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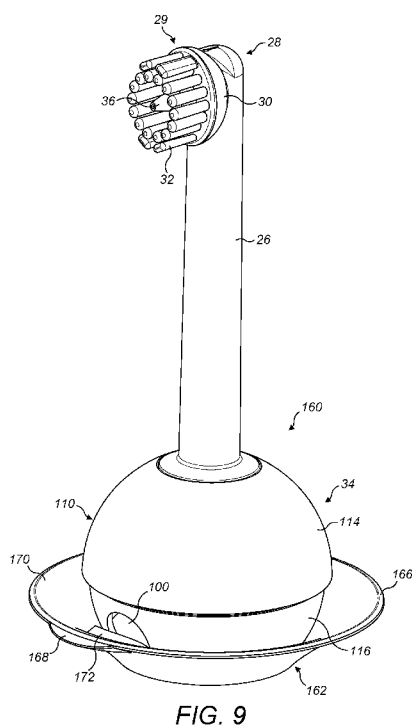
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(54) Title: CLEANING APPLIANCE



(57) Abstract: A dental cleaning appliance includes a nozzle for delivering a burst of working fluid to the teeth of a user, a fluid reservoir for storing working fluid, the fluid reservoir comprising a fluid inlet through which the fluid reservoir is replenished, and a flexible sleeve mounted on the fluid reservoir. The sleeve is flexible between a first configuration in which the fluid inlet is exposed by the sleeve to enable the fluid reservoir to be replenished, and a second configuration in which the sleeve occludes the fluid inlet.



CLEANING APPLIANCE

FIELD OF THE INVENTION

The present invention relates to a cleaning appliance. The cleaning appliance is preferably a handheld cleaning appliance, and is preferably a surface treating appliance. In preferred embodiments of the invention, the appliance is a dental cleaning appliance. In a preferred embodiment, the appliance is an electric toothbrush having a fluid delivery system for delivering a fluid to the teeth of the user. This fluid may be toothpaste, or a fluid for improved interproximal cleaning. Alternatively, the appliance may not include any bristles or other elements for brushing teeth, and may be in the form of a dedicated interproximal cleaning appliance. The invention also relates to a cleaning tool for use with a dental cleaning appliance.

BACKGROUND OF THE INVENTION

Electric toothbrushes generally comprise a cleaning tool which is connected to a handle. The cleaning tool comprises a stem and a brush head bearing bristles for brushing teeth. The brush head comprises a static section which is connected to the stem, and at least one moveable section which is moveable relative to the static section, for example with one of a reciprocating, oscillating, vibrating, pivoting or rotating motion, to impart a brushing movement to bristles mounted thereon. The stem houses a drive shaft which couples with a transmission unit within the handle. The transmission unit is in turn connected to a motor, which is driven by a battery housed within the handle. The drive shaft and the transmission unit convert rotary or vibratory motion of the motor into the desired movement of the moveable section of the brush head relative to the static section of the brush head.

It is known to incorporate into an electric toothbrush an assembly for generating a jet of fluid for interproximal cleaning. For example, US 8,522,384 describes an electric toothbrush in which the handle of the toothbrush defines a fluid chamber for storing a liquid such as water, and a slidable cover for enabling the fluid chamber to be accessed for replenishment by a user. A fluid path connects the fluid chamber to a nozzle located

on a static portion of the brush head. A pump located within the fluid path is actuated upon user operation of an actuator on the handle to pump fluid from the fluid chamber to the nozzle for release under pressure from the nozzle.

5 SUMMARY OF THE INVENTION

In a first aspect, the present invention provides a dental cleaning appliance comprising:

a nozzle for delivering a burst of working fluid to the teeth of a user;

a fluid reservoir for storing working fluid, the fluid reservoir comprising a fluid inlet through which the fluid reservoir is replenished; and

10 a sleeve extending about the fluid reservoir, and which is moveable between a first configuration in which the fluid inlet is exposed by the sleeve to enable the fluid reservoir to be replenished, and a second configuration in which the sleeve occludes the fluid inlet.

15 The sleeve is preferably formed from an elastomeric material, such as a rubber material, which allows the sleeve to flex between its first and second configurations. The sleeve may be internally biased towards the second configuration so that the user has to urge the sleeve away from the second configuration to expose the fluid inlet to enable the fluid reservoir to be replenished.

20 The sleeve is preferably arranged to be pulled by the user from the second configuration to the first configuration. The sleeve may be provided with a tab, which is preferably integral with the sleeve, which can be gripped by the user to pull the sleeve from the second configuration to the first configuration. The tab is preferably located at or
25 towards one end of the sleeve, and is preferably located adjacent to the fluid inlet when the sleeve is in its second configuration.

The working fluid is preferably a liquid working fluid, and preferably water, and so the fluid reservoir may be replenished by the user by locating the fluid inlet beneath a domestic tap and, whilst the sleeve is in the first configuration, opening the tap so that water from the tap passes through the fluid inlet and into the fluid reservoir.

The user may have to hold the sleeve in the first configuration during filling. In this case, after the fluid reservoir has been filled the user has to simply release the sleeve so that it returns automatically to the second configuration. The fluid inlet becomes
5 automatically occluded by the sleeve, inhibiting the leakage of working fluid from the fluid reservoir through the fluid inlet.

Alternatively, the sleeve may be movable between a stable first configuration and a stable second configuration, which prevents the user from having to maintain the sleeve
10 in the first configuration during filling of the fluid reservoir.

In the first configuration, at least part of the sleeve may be elastically deformed or folded so that part of the sleeve moves away from the fluid reservoir to expose the fluid inlet. The sleeve may comprise a hinge about which one part of the sleeve moves
15 relative to another part of the sleeve to expose the fluid inlet.

When the sleeve is in the second configuration, the fluid inlet may engage a seal which inhibits the leakage of working fluid from the fluid inlet. This seal may be located on a surface of the sleeve which faces the fluid inlet when the sleeve is in the second
20 configuration. The seal may be provided by a raised portion of the sleeve, which is provided on a surface of the sleeve which engages the fluid reservoir when the sleeve is in its second configuration. The seal may be an annular seal which surrounds the fluid inlet when the sleeve is in its second configuration. Alternatively, the sleeve may comprise a raised portion for at least partially entering the fluid inlet to form a seal with
25 the periphery of the fluid inlet when the sleeve is in the second configuration.

One end of the sleeve preferably moves relative to the other end of the sleeve as the sleeve moves between its first and second configurations. For example, the sleeve may be peeled back from said one end of the sleeve to expose the fluid inlet. The tab is
30 preferably located at or towards said one end of the sleeve.

The sleeve may surround an external wall of the fluid reservoir, and may be partially peeled back from the external wall to expose the fluid inlet. The other end of the sleeve may be connected to the fluid reservoir, for example using an adhesive. For example, the other end of the sleeve may be connected to a part of the external wall in which the fluid inlet is formed, or to a base or bottom wall or the fluid reservoir which is located adjacent to the fluid inlet. At least part of the external wall of the fluid reservoir is preferably transparent, and is preferably formed from transparent plastics material to allow a user to see the volume of working fluid within the fluid reservoir. In a preferred embodiment, the external wall preferably has one of a curved shape, a convex shape, and a faceted shape. The external wall may have a curvature which is one of ellipsoidal, spheroidal and spherical. The sleeve may be formed from transparent material. The external wall of the fluid reservoir may be configured such that, when the sleeve is in its second configuration in which it surrounds part of the external wall, the external surface of the sleeve is substantially flush with the external surface of the exposed part of the external wall of the fluid reservoir. When the sleeve is fully peeled back from the external wall of the fluid reservoir, the sleeve may depend downwardly from the bottom wall of the fluid reservoir.

The appliance preferably comprises a handle and a stem extending between the nozzle and the handle, and the fluid reservoir is preferably mounted on the stem. The fluid reservoir preferably extends at least partially about the stem. Preferably, the fluid reservoir surrounds the stem. As an alternative to connecting the other end of the sleeve to the fluid reservoir, the other end of the sleeve may be connected to the stem. The stem may be detachably connected to the handle.

The nozzle preferably forms part of a fluid delivery system of the appliance. The fluid delivery system preferably comprises a pump and a control circuit for actuating the pump to draw working fluid from the fluid reservoir and eject a burst of working fluid towards the nozzle. As the nozzle is moved between adjacent teeth of the user, the user may depress a button of a user interface provided on the handle to actuate the pump to cause a burst of working fluid to be ejected from the nozzle. Alternatively, the appliance

may be configured to actuate the delivery of working fluid to the teeth of the user automatically depending on the magnitude of an output from a sensor for detecting that the nozzle is located within an interproximal gap. For example, the sensor may be in the form of a light detector, such a camera or a light sensor, for receiving light, such a visible light or infrared light, reflected from a user's teeth. As another alternative, the appliance may be configured to actuate the delivery of working fluid to the teeth of the user automatically at a fixed frequency, for example between 0.5 and 5 Hz.

The nozzle, stem and fluid reservoir may form part of a cleaning tool which is detachably connectable to the handle.

The appliance may be in the form of a dedicated interproximal cleaning appliance for cleaning between the gaps in the user's teeth. Alternatively, the appliance may be in the form of a toothbrush which has the additional function of improved interproximal cleaning through the emission of a burst of working fluid into the interproximal gap. Where the appliance is in the form of a toothbrush, the cleaning tool, or stem, preferably comprises a plurality of bristles. The bristles are preferably arranged around the nozzle, and may be arranged circumferentially about the nozzle. A plurality of bristles may be attached to a static section of the cleaning tool, which section is not moveable relative to the handle. Alternatively, or additionally, a plurality of bristles may be attached to a moveable section of the cleaning tool, which section is moveable relative to the handle. In a preferred embodiment, the appliance comprises a brush unit comprising a bristle carrier and a plurality of bristles mounted on the bristle carrier, with the bristle carrier being moveable relative to the handle.

As mentioned above, the stem, or the entire cleaning tool, is preferably detachably connected to the handle. This can allow the appliance to be provided with a set of similar cleaning tools, each with a respective different identifier. This can also allow an appliance to be provided with a set of dissimilar stems or cleaning tools. For example, the set of cleaning tools may be selected from two or more of a first type of cleaning tool with a nozzle and a moveable brush unit, a second type of cleaning tool with a

nozzle and a static brush unit, and a third type of cleaning tool with a nozzle and no bristles. A number of respective different cleaning tools of the same type may also be provided, for example, of the first type of cleaning tool, with bristles having a respective different stiffness, or with nozzles having respective different fluid outlet sizes.

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The appliance is preferably a handheld appliance which includes all of the aforementioned components of the appliance.

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The cleaning tools may be sold as stand-alone items, for example as spare parts or as alternative cleaning tools for use with an existing handle.

In a second aspect, the present invention provides a cleaning tool for a dental cleaning appliance comprising a handle to which the cleaning tool is detachably connectable, the cleaning tool comprising:

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a nozzle for delivering a burst of working fluid to the teeth of a user;

a fluid reservoir for storing working fluid, the fluid reservoir comprising a fluid inlet through which the fluid reservoir is replenished; and

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a sleeve extending about the fluid reservoir, and which is moveable between a first configuration in which the fluid inlet is exposed by the sleeve to enable the fluid reservoir to be replenished, and a second configuration in which the sleeve occludes the fluid inlet.

Features described above in connection with the first aspect of the invention are equally applicable to the second aspect of the invention, and vice versa.

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BRIEF DESCRIPTION OF THE DRAWINGS

Preferred features of the present invention will now be described by way of example only with reference to the accompanying drawings, in which:

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Figure 1(a) is a right side view of a dental cleaning appliance, Figure 1(b) is a front view of the appliance, and Figure 1(c) is a left side view of the appliance;

Figure 2 illustrates schematically components of a fluid delivery system for delivering a burst of a working fluid to the teeth of a user;

- 5 Figure 3 is a right side perspective view, from above, of a first embodiment of a cleaning tool of the appliance;

Figure 4 is a right side perspective view, from above, of a handle of the appliance;

- 10 Figure 5 is a side sectional view of part of the cleaning tool of Figure 3;

Figure 6(a) is a sectional schematic view of a fluid reservoir of the cleaning tool of Figure 3, and with a diaphragm of the fluid reservoir in a fully contracted configuration, Figure 6(b) is a similar view to Figure 6(a) but with the diaphragm in a partially
15 expanded configuration, and Figure 6(c) is a similar view to Figure 6(a) but with the diaphragm in an almost fully expanded configuration;

Figure 7 is a perspective view of the appliance, with the cleaning tool of Figure 3 detached from the handle;

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Figure 8 is a perspective view, from below, of a second embodiment of a cleaning tool which is connectable to the handle;

- Figure 9 is a perspective view, from above, of the cleaning tool of Figure 8, with a
25 flexible sleeve of the cleaning tool in a first configuration; and

Figure 10 is a perspective view, from above, of the cleaning tool of Figure 8, with a flexible sleeve of the cleaning tool in a second configuration.

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DETAILED DESCRIPTION OF THE INVENTION

Figures 1(a) to 1(c) illustrate external views of an embodiment of a dental cleaning appliance 10. In this embodiment, the appliance is in the form of a handheld appliance, which is in the form of an electric toothbrush having an integrated assembly for dispensing a working fluid for improved interproximal cleaning.

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The appliance 10 comprises a handle 12 and a cleaning tool 14. The handle 12 comprises an external body 16 which is gripped by a user during use of the appliance 10. The body 16 is preferably formed from plastics material, and is preferably generally cylindrical in shape. The handle 12 comprises a plurality of user operable buttons 18, 20, 22 which are located within respective apertures formed in the body 16 so as to be accessible to the user. The handle 12 may comprise a display which is positioned so as to be visible to a user during use of the appliance.

The cleaning tool 14 comprises a stem 26 and a head 28. The stem 26 is elongate in shape, which serves to space the head 28 from the handle 12 to facilitate user operability of the appliance 10. In this embodiment, the head 28 of the cleaning tool 14 comprises a brush unit 29, which comprises a bristle carrier 30 and a plurality of bristles 32 mounted on the bristle carrier 30. However, in other embodiments the cleaning tool 14 may be provided without a brush unit 29 so that the appliance is in the form of a dedicated interproximal cleaning appliance for cleaning between the gaps in the user's teeth.

The cleaning tool 14 also comprises a fluid reservoir 34 for storing a working fluid, and a nozzle 36 for delivering one or more bursts of working fluid to the teeth of the user during use of the appliance 10. The fluid reservoir 34 is connected to the stem 26. The fluid reservoir 34 extends at least partially around the stem 26. In this embodiment which includes a brush unit 29, the brush unit 29 extends at least partially around the nozzle 36.

The nozzle 36 forms part of a fluid delivery system 40 for receiving working fluid from the fluid reservoir 34 and for delivering bursts of working fluid to the teeth of a user during use of the appliance 10. The tip of the nozzle 36 comprises a fluid outlet 42

through which a burst of working fluid is delivered to the teeth of the user. The fluid delivery system 40 is illustrated schematically in Figure 2. In overview, the fluid delivery system 40 comprises a fluid inlet 44 for receiving working fluid from the fluid reservoir 34. In this embodiment, the working fluid is a liquid working fluid, which is preferably water. The fluid delivery system 40 comprises a pump assembly 46 for drawing working fluid from the fluid reservoir 34 through the fluid inlet 44, and for delivering a burst of working fluid to the nozzle 36. The pump assembly 46 is located within the handle 12, and comprises a positive displacement pump 48 and a drive for driving the pump 48. The drive preferably comprises a motor 50. A battery 52 for supplying power to the motor 50 is also located in the handle 12. The battery 52 is preferably a rechargeable battery.

A first conduit 54 connects the fluid inlet 44 of the fluid delivery system 40 to a fluid inlet 56 of the pump 48. A first one-way valve 58 is located between the fluid inlet 44 and the pump 48 to prevent water from returning to the fluid reservoir 34 from the pump 48. A second conduit 60 connects a fluid outlet 62 of the pump 48 to the nozzle 36. A second one-way valve 64 is located between the pump 48 and the nozzle 34 to prevent water from returning to the pump 48. A control circuit 66 controls the actuation of the motor 50, and so the motor 50 and the control circuit 66 provide a drive for driving the pump 48. The battery 52 supplies power to the control circuit 66. The control circuit 66 includes a motor controller, which supplies power to the motor 50.

In this embodiment, the control circuit 66 receives signals generated when the user depresses the buttons 18, 20, 22 located on the handle 12 of the appliance 10. Alternatively, or additionally, the control circuit 66 may receive signals which are generated by a sensor located within the appliance, or which are received from a remote device, such as a display or a personal device. For brevity, in the following description the control circuit 66 receives signals which are generated when the user operates one of the buttons 18, 20, 22.

The cleaning tool 14 is detachably connected to the handle 12. With reference to Figures 3 to 5, the handle 12 comprises a male connector, preferably in the form of a spigot 70, which is received by a complementary female connector, preferably in the form of a recessed connector 72, of the cleaning tool 14. The recessed connector 72 defines a generally cylindrical recess 73 for receiving the spigot 70. The spigot 70 preferably protrudes outwardly from an end surface 74 of the body 16, and preferably in a direction which is parallel to a longitudinal axis of the handle 12. The end surface 74 defines an annular seat 76 for receiving an annular bottom wall 78 of the fluid reservoir 34 when the cleaning tool 14 is mounted on the handle 12. The annular seat 76 comprises the fluid inlet 44 of the fluid delivery system 40. The fluid inlet 44 receives fluid from a fluid outlet 80 of the fluid reservoir 34 when the cleaning tool 14 is mounted on the handle 12.

The second conduit 60, which connects the fluid outlet 62 of the pump 48 to the nozzle 36, comprises a handle conduit section located within the handle 12, and a cleaning tool conduit section located within the cleaning tool 14. The handle conduit section extends from the fluid outlet 62 of the pump 48 to a handle fluid outlet port 82 located adjacent to the spigot 70. The cleaning tool conduit section 84 extends from a cleaning tool fluid inlet port 86 to the nozzle 36. The cleaning tool fluid inlet port 86 protrudes from the base of the recessed connector 72. The recessed connector 72 is housed within, and connected to, a relatively wide base section 88 of the stem 26.

As mentioned above, the cleaning tool 14 includes a bristle carrier 30 which is moveable relative to the stem 26. The appliance 10 comprises a drive mechanism for driving the movement of the bristle carrier 30 relative to the stem 26. The drive mechanism comprises a transmission unit connected to the bristle carrier 30, and a drive unit for driving the transmission unit to move the bristle carrier 30 relative to the stem 26.

The handle 12 comprises the drive unit of the drive mechanism. The drive unit comprises a motor, preferably in the form of a dc motor, which is actuated by the

control circuit 66 in response to the user depression of one or more of the buttons of the handle 12. The motor of the drive unit is connected via a gear train to a rotatable drive unit coupling member 90 which protrudes outwardly from the spigot 70, and which rotates relative to the body 16 upon actuation of the motor of the drive unit.

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The cleaning tool 14 comprises the transmission unit of the drive mechanism. The transmission unit comprises a transmission unit coupling member 92 which couples with, and preferably receives, the drive unit coupling member 90 when the cleaning tool 14 is connected to the handle 12. The transmission unit coupling member 92 is connected to, and is preferably integral with, one end of a connecting rod 94 housed within the stem 26. The other end of the connecting rod 94 is connected to the side surface of the bristle carrier 30 so that periodic rotation of the connecting rod 94 about a 15° angle results in a 15° sweeping movement of the bristle carrier 30 relative to the stem 26.

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The fluid reservoir 34 is mounted on, and extends at least partially around, the stem 26 of the cleaning tool 14. In this embodiment, the fluid reservoir 34 is annular in shape, and so surrounds the stem 26. The fluid reservoir 34 is preferably located at or towards the end of the stem 26 which is remote from the head 28, and so in this embodiment extends around the base section 88 of the stem 26. The fluid reservoir 34 preferably has a capacity in the range from 5 to 50 ml, and in this embodiment has a capacity of 25 ml.

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The fluid reservoir 34 is filled through a reservoir fluid inlet port 100 formed in the external wall of the fluid reservoir 34. The fluid inlet port 100 is preferably formed in an annular external side wall 110 of the fluid reservoir 34. The reservoir fluid inlet port 100 is sealed by a closure member 102. The closure member 102 is moveable relative to the fluid reservoir 34 between a closed position, as shown in Figure 3, in which the closure member 102 inhibits the leakage of working fluid from the reservoir fluid inlet port 100, and an open position. In this embodiment, the closure member 102 is pivotably connected to the fluid reservoir 34. The closure member 102 is locatable within, and forms a fluid-tight seal against, the reservoir fluid inlet port 100. The

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closure member 102 comprises a head 104 which may be gripped by the user to move the closure member 102 from the closed position to the open position, and which may be pushed by the user towards the reservoir fluid inlet port 100 to return the closure member 102 to the closed position.

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The closure member 102 is connected to the fluid reservoir 34 by a pair of arms 106. One end of each arm 106 is connected to the closure member 102, and the other end of each arm 106 is connected to the fluid reservoir 34. In this embodiment, the arms 106 are integral with the closure member 102, with a portion of each arm 106 which is remote from the closure member 102 being connected to the bottom wall 78 of the fluid reservoir 34, for example using an adhesive or by welding. Each arm 106 comprises a hinge 108, which may be formed from a part of the arm 106 which has a locally reduced thickness, to enable the part of the arm 106 which is connected to the closure member 102 to pivot relative to the other part of the arm 106 which is connected to the fluid reservoir 34.

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To fill the fluid reservoir 34, the user detaches the cleaning tool 14 from the handle 12, as explained in more detail below, grips the head 104 of the closure member 102 between finger and thumb and pulls it out from the reservoir fluid inlet port 100. The fluid reservoir 34 may then be filled by the user, for example by locating the reservoir fluid inlet port 100 beneath a running tap. Once the fluid reservoir 34 has been filled, the user pushes the head 104 of the closure member 102 back into the reservoir fluid inlet port 100, and reconnects the cleaning tool 14 to the handle 12. The pivoting connection between the closure member 102 and the bottom wall 78 of the fluid reservoir 34 inhibits accidental loss of the closure member 102 while the reservoir fluid inlet port 100 is exposed, and enables the joint between the closure member 102 and the fluid reservoir 34 to be located between the handle 12 and the fluid reservoir 34 when the cleaning tool 14 is mounted on the handle 12. As shown in Figure 3, the lower parts of the arms 106 of the closure member 102 are located within a recessed section of the bottom wall 78 of the fluid reservoir 34 when the closure member 102 is in its closed

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position so that the bottom surfaces of the lower parts of the arms 106 are substantially flush with the bottom wall 78 of the fluid reservoir 34.

At least part of the external wall 110 of the fluid reservoir 34 is preferably transparent to allow a user to observe the contents of the fluid reservoir 34, and so assess whether the fluid reservoir 34 requires replenishment prior to the desired use of the appliance 10. The external wall 110 preferably has a shape which is symmetrical about the longitudinal axis of the cleaning tool 14. The external wall 110 preferably has a curved shape, more preferably a convex curved shape, but alternatively the external wall 110 may have a polygonal or faceted shape. In this embodiment, the external wall 110 has a spherical curvature. As described below, the fluid reservoir 34 is mounted on the relatively wide base section 88 of the stem 26, and so the external wall 110 has opposed circular apertures which are centred on the longitudinal axis of the cleaning tool 14 to allow the base section 88 of the stem 26 to pass therethrough.

The fluid reservoir 34 further comprises an inner wall 112 which is connected to the external wall 110. The inner wall 112 is tubular in shape. The ends of the inner wall 112 are preferably circular in shape, and are connected to the external wall 110 so as to form a fluid-tight seal between the external wall 110 and the inner wall 112. In this embodiment, the fluid reservoir 34 is formed from two housing parts. A first housing part 114 comprises an upper section of the external wall 110 and the inner wall 112, and so the upper end of the inner wall 112 is integral with an upper section of the external wall 110. A second housing part 116 comprises a lower section of the external wall 110 and the bottom wall 78 of the fluid reservoir 34.

The fluid reservoir 34 also comprises a diaphragm 118. The diaphragm 118 is tubular in shape, and surrounds the inner wall 112 of the fluid reservoir 34. The ends 120, 122 of the diaphragm 118 may be connected to the external wall 110, or to the inner wall 112. The diaphragm 118 thus has an external surface 124 which faces the external wall 110 of the fluid reservoir 34, and which defines with the external wall 110 the capacity of the fluid reservoir 34. As the diaphragm 118 is visible to the user through at least part of

the external wall 110, the external surface 124 of the diaphragm 118 may bear an identifier for user identification of the cleaning tool 14. For example, the identifier may be a coloured portion of the external surface 124 of the diaphragm 118, or one or more alphanumeric characters moulded or otherwise formed on the external surface 124 of the diaphragm 118.

Figures 5 and 6(a) illustrates the fluid reservoir 34 when it has been filled with working fluid. The thickness of the diaphragm 118, and the material from which the diaphragm 118 is formed, are selected so that at least part of the diaphragm 118 is moveable relative to the external wall 110 in response to a pressure differential which is established across the diaphragm 118 as working fluid is drawn from the fluid reservoir 34 by the pump 48. In this embodiment, the diaphragm 118 is expandable in response to a pressure differential which is generated across the surfaces 124, 126 of diaphragm 118 as working fluid is drawn from the fluid reservoir 34. Figure 6(a) illustrates the diaphragm 118 in a fully contracted configuration, or state, in which the capacity of the fluid reservoir 34 is maximised.

In this embodiment, the cleaning tool 14 comprises an expansion chamber 128 which is located adjacent to the inner wall 112. The expansion chamber 128 has a volume which increases as the volume of the fluid reservoir 34 decreases. In this embodiment, the expansion chamber 128 is open to the atmosphere to allow atmospheric air to enter the expansion chamber 128 as the inner wall 112 moves towards the external wall 110 as working fluid is supplied to the fluid delivery system 100. The expansion chamber 128 is shown in Figures 6(b) and 6(c), which illustrate the diaphragm 118 in a partially expanded configuration, and in an almost fully expanded configuration, respectively. The expansion chamber 128 is delimited by the internal surface 126 of diaphragm 118, and the external surface 130 of the inner wall 112. One or more apertures or ports 132 are formed in the inner wall 112 to allow atmospheric air to enter the expansion chamber 128, for example, from an air flow path which extends between the stem 26 and the inner wall 112, with expansion of the diaphragm 118.

As the diaphragm 118 expands towards its fully expanded configuration, the size and shape of the diaphragm 118 approaches that of the external wall 110. In other words, when the diaphragm 118 is in a fully expanded configuration, which occurs when the fluid reservoir 34 is substantially empty, the size and the shape of the diaphragm 118 are substantially the same as the size and the shape of the external wall 110 of the fluid reservoir 34. Thus, the maximum volume of the expansion chamber 128 is preferably substantially the same as the maximum volume of the fluid reservoir 34.

As mentioned above, the fluid reservoir 34 is mounted on the relatively wide base section 88 of the stem 26. To mount the fluid reservoir 34 on the stem 26, the circular aperture formed in the first housing part 114 of the fluid reservoir 34 is aligned with the free end of the base section 88 of the stem 26, and the fluid reservoir 34 is pushed on to the stem 26. The internal surface of the inner wall 112 of the fluid reservoir 34 bears against the base section 88 of the stem 26 so that frictional forces therebetween prevent the fluid reservoir 34 from falling from the stem 26. The movement of the fluid reservoir 34 along the stem 26 is restricted by a flange 140 which extends radially outwardly from the stem 26, and is located at the upper end of the base section 88 of the stem 26. The flange 140 is annular in shape, and is arranged to engage an annular planar end portion or recess 142 of the first housing part 114 of the fluid reservoir 34. When the recess 142 of the fluid reservoir 34 engages the flange 140 of the stem 26, the fluid reservoir 34 is in the correct axial position along the stem 26 for the subsequent connection of the fluid outlet 80 of the fluid reservoir 34 to the fluid inlet 44 of the fluid delivery system 40. To facilitate angular alignment of the fluid reservoir 34 relative to the stem 26, the flange 140 and the recess 142 may be provided a non-annular shape, for example a C- shape. Otherwise, the fluid reservoir 34 may be visually angularly aligned by the user relative to the head 28, for example so that the head 104 of the closure member 102 is aligned with the nozzle 36.

To mount the cleaning tool 14 on the handle 12, as shown in Figure 7 the spigot 70 of the handle 12 is aligned with the recess 73 formed in the connector 72 of the cleaning tool 14, and the handle fluid outlet port 82 located adjacent to the spigot 70 is aligned

with the cleaning tool fluid inlet port 86 of the cleaning tool 14. The cleaning tool 14 is then pushed on to the spigot 70 so that the handle fluid outlet port 82 connects to the cleaning tool fluid inlet port 86, and so that the fluid reservoir 34 engages the annular seat 76 to connect the fluid outlet 80 of the fluid reservoir 34 to the fluid inlet 44 of the fluid delivery system 40. The internal surface 150 of the connector 72 of the stem 26 bears against the external surface of the spigot 70 so that frictional forces therebetween retain the stem 26 on the handle 12. The connector 72 is preferably formed from resilient plastics material which flexes as the connector 72 is pushed on to the spigot 70 to increase the frictional forces therebetween. A spring clip 152 may be provided at least partially about the connector 72 for urging the internal surface 150 of the connector 72 against the spigot 70. To prevent the cleaning tool 14 from becoming accidentally dislodged from the handle 12, the connector 73 may comprise a detent 154 mounted on an arm 156 which is hingedly connected to the connector 72. For example, the arm 156 may be integral with the connector 72, and connected to the remainder of the connector 72 by an elastic hinge. As the cleaning tool 14 is pushed on to the spigot 70, the detent 154 enters a recess (not shown) formed on the external surface of the spigot 70. With reference to Figures 3 and 4, to inhibit accidental rotation of the fluid reservoir 34 relative to the handle 12, the bottom wall 78 of the fluid reservoir 34 may be provided with a male connector 160 which engages with a female connector 162 disposed on the annular seat 76 of the handle 12. In this embodiment, the male connector 160 at least partially surrounds the cleaning tool fluid inlet port 86, and the female connector 162 surrounds the handle fluid outlet port 82. Alternatively, the fluid reservoir 34 may be provided with a female connector which receives a male connector located on the handle 12 as the cleaning tool 14 is connected to the handle 12.

To operate the appliance 10, the user presses buttons 18, 20, 22 located on the handle 12. The user switches on the appliance 10 by depressing button 18, the action of which is detected by the control circuit 66. The user may select a mode of operation of the appliance 10 by depressing button 20. For example, through pressing button 20 once, the control circuit 66 may activate the motor to move the brush unit 29 relative to the handle 12. Pressing that button 20 again may switch off the motor. When the button 22

is pressed, a burst of water is emitted from the nozzle 36. The control circuit 66 activates the pump 48 to urge a volume of water from a fluid chamber of the pump 48 to the nozzle 36, and to replenish the fluid chamber through drawing a volume of water from the fluid reservoir 34.

5

The various connections between the handle 12, the stem 26 and the fluid reservoir 34 enable the appliance 10 to be readily dismantled by the user, for example to allow components of the appliance 10 to be replaced, for example due to wear. To replace the cleaning tool 14, the user grasps the stem 26 or the fluid reservoir 34 with one hand, and
10 the handle 12 with the other hand, and pulls the cleaning tool 14 away from the handle 12, as shown in Figure 7. Under the force applied by the user, the detent 154 moves away from the recess located on the external surface of the spigot 70 to enable the cleaning tool 14 to be detached from the handle 12.

15 Figure 8 illustrates a second embodiment of a cleaning tool 160 which is detachably connectable to the handle 12 of the appliance 10. The cleaning tool 160 has many features in common with the cleaning tool 14; the cleaning tool 160 comprises the same stem 26, head 28, fluid reservoir 34 and connector 72 as the cleaning tool 14. In this second embodiment, the closure member 102 of the fluid reservoir 34 is replaced by a
20 sleeve 162 for selectively occluding the fluid inlet 100 of the fluid reservoir 34 to inhibit the leakage of working fluid from the fluid inlet 100 during use of the appliance.

The sleeve 162 is formed from an elastomeric material, preferably a rubber material, and preferably from a transparent or translucent material. The sleeve 162 is annular in
25 shape. A first end 164 of the sleeve 162 is connected to the periphery of the bottom wall 78 of the fluid reservoir 34, whereas a second end 166 of the sleeve 162 is moveable relative to the first end 164.

The sleeve 162 is illustrated in a first configuration in Figure 9, and in a second
30 configuration in Figures 8 and 10. In the second configuration, the sleeve 162 surrounds the lower section of the external wall 110 which is defined by the second housing part

116, and so occludes the fluid inlet 100 of the fluid reservoir 34. As shown in Figure 9, the lower section of the external wall 110 may be formed with a reduced thickness, or with a reduced diameter, so that the external surface of the sleeve 162 is substantially flush with the external surface of the upper section of the external wall 110 which is defined by the first housing part 114.

In the first configuration, the sleeve 162 exposes the fluid inlet 100 to enable the user to replenish the fluid reservoir 334 through the exposed fluid inlet 100. The sleeve 162 comprises a tab 168 located at the second end 166 of the sleeve 162, and adjacent the fluid inlet 100, which may be pulled by the user to peel the sleeve 162 partially back from the external wall 110 to expose the fluid inlet 100. The sleeve 162 is preferably internally biased towards the second configuration so that the sleeve 162 automatically returns to the second configuration when the tab 168 is released by the user following replenishment of the fluid reservoir 34. As shown in Figure 9, the internal surface 170 of the sleeve 162 comprises a raised portion 172 which at least partially enters the fluid inlet 100 to form a seal with the periphery of the fluid inlet 100 as the sleeve 162 returns to the second configuration.

CLAIMS

1. A dental cleaning appliance comprising:
5 a nozzle for delivering a burst of working fluid to the teeth of a user;
a fluid reservoir for storing working fluid, the fluid reservoir comprising a fluid inlet through which the fluid reservoir is replenished; and
a sleeve extending about the fluid reservoir, and which is arranged to flex between a first configuration in which the fluid inlet is exposed by the sleeve to enable
10 the fluid reservoir to be replenished, and a second configuration in which the sleeve occludes the fluid inlet.
2. An appliance according to claim 1, wherein the sleeve is arranged to be pulled by the user from the second configuration to the first configuration.
15
3. An appliance according to claim 1 or claim 2, wherein the sleeve comprises a tab which can be gripped by the user to pull the sleeve from the second configuration to the first configuration.
- 20 4. An appliance according to any preceding claim, wherein the sleeve is mounted on the fluid reservoir.
5. An appliance according to claim 4, wherein an end of the sleeve is connected to a bottom wall of the fluid reservoir.
25
6. An appliance according to any preceding claim, wherein the fluid reservoir comprises an external wall in which the fluid inlet is formed, and at least part of the sleeve is arranged to engage the external wall when in its second configuration, and to flex away from the external wall as it moves from the second configuration to the first
30 configuration.

7. An appliance according to claim 6, wherein the external wall is annular in shape.

8. An appliance according to claim 7, wherein the external wall has one of a curved shape, a convex shape, and a faceted shape.

5

9. An appliance according to claim 8, wherein the external wall has a curvature which is one of ellipsoidal, spheroidal and spherical.

10. An appliance according to any preceding claim, wherein the sleeve comprises a raised portion for forming a seal with the fluid inlet when the sleeve is in the second configuration.

11. An appliance according to any preceding claim, comprising a handle and a stem extending between the nozzle and the handle, and wherein the fluid reservoir is mounted on the stem.

12. An appliance according to claim 11, wherein the fluid reservoir extends at least partially about the stem.

13. An appliance according to claim 11 or claim 12, wherein the fluid reservoir surrounds the stem.

14. An appliance according to any of claims 11 to 13, wherein the stem is detachably connected to the handle.

25

15. A cleaning tool for a dental cleaning appliance comprising a handle to which the cleaning tool is detachably connectable, the cleaning tool comprising:

a nozzle for delivering a burst of working fluid to the teeth of a user;

a fluid reservoir for storing working fluid, the fluid reservoir comprising a fluid inlet through which the fluid reservoir is replenished; and

30

a sleeve extending about the fluid reservoir, and which is arranged to flex between a first configuration in which the fluid inlet is exposed by the sleeve to enable the fluid reservoir to be replenished, and a second configuration in which the sleeve occludes the fluid inlet.

5

16. A cleaning tool according to claim 15, wherein the sleeve is arranged to be pulled by the user from the second configuration to the first configuration.

10

17. A cleaning tool according to claim 15 or claim 16, wherein the sleeve comprises a tab which can be gripped by the user to pull the sleeve from the second configuration to the first configuration.

15

18. A cleaning tool according to any of claims 15 to 17, wherein the sleeve is mounted on the fluid reservoir.

19. A cleaning tool according to any of claims 15 to 18, wherein an end of the sleeve is connected to a bottom wall of the fluid reservoir.

20

20. A cleaning tool according to any of claims 15 to 19, wherein the fluid reservoir comprises an external wall in which the fluid inlet is formed, and at least part of the sleeve is arranged to engage the external wall when in its second configuration, and to flex away from the external wall as it moves from the second configuration to the first configuration.

25

21. A cleaning tool according to claim 20, wherein the external wall is annular in shape.

30

22. A cleaning tool according to claim 21, wherein the external wall has one of a curved shape, a convex shape, and a faceted shape.

23. A cleaning tool according to claim 22, wherein the external wall has a curvature which is one of ellipsoidal, spheroidal and spherical.

5 24. A cleaning tool according to any of claims 15 to 23, wherein the sleeve comprises a raised portion for forming a seal with the fluid inlet when the sleeve is in the second configuration.

25. A cleaning tool according to any of claims 15 to 24, comprising a stem, and wherein the fluid reservoir is mounted on the stem.

10

26. A cleaning tool according to claim 25, wherein the fluid reservoir extends at least partially about the stem.

15 27. A cleaning tool according to claim 25 or claim 26, wherein the fluid reservoir surrounds the stem.

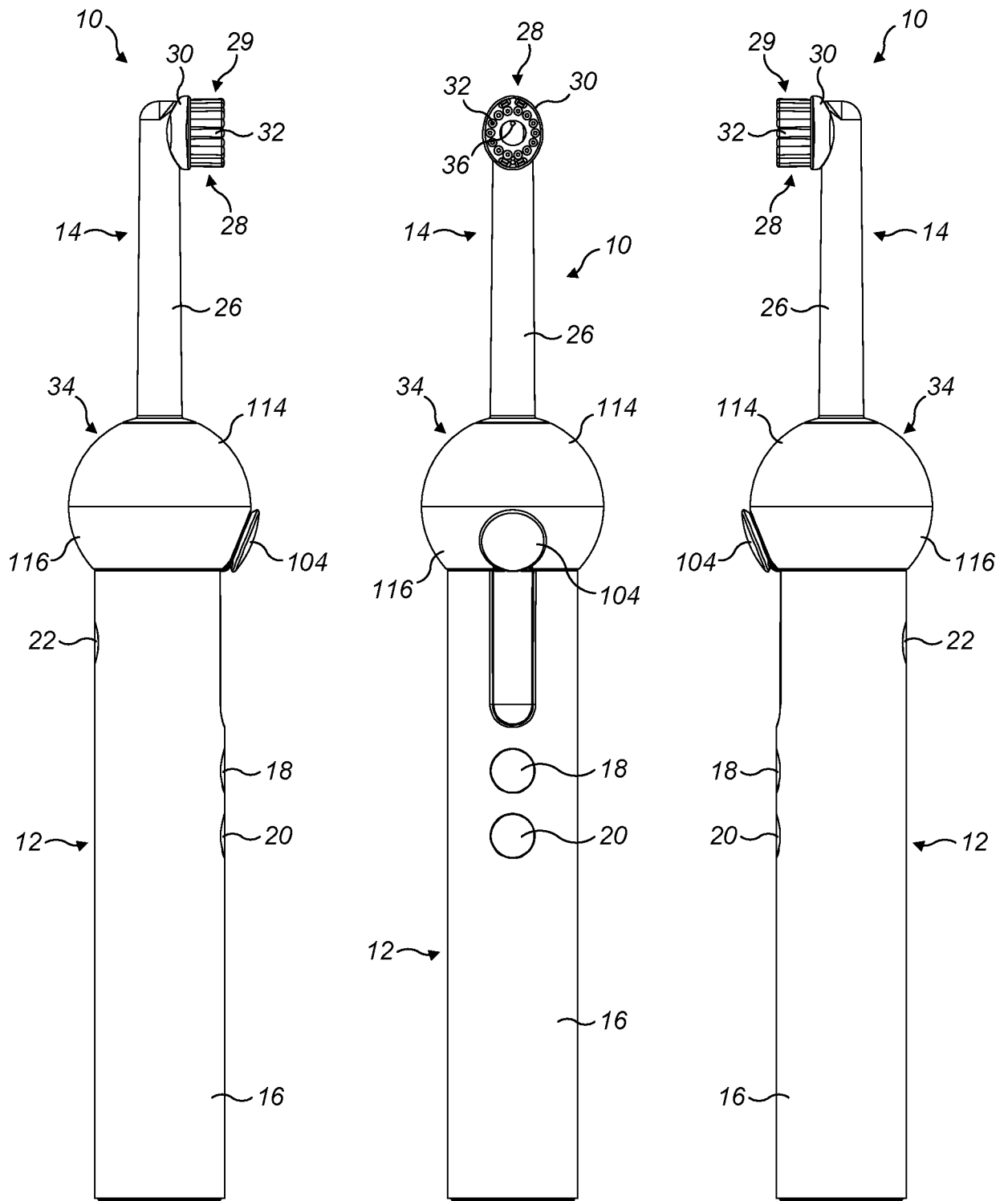
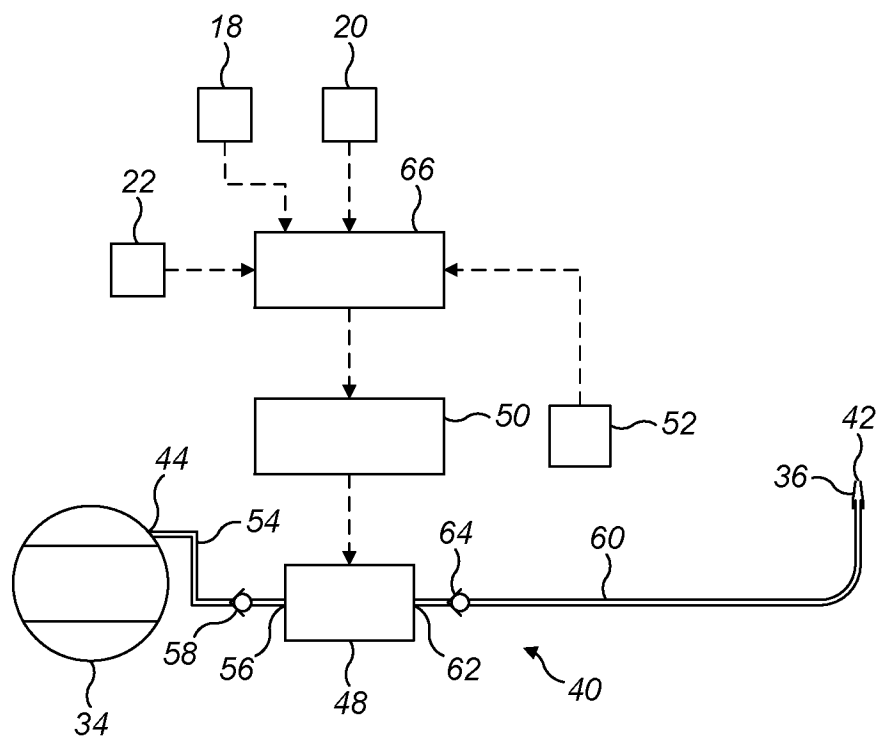


FIG. 1(a)

FIG. 1(b)

FIG. 1(c)

**FIG. 2**

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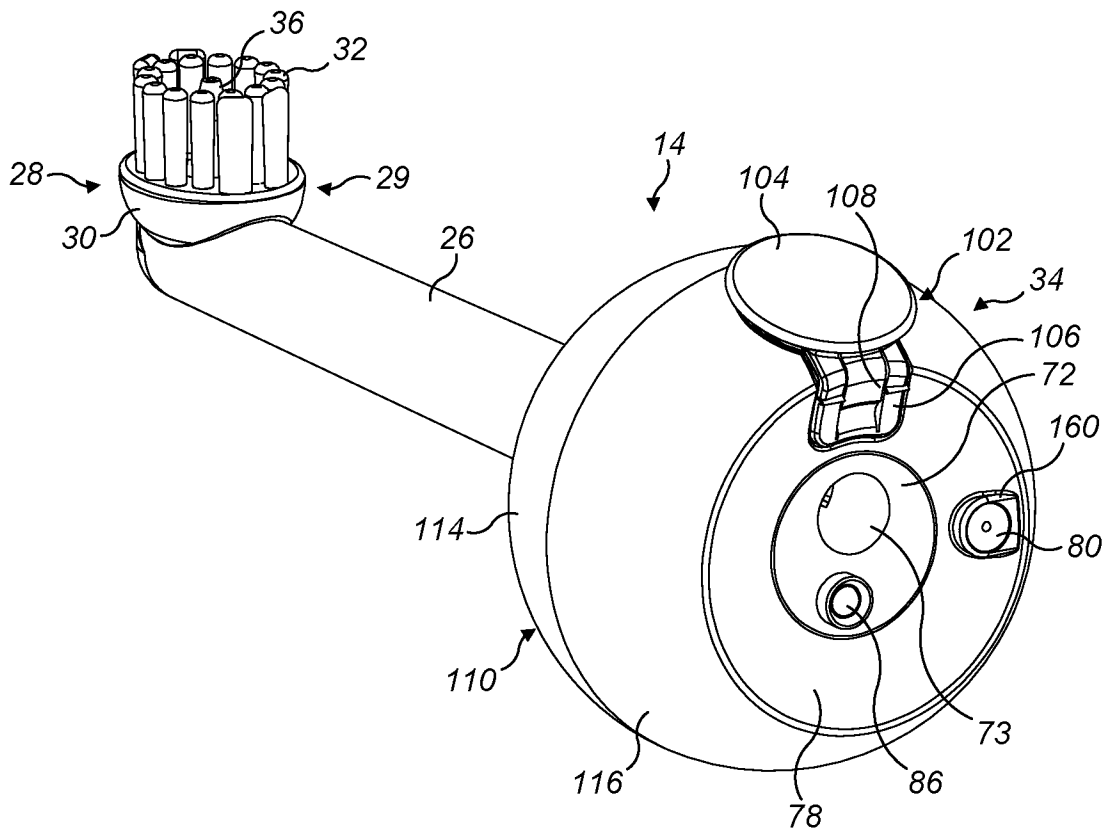


FIG. 3

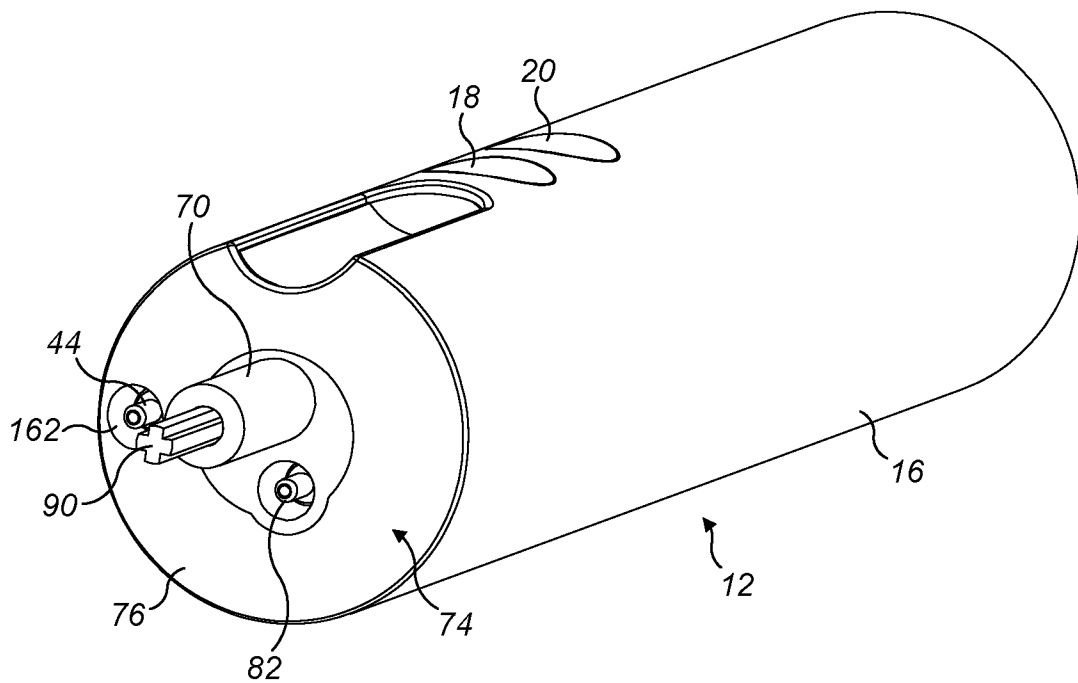


FIG. 4

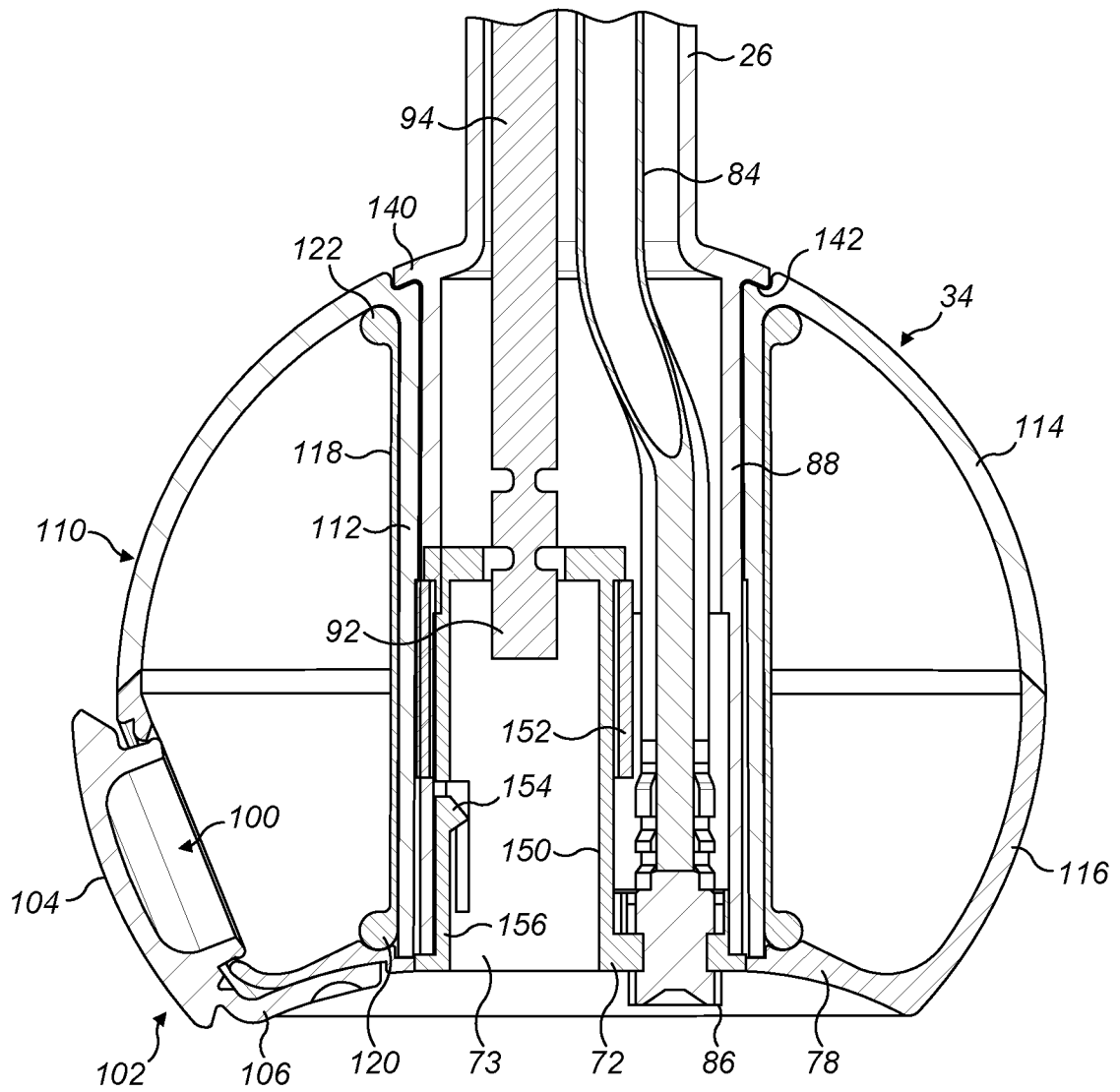


FIG. 5

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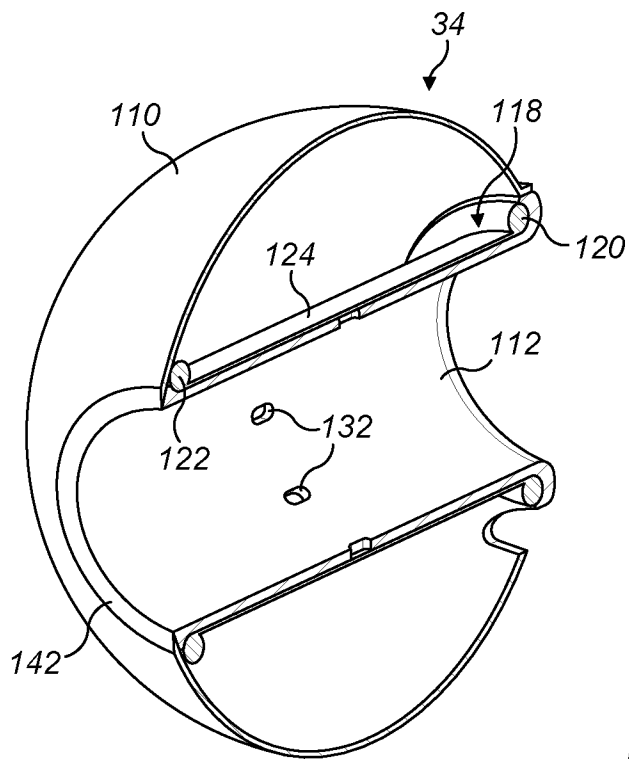


FIG. 6(a)

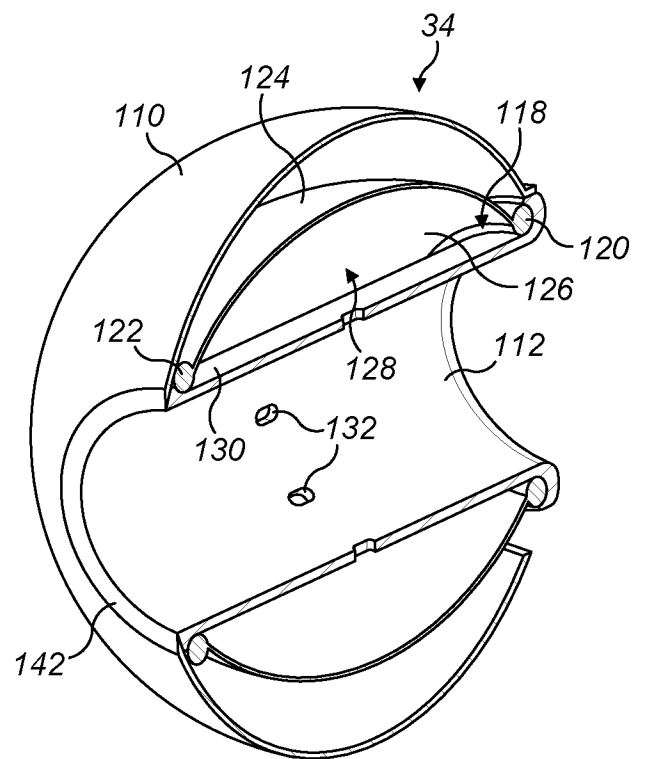


FIG. 6(b)

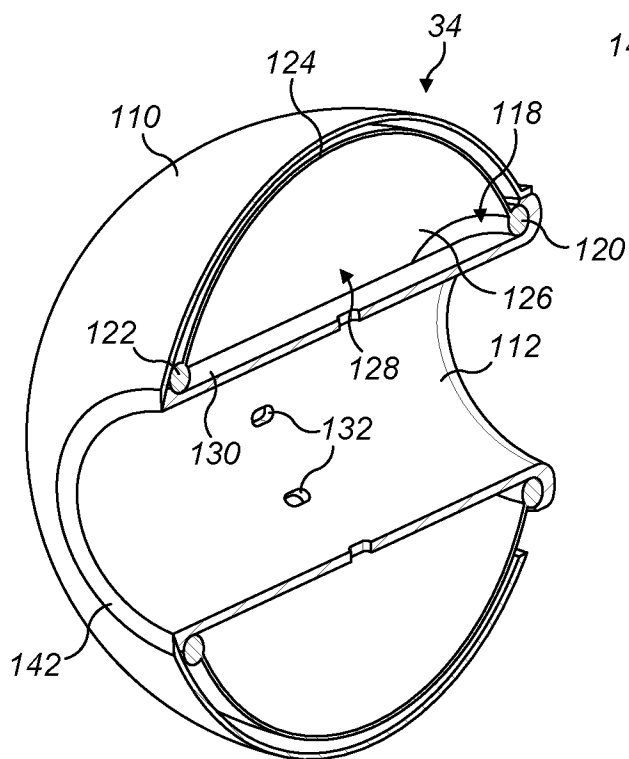


FIG. 6(c)

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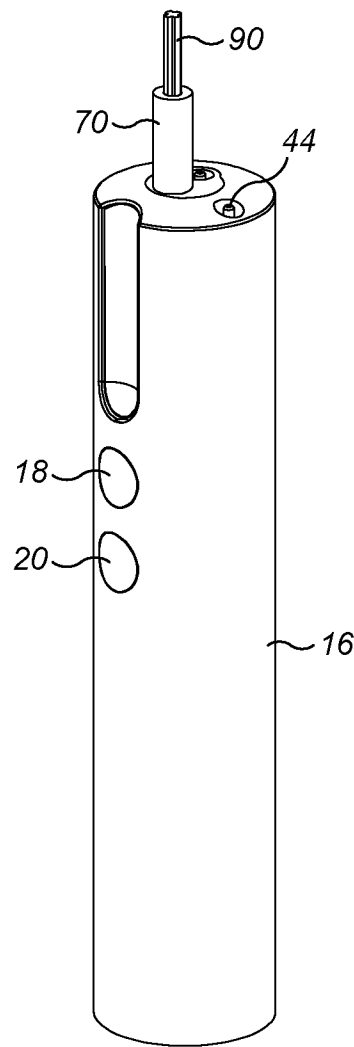
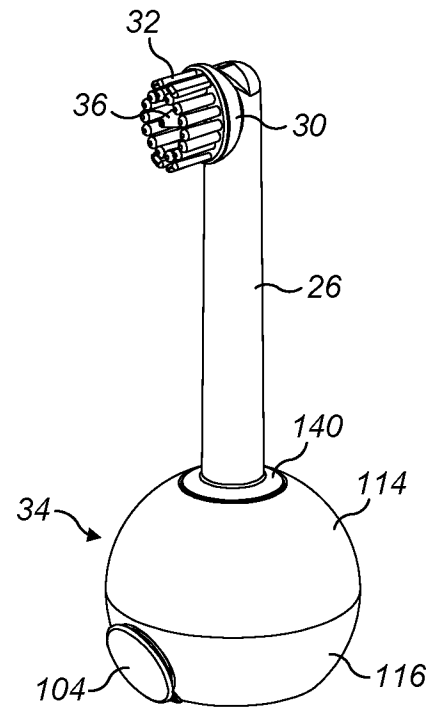


FIG. 7

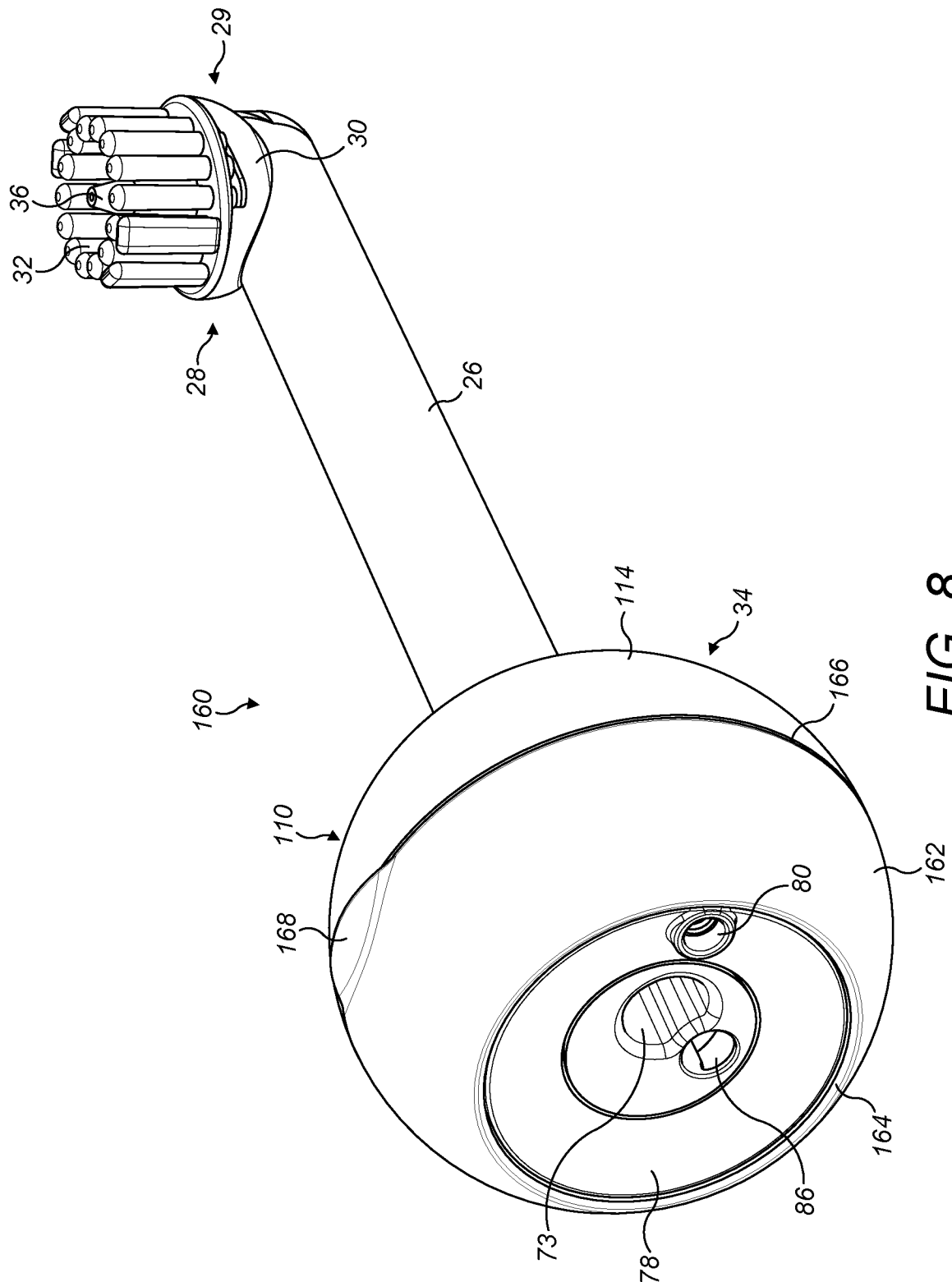


FIG. 8

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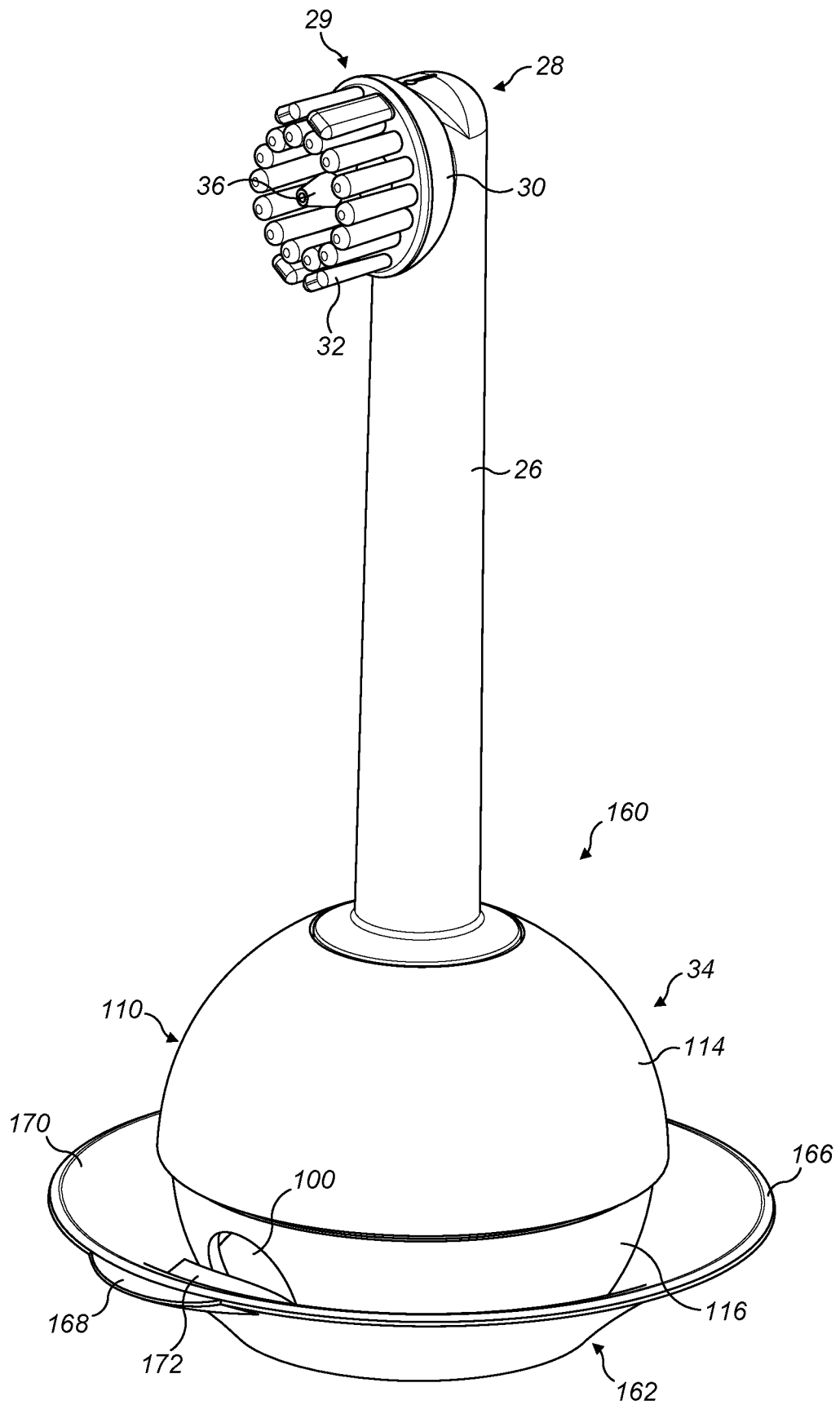


FIG. 9

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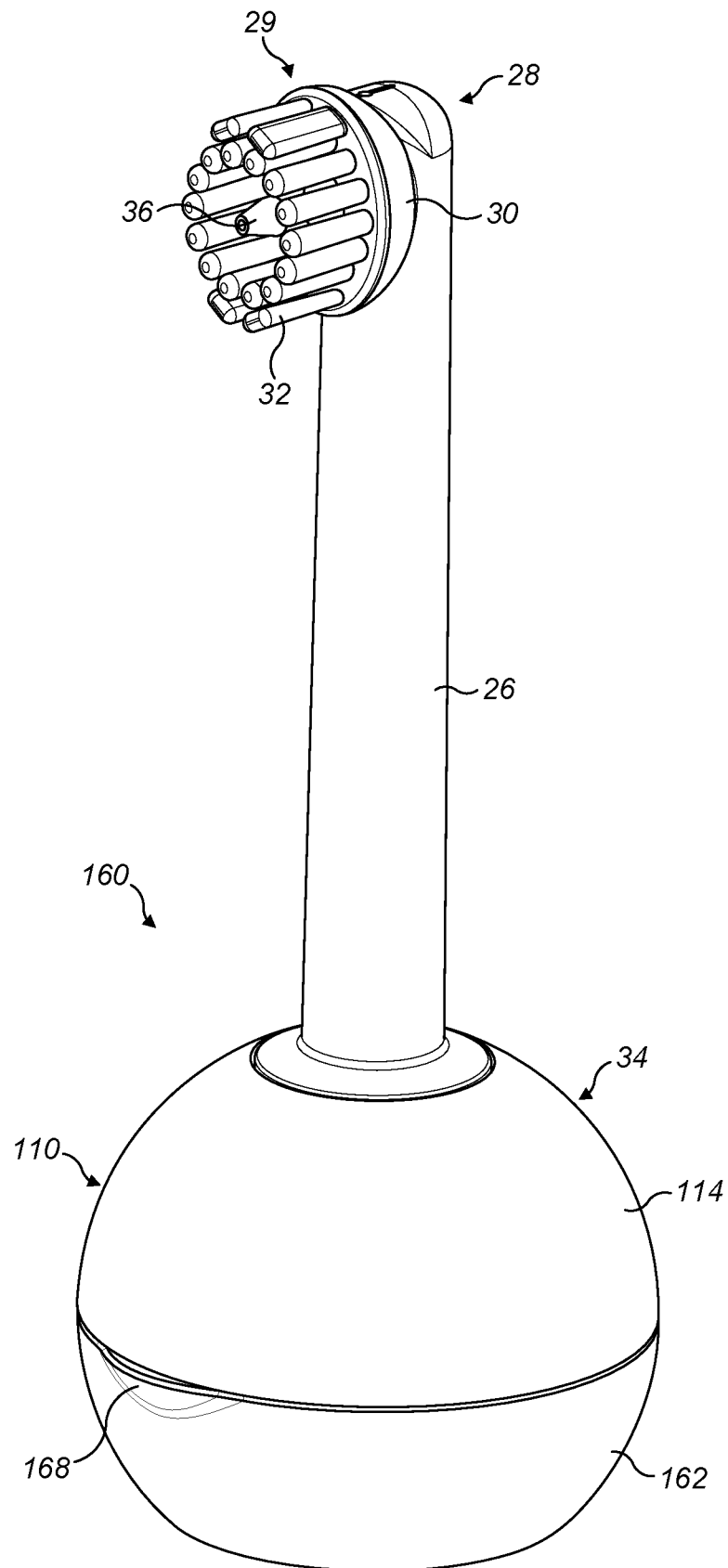


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2017/053198

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61C17/02 A61C17/22
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)
A61C

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

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	JP S63 83036 U (JP6383036U) 31 May 1988 (1988-05-31) figures	1-27
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A	US 2012/111891 A1 (MCNULTY JOHN JAMES [US] ET AL) 10 May 2012 (2012-05-10) figures	1-27
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

5 January 2018

Date of mailing of the international search report

13/02/2018

Name and mailing address of the ISA/

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Authorized officer

Fouquet, Michèle

INTERNATIONAL SEARCH REPORT

International application No
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