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(54) Title: ORAL IRRIGATOR

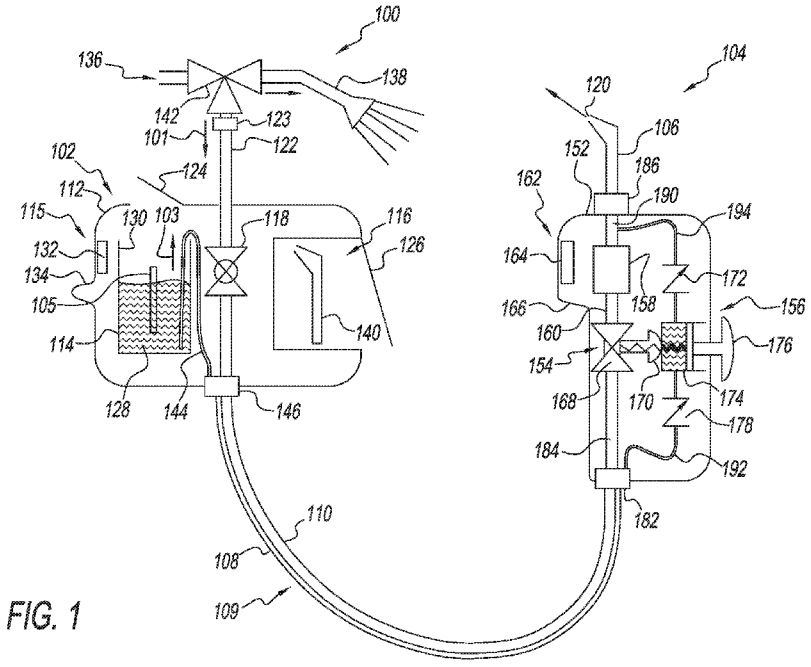

FIG. 1

(57) Abstract: An oral irrigator has a separate high pressure water system and low pressure mouth rinse system to deliver two different fluids to a pick or other accessory. The water system and mouth rinse system are combined in a handle. The pick is connected to the handle. The water system has a blocking valve with a valve button located in the handle and the mouth rinse system has a hand pump with a pump button located in the handle. The pump button is coupled to the valve button such that when the pump button is pressed, the blocking valve is shut off before the hand pump pumps mouth rinse to the pick. When the hand pump is released, the blocking valve opens up and high pressure water returns to the pick.

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Title of Invention:

Oral Irrigator

Technical Field:

Embodiments of the present invention relate to teeth and gum cleaning devices.

Background Art:

Current designs for oral irrigators combine mouth rinses with water in a common reservoir and use an electrically driven pump to deliver the mixture at high pressure to a pick. The high pressure flow may be a pulsatile flow. A user places the pick in said user's mouth to clean said user's teeth and irrigate said user's gums. There is need, however, for an oral irrigator that can deliver full strength mouth rinse to a user's mouth without dilution and high pressure, pulsatile, cleaning water to a user's mouth without requiring the use of an electric pump.

Disclosure of Invention:

The summary of the invention is provided as a guide to understanding the invention. It does not necessarily describe the most generic embodiment of the invention or the broadest range of alternative embodiments.

An improved oral irrigator comprises a high pressure water delivery system in parallel with a low pressure mouth rinse delivery system to alternatively deliver said fluids to a common pick. The water delivery system provides water from a source of high pressure water such as a shower head. The mouth rinse delivery system provides mouth rinse from a source of low pressure mouth rinse, such as a reservoir. Both systems are combined in a handle that a user holds. The pick is attached to the handle. The user irrigates said user's teeth and gums by placing the pick in said user's mouth and manipulating it using the handle. As used herein, a "pick" is any device with a fluid inlet and a fluid outlet. It includes conical tubes with a large inlet and small outlet, T devices with multiple fluid outlets, and devices with brushes, such as a toothbrush with a fluid inlet in the handle and one or more fluid outlets in the brush. The tooth brush may have multiple heads for simultaneously cleaning the tops and sides of teeth.

The water delivery system in the handle comprises a blocking valve with a spring loaded valve button. The spring loaded valve button is biased normally open. When the spring loaded valve button is depressed, the blocking valve and hence the high pressure water is shut off to the pick. This drops the pressure in the pick and allows low pressure mouth rinse to be pumped into the pick with a hand pump that is also in the handle. This also enables the user to turn off the high pressure water to the pick when entering or removing the pick from the mouth. When the user is done pumping mouth rinse into the pick, the spring loaded valve button in the blocking valve is released, the blocking valve opens up, and high pressure water is then reintroduced into the pick. A pressure oscillator may be present in the handle to cause the high pressure water to oscillate in pressure and thus provide a pulsing action to the user's teeth and gums. The pick may have a single exit orifice or may have multiple exit orifices.

The mouth rinse delivery system comprises a hand pump mounted in the handle. The hand pump is used to pump mouth rinse from a reservoir into the pick. Mouth rinse can be any fluid a user might want to introduce into said user's mouth. This includes Listerine® mouthwash, prescription mouth rinses such as chlorhexidine, teeth whitening agents, essential oils and saline rinses. The hand pump has a spring loaded piston that is biased to a normally expanded configuration. As used herein, "spring loaded piston" refers to any compressible chamber that will have a restoring force once compressed. This includes, for example, a thick walled elastomeric bladder. A pump button is attached to the spring loaded piston so that a user can compress the piston by hand and thus pump mouth rinse into the pick. In particular, the pump button is positioned and dimensioned to be pressed by a person's thumb.

The hand pump inside the handle is mounted adjacent to the blocking valve inside the handle such that the valve button on the blocking valve will be pressed in and close the blocking valve when a user puts pressure on the pump button of the hand pump. When the blocking valve closes, the high pressure water is disconnected from the pick. The pressure in the pick drops and allows the user to pump mouth rinse into the pick using the hand pump. When the user releases the pump button, the blocking valve opens and high pressure water is again delivered to the pick.

Alternatively, the pump button and the valve button may be coupled in any manner such that when the pump button is pressed by a user, the valve button will close the blocking valve before the spring loaded piston in the hand pump is substantially compressed. As used herein, "substantially compressed" means that an item is compressed to less than 90% of its original volume. Said coupling may be mechanical, electrical, fluidic and/or hydraulic. For example, in a mechanical coupling, the pump button may be connected to the valve button such that said pump button initially pushes the valve button closed before said pump button contacts the piston and pumps mouth rinse.

In another alternative embodiment, the blocking valve and the hand pump are incorporated into a single unit.

There is an outlet check valve attached to the outlet of the spring loaded piston to prevent high pressure water in the pick from backflowing into the hand pump. There is also an inlet check valve mounted to the inlet of the spring loaded piston to prevent mouth rinse from backflowing into the reservoir when the pump button is pressed. The inlet valve or the outlet valve may be spring loaded pressure relief valves that require a positive pressure to open. This will prevent siphoning of mouth rinse through the system.

The mouth rinse reservoir may be housed in a console mounted on the wall of a shower. High pressure water may be piped from the shower head and through the console. A dual lumen flexible supply tube may separately convey low pressure mouth rinse and high pressure water from the console to the handle. A mount may be provided on the console for holding the handle when the handle is not in use. The mount is dimensioned to hold the exit orifice of the pick above the top of the mouth rinse reservoir so that mouth rinse will not siphon out of the reservoir when the handle is stored on the console.

Brief Description of Drawings:

Figure 1 is a schematic of an oral irrigator.

Figure 2 is a rendering of an exemplary handle.

Figure 3A is a rendering of the handle of figure 2 with the housing removed so the internal fluid systems can be seen.

Figure 3B is a rendering of a handle similar to the handle of figure 3A except the spring loaded piston is shown as an elastomeric bladder.

Figure 4 is a cut away side view of the blocking valve of figure 3A in combination with the hand pump of Figure 3A.

Figure 5 is a rendering of the handle of figure 3B from a top perspective so that a pressure oscillator in the handle is visible.

Figure 6 is a rendering of the pressure oscillator of figure 5.

Figure 7 is a cut away bottom view of the pressure oscillator of figure 5 showing an internal turbine wheel.

Figure 8A is a rendering of a console.

Figure 8B is a rendering of the console of figure 8A with the reservoir cover and right storage door removed.

Figure 9A is a rendering of the console of figure 8A with the housing removed to show the mouth rinse reservoir inside.

Figure 9B is a rendering of the console of figure 9A from a top rear perspective.

Figure 10 is a drawing of a massager pick with left and right side branches and multiple exit orifices.

Figure 11 is a longitudinal cross sectional rendering of an exemplary massager pick.

Modes for Carrying Out the Invention:

The detailed description describes non-limiting exemplary embodiments. Any individual features may be combined with other features as required by different applications for at least the benefits described herein.

As used herein, the term "about" means plus or minus 10% of a given value unless specifically indicated otherwise.

As used herein, the term "shaped" means that an item has the overall appearance of a given shape even if there are minor variations from the pure form of said given shape.

As used herein, the term "substantially" means more than 90% of a given value unless specifically indicated otherwise.

Figure 1 is a schematic of an oral irrigator 100. The oral irrigator comprises a high pressure water delivery system 101 and a low pressure mouth rinse delivery system 103. Both systems are housed in part in a console 102 and an attached handle 104. Attachment is by a flexible supply tube 109.

Console

The water delivery system comprises a water supply tube 122. This conveys high pressure water from a source of high pressure water 136, such as the piping leading into a shower head 138. A three way valve 142 may be provided to redirect high pressure water from the shower head to the water delivery system. Any source of high pressure water may be used, such as an electrically driven pump. The water should have a minimum pressure of 0.695 bar. 2.75 to 4.13 bar is suitable. An electrically driven pump may be provided to boost and control the pressure of the water from the high pressure source. The electrically driven pump may be battery operated. A pressure regulator may be provided to reduce and control the pressure from the high pressure source of water. A pressure regulator may be needed if the source of high pressure water is 6.89 bar or more. A filter 123, such as a screen, may be provided in the water supply tube to remove particulates from the supply water.

The water supply tube proceeds into and through the console. The console may be mounted on the wall of a shower. Any mounting means may be used. The console may be mounted in any convenient location such as next to a sink. A shut off valve 118 may be provided in the water supply tube and as part of the console. A user can turn the high pressure water on or off using the shut off valve. The user can also regulate the flow of high pressure water to an intermediate value by partially closing the shut off valve. The water supply tube may be connected to a console bulkhead fitting 146 at about the bottom of the console. The attachment of tubes to bulkhead fittings may be permanent or removable (e.g. insert fittings). The flexible supply tube may connect to the console bulkhead fitting and convey both high pressure water and low pressure mouth rinse to the handle as separate streams. The flexible supply tube may be a dual lumen tube. The first lumen 110 of said dual lumen tube may have a relatively large internal diameter and connect to the water supply tube via said console bulkhead fitting. A relatively large diameter minimizes the pressure drop of the high pressure water as it passes through the first lumen. A suitable internal diameter is 3 mm or greater. A suitable diameter may further be in the range of 4.5 to 7.5 mm. The flexible supply tube can be any length suitable for conveying high pressure water from the console to the handle. A suitable length is in the range of .5 to 2 meters. A suitable length is about 1 meter.

The console may comprise a reservoir 114 for holding a volume of mouth rinse 128. Mouth rinse may be any fluid suitable for introduction into a person's mouth. The reservoir may have an open top 130 and thus be at about atmospheric pressure (i.e. 0.0 bar). A mouth rinse tube 144 may proceed from inside the reservoir at about its bottom, over about the top of the reservoir, and then outside of the reservoir and down to the console bulkhead fitting. The mouth rinse tube may then be connected to the second lumen 108 of the flexible supply tube. The internal diameter of the second lumen may be small relative to the internal diameter of the first lumen. This keeps the volume of the second lumen small so that a user does not have to pump a hand pump 156 in the handle many times in order to deliver mouth rinse to a pick 106. A suitable diameter for the second lumen is 4 mm or less. A suitable diameter may be in the range of 2.75 mm to 3.25 mm.

The lumens in the flexible supply tube do not have to be circular in cross section. They can be any suitable shape. Suitable dimensions for the noncircular lumens can be calculated from the corresponding suitable diameters of the circular lumens described herein using standard fluid mechanical calculations related to volume in a tube and/or pressure drop versus flow.

The console may comprise a console mount 115. This will be mated to a handle mount 162 on the handle. The combined mounts will hold the handle in a storage position when not in use. The console mount may comprise a magnet 132 and a shelf 134. The handle mount may comprise a magnet 164 and an overhang 166. The magnets, shelf and overhang align so that the overhang sits on the shelf and the magnets are about opposite of each other and urge towards each other when the handle is mounted on the console. The shelf height is set so that the exit orifice 120 of the pick is above the top of the reservoir 130. This will prevent mouth rinse from siphoning through the mouth rinse delivery system when the handle is stored on the console.

The console may have a housing 112. A cover 124 may be provided in the console housing and above the top of the reservoir to prevent shower water or other materials from entering the reservoir. The cover may be hinged to allow easy opening and refilling of the reservoir. A level gauge 105 may be provided so that the user can see when the reservoir needs to be refilled.

A storage chamber 116 may be provided in the console. The storage chamber may be used to store one or more additional picks 140. The additional picks may be used by different people that use the oral irrigator. The picks may be color coded. A door 126 may be provided in the console housing to cover the storage chamber.

Handle

The flexible supply tube conveys high pressure water and low pressure mouth rinse to the handle 104. The flexible supply tube may connect to a bottom bulkhead fitting 182 in the bottom of the handle. The first lumen of the flexible supply tube connects to an inlet water tube 184 in the handle. The inlet water tube connects to the inlet of a blocking valve 154 mounted in the handle. The outlet of the blocking valve connects to an outlet water

tube 160. The outlet water tube may connect to the inlet of an optional pressure oscillator 158. The outlet of the pressure oscillator 190 connects to a top bulkhead fitting 186 in about the top of the handle. The pick 106 connects to the top bulkhead fitting. A releasable connection may be provided in the top bulkhead fitting to hold the pick in place and then release it as needed. The releasable connection may be a quick disconnect that can be operated by hand.

The blocking valve comprises a body 168 and a spring loaded valve button 170. The handle may comprise a housing 152. The body of the blocking valve may rest against the housing of the handle so that it is held firmly in place when pressure is placed on the spring loaded valve button. The spring loaded valve button is biased normally open. When the button is pressed, the blocking valve closes. When the button is released, the blocking valve opens.

The second lumen in the flexible supply tube is connected through the bottom bulkhead fitting of the handle to a flexible inlet mouth rinse tube 192. The inlet mouth rinse tube connects to an inlet check valve 178 of the hand pump 156. The hand pump comprises the inlet check valve, a spring loaded piston 174, a pump button 176 and an outlet check valve 172. The outlet check valve connects to a flexible outlet mouth rinse tube 194. The outlet mouth rinse tube connects to the oscillator outlet 190.

The hand pump may be flexibly mounted inside the handle housing and adjacent to the blocking valve so that when the pump button is pressed and lateral force is placed on the spring loaded piston, the spring loaded piston can move laterally and provide force on the valve button and thus close the blocking valve. When the blocking valve is closed, the high pressure water in the pick drains out and the pressure in the oscillator outlet drops. The spring loaded piston can then compress under the hand force placed on the pump button and mouth rinse is pumped into the oscillator outlet and hence into the pick. When the pump button is released, the valve button on the blocking valve returns to its open position and high pressure water flows back into the pick.

Alternatively, the blocking valve and the hand pump may be mounted side by side in the handle. The valve button and pump button may then be mechanically connected such

that when the user pushes the pump button down, the valve button is pushed down and closes the blocking valve before the spring loaded piston is compressed by the pump button. The hand pump and blocking valve may be rigidly mounted inside the handle housing and adjacent to each other when the hand pump and blocking valve are in a side by side configuration.

The outlet check valve in the hand pump is biased away from the spring loaded piston so that said outlet check valve prevents high pressure water downstream of the blocking valve from backflowing into the hand pump. The inlet check valve on the hand pump is biased into the spring loaded piston so that mouth rinse does not backflow into the reservoir when said spring loaded piston is compressed.

The pressure oscillator 158 may be any device that causes fluctuations in the pressure of the water flowing into the pick. This includes mechanical devices, electrically powered devices, and fluidic devices. An exemplary turbine based pressure oscillator is described herein with reference to figures 6 and 7. A pressure oscillator is not required, however. The system is still efficacious if there is no pressure oscillator.

Exemplary Handle

Figure 2 is a rendering of an exemplary handle 200. The handle comprises a top bulkhead fitting 204, a housing 202, and a bottom bulkhead fitting 206. The housing is shaped to provide an overhang 224 above a bulge 222. This provides a grip for a user that will be secure even if the user has a slippery hand due to, for example, use in a shower. The overhang forms part of a handle mount. A magnet 226 may be provided inside the housing and underneath the overhang to mate with a corresponding magnet in a console. Any shape housing may be used, however, provided it can be held in a person's hand.

A pick button 212 may be provided so that a pick 214, may be held in place in the top bulkhead fitting. When the pick button is depressed, the pick is released. Any means of holding the pick, however, may be used.

A pump button 208 may protrude out of the housing so that a user may depress the pump button and pump mouth rinse into the pick as described above.

The bottom bulkhead fitting may be adapted to receive an end of a dual lumen flexible supply tube 232. The flexible supply tube may comprise a first lumen 234 for conveying high pressure water and a second lumen 236 for conveying low pressure mouth rinse. The tubing does not have to be dual lumen. Separate tubes for the mouth rinse and high pressure water may be used.

Figure 3A is a rendering 300 of the handle of figure 2 with the housing removed so that the internal fluid systems can be seen. The internal fluid systems comprise portions of the water delivery system 301 and mouth rinse delivery system 303. The water delivery system in the handle comprises a first lumen 342 in the bottom bulkhead fitting 307 (cover removed), a water inlet tube 308, a blocking valve 304 comprising a valve button 306, a water outlet tube 302 and a pressure oscillator 314. The pressure oscillator is hidden by the water outlet tube in the view presented in Figure 3A. It is visible as item 314 in figure 5. The pick 214 is shown mounted in the outlet of the pressure oscillator with the top bulkhead fitting that holds the pick in place rendered invisible. A pick exit orifice 324 is shown at the distal tip of the pick. A pick inlet 326 is shown at the proximal end of the pick.

The mouth rinse delivery system in the handle comprises a second lumen 344 in the bottom bulkhead fitting, an inlet mouth rinse tube 322, a hand pump 305 and an outlet mouth rinse tube 312. The hand pump comprises an inlet check valve 320, a spring loaded piston 318, the pump button 208, and an outlet check valve 316. The hand pump may be flexibly mounted inside the handle with its bottom located on the top of the valve button of the blocking valve. The blocking valve rests against the handle housing (item 202, figure 2) so that the blocking valve will be firmly mounted in place and the valve button can be depressed when the pump button on the hand pump is pressed and the bottom of the spring loaded piston is pushed down.

Figure 3B is a rendering of a handle 331 similar to the handle 300 of figure 3A except the spring loaded piston is shown as an elastomeric bladder 334. The outlet check valve 332 and inlet check valve 336 are shown as flap valves. Any configuration of spring loaded piston may be used provided said spring loaded piston can be mounted in a handle held by a person.

Figure 4 is a cut away side view of the blocking valve 304 of figure 3A in combination with the hand pump 305 of Figure 3A. The pick 214, pressure oscillator 314, outlet water tube 302, and inlet water tube 308 are shown schematically.

The blocking valve comprises a body 402, a cap 404, and a spring loaded valve button 306. The body comprises an inlet 412, an internal channel 416, a lateral bore 424 at right angles to the internal channel, and an outlet 414. The spring loaded valve button comprises a shaft 406, a spring 426 and a distal tip 422.

The inlet and outlet of the blocking valve are collinear so that pressurized water can flow from the bottom of the handle up to the pick mounted in the top of the handle. The collinearity of the inlet and outlet helps keep the width 410 of the blocking valve to less than twice the diameter of the inlet water tube or outlet water tube. This helps keep the overall width of the handle small enough to fit in a person's hand. A suitable width of the blocking valve is 12.5 mm. A suitable outer diameter of the inlet water tube is 8.5 mm. A suitable ratio of the width of the blocking valve to the outer diameter of the inlet water tube is 1.5 or less.

Alternatively, the inlet and outlet of the blocking valve may be codirectional with a lateral offset therebetween. As used herein, "codirectional" means that the longitudinal axis of the inlet and the longitudinal axis of the outlet are in about the same direction, but the axes may be offset laterally from each other. Collinearity is a special case of unidirectionality where the lateral offset is about zero. An offset that is greater than about zero may be referred to as a "dog leg".

The valve button is mounted horizontally in the bore of the valve body. The spring 426 surrounds the shaft of the valve button. The spring is normally compressed so that it biases the valve button out. A seal 428, such as an O ring, may be provided to make the spring loaded valve button water tight against the bore. The cap 404 may screw onto, snap onto, press fit onto or otherwise attached to the valve body to hold the valve button in the bore.

The tip of the valve button may partially extend into the internal channel of the valve body. 1 mm is a suitable extension for a diameter of the internal channel of 2 mm. A

recessed seat 418 may be provided in the internal channel and opposite the tip of the valve button. When the valve button is pressed in, the tip proceeds across the rest of the internal channel and into the seat to seal off said internal channel. The outer diameter of the shaft should be larger than the internal diameter of the internal channel so that it completely blocks the internal channel when the blocking valve is closed. A suitable outer diameter of the shaft is 3 mm when the internal diameter of the internal channel is 2 mm.

In order to keep the width of the blocking valve small, the diameter of the internal channel has to be small so that the tip of the valve button does not have to travel far to close the blocking valve. This helps keep the length of the valve button that extends above the top of the cap small. A suitable diameter of the internal channel is 2 mm.

A suitable internal diameter of the inlet and outlet of the blocking valve is about 4.5 mm. It is surprising that the diameter of the internal channel can be less than ½ of the diameter of the inlet or outlet. Normally this would produce an unacceptable pressure drop in a general purpose blocking valve. In the applications described herein, however, small diameter of the internal channel is acceptable due in part to the even smaller diameter of the exit orifice 324 in the pick. A suitable diameter of the exit orifice is in the range of 0.45 to 1.0 mm. This is required to get maximum velocity in the high pressure water exiting the pick without causing atomization. Thus most of the pressure drop of the high pressure water flowing through the handle occurs at the exit orifice of the pick where it translates to a high velocity water jet for cleaning teeth.

The hand pump 305 in figure 4 comprises an outlet check valve 316 (shown schematically), a cylinder 436, a spring loaded piston 318 and an inlet check valve 320 (shown schematically). The piston is mounted within the cylinder. A piston shaft 444 and piston spring 442 (shown schematically) extend laterally from the piston and are mounted to the pump button 208. A recess 432 is provided in the bottom of the cylinder. The valve button of the blocking valve is located in the recess. The recess may be large enough to fit over the top of the cap of the blocking valve.

A leading edge of mouth rinse 438 is shown emerging from the outlet check valve when the pump button is pressed, the blocking valve is closed, and mouth rinse is pumped

to the pick. The outlet of the hand pump is connected to the outlet of the pressure oscillator and hence to the inlet of the pick.

Figure 5 is a rendering of the handle 331 of figure 3B with the pressure oscillator 314 visible. The blocking valve 304 and elastomeric bladder 334 are also shown. The pressure oscillator comprises an oscillator inlet 502, an oscillator outlet 504, a turbine housing 506, one or more mounting tabs 512 and a mouth rinse port 508. The outlet water tube 302 proceeds from the blocking valve and is bent to introduce high pressure water horizontally into the turbine housing. The oscillator outlet proceeds upwards from the top of the turbine housing where it connects to the pick 214. The outlet mouth rinse tube 312 proceeds up from the elastomeric bladder and connects horizontally to the mouth rinse port. The mouth rinse port is connected to the oscillator outlet. Thus in operation, only water proceeds through the pressure oscillator. This minimizes clogging that might occur due to chemicals or other materials that may be present in the mouth rinse. It also reduces the hand pressure required to pump mouth rinse into the pick.

Figure 6 is a rendering of the pressure oscillator 314 of figure 5. The oscillator inlet 502, oscillator outlet 504, turbine housing 506 mouth rinse port 508 and mounting tabs 512 can be seen. The turbine housing comprises a top 602, side wall 604 and bottom 606.

Figure 7 is a cut away bottom view of the pressure oscillator 314 of figure 5. The oscillator inlet 502, oscillator outlet 504, and mouth rinse port 508 can be seen. The pressure oscillator comprises a turbine 700. The turbine comprises a turbine housing 506 and a turbine wheel 702. The turbine housing comprises a top 602, a side wall 604 and a bottom (item 606, figure 6). The turbine wheel comprises a hub 714, and a plurality of vanes 712. The turbine side wall has a generally circular horizontal cross section. A turbine inlet 708 introduces high pressure water into the housing from the oscillator inlet in a direction that is generally tangential to the side wall.

A turbine outlet 704 is located in the turbine top. The turbine outlet allows water to flow from the turbine into the outlet of the pressure oscillator. The mouth rinse port 508 is downstream of the turbine outlet.

The turbine housing comprises a vertical axle 706 located at about the center of the circular cross section of the side wall. The vertical axle can be attached to either the top of the turbine housing or the bottom. The hub of the turbine wheel sits on the axle. The turbine vanes proceed radially from the hub. They are spaced regularly on the hub. Each vane has a distal tip 732. There is a gap 726 between the distal tips of the vanes and the side wall. Each vane is described by a width 710 and a length 711.

In operation, high pressure water flows into the turbine inlet and causes the turbine wheel to spin. The high pressure water then flows out of the turbine outlet. When the vanes sweep past the turbine outlet, the outlet is partially blocked. This causes pressure fluctuations in the high pressure water flowing out of the turbine outlet and into the pick. A suitable width of the vanes is 1 mm or greater for a turbine outlet diameter of about 3 mm. The diameter of the side wall is about 13 mm. It has been found by experiment that a relatively wide gap of .5 mm or greater between the tips of the vanes and the side wall helps the turbine wheel spin freely. A suitable ratio of gap to side wall diameter, therefore, is 0.03 or greater.

A suitable hub diameter is about 5.5 mm. A suitable overall wheel diameter is about 12 mm. 6 is a suitable number of vanes. The turbine outlet should be located far enough away from the turbine inlet so that there is always at least one vane between the inlet and outlet. This will prevent water from flowing directly to the outlet without rotating the vanes. The closest spacing 718 between the turbine inlet and outlet, therefore, should be greater than the spacing 716 between the tips of two adjacent vanes. If the vane tips are spaced 5.5 mm apart, for example, then the closest spacing between the turbine inlet and the turbine outlet should be at least 5.5 mm. A spacing of 5.9 mm is suitable.

Exemplary Console

Figure 8A is a rendering of an exemplary console 800. The console comprises a housing 810, a reservoir for mouth rinse (item 902, figure 9A), a reservoir cover 802, a reservoir level gauge 812, a water supply tube 816, a shelf 808, a shut off valve 814, a console bulkhead fitting 818, a left storage door 804 and a right storage door 806. The dual lumen flexible supply tube 232 of figure 2 is attached to the bottom of the console bulkhead

fitting. The console bulkhead fitting is attached to about the bottom of the console. The water supply tube conveys high pressure water from a source of high pressure water to the console bulkhead fitting. The shut off valve is adapted to close the water supply tube or open it as required. The reservoir cover is attached to the top of the housing with a rear hinge. It overhangs the housing to form an air passage 822 from outside the housing to underneath the cover. This allows air to go into the reservoir when mouth rinse is pumped out. The left side door and right side door are each attached to the back of the housing by a hinge.

The shelf 808 is designed to form a stable cradle for the overhang 224 (Figure 2) of the handle. As used herein, a "stable cradle" is a mount that holds an item such that said item is held on said mount by the force of gravity. Said shelf forms a stable cradle for said overhang in part due to said self's arcuate form which wraps in part around the handle underneath the overhang. A magnet may still be provided, for example, in the shut off valve 814 so that the magnet in the handle will urge towards it and increase the stability of the handle being held on the cradle.

Figure 8B is a rendering 830 of the console of figure 8A with the reservoir cover and right storage door removed. A reservoir inlet 832 can be seen. In operation, a user can open the reservoir cover and pour mouth rinse into the reservoir inlet. The cover can then be closed to keep foreign matter, including shower water, from entering the reservoir. The right storage chamber 834 has room for one or more extra picks 836. The picks may be held in place by one or more clips 838. The picks may be color coded 842 so that different colored picks can be assigned to different users. The storage chamber is wider at its top than at its bottom. The top area may have clips or other holders for storing wider picks, such as the massager pick described in figure 11. A similar or different structure may be provided in a left storage chamber that is covered by the left storage door.

Figure 9A is a rendering 900 of the console of figure 8A and 8B with the housing removed. The water supply tube 816, reservoir inlet 832, level gauge 812, shut off valve 814 and console bulkhead fitting 818 (cover removed) are visible. The reservoir 902 can now be seen. The reservoir can be made of any material compatible with mouth rinses. Polyethylene is a suitable material. The material may be at least translucent or transparent

so that the level of mouth rinse can be seen in the level gauge. The shape of the reservoir can be adapted to conform to the desired housing shape.

The reservoir comprises a top 908 and a bottom 906. A console mouth rinse tube 904 may proceed from about the bottom of the reservoir to the top of the reservoir and then back down to the console bulkhead fitting. There it is connected to the second lumen 236 of the flexible supply tube 232. An advantage of having the console mouth rinse tube proceed up from the bottom of the reservoir to the top of the reservoir is that there is no need for a fitting in the bottom of the reservoir to remove mouth rinse. Said fitting might leak.

The shut off valve comprises a handle 912 and a body 914. The water supply tube connects to the body of the shut off valve and is shut off when the handle is turned. The shut off valve may be a ball valve. The shut off valve may alternatively be a regulating valve in case the pressure delivered to the handle needs to be reduced.

Figure 9B is a rendering 900 of the console of figure 9A from a top rear perspective. The water supply tube 816 proceeds down through a U channel 922 in the reservoir 902. It then connects to the body of the shut off valve 914. A connection is then made to the console bulkhead fitting and first lumen 234 of the flexible supply tube.

A shelf 926 may be provided to support the reservoir. The console mouth rinse tube 904 can be seen emerging from the top of the reservoir 908. A clip 924 is provided to secure the console mouth rinse tube.

Massager pick

Figure 10 is a drawing of a massager pick 1000. The massager pick may be used to massage a person's gums and/or clean said person's teeth. The massager pick comprises an inlet tube 1002 where fluid goes in 1022, a left side branch 1004 and a right side branch 1006. The left side branch and right side branch proceed horizontally from the distal end of the inlet tube. Said branches may be curved. Said branches may be flexible 1008. A plurality of exit orifices 1014 may be on said branches. Said exit orifices may all be on the

same side of the branches. Thus when a massager pick is placed inside a user's mouth, the outlet water 1024 will impinge the same side of said person's teeth and gums.

Raised nubs 1012 may be provided on the left and right side branches. The orifices may proceed through said nubs. The nubs may be rubbed against a person's gums for a massaging effect. In an alternative embodiment, only one branch may be provided in the massager pick.

Figure 11 is a longitudinal cross sectional rendering of an exemplary massager pick 1100. The massager pick comprises an inlet tube 1102, a hollow left side branch 1104, a hollow right side branch 1106 and a hollow bridge 1113. The inlet tube has an inlet 1152 and an outlet 1154. The left side branch has an inlet 1166 and an outlet 1168. The right side branch has an inlet 1156 and an outlet 1158. The bridge has a left end 1164, a right end 1162 and a top surface 1108. The outlet of the inlet tube is connected to the inlets of the left and right side branches. The outlets of the left and right side branches are connected to the left and right ends of the bridge. There is a plurality of exit orifices 1114 in the top surface of the bridge. These orifices may each have a diameter in the range of 0.45 to 1 mm.

The bridge may have a longitudinal concave arcuate shape 1172. The inlet tube, left side branch, right side branch and bridge may be made from a rigid material 1117 such as plastic. The bridge may nonetheless be flexible enough so that it bends in or out when pressed against a surface with a smaller or larger radius of curvature than the radius of curvature of the concave arcuate shape. For example, the arcuate shape of the bridge may conform to the shape of a user's teeth or gums when the massager pick is pressed against them using the normal force a person could provide. It may then return to its original shape when removed from said person's mouth. Alternatively, the massager may be designed to conform to a person's mouth shape upon initial use and remain in said shape when removed from said person's mouth.

The top surface of the bridge may form a plurality of upward directed converging nozzles 1116. The upward wall of the bridge may be covered with a layer of elastomer 1115 that is shaped into a plurality of upward directed nubs 1112. Each exit orifice passes

through one of the upward directed nozzles and upward directed nubs. The portions of the exit orifices that passes through the layer of elastomer may flare out. This may create a sub-atmospheric pressure at the interface of the bridge and the elastomeric layer. The sub-atmospheric pressure will reduce the likelihood of the water inside the exit orifice from leaking between the elastomeric layer and the top surface of the bridge and thus causing the two to separate from each other. The elastomeric layer may also be stepped back from the exit orifices in the bridge. This will reduce the possibility of stray flashing from a molding process used to make the elastomeric layer from overlapping the exit orifices and directing water underneath the elastomeric layer.

The inlet tube 1102 may comprise an inlet fitting 1103. The inlet fitting may be adapted to reversibly connect to an adapter fitting 1122. A thread 1105 and O ring 1107 may be provided to connect the inlet fitting to the adapter fitting. The adapter fitting may comprise one of a number of alternative connection means, such as a quick disconnect 1124. Figure 11 shows an alternative adapter fitting 1132 that comprises a tubing fitting 1134. Alternatively, inlet fitting itself may be a quick disconnect, tubing or other appropriate fitting.

Conclusion

While the disclosure has been described with reference to one or more different exemplary embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the disclosure. In addition, many modifications may be made to adapt to a particular situation without departing from the essential scope or teachings thereof. Therefore, it is intended that the disclosure not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention.

The Claims:

We claim:

1. An oral irrigator comprising:

    a) a water delivery system for connecting a source of high pressure water to an inlet of a pick;

    b) a mouth rinse delivery system for connecting a reservoir of mouth rinse to said inlet of said pick;

    c) a handle comprising:

        i) a blocking valve comprising:

            1) a blocking valve inlet;

            2) a blocking valve outlet;

            3) a body comprising an internal channel connecting said blocking valve inlet to said blocking valve outlet; and

            4) a spring loaded valve button wherein:

                a) said spring loaded valve button is biased to a normally open position; and

                b) said spring loaded valve button will close off said internal channel when urged closed; and

        ii) a hand pump comprising:

            1) a spring loaded piston wherein said spring loaded piston is biased to a normally expanded configuration;

            2) a pump button attached to said spring loaded piston such that said spring loaded piston will be compressed when pressure is placed on said pump button;

            3) an inlet check valve connected to said spring loaded piston and biased to allow fluid flow into said spring loaded piston; and

            4) an outlet check valve connected to said spring loaded piston and biased to allow fluid flow out of said spring loaded piston

    wherein:

    d) said water delivery system comprises said blocking valve;

    e) said mouth rinse delivery system comprises said hand pump; and

f) said pump button is coupled to said valve button such that when said pump button is pressed by a user, said valve button will close said blocking valve before said spring loaded piston in said hand pump is substantially compressed.

2. The oral irrigator of claim 1 which further comprises:

a) a console comprising:

i) said reservoir;

ii) a mouth rinse tube; and

iii) a water supply tube for connecting to said source of high pressure water; and

b) a flexible supply tube comprising:

i) a first lumen; and

ii) a second lumen

wherein:

c) said first lumen is part of said water delivery system and is adapted to convey said high pressure water from said water supply tube to said handle;

d) said mouth rinse tube is part of said mouth rinse delivery system and is adapted to convey mouth rinse from said reservoir to said second lumen; and

e) said second lumen is part of said mouth rinse delivery system and is adapted to convey mouth rinse from said mouth rinse tube to said handle.

3. The oral irrigator of claim 2 which further comprises said pick and wherein:

a) said handle comprises a handle mount;

b) said console comprises a console mount that mates with said handle mount;

c) said reservoir comprises a top and a bottom;

d) said pick is mounted on said handle; and

e) said console mount is vertically positioned on said console such that said exit orifice of said pick will be above said top of said reservoir when said handle is mounted on said console such that mouth rinse will not be siphoned out of said reservoir when said handle is mounted on said console.

4. The oral irrigator of claim 3 wherein said console mount is a stable cradle for said handle mount such that said handle will be held on said console by the force of gravity.

5. The oral irrigator of claim 3 wherein:

a) said handle mount comprises a magnet and an overhang;

b) said console mount comprises a magnet and a shelf; and

c) said magnets will urge towards each other and said overhang will rest on said shelf when said handle is mounted on said console.

6. The oral irrigator of claim 3 wherein:

a) said console comprises:

i) a top;

ii) a bottom; and

iii) a console bulkhead fitting comprising a top and a bottom;

b) said console bulkhead fitting is mounted on about said bottom of said console; and

c) said flexible supply tube is mounted into said bottom of said bulkhead fitting;

d) said mouth rinse tube proceeds from said bottom of said reservoir over said top of said reservoir and connects to said top of said bulkhead fitting and hence to said second lumen of said flexible supply tube.

7. The oral irrigator of claim 1 which further comprises said pick and wherein said pick is a massager pick comprising:

a) a hollow left side branch comprising an inlet and an outlet;

b) a hollow right side branch comprising an inlet and an outlet;

c) an inlet tube comprising an inlet and an outlet; and

d) a hollow bridge comprising a left end, a right end and a top surface

wherein:

e) said outlet of said inlet tube is connected to said inlet of said left side branch and said inlet of said right side branch;

f) said left end of said bridge is connected to said outlet of said left side branch;

g) said right end of said bridge is connected to said outlet of said right side branch; and

h) said top surface comprises a plurality of exit orifices.

8. The oral irrigator of claim 7 wherein said bridge has a longitudinal concave arcuate shape with a radius of curvature.

9. The oral irrigator of claim 8 wherein:

a) said top surface of said bridge comprises a plurality of upward directed converging nozzles;

b) said top surface of said bridge is covered with an elastomeric layer;

c) said elastomeric layer is shaped to form a plurality of upward directed nubs; and

d) each of said exit orifices passes through one of said nozzles and one of said nubs.

10. The oral irrigator of claim 7 wherein each of said plurality of exit orifices have a diameter in the range of 0.45 to 1 mm.

11. The oral irrigator of claim 1 wherein said inlet of said blocking valve is codirectional with said outlet of said blocking valve.

12. The oral irrigator of claim 1 wherein:

a) said hand pump comprises a cylinder.

13. The oral irrigator of claim 1 wherein:

a) said handle is dimensioned to fit in a person's hand; and

b) said pump button is dimensioned and positioned to receive pressure from said person's thumb.

14. The oral irrigator of claim 1 which further comprises said pick and wherein said pick comprises a brush.

15. A massager pick for an oral irrigator comprising:

a) a hollow left side branch comprising an inlet and an outlet;

b) a hollow right side branch comprising an inlet and an outlet;

c) an inlet tube comprising an inlet and an outlet; and

d) a hollow bridge comprising a left end, a right end and a top surface

wherein:

e) said outlet of said inlet tube is connected to said inlet of said left side branch and said inlet of said right side branch;

f) said left end of said bridge is connected to said outlet of said left side branch;

g) said right end of said bridge is connected to said outlet of said right side branch; and

h) said top surface comprises a plurality of exit orifices.

16. The massager pick of claim 15 wherein:

a) said bridge has a longitudinal concave arcuate shape with a radius of curvature.

17. The massager pick of claim 15 wherein:

a) said top surface of said bridge comprises a plurality of upward directed converging nozzles;

b) said top surface of said bridge is covered with an elastomeric layer;

c) said elastomeric layer is shaped to form a plurality of upward directed nubs; and

d) each of said exit orifices passes through one of said nozzles and one of said nubs.

18. The massager pick of claim 15 wherein said exit orifices each have a diameter in the range of 0.45 to 1 mm.

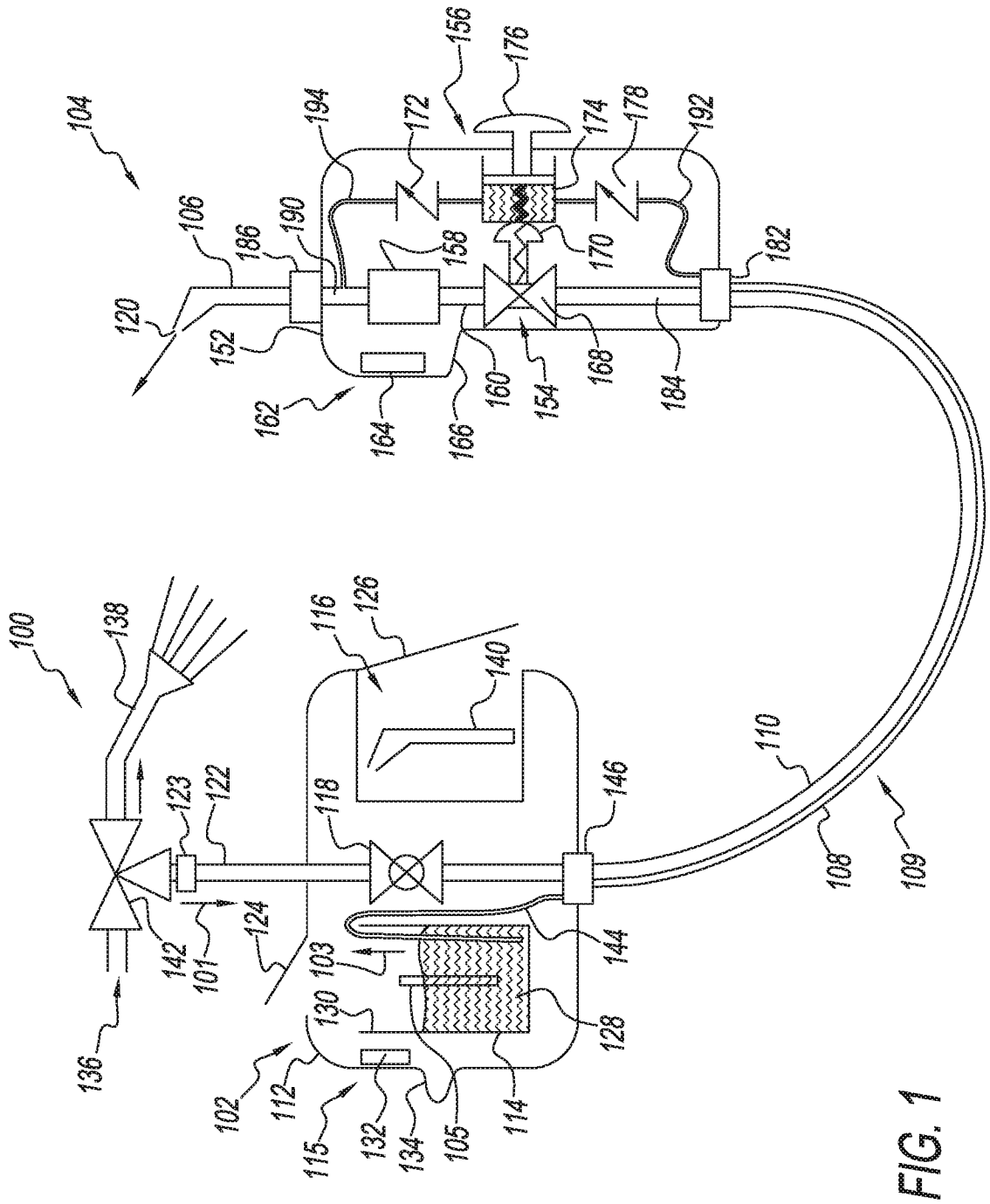
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FIG. 1

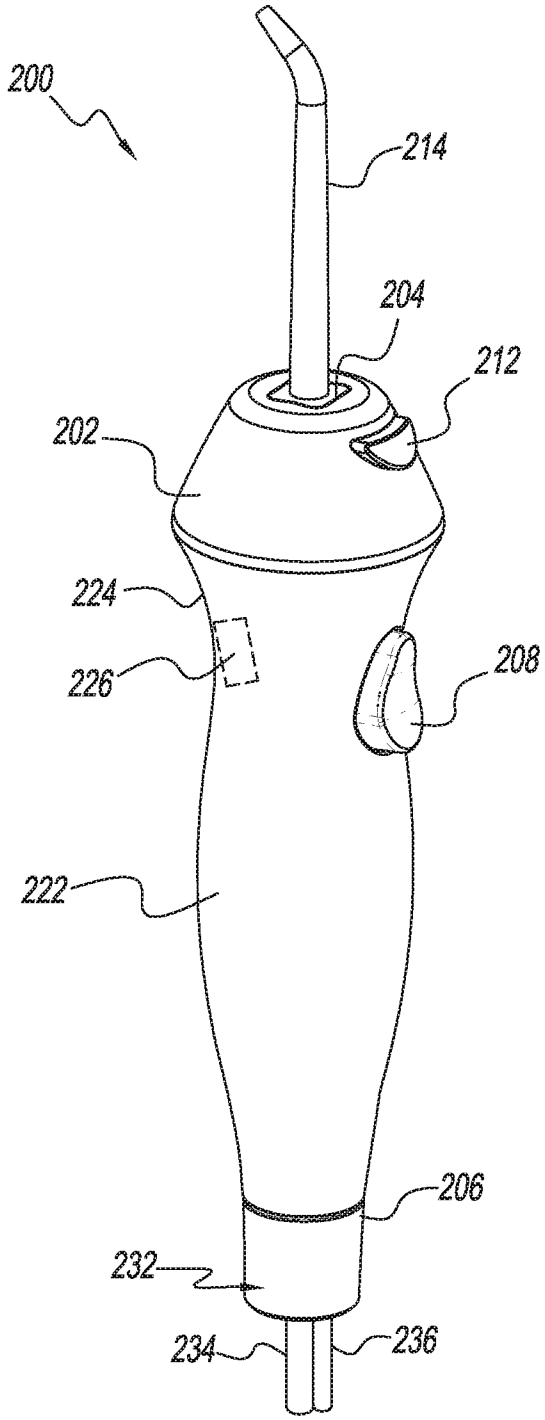

FIG. 2

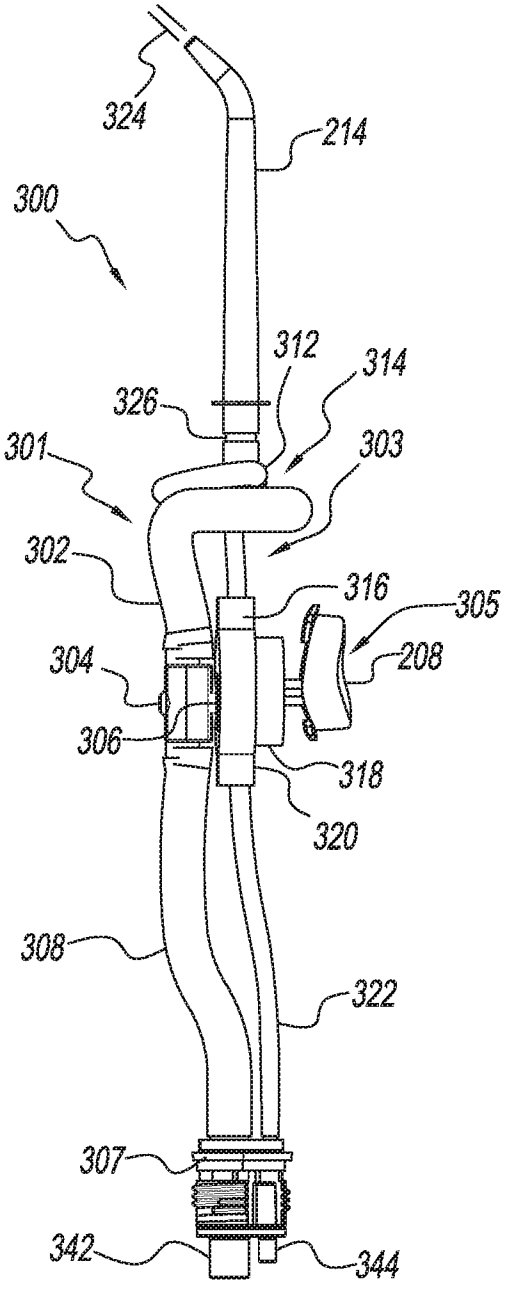
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FIG. 3A

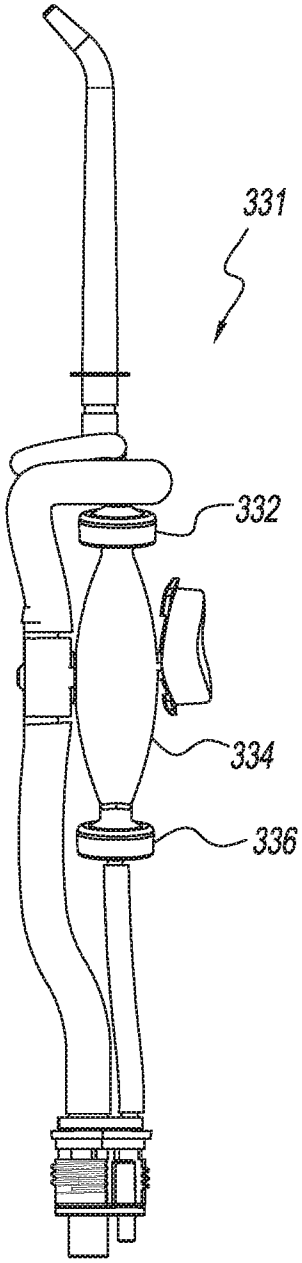
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FIG. 3B

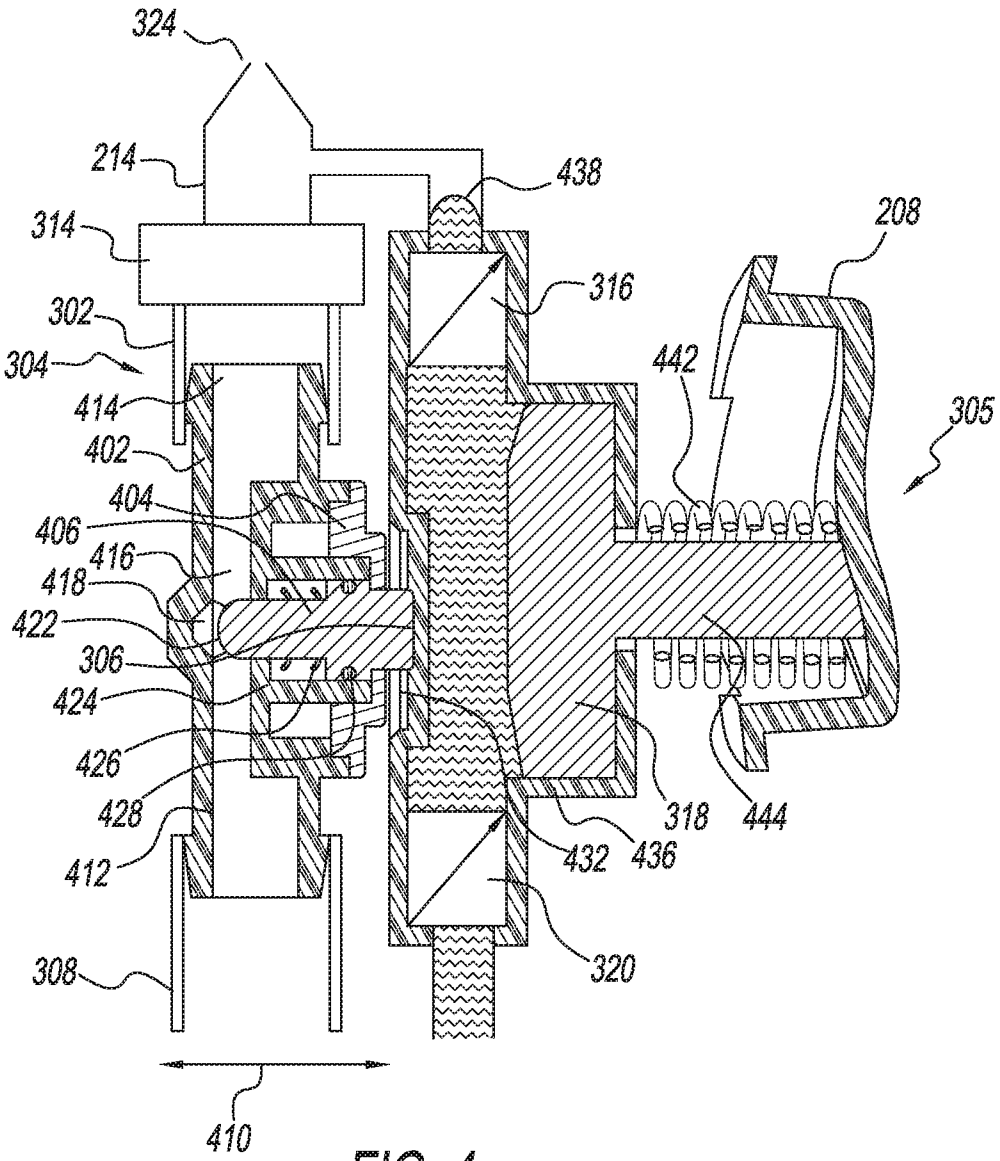
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FIG. 4

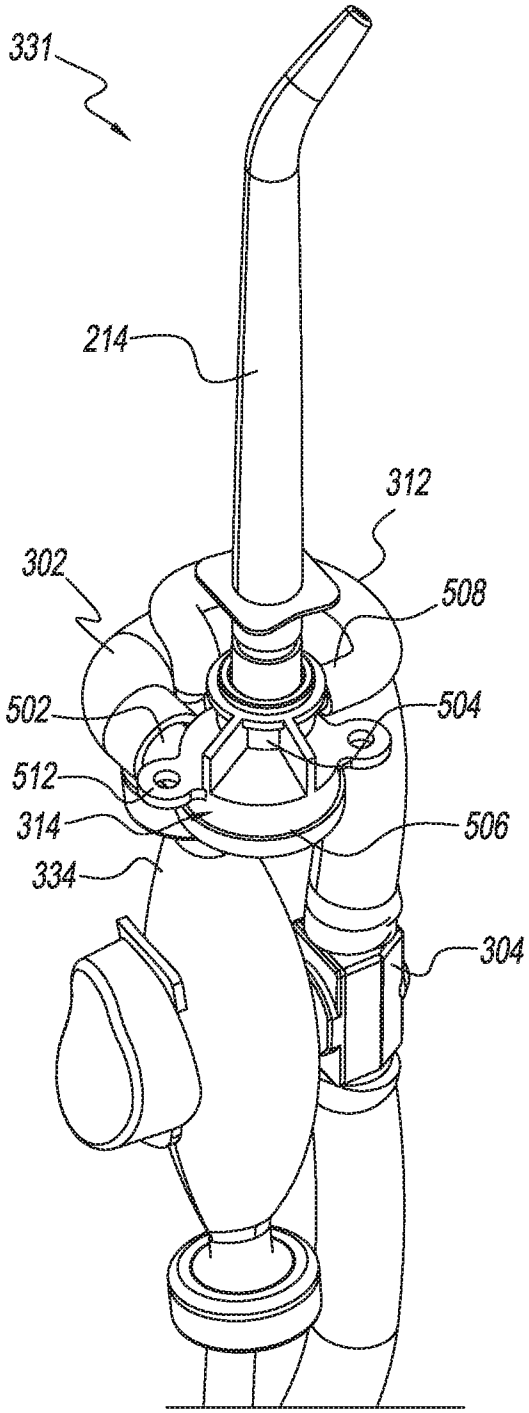

FIG. 5

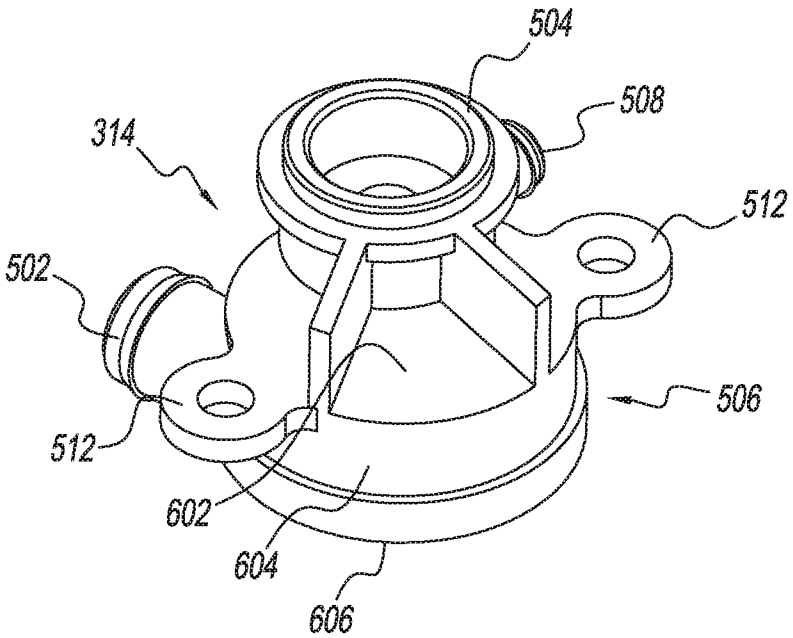

FIG. 6

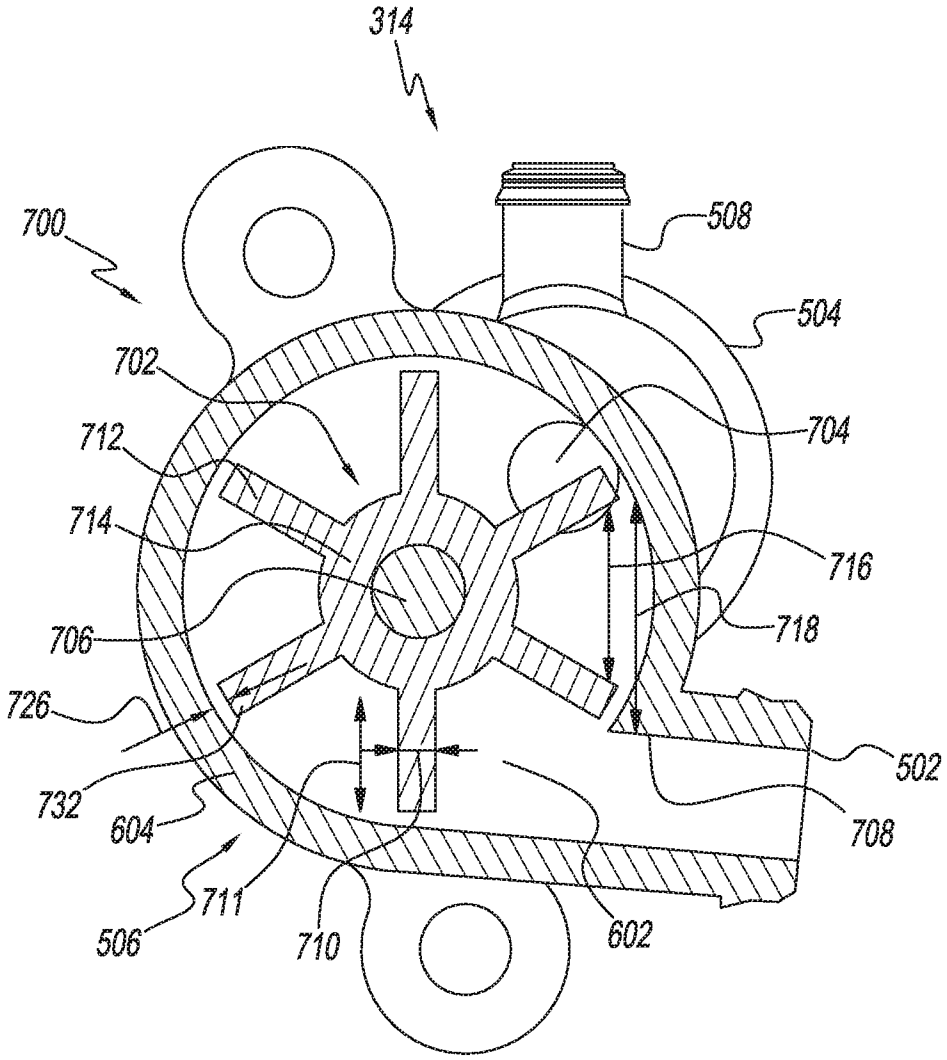
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FIG. 7

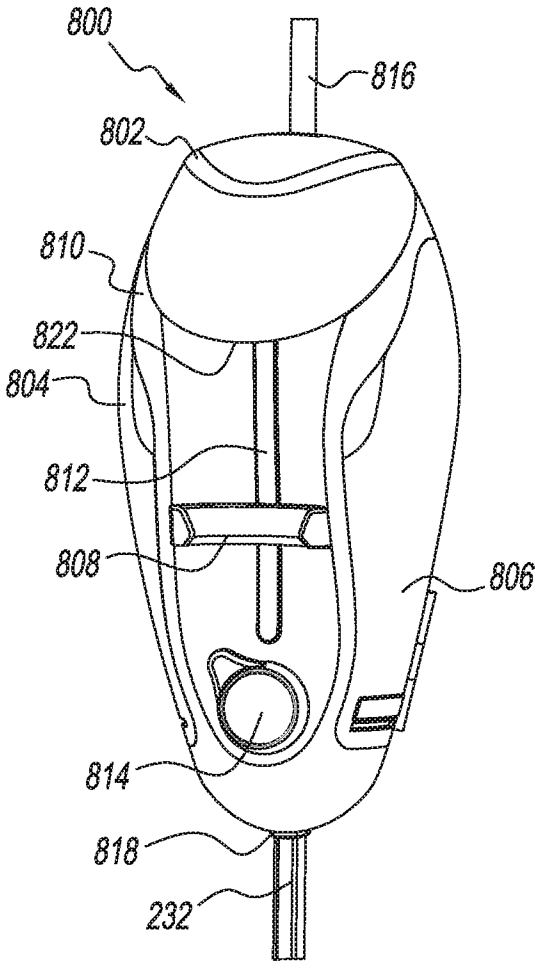
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FIG. 8A

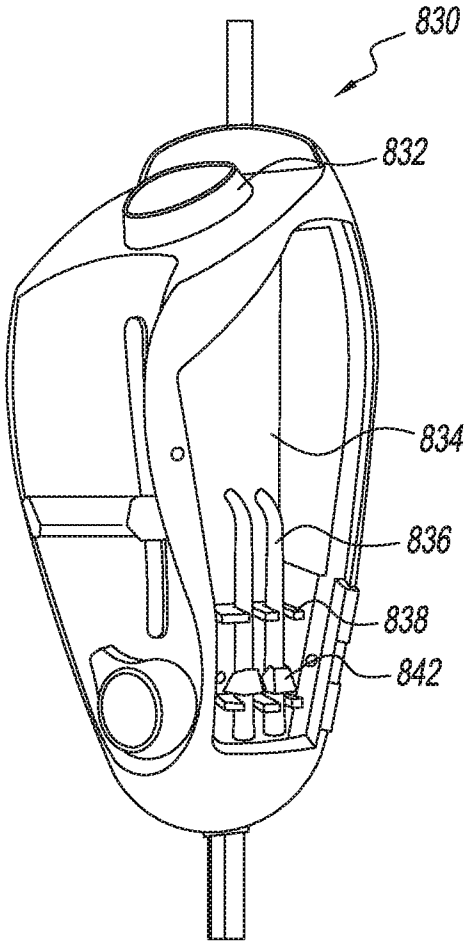
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FIG. 8B

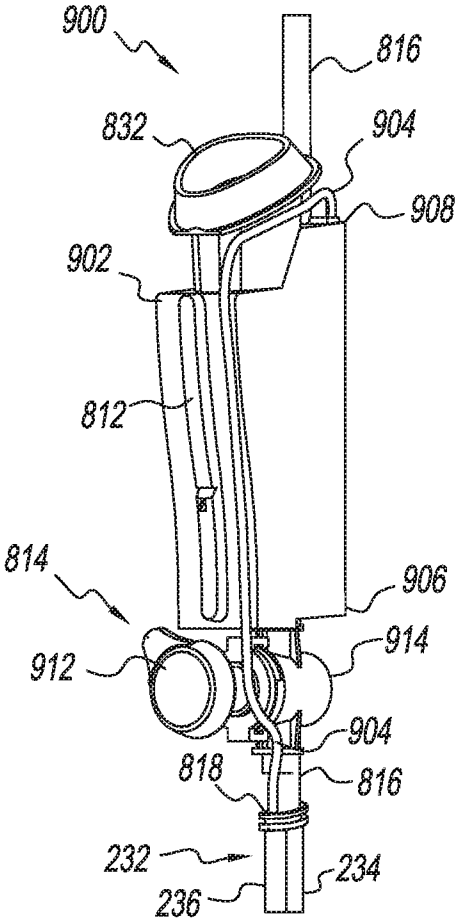
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FIG. 9A

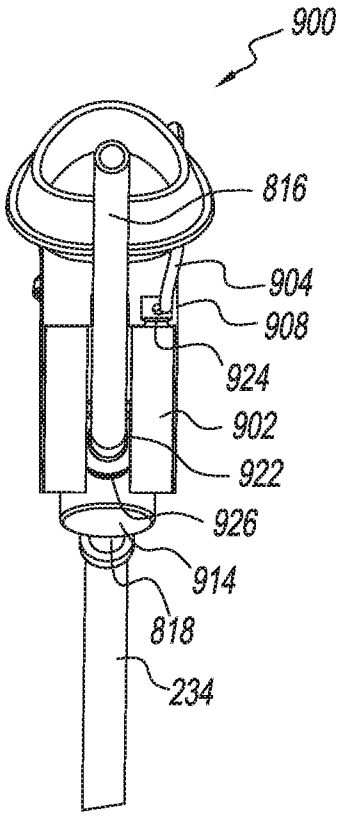
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FIG. 9B

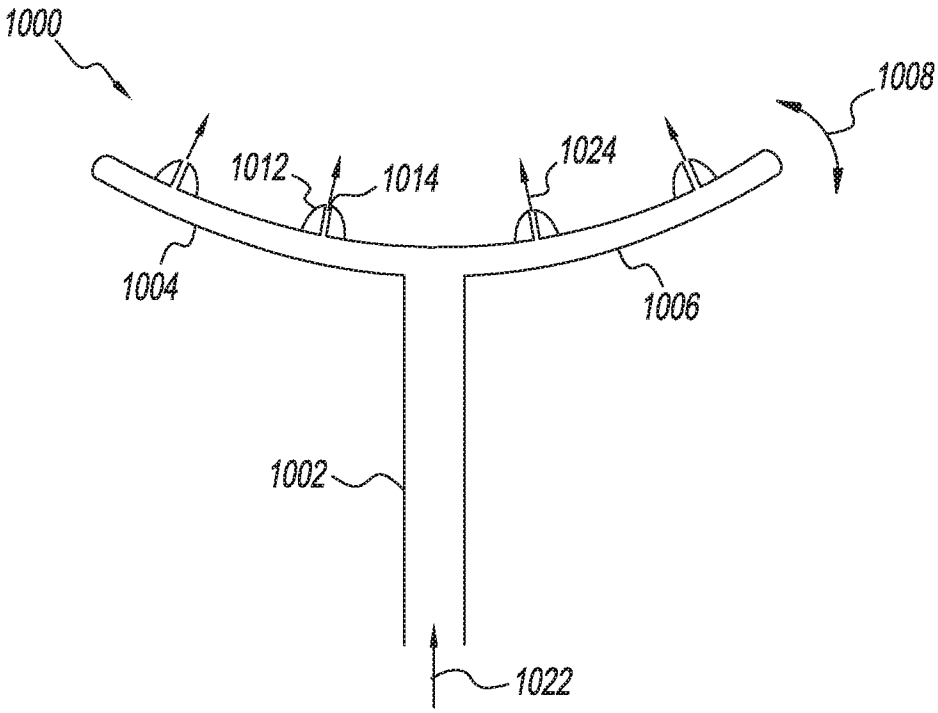

FIG. 10

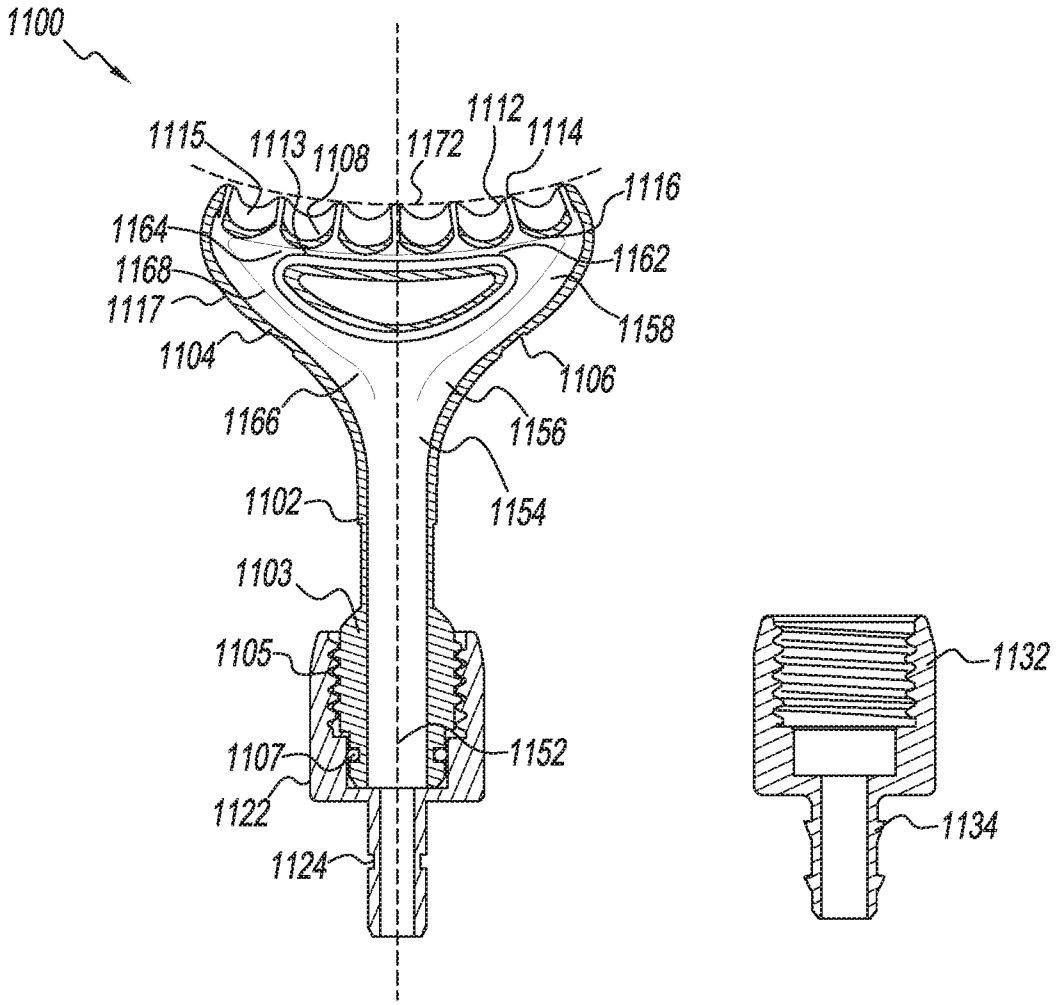
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FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/067792

A. CLASSIFICATION OF SUBJECT MATTER

A61C 17/02(2006.01)i, A61C 15/02(2006.01)i

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)
A61C 17/02; A61C 17/024; A46B 9/04; A61H 9/00; A61C 17/22; A61C 17/032; A61G 17/02; A61C 17/028; A46B 11/06; A61C 15/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & keywords: oral, irrigator, pump, valve, pick, rinse, water, pick, branch

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2012-0064480 A1 (HEGEMANN, KENNETH J.) 15 March 2012 See paragraphs [0084]-[0125]; claims 1-20; figures 1-22.	1-14
A	CN 2536202 Y (ZHENG, XIAODONG) 19 February 2003 See the whole document.	1-14
A	KR 10-2012-0126260 A (CHO, BONG HOAN et al.) 21 November 2012 See the whole document.	1-14
A	US 2015-0072303 A1 (WATER PIK, INC.) 12 March 2015 See the whole document.	1-14
A	US 2007-0184404 A1 (JOHNKI, BERND J.) 09 August 2007 See claims 1-29; figures 1-3c.	15-18
A	WO 2004-021958 A1 (REHCO, LLC) 18 March 2004 See the whole document.	15-18
A	JP 2006-141913 A (AKIYAMA, MIHOKO) 08 June 2006 See the whole document.	15-18

☒ 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	Date of mailing of the international search report
16 April 2018 (16.04.2018)	**16 April 2018 (16.04.2018)**

Name and mailing address of the ISA/KR
International Application Division
Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea
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Authorized officer
HAN, Inho
Telephone No. +82-42-481-3362

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/067792

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 20-0374492 Y1 (YANG, WON-DONG) 31 January 2005 See the whole document.	15-18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/067792

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

I. Claims 1-14 directed to an oral irrigator comprising a water delivery system; a mouth rinse delivery system; and a handle comprising a blocking valve and a hand pump.

II. Claims 15-18 directed to a massager pick for an oral irrigator comprising a hollow left side branch; a hollow right side branch; an inlet tube; and a hollow bridge.

1. ☐ As all required addtional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of any additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2017/067792

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012-0064480 A1	15/03/2012	US 2004-0072122 A1	15/04/2004
		US 2006-0292521 A1	28/12/2006
		US 2011-0262879 A1	27/10/2011
		US 2011-0308024 A1	22/12/2011
		US 7059853 B2	13/06/2006
		US 7972136 B2	05/07/2011
		US 8449295 B2	28/05/2013
CN 2536202 Y	19/02/2003	None	
KR 10-2012-0126260 A	21/11/2012	KR 10-1255572 B1	17/04/2013
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