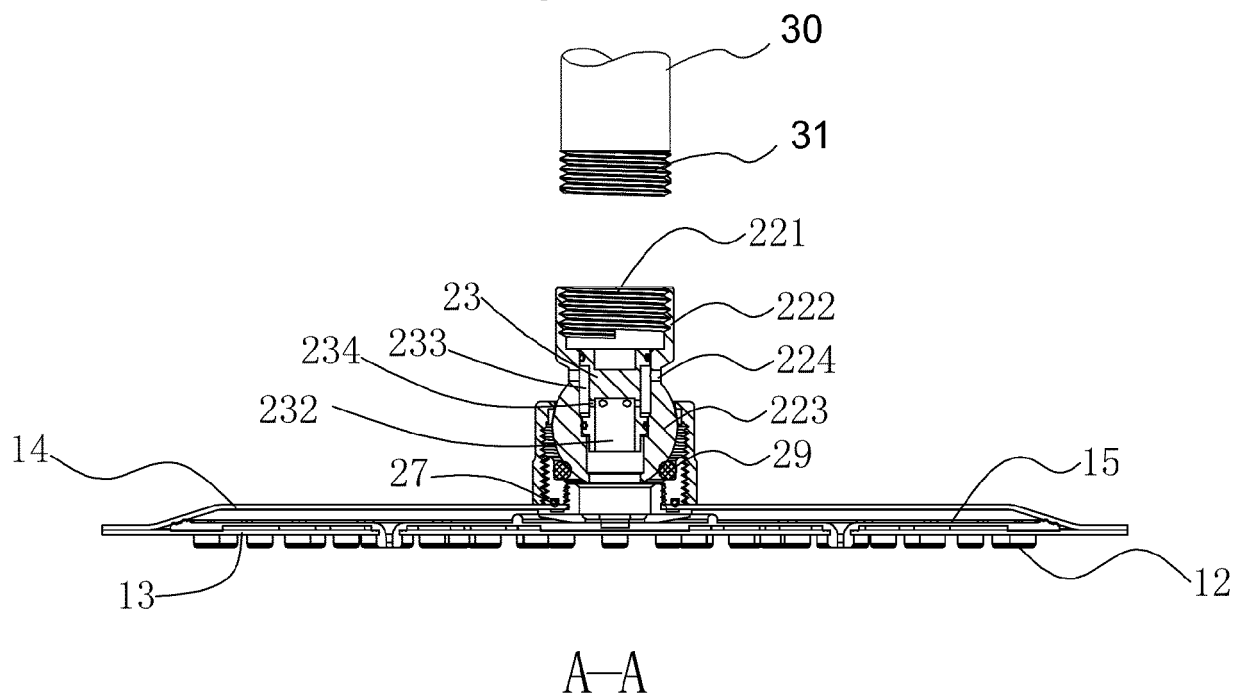


FIG. 3

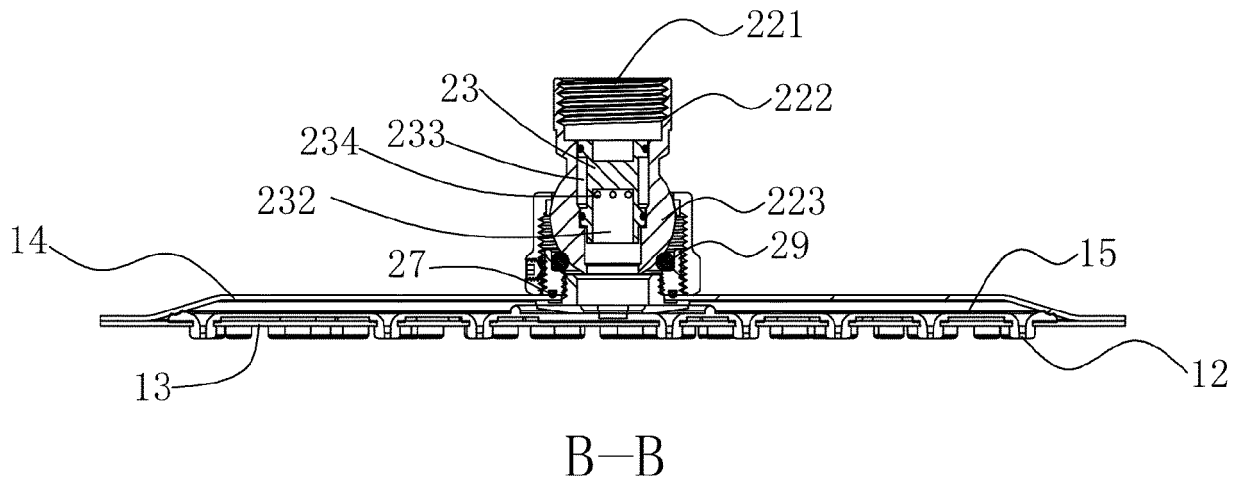


FIG. 4

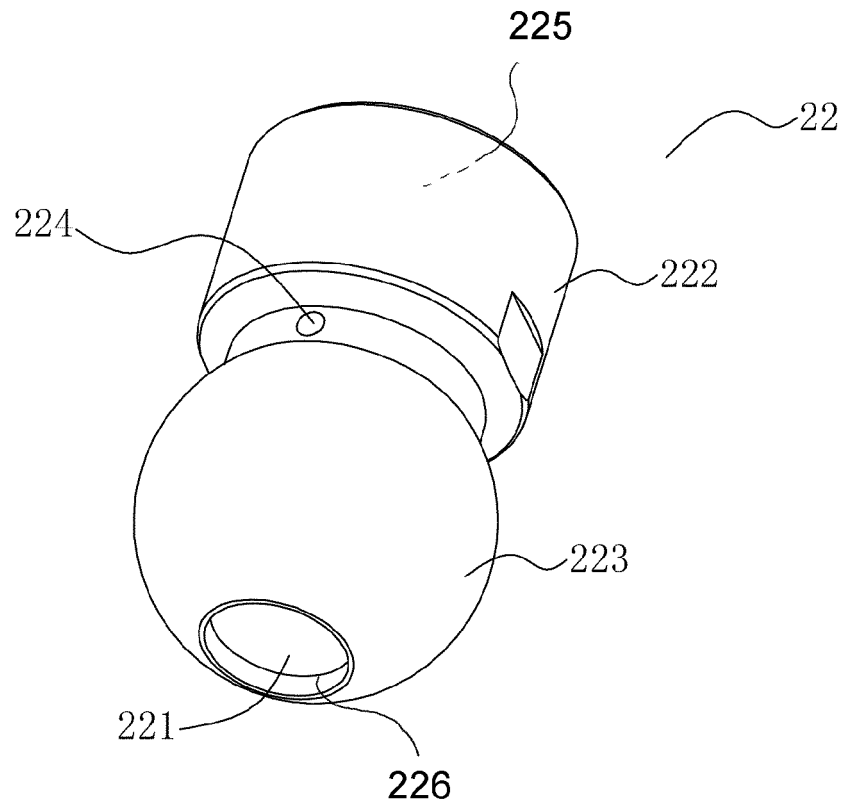


FIG. 5

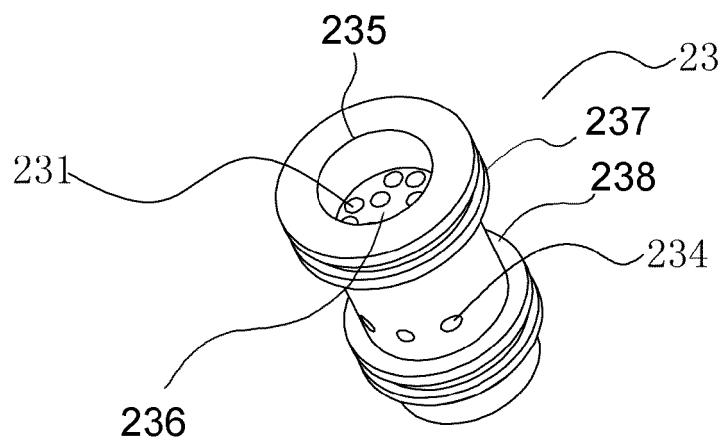


FIG. 6

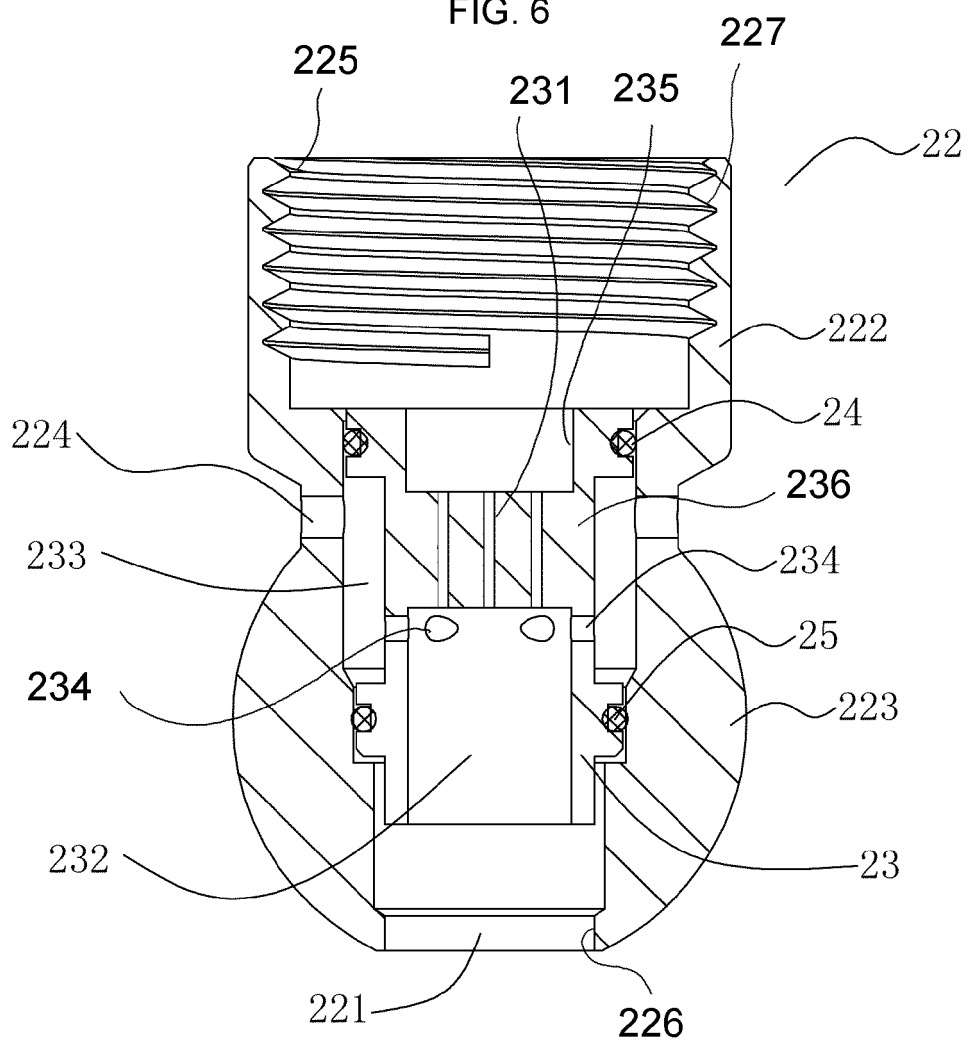


FIG. 7



EUROPEAN SEARCH REPORT

Application Number
EP 13 15 5087

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 38 25 537 A1 (PFISTER PRICE INC [US]) 9 February 1989 (1989-02-09) * column 6, line 6 - column 7, line 2; figures 3,4 *	1-3,5-13	INV. B05B7/04 B05B1/18
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			TECHNICAL FIELDS SEARCHED (IPC)
			B05B E03C
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		15 May 2013	Lostetter, Yorick
CATEGORY OF CITED DOCUMENTS			
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EP 13 15 5087

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