mode, the user depresses a button to actuate the delivery of working fluid from the nozzle. In a second mode, a control circuit actuates the delivery of working fluid to the nozzle automatically depending on a signal received from a sensor for detecting movement of the nozzle relative to the handle, for example as the nozzle moves into, or out from, an interproximal gap in the user's teeth.

The toothbrush includes a fluid reservoir which surrounds around a stem extending between the handle and the brush head. The fluid reservoir includes a fluid port which is connectable to the fluid delivery system, and the handle includes a seal which surrounds the fluid port to inhibit the leakage of working fluid from the fluid reservoir. The fluid reservoir is rotatable about the stem to expose the fluid port to enable the fluid reservoir to be replenished.

SUMMARY

In a first example, the present disclosure provides a dental cleaning appliance comprising:

a handle;

a fluid reservoir for storing a working fluid, the fluid reservoir comprising a fluid port; and

a fluid delivery system for receiving working fluid from the reservoir, and for delivering working fluid to the oral cavity of a user;

wherein the fluid reservoir is moveable along the handle between a first position in which the fluid port is connected to the fluid delivery system, and a second position in which the fluid port is exposed for replenishment of the fluid reservoir.

In a first aspect, the present disclosure refers to a dental cleaning appliance comprising:

a handle;

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

a fluid delivery system for receiving working fluid from the reservoir, the fluid delivery system comprising a nozzle for delivering working fluid to the oral cavity of a user;

wherein the fluid reservoir is moveable along the handle between a first position in which the fluid port is connected to the fluid delivery system, and a second position in which the fluid port is exposed to allow the fluid reservoir to be replenished, the fluid reservoir moving towards the nozzle as it moves from the first position towards the second position.

In comparison to the appliance disclosed in WO2016/185166, this aspect of the disclosure can increase the life of a seal for engaging the fluid reservoir when the fluid reservoir is in its first position, to inhibit the leakage of working fluid from the fluid reservoir, through a change in the motion of the fluid reservoir relative to the handle. By moving the fluid reservoir along the length of the handle between the first and second positions to expose the fluid port, as opposed to rotating the fluid reservoir about the stem, wear of the seal can be reduced. The movement of the fluid reservoir relative to

the handle may be in a direction which is substantially parallel to the longitudinal axis of the handle, or at an angle which is inclined at an acute angle to the longitudinal axis of the handle. The fluid reservoir may move along a path arranged relative to the handle so that, as the fluid reservoir moves relative to the handle, a component of its motion is aligned with the longitudinal axis of the handle. For example, the fluid reservoir may move in a spiral path extending about the handle.

The fluid reservoir may be free to move to one of a number of different positions intermediate the first position and the second position. Alternatively the fluid reservoir may be urged towards either the first position or the second position depending on its position relative to the handle. For example, the appliance may comprise a spring mechanism, such as an over-centre mechanism, for urging the fluid reservoir towards the first position or the second position, or an arrangement of magnets for attracting the fluid reservoir towards either the first position or the second position depending on its current position relative to the handle. The fluid reservoir is preferably slidable along the handle.

To maximize the capacity of the fluid reservoir and to provide for a relatively even weight distribution about the longitudinal axis of the appliance, the fluid reservoir preferably extends around at least part of the handle. In a preferred example, the fluid reservoir surrounds the handle. The fluid reservoir is preferably annular in shape.

The fluid delivery system preferably comprises a nozzle for delivering working fluid to the oral cavity of the user. The fluid delivery system preferably further comprises a pump and a controller for actuating the pump to draw working fluid from the fluid reservoir and eject 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 working fluid to be ejected from the nozzle. Alternatively, the appliance may be configured to actuate the delivery of working fluid to the oral cavity of the user automatically at a fixed frequency, for example between 0.5 and 5 Hz. The controller is preferably arranged to actuate the pump to eject a burst

of working fluid towards the nozzle. The volume of each burst of working fluid which is generated by the fluid delivery system is preferably less than 1 ml, more preferably less than 0.5 ml. In a preferred example, the volume of the burst of working fluid generated by the fluid delivery system is in the range from 0.1 to 0.4 ml. The fluid delivery system is preferably configured to deliver a burst of working fluid to the nozzle at a static pressure in the range from 3 to 10 bar.

The handle preferably comprises a number of sections, which are preferably integral with each other. The handle preferably comprises a first section, or "grip section", which is held or grasped by a user during use of the appliance. The grip section preferably comprises a user interface which is engaged by the user during use of the appliance, for example to actuate the delivery of working fluid from the fluid delivery system. The handle preferably further comprises a second section which is spaced from the grip section, and along which the fluid reservoir moves relative to the handle. The second section of the handle is preferably located proximate to an end of the handle, preferably the end of the handle which is closest to the nozzle, and so can be referred to as an "end section" of the handle. The end section preferably defines, at least in part, the end of the handle which is closest to the nozzle. When in its first position, the fluid reservoir preferably encloses or surrounds the end section of the handle so that it is not visible to the user of the appliance.

The end section of the handle preferably has a cross-section, in a plane perpendicular to the longitudinal axis of the handle, which is smaller than that of the grip section of the handle. This can allow the appliance to have a relatively uniform appearance when the fluid reservoir is in its first position, for example when the fluid reservoir has an external diameter which is the same as that of the grip section of the handle. Alternatively, or additionally, this can also allow, for a given fixed capacity of the fluid reservoir, the width of the fluid reservoir to be minimised.

The appliance preferably comprises means for inhibiting rotation of the fluid reservoir as it moves between the first position and the second position. This can ensure that the

fluid port remains in angular alignment with a fluid inlet of the fluid delivery system as it moves along the handle between the first position and the second position. For example, the fluid reservoir may move along an axially-aligned slot or groove formed in the end section of the handle. In a preferred example, the end section of the handle comprises a tubular external surface and the fluid reservoir comprises a tubular internal surface which surrounds the external surface of the end section of the handle when the fluid reservoir is in its first position. The tubular external surface of the end section of the handle preferably has substantially the same shape as the tubular internal surface of the fluid reservoir, which is preferably non-circular in a plane perpendicular to the longitudinal axis of the handle. In a preferred example, the external surface of the end section has an irregular shape in that plane; two opposing parallel surfaces and two opposing curved surfaces which define a “racetrack” shape. However, the external surface may have any desired shape, such as a regular or irregular polygon, which, when matched by the internal surface of the fluid reservoir, inhibits rotation of the fluid reservoir relative to the handle.

The handle preferably comprises a seat for receiving the fluid reservoir when in its first position. The seat preferably comprises a fluid inlet of the fluid delivery system which receives fluid from the fluid reservoir when in its first position. In a preferred example, the fluid port of the fluid reservoir is located in a base of the fluid reservoir which faces towards the seat. The seat is preferably located between the grip section and the end section of the handle, and is preferably arranged perpendicular to the longitudinal axis of the handle. Each one of the seat and the base of the fluid reservoir is preferably annular in shape. The seat and the base of the fluid reservoir preferably have substantially the same external diameter.

The seat preferably has a locally-enlarged cross-section compared to the grip section of the handle. Adjoining external surfaces of the seat and the fluid reservoir preferably have substantially the same curvature, so that when the fluid reservoir is in its first position the fluid reservoir and the seat together appear as a single curved unit. In the

preferred example, the adjoining external surfaces of the seat and fluid reservoir preferably have a spherical or spheroidal curvature.

As mentioned above, the fluid reservoir is preferably urged towards its first position, in which the fluid port of the fluid reservoir is connected to the fluid delivery system. This can reduce the likelihood of the fluid reservoir moving away from its first position during use of the appliance in the event that the fluid reservoir is accidentally knocked or otherwise impacted during use of the appliance. This can, in turn, reduce the risk of unwanted leakage of fluid from the fluid reservoir during use of the appliance.

In a second example, the present disclosure provides a dental cleaning appliance comprising:

a handle;

a fluid reservoir for storing a working fluid, the fluid reservoir comprising a fluid port; and

a fluid delivery system for receiving working fluid from the reservoir, and for delivering working fluid to the oral cavity of a user;

wherein the fluid reservoir is moveable relative to the handle between a first position in which the fluid port is connected to the fluid delivery system, and a second position in which the fluid port is exposed to allow the fluid reservoir to be replenished, the appliance comprising means for urging the fluid reservoir towards the first position.

Preferably, the urging means is configured to magnetically attract the fluid reservoir towards its first position. In a preferred example, the urging means comprises at least one permanent magnet carried by the fluid reservoir. The fluid port and the magnet(s) are preferably located on a common wall of the fluid reservoir, which in the preferred example is the base of the fluid reservoir. As mentioned above, the base of the fluid reservoir is preferably annular in shape, and so the fluid port and the magnets are preferably angularly spaced about the base of the fluid reservoir. In a preferred example, the fluid reservoir comprises two diametrically opposed magnets of the same polarity.

The urging means may further comprise at least one permanent magnet of opposite polarity located on the handle, and to which the magnet(s) of the fluid reservoir are attracted. Alternatively, the handle may comprise ferromagnetic material to which the magnet(s) of the fluid reservoir are attracted. The ferromagnetic material is preferably located on or adjacent the seat of the handle, and is preferably in the form of a loop or a ring which extends around the longitudinal axis of the handle.

The fluid reservoir moves away from the seat, and preferably towards the nozzle, as it moves from its first position towards its second position. The appliance preferably comprises a stem which extends between the handle and the nozzle. When the fluid reservoir is in its second position, preferably at least part of the fluid reservoir extends about the stem. In a preferred example, substantially only the base of the fluid reservoir continues to extend around the handle when the fluid reservoir is in its second position. To prevent the fluid reservoir from becoming fully detached from the handle as it moves away from the first position, the stem preferably comprises means for inhibiting movement of the fluid reservoir beyond the second position.

In a third example, the present disclosure provides a dental cleaning appliance comprising:

a handle;

a fluid reservoir for storing a working fluid, the fluid reservoir comprising a fluid port;

a fluid delivery system for receiving working fluid from the reservoir, the fluid delivery system comprising a nozzle for delivering working fluid to the oral cavity of a user; and

a stem extending between the handle and the nozzle;

wherein the fluid reservoir is moveable between a first position in which the fluid port is connected to the fluid delivery system, and a second position in which the fluid port is exposed to allow the fluid reservoir to be replenished, and wherein the stem comprises means for inhibiting movement of the fluid reservoir beyond the second position.

The inhibiting means preferably comprises a stop member protruding from an external surface of the stem. As the fluid reservoir reaches the second position, the stop member engages part of the fluid reservoir to inhibit movement of the fluid reservoir beyond the second position. The stop member may be arranged to engage an internal wall of the fluid reservoir, for example a wall which defines the tubular internal surface of the fluid reservoir. In a preferred example, the stop member is arranged to engage an external wall of the fluid reservoir when the fluid reservoir is in its second position. As mentioned above, the external wall of the fluid reservoir preferably has a curvature which is substantially spherical or spheroidal. The external wall is preferably shaped such that a portion of the external wall defines an aperture through which the stem passes when the fluid reservoir is in its second position. The stop member is preferably arranged to engage that portion of the external wall when the fluid reservoir is in its second position.

The stem is preferably detachably connected to the handle. This allows the stem to be replaced, for example, when the nozzle has become worn, to allow a replacement stem having a different size or shape to be connected to the handle, or to allow a different user to attach a personal stem to the handle. The stem preferably forms an interference fit with the handle.

The fluid reservoir is preferably detachably connected to the handle. The fluid reservoir may be detached from the handle, for example, for replacement of the fluid reservoir. Preferably, the fluid reservoir is detachable from the handle only following the detachment of the stem from 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 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 example, 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. The appliance comprises a drive mechanism for driving the movement of the bristle carrier relative to the handle. The drive mechanism preferably comprises a transmission unit connected to the bristle carrier, and a drive unit for driving the transmission unit to move the bristle carrier relative to the handle. The drive unit is preferably located in the handle, and more preferably located in the end section of the handle. The fluid reservoir preferably extends about at least part of the drive unit. In a preferred example, the drive unit comprises a motor and the fluid reservoir extends about the motor of the drive unit. Accommodating the motor in the end section of the handle can reduce the number of components of the appliance which are housed within the grip section of the handle, and so can enable the shape of the grip section to be optimized for being grasped by the user.

In a fourth example, the present disclosure provides a dental cleaning appliance comprising:

a handle;

a fluid reservoir for storing a working fluid;

a fluid delivery system for receiving working fluid from the reservoir, and for delivering working fluid to the oral cavity of a user;

a brush unit comprising a bristle carrier and a plurality of bristles mounted on the bristle carrier; and

a drive unit for driving movement of the bristle carrier relative to the handle;

wherein the fluid reservoir extends about at least part of the drive unit.

The drive unit may be arranged to move the bristle carrier relative to the stem. Alternatively, the drive unit may be arranged to move the stem, and thus the bristle carrier, relative to the handle. The stem is preferably mounted on the transmission unit. The fluid reservoir preferably extends about at least part of the transmission unit.

The transmission unit is preferably in the form of a shaft which is moved, preferably vibrated, relative to the handle by the motor. The frequency of the vibration of the shaft is preferably in the range from 250-300Hz. The motor preferably extends about the shaft so that the shaft vibrates relative to the handle upon excitation of the motor.

The transmission unit preferably defines part of the fluid delivery system. The shaft preferably comprises a bore which defines part of the fluid delivery system.

The fluid delivery system preferably comprises a handle conduit system and a cleaning tool conduit system for receiving fluid from the handle conduit system. The cleaning tool conduit system preferably comprises at least one conduit for conveying the burst of working fluid to the nozzle. In a preferred example, the stem comprises a bore which defines a fluid conduit of the cleaning tool conduit system. The handle conduit system preferably comprises the fluid inlet for receiving working fluid from the fluid port of the fluid reservoir, and a plurality of conduits for conveying working fluid between the fluid inlet port, the pump and a fluid outlet of the handle. The plurality of conduits comprises a fluid inlet conduit for conveying fluid from the fluid inlet towards the pump, and a fluid outlet conduit for conveying a burst of working fluid from the pump to the fluid outlet. At least part of the fluid outlet conduit is preferably defined by the bore of the transmission unit, and thus preferably extends through the motor. At least part of the fluid inlet conduit preferably extends from the fluid inlet to the pump adjacent the external surface of the motor. At least part of the inlet conduit is preferably defined by the seat of the handle.

Conveying fluid to the pump along the outside of the motor, and subsequently conveying fluid from the pump through the motor, can further improve the compactness

of the appliance. In a fifth example, the present disclosure provides a dental cleaning appliance comprising:

a handle;

a fluid reservoir for storing a working fluid;

a fluid delivery system for receiving working fluid from the reservoir, the fluid delivery system comprising a pump, an inlet conduit for conveying working fluid from the reservoir towards the pump, a nozzle for delivering working fluid to the oral cavity of a user, and an outlet conduit for conveying working fluid from the pump towards the nozzle;

a brush unit comprising a bristle carrier and a plurality of bristles mounted on the bristle carrier; and

a drive unit for driving movement of the bristle carrier relative to the handle, the drive unit comprising a motor;

wherein at least part of the inlet conduit is adjacent to the external surface of the motor, and at least part of the outlet conduit extends through the motor.

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

BRIEF DESCRIPTION OF THE DRAWINGS

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

Figure 1(a) is a perspective view, from the front, of a dental cleaning appliance, with a fluid reservoir in a first position, and Figure 1(b) is a perspective view, from the rear, of the dental cleaning appliance of Figure 1(a);

Figure 2(a) is a right side view of the appliance of Figure 1(a), Figure 2(b) is a front view of the appliance of Figure 1(a) and Figure 2(c) is a left side view of the appliance of Figure 1(a);