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**Zhang et al.**

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(54) **ORAL CARE IMPLEMENT**

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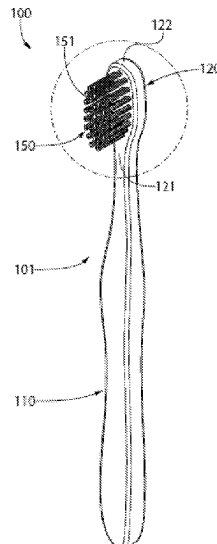
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(57) **ABSTRACT**

An oral care implement (100) including a head portion (120) that extends from a proximal end (121) to a distal edge (122) along a longitudinal axis (A-A). The head portion (120) may be formed of a cellulosic material such as a wood material or a bamboo material having a longitudinal grain direction. The head portion (120) may include a plurality of tuft holes (130) such that a bristle tuft (151) is anchored to the head portion (120) within each of the tuft holes (130) by an anchor (200). The anchors (200) may extend along an anchor axis that is oblique to the longitudinal axis (A-A). The bristle tufts (151) may include perimeter bristle tufts (153,154) located within perimeter tuft holes (140) that are adjacent to a perimeter (128) or peripheral edge (126,127) of the head portion (120). The perimeter tuft holes (140) may be located at least 1.80 mm from the perimeter (128) of the head portion (120).

**20 Claims, 5 Drawing Sheets**



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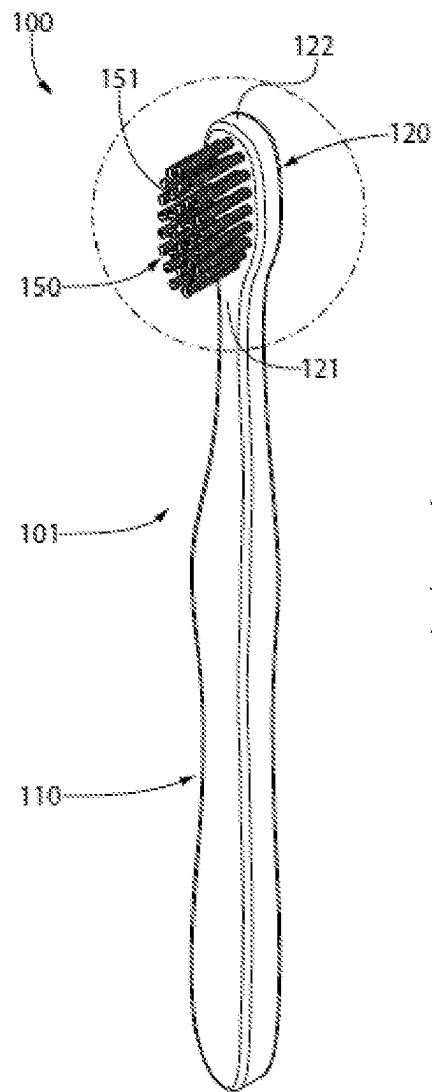


FIG. 1

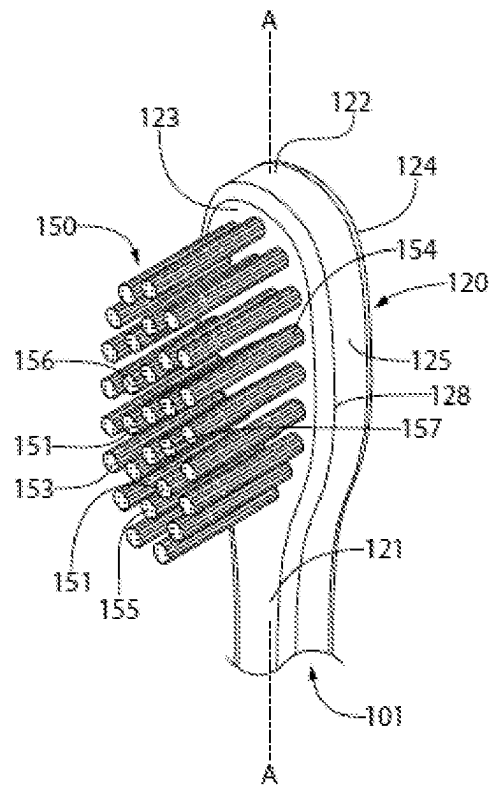


FIG. 2

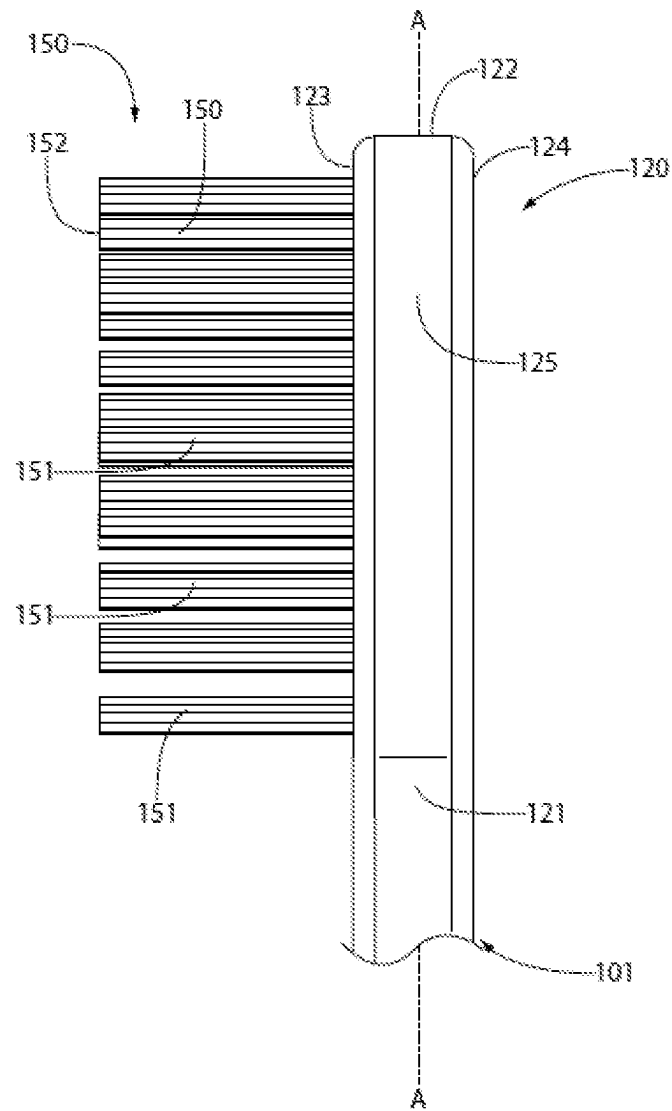


FIG. 3

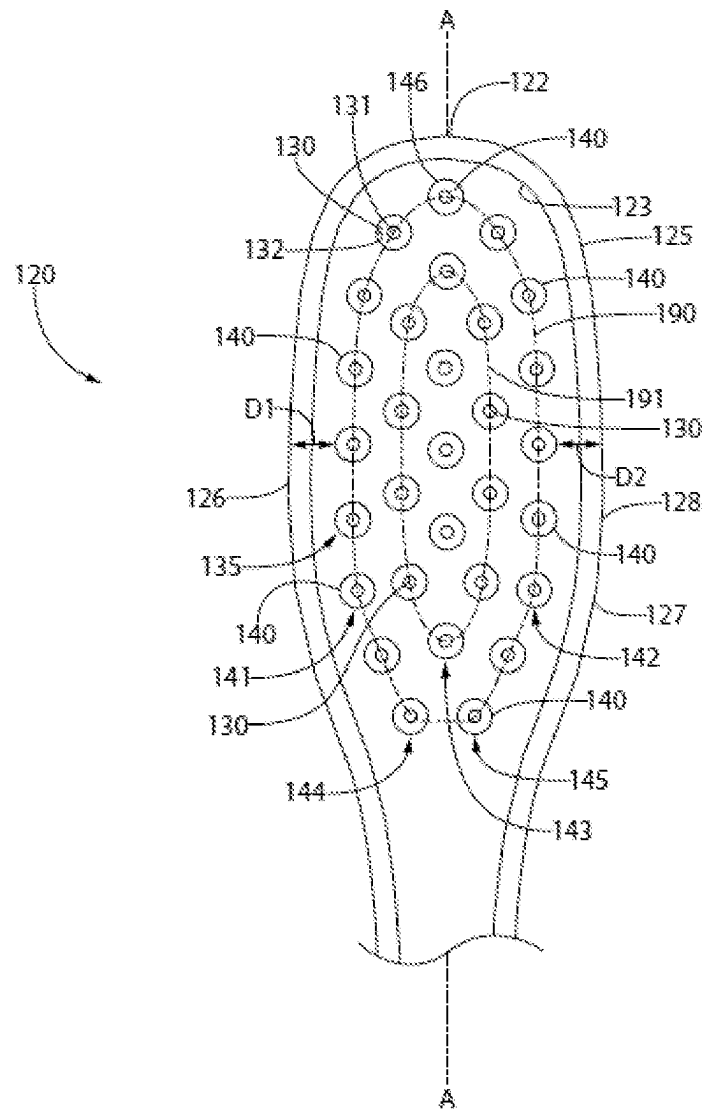


FIG. 4

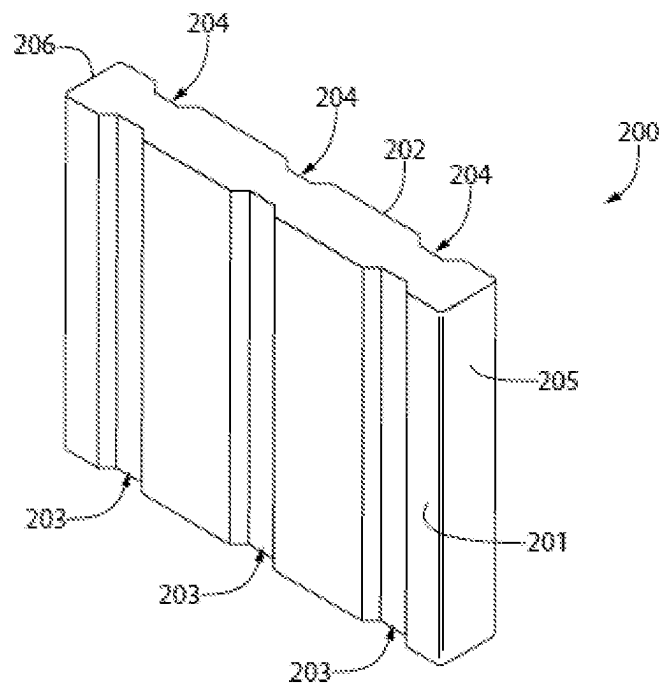


FIG. 5

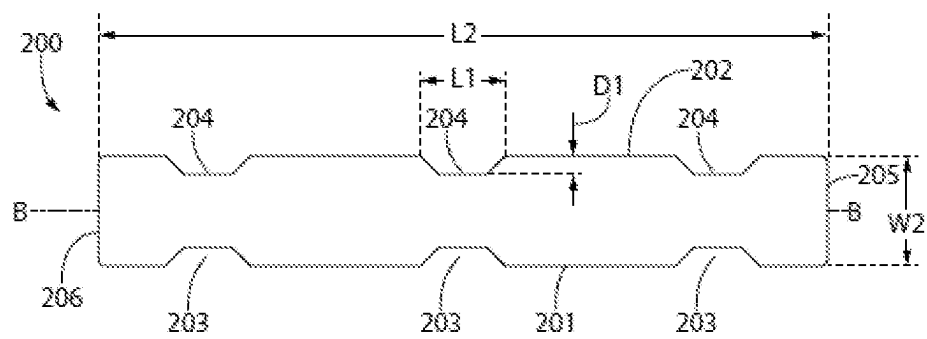


FIG. 6

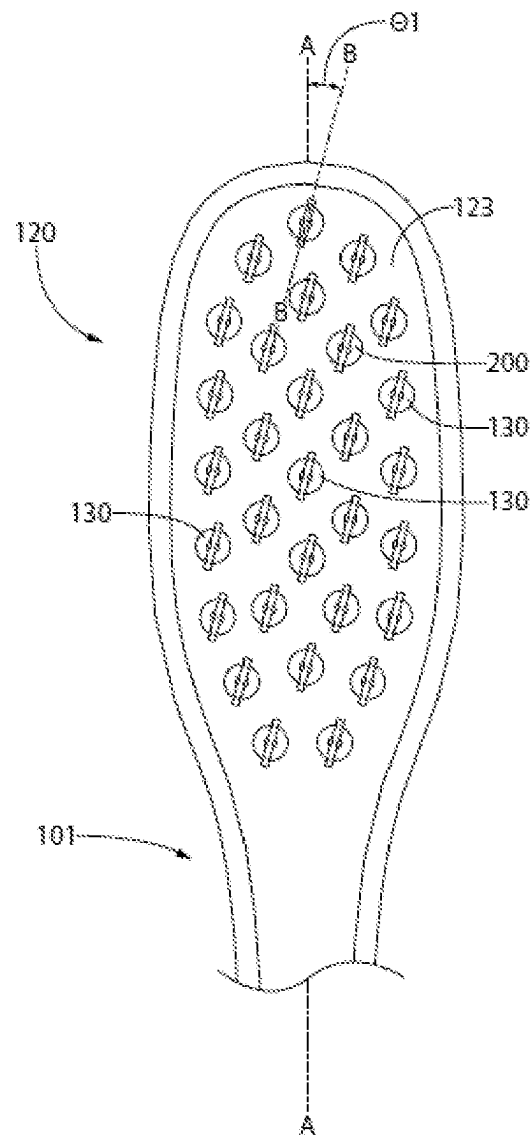


FIG. 7

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**ORAL CARE IMPLEMENT****BACKGROUND**

As the deleterious effects of plastic on the environment become more of a concern, consumers are looking to purchase products that use less plastic. One industry that has products made predominately out of plastic is the toothbrush industry. One reason for this is that significant research and development has taken place to improve tuft retention in such plastic toothbrushes so that the bristles are not detaching from the toothbrush body during use. When looking to use a different base material for the toothbrush, bristle retention must be considered once again. Thus, a need exists for a non-plastic based toothbrush having an improved tuft retention.

**BRIEF SUMMARY**

The present invention is directed to an oral care implement including a head portion that extends from a proximal end to a distal edge along a longitudinal axis. The head portion may be formed of a cellulosic material such as a wood material or a bamboo materials having a longitudinal grain direction. The head portion may include a plurality of tuft holes such that a bristle tuft is anchored to the head within each of the tuft holes by an anchor. The anchors may extend along an anchor axis that is oblique to the longitudinal axis. The bristle tufts may include perimeter bristle tufts located within perimeter tuft holes that are adjacent to a perimeter or peripheral edge of the head. The perimeter tuft holes may be located at least 1.80 mm from the perimeter of the head.

In one aspect, the invention may be an oral care implement comprising: a head portion extending along a longitudinal axis from a proximal end to a distal edge, the head portion formed of a cellulosic material having a longitudinal grain direction; the head portion comprising a plurality of tuft holes; and a plurality of bristles tufts anchored to the head portion within the plurality of tuft holes by a plurality of anchors, each of the anchors extending along an anchor axis that is oblique to the longitudinal axis.

In another aspect, the invention may be an oral care implement comprising: a head portion extending along a longitudinal axis from a proximal end to a distal edge, the head portion formed of a cellulosic material; the head portion comprising a plurality of tuft holes; and a plurality of bristles tufts anchored to the head portion within the plurality of tuft holes by a plurality of anchors; the plurality of tuft holes comprising a plurality of perimeter tuft holes arranged in a loop that is adjacent a perimeter of the head portion, the plurality of bristle tufts comprising a plurality of perimeter bristle tufts disposed within and extending from the perimeter tuft holes; and wherein a distance between the perimeter and any one of the perimeter tuft holes is greater than 1.80 mm.

In yet another aspect, the invention may be an oral care implement comprising: a head portion extending along a longitudinal axis from a proximal end to a distal edge, the head portion formed of a cellulosic material; the head portion comprising a plurality of tuft holes; and a plurality of bristles tufts anchored to the head portion within the plurality of tuft holes by a plurality of anchors; the plurality of tuft holes comprising a plurality of perimeter tuft holes arranged in a loop that is adjacent a perimeter of the head portion, the plurality of bristle tufts comprising a plurality of perimeter bristle tufts disposed within and extending from

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the perimeter tuft holes; and wherein the plurality of perimeter bristle tufts comprises a distal-most bristle tuft located adjacent the distal edge of the head, and wherein the distal-most bristle tuft is located closer to the perimeter of the head than any of the other perimeter bristle tufts.

In a further aspect, the invention may be an oral care implement comprising: a head portion formed of bamboo and extending along a longitudinal axis, the head portion comprising a plurality of tuft holes; a plurality of bristle tufts anchored to the head portion within the plurality of tuft holes by a plurality of anchors; and wherein the plurality of tuft holes are arranged in a plurality of longitudinal rows that are staggered relative to one another so that no tuft hole in any of the plurality of longitudinal rows is aligned with a tuft hole in an adjacent one of the plurality of longitudinal rows in a direction transverse to the longitudinal axis.

Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

FIG. 1 is a perspective view of an oral care implement in accordance with an embodiment of the present invention;

FIG. 2 is a close-up view of area II of FIG. 1 illustrating a head portion of the oral care implement;

FIG. 3 is a side view of the head portion of the oral care implement of FIG. 1;

FIG. 4 is a front view of the head portion of the oral care implement of FIG. 1 with bristle tufts omitted so that tuft holes are visible;

FIG. 5 is a perspective view of an anchor used for anchoring the bristle tufts to the head portion of the oral care implement of FIG. 1 in accordance with an embodiment of the present invention;

FIG. 6 is a top view of the anchor of FIG. 5; and

FIG. 7 is a front view of the head portion of FIG. 4 illustrating the anchors of FIG. 5 positioned within the tuft holes.

**DETAILED DESCRIPTION**

The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

The description of illustrative embodiments according to principles of the present invention is intended to be read in connection with the accompanying drawings, which are to be considered part of the entire written description. In the description of embodiments of the invention disclosed herein, any reference to direction or orientation is merely intended for convenience of description and is not intended in any way to limit the scope of the present invention. Relative terms such as "lower," "upper," "horizontal," "vertical," "above," "below," "up," "down," "top" and "bottom" as well as derivatives thereof (e.g., "horizontally," "downwardly," "upwardly," etc.) should be construed to refer to the orientation as then described or as shown in the drawing under discussion. These relative terms are for convenience of description only and do not require that the apparatus be



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constructed or operated in a particular orientation unless explicitly indicated as such. Terms such as “attached,” “affixed,” “connected,” “coupled,” “interconnected,” and similar refer to a relationship wherein structures are secured or attached to one another either directly or indirectly through intervening structures, as well as both movable or rigid attachments or relationships, unless expressly described otherwise. Moreover, the features and benefits of the invention are illustrated by reference to the exemplified embodiments. Accordingly, the invention expressly should not be limited to such exemplary embodiments illustrating some possible non-limiting combination of features that may exist alone or in other combinations of features; the scope of the invention being defined by the claims appended hereto.

Referring first to FIG. 1, an oral care implement **100** is illustrated in accordance with an embodiment of the present invention. The oral care implement **100** comprises a body **101** having a handle portion **110** and a head portion **120**. The body **101** is a single, unitary construction such that the handle portion **110** and the head portion **120** are part of the same monolithic component. The body **101** may be formed from a cellulosic material. More specifically, the body **101** may be formed from wood. Still more specifically, in some embodiments the body **101** may be formed from bamboo. As used herein, the term cellulosic may comprise wood materials and parts thereof and bamboo materials and parts thereof.

The handle portion **110** is the portion of the body **101** that is gripped by a user during use thereof. Thus, the handle portion **110** preferably has a length and width that is selected for user comfort so that a user can clasp his/her hand around the handle portion **110** to use the oral care implement **100** for oral cavity treatment such as toothbrushing. The handle portion **110** is elongated and may have various contours to enhance user comfort. In the exemplified embodiment, the side surfaces of the handle portion **110** appear to be wavy which may allow the handle portion **110** to sit more comfortably within a user's palm. The handle portion **110** may have flat front and rear surfaces and/or may include bumps, ridges, or protrusions to enhance grip. The handle portion **110** may be partially or fully encased or covered with a gripping material, such as a thermoplastic elastomer, to further increase usability. Thus, various modifications to the handle are possible within the scope of the invention described herein and the invention is not intended to be limited by the structure or shape of the handle portion **110** shown in the drawings. In some embodiments, the cellulosic material (e.g., wood, bamboo) that forms the body **101** may be coated with a beeswax to prevent any possibilities of mold growth thereon.

Referring to FIGS. 1-3, the head portion **120** will be described. The head portion **120** extends from a proximal end **121** where it is connected to the handle portion **110** to a distal edge **122** that forms a distal end of the body **101**. The head portion **120** extends along a longitudinal axis A-A from the proximal end **121** to the distal edge **122**. The head portion **120** comprises a front surface **123**, a rear surface **124** opposite the first surface **123**, and a peripheral surface **125** extending between the front and rear surfaces **123**, **124**. The region where the peripheral surface **125** intersects the front surface **123** may be referred to herein as a perimeter **128** of the head portion **120**.

A plurality of bristle tufts **151** are anchored to the head portion **120** of the body **101** so that the bristle tufts **151** extend outwardly from the front surface **123** of the head portion **120**. Only a few of the bristle tufts **151** are labeled in the figures in order to prevent clutter. As will be discussed

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in detail below with reference to FIG. 4, each of the plurality of bristle tufts **151** is located within a tuft hole in the head portion **120** and then secured thereto by an anchor. The bristle tufts **151** collectively define a bristle field **150**. Each of the bristle tufts **151** comprises a plurality of bristles that are clumped together into the tuft and inserted into a singular tuft hole formed into the head portion **120**. The bristles within each of the bristle tufts **151** may be, for example without limitation, filament bristles, fiber bristles, nylon bristles, polybutylene terephthalate (PBT) bristles, spiral bristles, core-sheath bristles, tapered bristles, end-rounded bristles, or the like. Combinations of these different bristle types may be positioned in the same bristle tuft **151** or each bristle tuft **151** may contain only one bristle type. The bristles may have varying diameters including 7 mm, 8 mm, and 9 mm. Some of the bristles and/or bristle tufts **151** may be infused with charcoal, bamboo salt, or other natural ingredients as may be desired.

In the exemplified embodiment, the bristle tufts **151** are the only tooth cleaning elements coupled to and extending from the head portion **120**. Of course, the invention is not to be so limited in all embodiments and in some alternative embodiments there may also be lamella or rubber cleaning elements including rubber bristles, elastomeric protrusions, flexible polymer protrusions, or the like extending from the head. Thus, cleaning elements for cleaning, polishing, or wiping the teeth and/or soft oral tissue may be formed from other materials.

As best seen in FIG. 3, in the exemplified embodiment the bristle field **150** formed by the plurality of bristle tufts **151** has a flat trim profile. Specifically, each of the bristle tufts **151** has the same height measured from the front surface **123** of the head portion **120** to a distal end **152** of the bristle tuft **151**. As a result, the distal ends **152** of the bristle tufts **151** collectively lie on a common plane that is parallel to the front surface **123** of the head portion **120**. However, the invention is not to be so limited in all embodiments and in some other embodiments the bristle tufts **151** may have varying heights to create a wavy or other trim profile that is not flat and planar as shown in the exemplified embodiment.

As mentioned above, the body **101** of the oral care implement **100** may be formed of a wood material. In such embodiments, the wood material may have a longitudinal grain direction. Thus, the grain direction of the wood material of the body **101**, and particularly the head portion **120** thereof, is substantially parallel to the longitudinal axis A-A. Stated another way, the wood material of the body **101** has a straight grain, which runs parallel to the longitudinal axis A-A thereof. Of course, as used herein parallel does not mean perfectly parallel and longitudinal grain direction does not mean perfectly longitudinal. The grain direction may be at a slight angle relative to the longitudinal axis A-A, but so long as the grain direction is generally in the longitudinal direction (i.e., the direction of the longitudinal axis A-A) it will be understood to have a longitudinal grain direction.

Referring now to FIG. 4, the head portion **120** of the oral care implement **100** is illustrated with the bristle tufts **151** removed. The head portion **120** comprises a plurality of tuft holes **130** formed into the front surface **123** thereof. Only a few of the tuft holes **130** are labeled in FIG. 4 in an effort to avoid clutter. Each of the tuft holes **130** is a hole formed into the front surface **123** of the head portion **120** having a height that is less than a thickness of the head portion **120** measured between the front and rear surfaces **123**, **124** of the head portion **120**. Thus, the tuft holes **130** are each defined by a floor **131** that is recessed relative to the front surface **123** of the head portion **120** and a sidewall **132** that extends from

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the floor **131** to the front surface **123** of the head portion **120**. The tuft holes **130** have round cross-sectional areas in the exemplified embodiment, but they could take on other shapes in other embodiments. The tuft holes **130** may have a diameter of between 1.4 and 1.8 mm, more specifically between 1.5 and 1.7 mm, and still more specifically approximately 1.6 mm.

In the exemplified embodiment, the tuft holes **130** are arranged in longitudinal rows that are staggered relative to one another. Thus, no tuft hole **130** in any of the plurality of longitudinal rows is aligned with a tuft hole **130** in an adjacent one of the plurality of longitudinal rows. Although there may be some overlap between tuft holes in adjacent longitudinal rows, the centerpoints of the tuft holes **130** in adjacent longitudinal rows are not aligned (i.e., a plane that is transverse to the longitudinal axis A-A will not intersect the centerpoints of any two tuft holes **130** in two adjacent longitudinal rows). The tuft holes **130** collectively define a tuft hole field **135**. A spacing between the plurality of tuft holes **130**, which is measured as a linear distance from one of the plurality of tuft holes **130** to an adjacent one of the plurality of tuft holes **130**, varies throughout the tuft hole field **135**. Thus, there is not an equal spacing amongst all of the tuft holes **130**. This may be true both within one of the longitudinal rows and between adjacent longitudinal rows in some embodiments. In some embodiments, the tuft holes **130** of the tuft hole field **135** are symmetric about the longitudinal axis A-A of the head portion **120**.

The peripheral surface **125** of the head portion **120** comprises a first side edge **126** and a second side edge **127**. The first and second side edges **126**, **127** are portions of the peripheral surface **125** that are located on opposite sides of the longitudinal axis A-A. The plurality of tuft holes **130** comprises a first longitudinal row of outermost tuft holes **141** located adjacent to the first side edge **126** and a second longitudinal row of outermost tuft holes **142** located adjacent to the second side edge **127**. The plurality of tuft holes **130** also comprises a central longitudinal row of tuft holes **143** located along the longitudinal axis A-A, a first longitudinal row of inner tuft holes **144** located between the central longitudinal row of tuft holes **143** and the first longitudinal row of outermost tuft holes **141**, and a second longitudinal row of inner tuft holes **145** located between the central longitudinal row of tuft holes **143** and the second longitudinal row of outermost tuft holes **142**.

In the exemplified embodiment, the central longitudinal row of tuft holes **143** is generally aligned on the longitudinal axis A-A. However, in the exemplified embodiment the first and second longitudinal rows of outermost tuft holes **141**, **142** and the first and second longitudinal rows of inner tuft holes **144**, **145** have some curvature to them such that they are not perfectly straight. Specifically, the first and second longitudinal rows of outermost tuft holes **141**, **142** and the first and second longitudinal rows of inner tuft holes **144**, **145** are curved so that they have concave sides that face the central longitudinal row of tuft holes **143**. Of course, various modifications to the nature of the curvature of each of the various longitudinal rows may be permissible in some alternative embodiments.

In some embodiments, a distance between any two adjacent ones of the tuft holes **130** of the central longitudinal row **143** is greater than 1.5 mm. In another embodiment, the distance between any two adjacent ones of the tuft holes **130** of the central longitudinal row **143** is greater than 1.75 mm. In another embodiment, the spacing between any two adja-

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cent ones of the tuft holes **130** of the central longitudinal row **143** excluding the distal-most tuft hole **146** is at least 2.1 mm.

In addition to being arranged in longitudinal rows, the plurality of tuft holes **130** comprises a plurality of perimeter tuft holes **140** that are arranged in a perimeter loop **190** that is adjacent to the perimeter **128** of the head portion **120**. Stated another way, the perimeter tuft holes **140** are those tuft holes **130** that are located closest to the perimeter **128** and the peripheral surface **125** of the head portion **120**. Only a few of the perimeter tuft holes **140** are labeled in FIG. 4, but it should be easily understood which of the tuft holes **130** are the perimeter tuft holes **140** (i.e., the tuft holes **130** that are intersected by the perimeter loop **190** that is drawn schematically on FIG. 4).

The tuft holes **130** also form an inner loop **191** that is surrounded by the perimeter loop **190**. The tuft holes **130** of the first and second longitudinal rows of inner tuft holes **144**, **145** as well as two of the tuft holes **130** of the central longitudinal row of tuft holes **143** collectively form the inner loop **191**. In the exemplified embodiment, the inner loop **191** surrounds a plurality, and specifically the three remaining ones of the tuft holes **130** of the central longitudinal row of tuft holes **143**.

In the exemplified embodiment, at least one of the perimeter tuft holes **140** is also in the first longitudinal row of outermost tuft holes **141**, at least one of the perimeter tuft holes **140** is also in the second longitudinal row of outermost tuft holes **142**, at least one of the perimeter tuft holes **140** is also in the first longitudinal row of inner tuft holes **144**, at least one of the perimeter tuft holes **140** is also in the second longitudinal row of inner most tuft holes **145**, and at least one of the perimeter tuft holes **140** is also in the central longitudinal row of tuft holes **143**. Thus, the perimeter tuft holes **140** are not mutually exclusive from the various longitudinal rows of tuft holes, but rather many if not all of the perimeter tuft holes **140** are also located in one of the longitudinal rows **141-145** noted herein.

In the exemplified embodiment, the plurality of perimeter tuft holes **140** comprises a distal-most tuft hole **146**, which is the tuft hole **130** that is located closest to the distal edge **122** of the head portion **120**. In the exemplified embodiment, the distal-most tuft hole **146** is located in the central longitudinal row of tuft holes **143**. Specifically, in the exemplified embodiment the distal-most tuft hole **146** is the only tuft hole that is both a perimeter tuft hole **140** and located in the central longitudinal row of tuft holes **143**. Thus, in the exemplified embodiment the distal-most tuft hole **146** is located on (or is aligned with) the longitudinal axis A-A.

Referring briefly to FIG. 2, there are bristle tufts **151** located in each of the tuft holes **130**. Specifically, each of the bristle tufts **151** is anchored to the head within one of the plurality of tuft holes **130** by an anchor, such as a staple or the like, which will be described in greater detail below with reference to FIGS. 5-7. More specifically, the plurality of bristle tufts **151** comprises a first longitudinal row of outermost bristle tufts **153** disposed within and extending from the first longitudinal row of outermost tuft holes **141**, a second longitudinal row of outermost bristle tufts **154** disposed within and extending from the second longitudinal row of outermost tuft holes **142**, a central longitudinal row of bristle tufts **155** disposed within and extending from the central longitudinal row of tuft holes **143**, a first longitudinal row of innermost bristle tufts **156** disposed within and extending from the first longitudinal row of inner tuft holes **144**, and a second longitudinal row of innermost bristle tufts **157** disposed within and extending from the second longi-

tudinal row of innermost tuft holes **145**. Only one bristle tuft **151** within each of the various longitudinal rows is labeled to avoid clutter.

Referring again to FIG. 4, as mentioned above the first longitudinal row of outermost tuft holes **141** are located adjacent to the first side edge **126** of the peripheral surface **125** of the head portion **120**. In the exemplified embodiment, a distance D1 between the first side edge **126** and any one of the outermost tuft holes **130** of the first longitudinal row of outermost tuft holes **141** is greater than 1.8 mm. In some embodiments, the distance D1 may be greater than 1.9 mm. In some embodiments, the distance D1 may be greater than 1.95 mm. In some embodiments, the distance D1 is greater than 2.0 mm for all but one of the tuft holes **130** of the first longitudinal row of outermost tuft holes **141**. Thus, in some embodiments only one of the tuft holes **130** of the first longitudinal row of outermost tuft holes **141** is located less than 2.0 mm from the first side edge **126** of the head portion **120**. In other embodiments, all of the tuft holes **130** of the first longitudinal row of outermost tuft holes **141** may be located at least 2.0 mm from the first side edge **126** of the head portion **120**.

As also mentioned above, the second longitudinal row of outermost tuft holes **142** are located adjacent to the second side edge **127** of the peripheral surface **125**. In the exemplified embodiment, a distance D2 between the second side edge **127** and any one of the outermost tuft holes **130** of the second longitudinal row of outermost tuft holes **142** is greater than 1.8 mm. In some embodiments, the distance D2 may be greater than 1.9 mm. In some embodiments, the distance D2 may be greater than 1.95 mm. In some embodiments, the distance D2 is greater than 2.0 mm for all but one of the tuft holes **130** of the second longitudinal row of outermost tuft holes **142**. Thus, in some embodiments only one of the tuft holes **130** of the second longitudinal row of outermost tuft holes **142** is located less than 2.0 mm from the second side edge **127** of the head portion **120**. In other embodiments, all of the tuft holes **130** of the second longitudinal row of outermost tuft holes **142** may be located at least 2.0 mm from the second side edge **127** of the head portion **120**.

In some embodiments, the distance D1 between the first side edge **126** and any one of the tuft holes **130** of the first longitudinal row of outermost tuft holes **141** may be measured along a first reference line that is radial to a center of the tuft hole **130** and perpendicular to a tangent line of the first side edge **126**. The distance D1 is measured from the first side edge **126** to a part of the relevant tuft hole that is closest to the first side edge **126**. Similarly, wherein the distance D2 between the second side edge **127** and any one of the outermost tuft holes **130** of the second longitudinal row of outermost tuft holes **142** may be measured along a reference line that is radial to a center of the tuft hole **130** and perpendicular to a tangent line of the second side edge **127**. The distance D2 is measured from the second side edge **127** to a part of the relevant tuft hole that is closest to the second side edge **127**.

In some embodiments, a distance between the perimeter **128** and any one of the perimeter tuft holes **140** may be greater than 1.80 mm. In some embodiments, the distance between the perimeter **128** and any one of the perimeter tuft holes **140** may be greater than 1.90 mm. In some embodiments, the distance between the perimeter **128** and any one of the perimeter tuft holes **140** may be greater than 1.95 mm. In some embodiments, the distance between the perimeter **128** and each of the perimeter tuft holes **140** with the exception of the distal-most tuft hole **146** may be greater

than 2.0 mm. Maintaining this type of spacing between the perimeter **128** of the head portion **120** and the tuft holes that are positioned closest to the perimeter **128** of the head portion **120** (i.e., the perimeter tuft holes **140**) increases tuft retention.

In some embodiments, at least 80% of the tuft holes **130** of the perimeter tuft holes **140** are spaced a distance of at least 2.0 mm from the perimeter **128** of the head portion **120**. Furthermore, in some embodiments at least 20% of the tuft holes **130** of the perimeter tuft holes **140** are spaced a distance of at least 2.5 mm from the perimeter **128** of the head portion **120**. In some embodiments, the proximal-most tuft holes of the perimeter tuft holes **140** (those located closest to the handle portion **110**) are located further from the perimeter **128** of the head portion **120** than any of the other tuft holes of the perimeter tuft holes **140** while the distal-most tuft hole **146** is located closer to the perimeter **128** of the head portion **120** than any of the other tuft holes of the perimeter tuft holes **140**.

Referring to FIGS. 5 and 6, an anchor **200** that may be used to secure the bristle tufts **151** within the tuft holes **130** of the oral care implement **100** will be described. The use of the anchors **200** for securing the bristle tufts **151** to the head portion **120** of the oral care implement **100** is commonly referred to as a staple technique. The anchor **200** may be formed out of a metal material in some embodiments, although this is not required in all embodiments. Basically, the bristle tufts **151** are bent into a U shape and then placed into the tuft holes **130** and the anchors **200** are then placed into the tuft holes **130** and secured to the head portion **120** to retain the bristle tufts **151** within the tuft holes **130**. The ability of the anchors **200** to remain in place assists with bristle retention by preventing bristles from being detached from the head portion **120** during normal use of the oral care implement **100**.

In the exemplified embodiment, the anchor **200** is a double sided grooved anchor. Specifically, the anchor **200** has a first major surface **201** and a second major surface **202** opposite the first major surface **201**. There are a plurality of first grooves **203** formed into the first major surface **201** and a plurality of second grooves **204** formed into the second major surface **202**. In the exemplified embodiment, each of the first grooves **203** in the first major surface **201** is aligned with one of the second grooves **204** in the second major surface **202**. However, this is not required in all embodiments and the first and second grooves **203**, **204** may not be aligned in other embodiments. In the exemplified embodiment, there are three grooves on each of the first and second major surfaces **201**, **202**, although more or less grooves could be used in other embodiments and the spacing therebetween adjusted accordingly. However, the anchor **200** as shown herein with three of the first grooves **203** and three of the second grooves **204** has been found to have an enhanced bristle retention capability.

In the exemplified embodiment, each of the first and second grooves **203**, **204** has a trapezoidal shape. However, the invention is not to be so limited in all embodiments. Thus, in some alternative embodiments the first and/or second grooves **203**, **204** could have a square, rectangular, rounded, arcuate, or the like shape. Thus, the invention is not to be particularly limited by the shape or alignment of the first and second grooves **203**, **204** in all embodiments.

In the exemplified embodiment, each of the first and second grooves **203**, **204** has a length L1 of between 0.2 and 0.3 mm, more specifically between 0.2 and 0.25 mm, and still more specifically approximately 0.23 mm. The first and second grooves **203**, **204** may also have a depth D1 of

between 0.03 and 0.1 mm, more specifically 0.04 and 0.06 mm, and still more specifically approximately 0.05 mm.

The anchor **200** extends from a first end **205** to a second end **206** along an anchor axis B-B. The anchor **200** is elongated along the anchor axis B-B. The anchor **200** may have a length L2 of between 1.8 and 2.2 mm, and more specifically approximately 2.0 mm. In other embodiments, the anchor **200** may have a length L2 of between 1.5 and 1.6 mm, with the length L2 being dictated in part by the diameter of the tuft hole within which it is to be used. The anchor **200** may have a width W1 of between 0.25 and 0.35 mm, and more specifically approximately 0.3 mm.

Referring to FIG. 7, the head portion **120** of the oral care implement **100** is illustrated with the bristle tufts omitted. Furthermore, in FIG. 7 one of the anchors **200** is illustrated positioned within each of the tuft holes **130**. In the exemplified embodiment, each of the anchors **200** is positioned within one of the tuft holes **130** in the same orientation. Thus, the anchor axes B-B of each of the plurality of anchors **200** are parallel to one another when the anchors **200** are disposed within the tuft holes **130**. Moreover, each of the anchors **200** is positioned within one of the tuft holes **130** so that its anchor axis B-B is oblique to the longitudinal axis A-A of the head portion **120**. More specifically, the anchor axes B-B of the anchors **200** form a minimum intersection angle  $\theta_1$  with the longitudinal axis A-A of the head portion **120** of at least 10 degrees. In other embodiments, the minimum intersection angle  $\theta_1$  is at least 15 degrees. In some embodiments, the minimum intersection angle  $\theta_1$  is between 10 degrees and 20 degrees, and more specifically between 12 degrees and 18 degrees, and more specifically between 14 degrees and 16 degrees, and still more specifically approximately 15 degrees. In some embodiments, the anchor axis B-B may extend at an oblique axis to the grain direction.

The minimum intersection angle  $\theta_1$  between the anchor axes B-B and the longitudinal axis A-A of the head portion **120** is also the angle at which the anchor axes B-B intersects the longitudinal grain direction of the wood material of the body **101**. Specifically, because the cellulosic or wood or bamboo material of the body **101** (and head portion **120** thereof) has a longitudinal grain direction, the anchor axes B-B intersects the longitudinal grain direction at an angle that is approximately equal to  $\theta_1$ . This further enhances the ability of the anchor **200** to retain the bristles of the bristle tufts **151** in the tuft holes **130** on the head portion **120** of the oral care implement **100**.

As used throughout, ranges are used as shorthand for describing each and every value that is within the range. Any value within the range can be selected as the terminus of the range. In addition, all references cited herein are hereby incorporated by reference in their entireties. In the event of a conflict in a definition in the present disclosure and that of a cited reference, the present disclosure controls.

While the invention has been described with respect to specific examples including presently preferred modes of carrying out the invention, those skilled in the art will appreciate that there are numerous variations and permutations of the above described systems and techniques. It is to be understood that other embodiments may be utilized and structural and functional modifications may be made without departing from the scope of the present invention. Thus, the spirit and scope of the invention should be construed broadly as set forth in the appended claims.

The invention claimed is:

1. An oral care implement comprising:

a head portion extending along a longitudinal axis from a proximal end to a distal edge, the head portion formed of a cellulosic material having a longitudinal grain direction;

the head portion comprising a plurality of tuft holes; and

a plurality of bristle tufts anchored to the head portion within the plurality of tuft holes by a plurality of anchors, each of the plurality of anchors comprises an anchor body having a first surface having first anchor grooves and a second surface opposite the first surface having second anchor grooves, wherein the first anchor grooves and the second anchor grooves each have a first length, the first surface and the second surface have a second length and, the second length being at least three times the first length, each of the anchors extending along an anchor axis that is oblique to the longitudinal axis.

2. The oral care implement according to claim 1 wherein the anchor axes of the plurality of anchors are parallel to one another.

3. The oral care implement according to claim 1 wherein the anchor axes form a minimum intersection angle of at least 10 degrees with the longitudinal axis.

4. The oral care implement according to claim 1 further comprising:

the head portion comprises a first side edge and a second side edge opposite the first side edge;

the plurality of tuft holes comprising a first longitudinal row of outermost tuft holes adjacent the first side edge, the plurality of bristle tufts comprising a first longitudinal row of outermost bristle tufts disposed within and extending from the first longitudinal row of outermost tuft holes;

the plurality of tuft holes comprising a second longitudinal row of outermost tuft holes adjacent the second side edge, the plurality of bristle tufts comprising a second longitudinal row of outermost bristle tufts disposed within and extending from the second longitudinal row of outermost tuft holes;

wherein a distance between the first side edge and any one of the outermost tuft holes of the first longitudinal row of outermost tuft holes is greater than 1.80 mm; and

wherein a distance between the second side edge and any one of the outermost tuft holes of the second longitudinal row of outermost tuft holes is greater than 1.80 mm.

5. The oral care implement according to claim 4 wherein the distance between the first side edge and any one of the outermost tuft holes of the first longitudinal row of outermost tuft holes is greater than 1.90 mm; and wherein the distance between the second side edge and any one of the outermost tuft holes of the second longitudinal row of outermost tuft holes is greater than 1.90 mm.

6. The oral care implement according to claim 5 wherein the distance between the first side edge and any one of the outermost tuft holes of the first longitudinal row of outermost tuft holes is at least 1.95 mm; and wherein the distance between the second side edge and any one of the outermost tuft holes of the second longitudinal row of outermost tuft holes is at least 1.95 mm.

7. The oral care implement according to claim 1 further comprising:

the plurality of tuft holes comprising a central longitudinal row of tuft holes located along the longitudinal axis, the plurality of bristle tufts comprising a longitudinal

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row of central bristle tufts disposed within and extending from the central longitudinal row of tuft holes; and wherein a distance between any two adjacent ones of the tuft holes of the central longitudinal row is greater than 1.50 mm.

8. The oral care implement according to claim 7 wherein the distance between any two adjacent ones of the tuft holes of the central longitudinal row is greater than 1.75 mm.

9. The oral care implement according to claim 1 wherein a ratio of the first length to the second length is 3:11.

10. An oral care implement comprising:

a head portion extending along a longitudinal axis from a proximal end to a distal edge, the head portion formed of a cellulosic material;

the head portion comprising a plurality of tuft holes;

a plurality of bristle tufts anchored to the head portion within the plurality of tuft holes by a plurality of anchors, each of the plurality of anchors comprises an anchor body having a first surface having first anchor grooves and a second surface opposite the first surface having second anchor grooves, wherein the first anchor grooves and the second anchor grooves each have a first length, the first surface and the second surface have a second length and, the second length being at least three times the first length;

the plurality of tuft holes comprising a plurality of perimeter tuft holes arranged in a loop that is adjacent a perimeter of the head portion, the plurality of bristle tufts comprising a plurality of perimeter bristle tufts disposed within and extending from the perimeter tuft holes; and

wherein a distance between the perimeter and any one of the perimeter tuft holes is greater than 1.80 mm.

11. The oral care implement according to claim 10 wherein the distance between the perimeter and any one of the perimeter tuft holes is greater than 1.90 mm.

12. The oral care implement according to claim 10 wherein each of the anchors extends along an anchor axis that is oblique to the longitudinal axis.

13. The oral care implement according to claim 12 wherein the anchor axis of the plurality of anchors are parallel to one another, and wherein the anchor axes form an intersection angle of between 10 degrees and 20 degrees with the longitudinal axis.

14. The oral care implement according to claim 10 wherein the plurality of perimeter tuft holes comprises a

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distal-most tuft hole located adjacent the distal edge of the head, and wherein the distal-most tuft hole is located closer to the perimeter of the head portion than any of the other perimeter tuft holes.

15. The oral care implement according to claim 10 wherein the plurality of tuft holes define a tuft hole field, and wherein a spacing between the plurality of tuft holes, which is measured as a minimum linear distance from one of the plurality of tufts holes to an adjacent one of the plurality of tuft holes, varies throughout the tuft hole field.

16. The oral care implement according to claim 15 wherein the plurality of tuft holes are arranged in a plurality of longitudinal rows that are staggered relative to one another so that no tuft hole in any of the plurality of longitudinal rows is aligned with a tuft hole in an adjacent one of the plurality of longitudinal rows.

17. The oral care implement according to claim 10 wherein the cellulosic material comprises bamboo.

18. An oral care implement comprising:

a head portion formed of bamboo and extending along a longitudinal axis, the head portion comprising a plurality of tuft holes;

a plurality of bristle tufts anchored to the head portion within the plurality of tuft holes by a plurality of anchors, each of the plurality of anchors comprises an anchor body having a first surface having first anchor grooves and a second surface opposite the first surface having second anchor grooves, wherein the first anchor grooves and the second anchor grooves each have a first length, the first surface and the second surface have a second length and, the second length being at least three times the first length; and

wherein the plurality of tuft holes are arranged in a plurality of longitudinal rows that are staggered relative to one another so that no tuft hole in any of the plurality of longitudinal rows is aligned with a tuft hole in an adjacent one of the plurality of longitudinal rows in a direction transverse to the longitudinal axis.

19. The oral care implement according to claim 18 wherein no plane that is transverse to the longitudinal axis intersects a centerpoint of any two tuft holes in two adjacent longitudinal rows of the plurality of longitudinal rows.

20. The oral care implement according to claim 18 wherein the plurality of tuft holes are symmetric about the longitudinal axis of the head portion.

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