(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 810 580 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
10.12.2014 Bulletin 2014/50

(51) Int Cl.:
A46B 9/02 *(2006.01)* ***A46B 9/04*** *(2006.01)*
A46B 9/06 *(2006.01)*

(21) Application number: **13170759.8**

(22) Date of filing: **06.06.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(71) Applicant: **The Gillette Company**
Boston, MA 02127 (US)

(72) Inventor: **Jungnickel, Uwe**
61476 Kronberg/Taunus (DE)

(74) Representative: **Töpert, Verena Clarita**
Procter & Gamble Service GmbH
Patent Department
Frankfurter Str. 145
61476 Kronberg im Taunus (DE)

(54) Head for an oral care implement

(57) A head for an oral care implement has at least one tuft extending from a mounting surface of the head and having an outer lateral area. The tuft has a first group of filaments defining a first lateral area, and at least a second group of filaments defining a second lateral area. The filaments of the first group have a first length and the filaments of the second group have a second length, wherein the first length is different from the second length. The outer lateral area of the tuft is composed of at least a section of the first lateral area and of at least a section of the second lateral area.

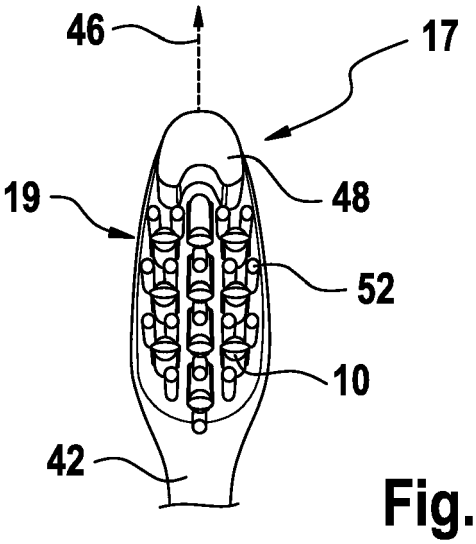

Fig. 13

EP 2 810 580 A1

Description

FIELD OF THE INVENTION

[0001] The present disclosure is concerned with a head for an oral care implement and in particular with such a head comprising at least one tuft having filaments of different types.

BACKGROUND OF THE INVENTION

[0002] Tufts composed of a plurality of filaments for oral care implements, like manual and powered toothbrushes are well known in the art. Generally, the tufts are attached to a mounting surface of a head intended for insertion into a user's oral cavity. A grip handle is usually attached to the head, which handle is held by the user during brushing. The head is either permanently connected or repeatedly attachable to and detachable from the handle.

[0003] It is known that filaments forming one tuft often have substantially the same dimensions and characteristics. While toothbrushes comprising these types of tufts clean the outer buccal face of teeth adequately, they are not as well suited to provide adequate removal of plaque and debris from the gingival margin, interproximal areas, lingual surfaces and other hard to reach areas of the mouth.

[0004] Tufts composed of two different types of filaments, so called tuft-in-tufts, are also known in the art. In general, each type of filament is arranged in a group, wherein an inner group is substantially coaxially enclosed by an outer group to form the tuft. For example, a toothbrush head is known having a bristle surface from which tufts comprising plural filaments extend in a filament direction. Each tuft comprises shorter filaments having a cross section which does not taper from their lower end toward their upper end and longer filaments which taper from their lower end toward their upper end. The longer bristles are surrounded by the shorter bristles.

[0005] The tuft-in-tufts known in the art, in particular the longer filaments located in the central region of the tuft, show substantially isotropic bending stiffness. However, on the one hand, a relatively low bending stiffness results in reduced efficiency of interdental cleaning performance, and, on the other hand, in case the bending stiffness is relatively high, a risk may occur to injure the gums of the user.

[0006] It is an object of the present disclosure to provide a head for an oral care implement which provides improved cleaning properties, in particular with respect to interproximal and gingival marginal regions of teeth. It is also an object of the present disclosure to provide an oral care implement comprising such head.

SUMMARY OF THE INVENTION

[0007] In accordance with one aspect, a head for an oral care implement is provided that comprises:

- at least one tuft extending from a mounting surface of the head and having an outer lateral area,
- the tuft comprising a first group of filaments defining a first lateral area, and at least a second group of filaments defining a second lateral area,
- the filaments of the first group having a first length and the filaments of the second group having a second length, the first length being different from the second length, wherein
- the outer lateral area of the tuft is composed of at least a section of the first lateral area and of at least a section of the second lateral area.

[0008] In accordance with one aspect, an oral care implement is provided that comprises such head.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The invention is described in more detail below with reference to various embodiments and figures, wherein:

Fig. 1 shows a top view of a first example embodiment of a tuft;
Fig. 2 shows a top view of a second example embodiment of a tuft;
Fig. 3 shows a top view of a third example embodiment of a tuft;
Fig. 4 shows a top view of a fourth example embodiment of a tuft;
Fig. 5 shows a top view of a fifth example embodiment of a tuft;
Fig. 6 shows a perspective view of the tuft of Fig. 1;
Fig. 7 shows a side view of one of the tufts of Fig. 1 to 4;
Fig. 8 shows a side view of one of the tufts of Fig. 1 to 4;
Fig. 9 shows a side view of one of the tufts of Fig. 1 to 4;

Fig. 10 shows a perspective view of the tuft of Fig. 1;
Fig. 11 shows a schematic top view of a first embodiment of an oral care implement;
Fig. 12 shows a schematic top view of a second embodiment of an oral care implement;
Fig. 13 shows a schematic top view of a third embodiment of an oral care implement;
Fig. 14 shows a schematic front view of the oral care implement of Fig. 13;
Fig. 15 shows a schematic side view of the oral care implement of Fig. 13;
Fig. 16 shows a schematic perspective view of the oral care implement of Fig. 13; and
Fig. 17 shows detail I of Fig. 16.

DETAILED DESCRIPTION OF THE INVENTION

[0010] A head for an oral care implement in accordance with the present disclosure comprises at least one tuft which extends from a mounting surface of the head and has an outer lateral area. In the context of this disclosure the term "outer lateral area" means the outer lateral surface of the tuft excluding the base/bottom and the top surface of the tuft. The tuft may have a circular or non-circular cross-section (the cross-section being perpendicular to length extension of the tuft) and is defined by its outer lateral area. For example, the cross-sectional shape can be ellipsoid, squared, rectangular, triangular, cross-shaped, or it can be a prolate ellipsoid with flattened long sides, even though other shapes may be considered as well. The cross-section of the tuft may have a width from about 2 mm to about 4 mm and a depth from about 2 mm to about 4 mm.

[0011] The tuft comprises a first group of filaments which have a first lateral area, and at least a second group of filaments which have a second lateral area. The first group and the second group of filaments are arranged in a manner that each of the groups forms at least a portion of the outer lateral area of the tuft, i.e. both groups are exposed with their first and second lateral area, respectively, to the outer surface of the tuft. Thus, at least one section of the first lateral area and at least one section of the second lateral area form at least a portion of the outer lateral area of the tuft. In other words, the first group of filaments is partially surrounded by or partially abuts on the second group of filaments. Neither the first nor the second group of filaments is completely surrounded by the respective other group.

[0012] The filaments of the first group have a first length and the filaments of the second group have a second length which is different to the first length. The length of a filament is defined by the extension of the filament measured from its lower end being secured at the mounting surface of the head to its upper free end.

[0013] In other words, the tuft is composed of at least two types of separated/single or isolated filaments which differ in terms of length and which are arranged in respective groups. In the context of this disclosure, a "group of filaments" means at least 10 single filaments having substantially the same length. In some embodiments, the group of filaments having the shorter length comprises at least three times the number of filaments of the other group having the greater length.

[0014] In the present context, the term "substantially" refers to an arrangement of elements or features that, while in theory would be expected to exhibit exact correspondence or behavior, may, in practice embody something slightly less than exact. As such, the term denotes the degree by which a quantitative value, measurement or other related representation may vary from a stated reference without resulting in a change in the basic function of the subject matter at issue.

[0015] The filaments of greater/increased length may assure access to narrow spaces and are able to penetrate into the gaps between teeth and remove plaque and other residues more effectively.

[0016] In order to clean the teeth effectively during brushing, appropriate contact pressure has to be provided between the free end of the tuft and the teeth. Generally, the contact pressure depends on the bending stiffness and the displacement of the filaments, while the bending stiffness of a single filament depends on the length of the filament, the diameter of the filament and the Young's-modulus of the filament material. The bending stiffness C_F of a single filament is defined by:

$$C_F = \frac{3\,EJ}{l^3}$$

with E = Young's modulus, J = moment of inertia, l = length of the filament, while for a cylindrical filament

$$J = \frac{\pi}{64} d^4$$

[0017] For an entire tuft with *n* filaments the bending stiffness C_T of the tuft is approximately given by the sum over the bending stiffness of the filaments of the tuft:

$$C_T = \sum_n C_F = \sum_n \frac{3\pi}{64} \frac{E\, d^4}{l^3}$$

[0018] Generally, filaments with greater length show lower bending stiffness compared to filaments having a shorter length. In order to compensate said reduction in bending stiffness, the diameter of a filament could be increased. However, relatively long and relatively thick filaments may injure the gums or may cause damages to the soft tissues of the oral cavity.

[0019] In order to overcome this drawback the tuft in accordance with the present disclosure has a group of filaments with increased/greater length but with identical diameter (in case cylindrical filaments are used) to provide better penetration of said filaments into interdental spaces. In order to provide sufficient bending stiffness of these filaments at least in one direction, the group of filaments having the greater length abuts on the other group of filaments having the shorter length. The bending stiffness of the group of greater filaments is higher in the direction where the group of greater filaments abuts on the group of shorter filaments and vice versa, i.e. the bending stiffness of the group of greater filaments is lower in the direction where the group of shorter filaments does not surround/abut on the group of longer filaments. In other words, the group of greater filaments show higher bending stiffness in the direction where they are supported by the group of shorter filaments as the shorter filaments have to bend away when the longer filaments are bend in the direction toward the shorter filaments - the group of shorter filaments act like a counterforce. In case the group of longer filaments is bend in a direction where said group does not abuts on the group of shorter filaments, the group of shorter filaments does not support the longer filaments. The group of shorter filaments does not act as a counterforce and, thus, the bending stiffness in said direction is lower.

[0020] The resulting bending stiffness of the group of filaments having greater length is defined in a first direction x (longer filaments abut on shorter filaments) and in a second direction y (longer filaments do not abut on shorter filaments) by:

$$C_{TX} = \sum_{n_i} C_{Fi} + \sum_{n_o} C_{Fo} = \sum_{n_i} \frac{3\pi}{64} \frac{E\, d_i^4}{l_i^3} + \sum_{n_o} \frac{3\pi}{64} \frac{E\, d_o^4}{l_o^3}$$

$$C_{TY} = \sum_{n_i} C_{Fi} = \sum_{n_i} \frac{3\pi}{64} \frac{E\, d_i^4}{l_i^3}$$

while index *i* indicates the longer filaments and index *o* indicates the shorter filaments.

[0021] In other words, the group of filaments having greater length shows anisotropic bending stiffness. The different groups of filaments act like a stapled leaf spring by adding up their individual bending stiffness to the resulting overall bending stiffness of the tuft. Therefore, regular or thin filaments can be used in an interior part of the tuft in order to access and clean narrow interdental spaces when the head of the oral care implement is moved forward and backward on the occlusal, buccal and lingual surfaces of the teeth. Due to the anisotropic bending stiffness of the group of filaments having a greater length, better cleaning effects can be provided.

[0022] In some embodiments, the tuft may be arranged on the mounting surface of the head in a manner that higher bending stiffness is provided in a brushing direction where the risk of injury to gums is relatively low, like in a direction parallel to the longitudinal extension of the head in order to clean the occlusal, buccal and lingual surfaces of the teeth with higher force in a forth and back movement (x-direction). Lower bending stiffness may be provided in a direction orthogonal to the longitudinal extension of the head (y-direction) in order to provide a more gentle brushing when the head is moved from the teeth to the gums and vice versa. In other words, the bending stiffness is higher in the direction x along the occlusal, buccal and lingual surfaces of the teeth, while the bending stiffness is lower when the tuft is moved in a sideward direction y, i.e. between the teeth and the gums and vice versa. The lower bending stiffness in the sideward

direction y may reduce the risk of injury of gums and/or other soft tissues of the oral cavity. In other words, the tuft of the head for the oral care implement may ensure high cleaning performance for forth and back movement while the lower bending stiffness in the sideward direction y may protect the gums.

[0023] Each of the different groups of filaments may have a specific topography/geometry at its free ends, i.e. at their upper top surfaces, which may be shaped to optimally adapt to the teeth contour. For example, at least one group of filaments may have a topography, i.e. an upper top surface which is chamfered or rounded in one or two directions, pointed or formed linear.

[0024] The filaments may be made of nylon with or without an abrasive such as kaolin clay, polybutylene terephtalate (PBT) with or without an abrasive such as kaolin clay and/or from nylon indicator material colored at the outer surface. The coloring on the nylon indicator material is slowly worn away as the filament is used over time to indicate the extent to which the filament is worn.

[0025] Optionally, the head for the oral care implement may further comprise at least one thermoplastic elastomer element for cleaning and/or massaging the teeth and/or soft tissues of the oral cavity. The thermoplastic elastomer element may be made up of a unitary structure or of a number of substructures. For example, the thermoplastic elastomer element may comprise a large unitary bristle, i.e. a nub, or a number of smaller bristles. The thermoplastic elastomer element may also comprise a fin, cup, like a prophy cup, or a curved or straight wall.

[0026] In some embodiments the first length of the first group of filaments is greater than the second length of the second group of filaments. The difference in length between the first and the second length may be from about 1 mm to about 3 mm, optionally from about 1 mm to about 2 mm, further optionally about 1.5 mm. The length of the shorter filaments measured from the mounting surface to their upper free ends may be from about 8 mm to about 12 mm, optionally from about 10 mm to about 11 mm, further optionally about 10.5 mm.

[0027] In some embodiments, the tuft further comprises at least a third group of filaments having a third lateral area. Thus, the tuft comprises at least three groups of filaments, wherein at least the first and the second group differ in terms of length. The filaments of the third group may have a length which is equal to the first or second length, or the filaments of the third group may have a third length which is different to the first and second length. The first group of filaments is neither completely enclosed by the second nor by the third group of filaments. This provides a tuft for a head for an oral care implement having a group of filaments with greater length for cleaning interdental areas while the bending stiffness of this group can be adjusted in different directions. For example higher bending stiffness can be provided in a brushing direction along the longitudinal extension of the head, i.e. for brushing the occlusal, buccal and lingual surfaces of the teeth, and a lower bending stiffness in an orthogonal direction thereto, i.e. for brushing in a sideway direction from the teeth to the gums and vice versa.

[0028] In some embodiments, the outer lateral area of the tuft is composed of at least one section of the first lateral area of the first group of filaments, at least one section of the second lateral area of the second group of filaments and at least one section of the third lateral area of the third group of filaments. In some embodiments, the first group of filaments having longer filaments is sandwiched between the second and the third group of filaments. The term "sandwiched" shall mean that the first group of filaments is centrally located and forms at two opposite sides the outer lateral surface of the tuft. In some embodiments, the filaments of the third group have a third length being substantially equal to the second length of the second group of filaments. The first group having a greater length may form a wiping element which may be aligned orthogonal to the longitudinal direction of the head, i.e. across the width of the head. In the context of this disclosure, the term "wiping element" is directed to a section of the first group of filaments which projects above the upper top surfaces of the second and third group of shorter filaments. This protruding section may flap in different directions during the brushing process thereby wiping over the teeth. In some embodiments, the wiping element has a rectangular or oval cross-sectional shape in order to facilitate penetration of the longer filaments into interdental areas. While the wiping element is designed to reach deeply into the interdental areas, the groups of shorter filaments are designed to clean the occlusal, buccal and lingual surfaces of the teeth when the head of the oral care implement is moved forward and backward, i.e. in a forward and reverse direction x. In said forward and reverse direction x, the longer filaments abut on the outer filaments of the second and third group, respectively. Thus, the group of filaments having a greater length shows higher bending stiffness when the oral care implement is moved along its longitudinal axis and lower bending stiffness when the oral care implement is moved sideward, i.e. orthogonal to the longitudinal axis.

[0029] Alternatively, the first group of filaments being centrally located does not extend completely through the cross-section of the overall tuft. In other words, the outer lateral area of the tuft is composed of one connected section of the first lateral area of the first group of filaments, one connected section of the second lateral area of the second group of filaments and one section of the third lateral area of the third group of filaments. Such an arrangement of filaments provides increased anisotropic bending stiffness in several directions.

[0030] In addition or alternatively, the group of filaments having the greater length may have a first bending stiffness in a first direction x and a second bending stiffness in a second direction y, the first direction x being substantially orthogonal to the second direction y and the first bending stiffness is higher than the bending stiffness. In addition, the first direction x of the first bending stiffness may be substantially parallel to the longitudinal extension of the head.

[0031] In some embodiments, the cross-section of the first group of filaments (the cross-section being perpendicular to length extension of the group of filaments) has a width from about 2 mm to about 4 mm, optionally about 3.5 mm and a depth from about 0.6 mm to about 0.8 mm, optionally about 0.7 mm. This relatively small depth may ensure deep penetration of the longer filaments into narrow, hard to reach areas between the teeth while the relatively great width may ensure that the longer filaments clean the teeth in the interdental area over their width.

[0032] In addition or alternatively, the filaments of the greater length may be tapered filaments having a pointed tip. Tapered filaments may achieve optimal penetration in areas between two teeth as well in gingival pockets during brushing and may provide improved cleaning properties. In some embodiments, the tapered filaments may have an overall length extending above the mounting surface of about 10 mm to 16 mm and a tapered portion of about 5 mm to 10 mm measured from the tip of the filament. The pointed tip may be needle shaped, may comprise a split or a feathered end. The tapering portion may be produced by a chemical and/or mechanical tapering process.

[0033] In addition or alternatively, the filaments of the first group and the filaments of the second group may further differ from each other at least in one of the following characteristics: diameter, bending stiffness, material, texture, cross sectional shape, color and combinations thereof. The filaments may be crimped, notched, dimpled, flocked or may comprise a series of ribs, for example. Textured filaments tend to enhance cleaning effects on the teeth. The filaments may have a circular or non-circular cross-section, in particular the filaments may have a diamond-shaped cross-section, triangular cross-section or a cross-section that can be described as a prolate ellipsoid with flattened long sides. Further, the filaments may be flagged at their free ends or may also be hollow. The filaments may be made up from nylon with or without an abrasive such as kaolin clay, from polybutylene terephtalate (PBT) with or without an abrasive such as kaolin clay or from nylon indicator material colored at the external surface. The coloring on nylon indicator material is slowly worn away as the filament is used over time to indicate the extent to which the filament is worn. The filaments may have a diameter from about 0.1 to about 0.3 mm, optionally from about 0.15 mm to about 0.2 mm. Optionally, the filaments of the third group may also differ from the filaments of the first and/or second group at least in one of the characteristics cited above.

[0034] In addition or alternatively, the at least one tuft may be inclined with respect to the mounting surface of the head. In other words, the at least one tuft may be oriented at an angle α relative to that portion of the mounting surface of the head from which it extends. The tuft is angled relative to an imaginary line which is tangent to or co-planar with the mounting surface of the head through which the tuft is secured to the head. The at least one tuft may be oriented at an angle α in a direction that is substantially parallel to the longitudinal extension of the head and/or orthogonal thereto, i.e. across the width of the head. In some embodiments, one or more tufts are tilted in the direction that is substantially parallel to the longitudinal extension of the head. The at least one inclined tuft may have better cleaning properties, in particular with respect to interdental areas, as the inclination of the tuft facilitates that the longer filaments may slide into small gaps between the teeth to clean the interdental areas, while the shorter filaments may clean the occlusal, buccal and lingual surfaces of the teeth. In some embodiments, the head comprises a plurality of tufts, wherein at least one tuft is angled in a direction toward the handle and at least one tuft is angled in a direction away from the handle. The cleaning efficiency is even further improved if more than one row of angled tufts is consecutively arranged. Further, the tufts can also be oriented at two or more different angles α and can also be angled in different directions such as along the length of the head, across the width of the head or part way between the length and the width of the head.

[0035] The inclination angle α between the tuft and the mounting surface of the head may be from about 45° to about 89°, optionally from about 60° to about 85°, further optionally from about 65° to about 83°, even further optionally from about 70° to about 80°, even further optionally from about 72° to about 78°, even further optionally about 74°, about 75° or about 76°.

[0036] In addition or alternatively, the tuft may be attached to the head by means of a hot tufting process. One method of manufacturing the oral care implement may comprise the following steps: In a first step, tufts are formed by providing a desired amount of filaments. In a second step, the tufts are placed into a mold cavity so that ends of the filaments which are supposed to be attached to the head extend into said cavity. The opposite ends of the filaments not extending into said cavity may be either end-rounded or non-end-rounded. For example, the filaments may be not end-rounded in case the filaments are tapered filaments having a pointed tip. In a third step the head or an oral care implement body comprising the head and the handle is formed around the ends of the filaments extending into the mold cavity by an injection molding process, thereby anchoring the tufts in the head. Alternatively, the tufts may be anchored by forming a first part of the head - a so called "sealplate" - around the ends of the filaments extending into the mold cavity by an injection molding process before the remaining part of the oral care implement is formed. Before starting the injection molding process the ends of the tufts extending into the mold cavity may be optionally melted or fusion-bonded to join the filaments together in a fused mass or ball so that the fused masses or balls are located within the cavity. The tufts may be held in the mold cavity by a mold bar having blind holes that correspond to the desired position of the tufts on the finished head of the oral care implement. In other words, the tufts attached to the head by means of a hot tufting process are not doubled over a middle portion along their length and are not mounted in the head by using an anchor/staple. The tufts are mounted on the head by means of an anchorfree tufting process.

[0037] The oral care implement may be a toothbrush comprising a handle and a head according to any of the embodiments described above. The head extends from the handle and may be either repeatedly attachable to and detachable from the handle or the head may be non-detachably connected to the handle. The toothbrush may be an electrical or a manual toothbrush.

[0038] The following is a non-limiting discussion of example embodiments of tufts and oral care implements in accordance with the present disclosure, where reference to the Figures is made.

[0039] Fig. 1 shows a top-down view of a first example embodiment of a tuft 10 for a head 12, 13, 19 of an oral care implement 14, 15, 17 as shown in Fig. 11 and 13 to 17. The tuft 10 comprises three groups of filaments 16, 18, 20, wherein the filaments of the first group 16 are longer than the filaments of the second and third group 18, 20. The first group 16 is sandwiched between the second and third group 18, 20. The first group 16 has a first lateral area 24, the second group 18 has a second lateral area 26 and the third group 20 has a third lateral area 28. The outer lateral area 22 of the tuft 10 is composed of two sections 72, 74 of the first lateral area 24 of the first group 16, one section 76 of the second lateral area 26 of the second group 18 and one section 78 of the third lateral area 28 of the third group 20. A section 80 of the second lateral area 26 of the second group of filaments 18 abuts on a section 82 of the first lateral area 24 of the first group of filaments 16 whereas a section 84 of the third lateral area 38 of the third group of filaments 20 abuts on another section 86 of the first lateral area 24 of the first group of filaments 16. The cross sectional shape of tuft 10 is elliptical with flattened sides. These flattened sides are provided by a rectangular shape of the first group 16 of filaments whereas the second and third group 18, 20 have a semicircular shape. This arrangement of filaments provides a first group of filaments 16 with anisotropic bending stiffness properties revealing the advantages described above. The bending stiffness of the tuft 10 is indicated by arrow 56 in the x-direction and by arrow 58 in the y-direction. As illustrated in Fig. 1, the bending stiffness is higher in the x-direction (longer filaments abuts on the shorter filaments) than in the y-direction (longer filaments do not abut on the shorter filaments).

[0040] Fig. 2 shows a second example embodiment of a tuft 30 which differs from the first example embodiments of tuft 10 in that the first group of filaments 16 has a cross-sectional width which is wider than that of the first example embodiment of tuft 10. The width of the first group of filaments 16 extends beyond the width of the cross-sectional area of the second and third group 18, 20. The cross-sectional shape of the first group 16 has a depth which is below the diameter of a standard tuft and a width which is larger compared to a standard tuft. This relatively small depth may ensure deep penetration of the longer filaments into narrow, hard to reach areas between the teeth while the relatively great width may ensure that the longer filaments clean the teeth in the interdental area over their width.

[0041] Fig. 3 shows a third example embodiment of a tuft 32 which differs from the first example embodiment of tuft 10 in that the cross-sectional shape of tuft 32 is rectangular.

[0042] Fig. 4 shows a fourth example embodiment of a tuft 34 similar to the first example embodiment of a tuft 10. However, the first group of filaments 16 does not reach completely through the cross section of the overall tuft 34. Thus, the outer lateral area 22 of tuft 34 is composed of one section 72 of the first lateral area 24 of the first group of filaments 16, one section 76 of the second lateral area 26 of the second group of filaments 18 and one section 78 of the third lateral area 28 of the third group of filaments 20. This arrangement of filaments further enhances the anisotropic bending stiffness behavior of the first group of filaments 16. The bending stiffness is indicated by arrow 60 in the +x-direction, by arrow 62 in the +y-direction and by arrow 64 in the opposite -y-direction. As shown in Fig. 4, the bending stiffness in direction +y is lower than in the opposite direction -y whereas the bending stiffness in direction +x is higher than in direction +y. Such tufts can be arranged on the toothbrush head at an outer region of the field of tufts.

[0043] Fig. 5 shows a fifth example embodiment of a tuft 36 which differs from the third example embodiment of tuft 32 in that tuft 36 comprises only a first and a second group of filaments 16, 18, both groups forming a rectangular cross-sectional shape. Such an arrangement creates strong anisotropic bending stiffness properties of the first group of filaments 16. The longer filaments of the first group 16 abuts on the shorter filaments of the second group 18 in one direction only, namely in the opposite direction of direction x. The bending stiffness is indicated by arrow 66 in the +x-direction, by arrow 68 in the opposite direction -x and by arrow 70 in the +y-direction. The bending stiffness in direction +x is lower compared to the opposite direction -x. The bending stiffness in direction +y is higher than in direction +x and lower than in the opposite direction -x. If tuft 36 is moved in direction +x the longer filaments will be supported by the shorter filaments. The higher bending stiffness forces the longer filaments to penetrate into interdental gaps and other narrow spaces. If tuft 36 is moved in the opposite direction -x the longer filaments show lower bending stiffness as they are not supported by the shorter filaments and, thus, the loner filaments can gently move over the teeth surface without creating a stuttering effect.

[0044] Figs. 6 and 10 show two different geometries of the first group of filaments 16 which may be implemented into tuft 10 of Fig. 1. The first group of filaments 16 may have the form of a wiping element 38 as illustrated in Fig. 6 or may have the form of a fin 40 as shown in Fig. 10. The second and third group of filaments 18, 20 may have the same length and may have a semicircular cross-section. These tufts 10 may be adapted to the teeth contour.

[0045] Figs. 7 to 9 show side views of tufts 10, 30, 32, 34 of Figs. 1 to 4. According to Fig. 7, the first group 16 consists of filaments having greater length whereas the second and third group 18, 20 consist of shorter filaments each having

the same length. The tuft according to Fig. 8 is similar to the tuft shown in Fig. 7, however the upper top surface of the second and third group 18, 20 are chamfered at the outer region of the tuft. The tuft according to Fig. 9 is also similar to the tuft shown in Fig. 7, however the filaments of the second group 18 are greater compared to the filaments of the third group 20. Further, the upper top surface of the second group 18 shows a slightly curved profile at the outer region of the tuft and the upper top surface of the third group 20 is slanted at the outer region of the tuft. These tufts 10, 30, 32, 34 may be adapted to the teeth contour.

[0046] Fig. 11 shows an oral care implement 14, which could be a manual or an electrical toothbrush 14 comprising a handle 42 and a head 12 extending from the handle 42 in a longitudinal direction. A plurality of tufts 10, 34 are secured to the head 12 by means of a hot tufting process. The tufts 10, 34 extend from a mounting surface 44 of the head 12. The head 12 comprises two different example embodiments of tufts, namely the first example embodiment of tuft 10 illustrated in Fig. 1 and the fourth example embodiment of tufts 34 outlined in Fig. 4. The first example embodiment of tufts 10 are arranged in a central portion of the mounting surface 44 and the fourth example embodiment of tufts 34 are arranged along the outer longitudinal edge of the mounting surface 44 of the head 12. Tufts 10 are secured to the mounting surface 44 in a manner that the extension of the first group of filaments 16 is orthogonal to the longitudinal extension 46 of the head 12. Thus, the bending stiffness of the first group of filaments 16 is higher in the direction of the longitudinal extension 46 of the head 12 than in the direction orthogonal thereto.

[0047] Tufts 34 are also secured to the mounting surface 44 in a manner that the extension of the first group of filaments 16 is orthogonal to the longitudinal extension 46 of the head 12. Further, the section 72 of the first lateral area 24 of the first group of filaments 16 comprised by the outer lateral area 22 of the tuft 34 faces the central part of the mounting surface 44, i.e. this section 72 of the first lateral area 24 faces tufts 10.

[0048] Toothbrush 14 having this arrangement of tufts 10, 34 may provide high interdental cleaning capabilities. The longer filaments of the first group 16 penetrate into interdental spaces when the toothbrush 14 is moved back- and forward. Generally, the longer filaments of the first group 16 do not reach the gums, however in case of contact, they may bend away due to reduced bending stiffness in a brushing direction from the teeth to the gums. Gums and other soft tissues are protected from getting injured by the longer filaments.

[0049] The head 13 of a toothbrush 15 shown in Fig. 12 comprises five different types of tufts 36, 48, 50, 52, 54 secured on the mounting surface of the head 13.

[0050] In the toe region at the distal end of the head 13, i.e. furthest away from the handle 42, one crescent-shaped tuft 48 is attached to the head 13. The crescent-shaped tuft 48 is angled by about 81° or less to an imaginary line which is tangent to or co-planar with the mounting surface 44 of the head 13 through which the crescent-shaped tuft 48 is secured to the head 13. The crescent-shaped tuft 48 is tilted away from the handle 42. The crescent-shaped tuft 48 extends past the end of the head 13 of the toothbrush 15 and, thus, may clean molars (e.g. wisdom teeth and second molars) in the back of the oral cavity in a more sufficient manner. In some embodiments, the crescent-shaped tuft 48 is made up of filaments formed of PBT with an abrasive such as kaolin clay particles mixes throughout the PBT. In some embodiments, the crescent-shaped tuft 48 has a cross-section which is at least four times as large as any other tuft 36, 50, 52, 54 secured to the head 13.

[0051] Along the outer longitudinal edge of the head 13 there are two further types of tufts 50, 52 arranged in an alternating manner. These types of tufts 50, 52 are angled toward the handle 42 relative to an imaginary line which is tangent to or co-planar with the mounting surface 44 of the head 13. Tufts 50 have a rectangular cross-sectional shape with rounded ends. Tufts 50 comprise filaments which may be formed of PBT with an abrasive, such as kaolin clay particles mixes throughout the PBT. There are between six to twelve tufts 50 secured to the mounting surface 44 of the head 13. Tufts 52 have a circular cross-sectional shape and comprise filaments which may consist of a nylon indicator material. In some embodiments, these filaments are blue colored on their external surface. The color is slowly worn away as the toothbrush is used over time to indicate the extent to which the filaments are worn. There are between six to twelve tufts 52 secured to the mounting surface 44 of the head 13.

[0052] Moreover, three to six tufts 36 of Fig. 5 are arranged in a central row along the longitudinal extension 46 of the head 13 between tufts 50 and 52. Tufts 36 are angled in a direction away from the handle 42 and are arranged in a manner that the first group of filaments 16 are oriented orthogonal with respect to the longitudinal extension 46 of the head 13. In some embodiments, these tufts 36 are made of PBT with an abrasive, such as kaolin clay particles mixes throughout the PBT. Between crescent-shaped tuft 48 and tuft 36 a single further tuft 54 is secured on the mounting surface 44. Said tuft 54 is similar to tuft 36, however tuft 54 is merely composed of filaments having the same length in order to avoid that filaments of tuft 48 and 36 intermingle during a forward and backward motion of the toothbrush 15.

[0053] The tufts 36, 48, 50, 52, 54 attached to the head 13 of Fig. 12 may have an inclination angle α between the respective tuft 36, 48, 50, 52, 54 and the mounting surface 44 of the head 13 of about 45° to about 89°, optionally from about 60° to about 85°, further optionally from about 65° to about 83°, even further optionally from about 70° to about 80°, even further optionally from about 72° to about 78°, even further optionally about 74°, about 75° or about 76°.

[0054] In a forward motion of the toothbrush 15 the longer filaments of the first group 16 of tufts 36 are supported by the shorter filaments of the second group 18 resulting in higher bending stiffness. The higher bending stiffness helps to

drive the longer filaments of the first group 16 deeply into narrow spaces. On a backward motion the bending stiffness of the longer filaments is lower and, thus, the longer filaments of the first group 16 may gently move over the teeth surface without creating a stuttering effect.

[0055] The toothbrush according to Fig. 12 may provide improved removal of plaque and debris from the gingival margin, interproximal areas, lingual surfaces, the outer buccal face and rearward molars.

[0056] The head 19 of the toothbrush 17 according to Figs. 13 to 17 comprises three different types of tufts 10, 48, 52. The first type of tuft 10 (first example embodiment) is illustrated in Figs. 1 and 6. The other type of tufts 48, 52, namely the crescent-shaped tuft 48 and tuft 52 are the same as described with respect to Fig. 12. The crescent-shaped tuft 48 is secured in the toe region at the distal end of the head 19, i.e. furthest away from the handle 42. A first row of first example embodiment of tufts 10 alternating with tufts 52 is arranged in the central part of the mounting surface 44. All tufts 10, 52 of the first row are angled toward the handle 42. A second and a third row of first example embodiment of tufts 10 alternating with tufts 52 are arranged on each side of the first row and are angled in the opposite direction, i.e. away from the handle 42. Each tuft 10 of the first row alternate with one tuft 52. Each tuft 10 of the second and third row alternate with two tufts 52, except of the last tuft 10 proximal to the handle 42 which alternate only with one tuft 52.

[0057] The first example embodiment of tufts 10 are arranged on the mounting surface 44 of the head 19 in a manner that the first group of filaments 16 extends orthogonal to the longitudinal extension 46 of the head 19. Consequently, the first group of filaments 16 shows a higher bending stiffness when the toothbrush 17 is moved along its longitudinal extension and a lower bending stiffness when the toothbrush 17 is moved orthogonal thereto, i.e. from the teeth to the gums and vice versa. This may ensure higher cleaning performance for forth and back movement while the lower bending stiffness in the sideward direction ensures a protection of the gums.

[0058] The tufts 10, 48, 52 attached to the head 19 according to Figs. 13 to 17 may have an inclination angle α between the respective tuft 10, 48, 52 and the mounting surface 44 of the head 19 of about 45° to about 89°, optionally from about 60° to about 85°, further optionally from about 65° to about 83°, even further optionally from about 70° to about 80°, even further optionally from about 72° to about 78°, even further optionally about 74°, about 75° or about 76°.

[0059] The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as "40 mm" is intended to mean "about 40 mm."

Claims

1. A head (12, 13, 19) for an oral care implement (14, 15, 17) comprising:

at least one tuft (10, 30, 32, 34, 36) extending from a mounting surface (44) of the head (12, 13, 19) and having an outer lateral area (22),
the tuft (10, 30, 32, 34, 36) comprising a first group of filaments (16) defining a first lateral area (24), and at least a second group of filaments (18) defining a second lateral area (26),
the filaments of the first group (16) having a first length and the filaments of the second group (18) having a second length, the first length being different from the second length,
wherein the outer lateral area of the tuft (22) is composed of at least a section (72) of the first lateral area (24) and of at least a section (76) of the second lateral area (26).

2. A head (12, 13, 19) according to claim 1, wherein at least a section (82) of the first lateral area (24) abuts on at least a section (80) of the second lateral area (26).

3. A head (12, 13, 19) according to claim 1 or 2, wherein the tuft (10, 30, 32, 34) further comprises at least a third group of filaments (20) defining a third lateral area (28).

4. A head (12, 13, 19) according to claim 3, wherein the outer lateral area (22) of the tuft (10, 30, 32, 34) is composed of at least one section (72) of the first lateral area (24), at least one section (76) of the second lateral area (26) and at least one section (78) of the third lateral area (28).

5. A head (12, 13, 19) according to any of claim 3 to 4, wherein the filaments of the third group (20) have a third length being substantially equal to the second length.

6. A head (12, 13, 19) according to any of claims 2 to 5, wherein the first group (16) is sandwiched between the second and the third group (18, 20).

7. A head (12, 13, 19) according to any of the preceding claims, wherein the first length is greater than the second length.

8. A head (12, 13, 19) according to any of the preceding claims, wherein the group of filaments having the greater length (16) has a first bending stiffness in a first direction (x) and a second bending stiffness in a second direction (y), the first direction (x) being substantially orthogonal to the second direction (y) and the first bending stiffness is higher than the second bending stiffness.

9. A head (12, 13, 19) according to claim 8, wherein the first direction (x) of the first bending stiffness is substantially parallel to the longitudinal extension (46) of the head (12, 13, 19).

10. A head (12, 13, 19) according to any of the preceding claims, wherein the filaments of the greater length are tapered filaments having a pointed tip.

11. A head (12, 13, 19) according to any of the preceding claims, wherein the filaments of the first group (16) and the filaments of the second group (18) further differ from each other at least in one of the following characteristics: diameter, bending stiffness, material, texture, cross sectional shape, color and combinations thereof.

12. A head (12, 13, 19) according to any of the preceding claims, wherein the tuft (10, 30, 32, 34, 36) is inclined with respect to the mounting surface (44) of the head (12, 13, 19).

13. A head (12, 13, 19) according to claim 12, wherein an inclination angle (α) defined between the tuft (10, 30, 32, 34, 36) and the mounting surface (44) of the head (12, 13, 19) is about 45° to about 89°, optionally from about 70° to about 80°, further optionally from about 74° to about 76°.

14. A head (12, 13, 19) according to any of the preceding claims, wherein the tuft (10, 30, 32, 34, 36) is attached to the head (12, 13, 19) by means of a hot-tufting process.

15. An oral care implement (14, 15, 17) comprising a head (12, 13, 19) according to any of the preceding claims.

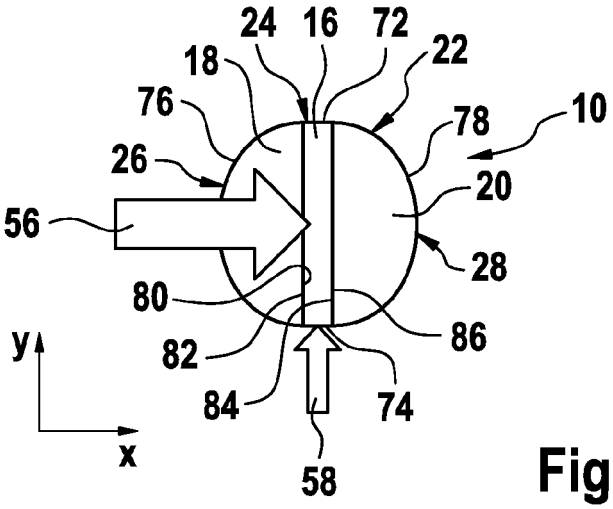

Fig. 1

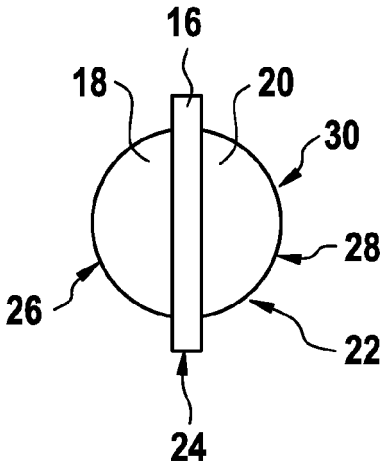

Fig. 2

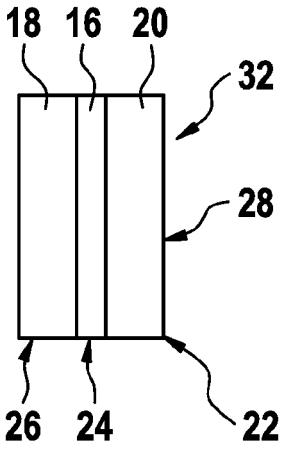

Fig. 3

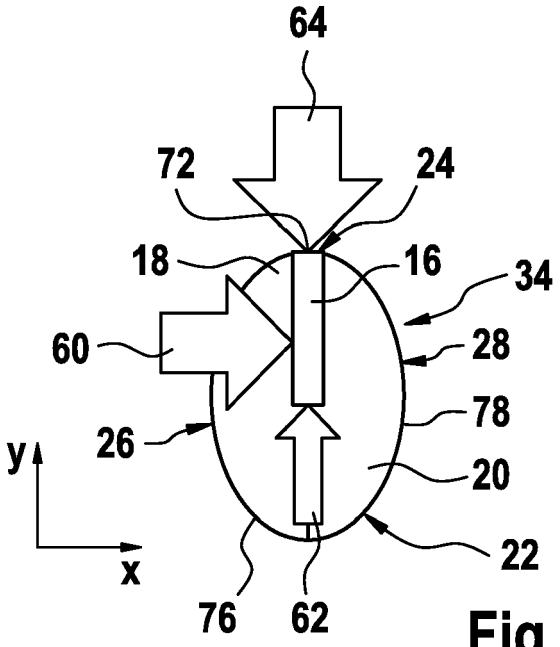
64
72
24
18
16
34
60
28
78
26
20
y
x
22
76
62

Fig. 4

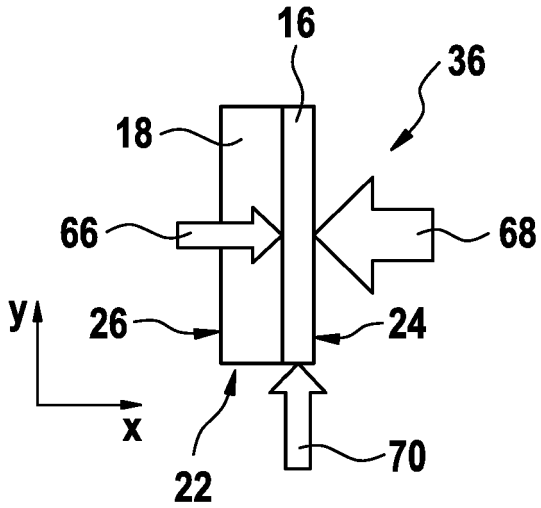
16
36
18
66
68
y
26
24
x
22
70

Fig. 5

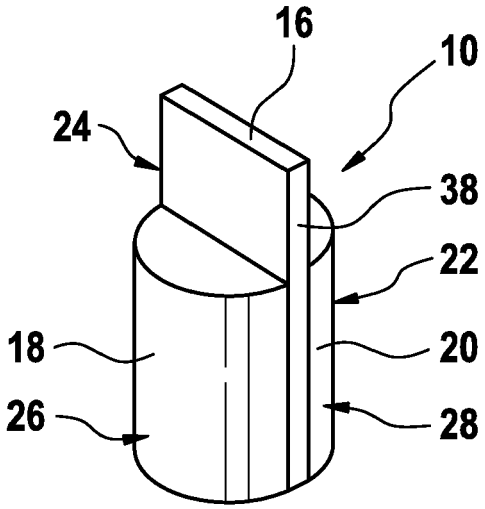

Fig. 6

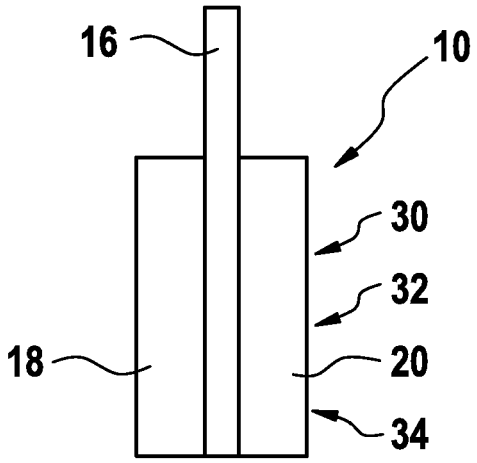

Fig. 7

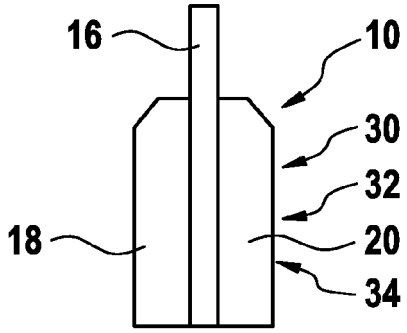

Fig. 8

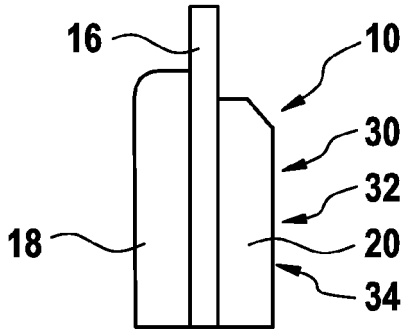

Fig. 9

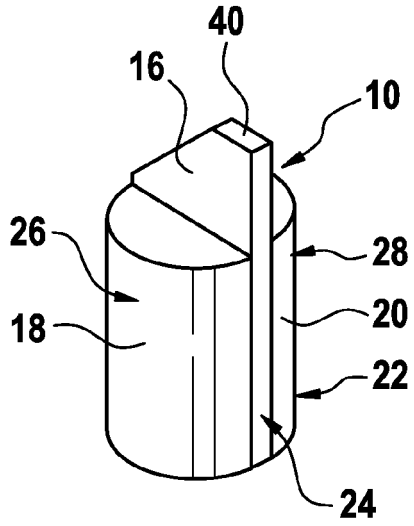

Fig. 10

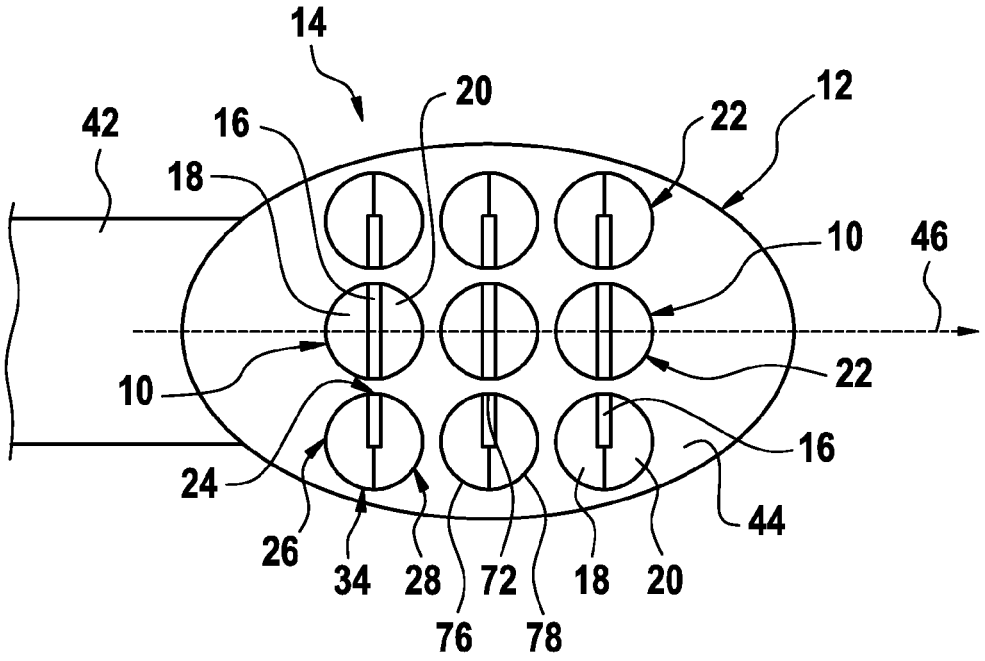
14
20
12
42
16
22
18
10
46
10
22
16
24
44
26
34
28
72
18
20
76
78

Fig. 11

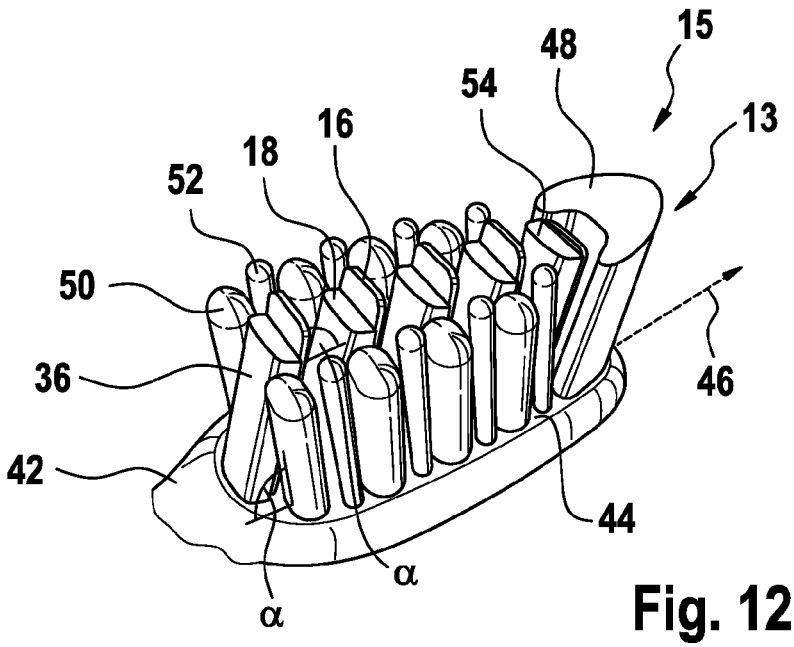
15
48
54
13
16
18
52
50
36
46
42
44
α
α

Fig. 12

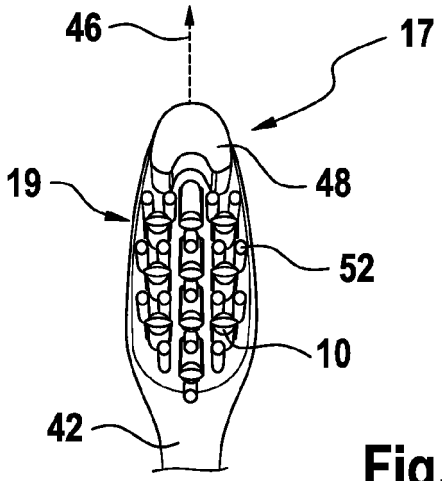

Fig. 13

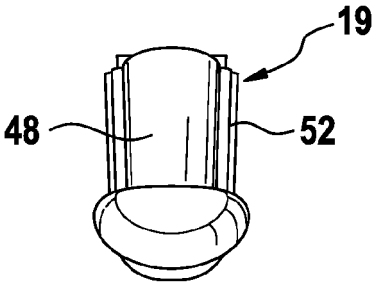

Fig. 14

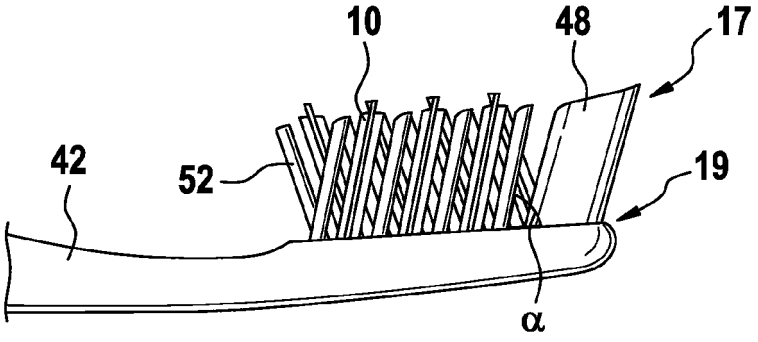

Fig. 15

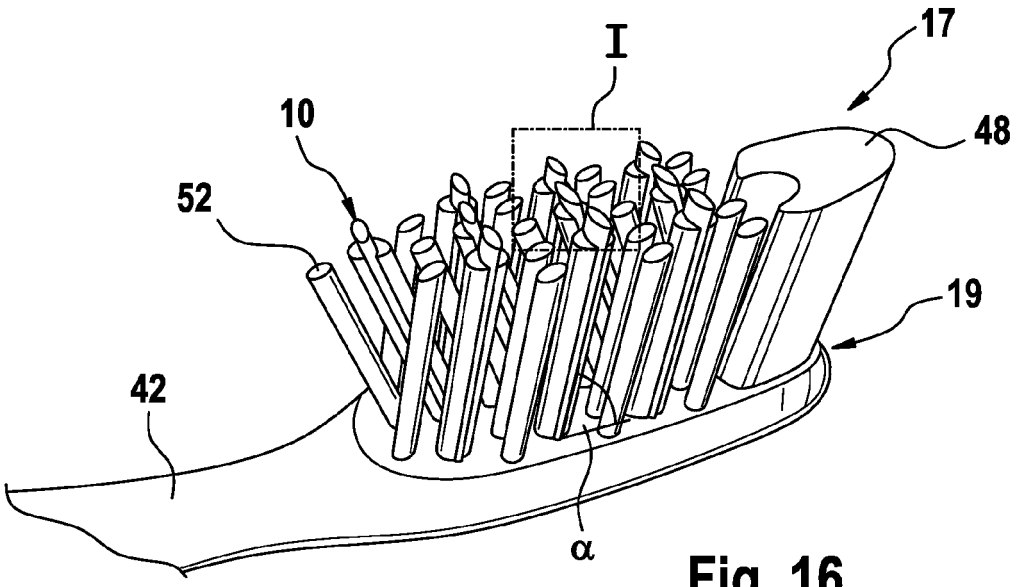

Fig. 16

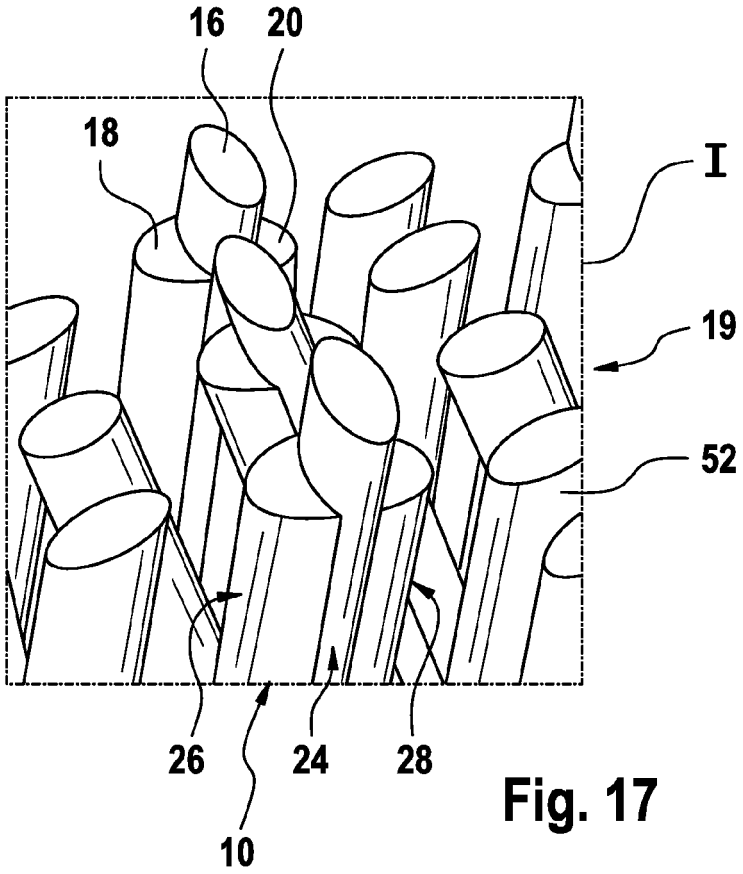

Fig. 17

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 17 0759

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 716 821 A1 (CORONET WERKE GMBH [DE]) 19 June 1996 (1996-06-19) * column 1, lines 1-2, 41-43 * * column 2, lines 1-7, 28-33, 45-49 * * column 3, lines 6-10 * * column 6, lines 1-8; claims 1, 5, 6; figures 2a, 4b *	1-15	INV. A46B9/02 A46B9/04 A46B9/06
X	WO 2012/022431 A1 (TRISA HOLDING AG [CH]; HESS WALTER [CH]; TREVISAN OSKAR [CH]) 23 February 2012 (2012-02-23) * page 1, lines 28-33, 45-49 * * page 8, lines 30-31; figures 7a-7c, 8a-8c, 9a-9c *	1-15	
X	WO 00/51462 A1 (CORONET WERKE GMBH [DE]; WEIHRAUCH GEORG [DE]) 8 September 2000 (2000-09-08)	1-11,14, 15	
A	* page 7, lines 2-6, 26-30; figures 28, 31 *	12,13	
A	AU 2003 252 861 A1 (GILLETTE CANADA) 21 April 2005 (2005-04-21) * page 5, lines 24-31; figures 4, 5, 7 *	1-15	TECHNICAL FIELDS SEARCHED (IPC) A46B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 November 2013	Dal Bó, Paolo

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 17 0759

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

15-11-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0716821 A1	19-06-1996	BR 9505909 A	23-12-1997
		CA 2163314 A1	17-06-1996
		CN 1133155 A	16-10-1996
		DE 4444926 A1	27-06-1996
		EP 0716821 A1	19-06-1996
		ES 2142441 T3	16-04-2000
		JP H08214947 A	27-08-1996
		NO 955045 A	17-06-1996
		PL 311842 A1	24-06-1996
		ZA 9509831 A	29-05-1996
WO 2012022431 A1	23-02-2012	AU 2011291060 A1	04-04-2013
		CA 2808212 A1	23-02-2012
		CN 103140148 A	05-06-2013
		CO 6690772 A2	17-06-2013
		EP 2420157 A1	22-02-2012
		EP 2605683 A1	26-06-2013
		US 2013139338 A1	06-06-2013
		WO 2012022431 A1	23-02-2012
WO 0051462 A1	08-09-2000	AR 022838 A1	04-09-2002
		AT 265164 T	15-05-2004
		AU 758677 B2	27-03-2003
		AU 3282000 A	21-09-2000
		BR 0008742 A	08-01-2002
		CA 2362595 A1	08-09-2000
		CN 1342048 A	27-03-2002
		CZ 20013125 A3	13-03-2002
		DE 19909435 A1	07-09-2000
		EG 22879 A	30-10-2003
		EP 1158880 A1	05-12-2001
		HU 0200098 A2	29-05-2002
		JP 2002537880 A	12-11-2002
		NO 20014271 A	01-11-2001
		PL 350320 A1	02-12-2002
		RU 2233605 C2	10-08-2004
		TR 200102571 T2	21-01-2002
		TW 427890 B	01-04-2001
		US 6726789 B1	27-04-2004
		WO 0051462 A1	08-09-2000
		ZA 200107073 A	26-02-2003
AU 2003252861 A1	21-04-2005	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82