

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
27 April 2006 (27.04.2006)

PCT

(10) International Publication Number
WO 2006/043114 A2

- (51) International Patent Classification:
A46B 5/00 (2006.01) A46B 9/06 (2006.01)
- (21) International Application Number:
PCT/GB2005/050187
- (22) International Filing Date: 18 October 2005 (18.10.2005)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
0423423.3 22 October 2004 (22.10.2004) GB
05102888.4 12 April 2005 (12.04.2005) EP
05106549.8 15 July 2005 (15.07.2005) EP
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- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

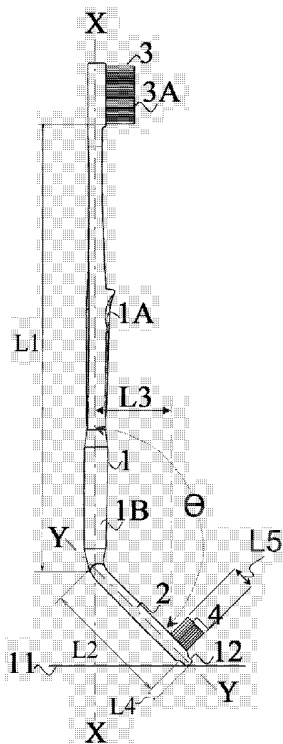
Declarations under Rule 4.17:

- as to the identity of the inventor (Rule 4.17(i))
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

[Continued on next page]

(54) Title: IMPROVEMENTS IN THE DESIGN OF TOOTHBRUSHES

(57) Abstract: A toothbrush is formed with an angled extension (2) at one end carrying a small brush, not substantially longer than about 12mms, for cleaning lingual tooth surfaces. By designing the geometry of the brush handle (1) and extension (2) so that they define an angle of between 100 and 150 degrees and so that the brush is displaced from the handle axis by at least 20mms, it becomes possible to clean effectively the surfaces which are rarely cleaned well using a conventional brush. Other tooth surfaces are cleaned using a conventional brush (3) at the opposite end of the handle.



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- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
- *of inventorship (Rule 4.17(iv))*

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Published:

- *without international search report and to be republished upon receipt of that report*

IMPROVEMENTS IN THE DESIGN OF TOOTHBRUSHES

This invention relates to a new geometry for the design of toothbrushes.

- 5 Tooth loss occurs either as a result of tooth decay or as a result of gum disease.
90% of tooth loss is currently due to gum disease.

Gum disease is as a process whereby plaque (a mixture of food debris, bacteria
and several other constituents) collects on the tooth surface, adjacent to the gum
10 margin. Over a period of time, if not effectively removed, this plaque
undermines the tissue attachment of the tooth to the body.

Put simply, if one can effectively and regularly remove the collected plaque
deposits, tooth loss due to gum disease will not occur.

15

It has long been recognised by dental experts that the lingual surfaces (i.e. the
surfaces of the lower teeth facing the tongue) are rarely effectively cleaned; and
this invention arose from a study of this problem and of possible solutions.

- 20 Over many years, different devices have been designed to enable the effective
cleaning of teeth. These include conventional toothbrushes, electric
toothbrushes and products to assist in the cleaning of inter-dental spaces. Some
such devices have included an articulated joint eg as described in US patent

specification 4796325 to allow the brush to reach different parts of the mouth. However, this arrangement is too complex and difficult to manipulate.

Other proposals have employed the use of double-ended toothbrushes. For example, patent specification US3934298 describes a toothbrush, one end of which has a normal brush-head; whilst the other end has a brush-head with a pointed shape for cleaning inter-proximal surfaces. This however does not address the problem of cleaning the lingual tooth surfaces.

10 It is also common for brush handles to be designed with a slight bend or loop to help to reach different parts of the mouth. Examples of this are described in patent specification US1132326, US5315730, US2084873, US4150457 and US 2668308. However, whilst some of those arrangements may give slightly improved access to the lingual surfaces of the lower canines as compared with
15 an entirely straight brush, they are not sufficiently easy to manoeuvre so as to provide effective access to all lingual tooth surfaces.

This invention arose in the course of a careful study in situ of the anatomical arrangement of the mouth cavity and in particular of the areas proven clinically
20 to be poorly accessed by conventional brushing.

According to the invention there is provided a toothbrush comprising a handle and a brush carried by a relatively narrow extension at one end of the handle,

the extension being arranged at an angle of between about 95° and 150° to an axis of the handle so that the brush is offset laterally by a distance of at least 20mms from the handle to facilitate access to lingual surfaces of the user's teeth.

5

It will be appreciated that there is a balance between the angle of bend and the offset distance referred to above. If the angle is too large, the toothbrush becomes effectively straight and the lingual surfaces cannot be effectively cleaned without the handle being obstructed by the upper teeth or nose of the
10 user. If the angle is too small, the offset distance needs to be increased in order that the extension should have sufficient reach to clean teeth towards the back of the mouth, and this in turn causes obstruction by the user's upper teeth and nose when used towards the front of the mouth. Previous angled toothbrush designers have failed to appreciate the sensitive trade-off between these two geometrical
15 considerations. It has been found that, by using an angled extension and a geometry as defined in the appended Claims, it becomes possible to remove plaque from areas of the mouth that a conventional brush cannot access easily, these areas being the whole of the lingual surfaces of the upper and lower arches. This can be done relatively easily whilst holding the handle of the brush
20 at a convenient angle, un-obstructed by the anatomy of the mouth or face. Furthermore, the position of the brush can be moved so as to clean different lingual tooth surfaces simply by rotating the handle about its axis, without

significantly moving the attitude of the handle from a range of positions where it is comfortable to use.

The brush referred to above preferably has a flat working plane; i.e. the ends of
5 at least some of the bristles terminate at an imaginary flat or slightly rounded
plane rather than being formed into a point as would be appropriate had the
brush been intended for inter-dental cleaning. However, in certain
embodiments, this brush may have a small portion formed from stiff rubbery
filaments which are slightly longer than adjoining filaments of the brush. These
10 stiff rubbery filaments can help to dislodge softer newly formed calcified
deposits of plaque. The dimension of this brush-head in the direction of the
extension is also of some importance and should preferably be between 5 mms
and 20 mms. It is best for this dimension to be less than 15 mms, since this
latter dimension allows for effective cleaning of the difficult to access lingual
15 surfaces of the upper and lower dental arches. This dimension reflects the
clinical length of the tooth structure present in the oral cavity.

The extension to the handle should not be so long as to cause difficulty of
manipulation or to be obstructed, as is a conventional toothbrush, by the
20 anatomical position of the opposing arch. For that reason a length of less than
70mms is preferred. However, it needs to have sufficient length to allow the
brush-head to clear the incisal tips of the incisal region it is cleaning. Lengths

between 25 and 50mms are considered to be suitable, preferably between 35 and 50 mms.

Although there is preferably a well defined transition between the handle and
5 the extension, this is not essential and it would be possible to design a product
which gradually diminishes in width or cross-sectional area towards its free end.
Also, neither the extension nor the handle itself need be perfectly straight and
they could both be formed by a series of suitably shaped curves. A common
essential feature of all such variations is that the whole of the brush should be
10 held at a position displaced laterally from a notional axis of the handle, this axis
being formed by a line connecting the most forward and rearward points where
it makes contact with the user's hand and fingers. This displacement needs to be
at least 20mms to have the desired effect and is preferably between 20 and
40mms. Because of this feature, the brush can be steered to any desired lingual
15 tooth surface by rotating the brush around the aforementioned axis using the
thumb and forefinger acting on a part of the handle adjacent the extension. This
feature contrasts with existing designs of curved toothbrushes which assume,
wrongly, that it is necessary for the brush head to be in line with the axis of the
handle.

20

Some toothbrush handles have a curved shape and therefore may not have a
clearly defined axis of symmetry. In such cases, the term "axis" as used in this

specification is to be construed as referring to a median line passing through the handle or that part of it which is held in the hand when in use.

In a preferred form of the invention, the handle and the extension are made as
5 one moulded component. However, an alternative possibility is for the extension to be removable so that it can be replaced when the brush is worn. Where two brushes are included, as discussed below, they could both be replaceable.

10 To clean the outer surfaces of the teeth, a second brush is preferably included at the opposite end of the handle and this can be more conventional in size and shape. The length of the handle needs to be sufficiently long to allow that brush which is not currently in use to be held clear of the user's hand. However it must not be so long as to be unwieldy. A range of between 55 and 250 mms is
15 considered suitable. For an adult a range from 120 to 200 mms and preferably 140 to 180 would be appropriate; whereas for a child a range from 55 to 130 mms and preferably 80 to 150 mms would be more suitable.

Three embodiments of the invention will now be described by way of example
20 with reference to the accompanying drawings in which:

Fig 1 is a side elevation of a toothbrush constructed in accordance with the invention;

Fig 2 is a front elevation of the same toothbrush;

Fig 3 illustrates the brush of Figs 1 and 2 in use, the user's mouth being
5 shown in cross-section and the handle of the brush being shown partly
broken away;

Figs 4 and 5 are equivalent to Figs 1 and 2 but show an alternative
design variant;

10

Fig 6 illustrates a third embodiment of the invention, in use, illustrating
how the features of the invention allow the lower lingual tooth surfaces
to be effectively cleaned and, in a similar manner this brush design also
allows for the effective cleaning of the palatal surfaces of the teeth of the
15 upper dental arch; and

Fig 7 is side elevation of the third embodiment illustrating a small
bundle of rubbery filaments forming part of one of its two brush-heads.

20 Referring to Figs 1 and 2, the illustrated toothbrush comprises a handle 1, of
length L1, having an axis X - X; and an extension 2 of length L2 having an axis
Y - Y. The handle and the extension are formed as a single moulding of
synthetic plastics material. The handle is of generally rectangular cross-section

and is enlarged and contoured at 1A to form a thumb grip. A lower part 1B is of rounded, elliptical, almost circular, cross-section for a purpose to be explained later.

- 5 The extension 2 is of considerably reduced width compared with the handle, this being best seen on Fig 2. It is of circular cross-section and its axis Y – Y forms an angle Θ of about 135 degrees with the axis X – X.

The upper end (as viewed in figs 1 and 2) of the handle carries a conventional
10 brush 3 having parallel bristles extending perpendicularly to the axis X - X and terminating in a flat working surface 3A for cleaning the buccal surfaces (the surfaces facing the cheeks and lips) of the teeth.

The free end of the extension 2 carries a second brush 4, much smaller than the
15 brush 3, which is displaced by a distance L3 from the axis X-X. It is formed from parallel bristles extending perpendicularly to the axis Y -Y and terminating in a flat working surface 4A for cleaning the lingual surfaces. The brush 3 is of elliptical cross-section having a major axis L5 (as measured in the direction of axis Y – Y) of about 10mms and a perpendicular minor axis of about 8mms.

- 20 The dimension L5 is of importance because, for effective brushing, it has been found that it should not be substantially greater than 25 mms, and should preferably be slightly less than 12 mms. The length of the brush should ideally

be smaller than the conventional brush length to allow for more effective access of the lingual surfaces of the mouth it is attempting to clean.

Fig 3 shows the toothbrush in use cleaning the lingual surfaces of the lower
5 incisors 5. The upper incisors are shown at 6, gums at 7, tongue at 8 and upper
and lower lips at 9 and 10 respectively. As can be seen from this drawing, the
working surface 4A of the brush 4 can be used approximately parallel to the
tooth surface while the handle 1 is comfortably held at a near-horizontal
position where movement is not obstructed by contact with the user's lips or
10 nose. At all times only the relatively narrow extension 2 need enter beyond the
user's lips and this allows it to be easily and comfortably received inside the
mouth. The user grips the near-cylindrical part 1B of the handle and, by rotating
the latter about its axis X – X can steer the brush 4 to any desired lingual or
palatal tooth surface whilst still holding the handle at a comfortable angle
15 similar to that shown on Fig 3. This action is made possible because the whole
of the brush 4 is offset from the axis X – X by a distance L3, as shown on Fig 1,
which is at least 20mms; and because the angle θ is within the range of between
about 95° and 150°; this range of angles allowing sufficient “bend” for the
brush to engage the tooth surfaces correctly but not so great as to cause the
20 handle to be obstructed by hard and soft tissue of the rest of the face. Brushing
is performed using a reciprocating movement in the direction Y – Y.

Referring back to Figs 1 and 2, the toothbrush is shown resting on a horizontal surface 11, typically the bottom of a beaker used to store the brush. It will be seen that the extension 2 has a rounded nodule 12 at its free end which makes contact with the surface 11, and which has a length L4 ensuring that the brush 4 is kept well clear of any bacterial matter on that surface.

Figs 4 and 5 show a different toothbrush and parts similar to those of Figs 1 and 2 are denoted with identical reference numerals. In this design variant, the handle is slightly curved as shown whilst still generally following the line of the axis X – X. Instead of a cylindrical section 1B, this embodiment has recesses 1C lying at 90 degrees to the thumb-grip 1A. These recesses allow the small brush head 4 to be comfortably held between finger and thumb.

Fig 6 illustrates a third embodiment of the invention which has a shape slightly different to that of Figs 4 and 5 but which operates in an equivalent way. Fig 6 shows how, the angle of the extension, and the distance L3 are selected to allow the brush to be used effectively to remove plaque from the lingual surface of lower teeth on one side of the mouth, and how, by rotating the brush about its axis X-X, it can equally well be used on the other side as shown in broken lines, without changing the angle at which the handle is held. Angles of rotation in-between the two illustrated extremes are appropriate for cleaning the incisors. Some movement away from the centre-line is necessary to reach the back of the mouth. If the angle θ of the extension were greater than about 150° , the brush

would need to be manipulated so far away from the centre-line that effective removal of plaque from all tooth surfaces would be difficult or impossible on one side or the other of the mouth depending on the handedness of the user. In Fig 6 the dimensions are as follows.

5 L1 = 145 mms

L2 = 40 mms

L3 = 23 mms

L4 = 12 mms

$\Theta = 135^\circ$

10

As illustrated in Fig 7 the extension in the third embodiment also supports, in addition to brush 4, a plurality of rubbery filaments 4A. The filaments, which are made from a synthetic plastic rubberised compound and are longer than the bristles of brush 4, aid to dislodge early calcified deposits of plaque. This
15 filament brush feature is thought to be particularly effective for smokers. So as to maintain the functionality provided by the small head of extension 2 the brush 4 has a smaller area than in the previous embodiments so as to accommodate the addition of the filaments 4A.

20 The illustrated embodiments of the invention have been described only by way of example and that many other variations in shape and dimensions are possible within the scope of the accompanying claims. However, in all variations, the use of the relatively slim extension at an angle of 95° to 150° creating a 20mm or

greater offset between the brush and the handle, will, it is believed make the effective removal of plaque from lingual tooth surfaces much easier; and it is believed that those who use products employing this principle are likely to experience a significant improvement towards the objective of keeping their

5 teeth for life.

CLAIMS

1. A toothbrush comprising a handle and a brush carried by an extension at one end of the handle, characterised in that the extension (2) is arranged at an angle (θ) of between about 95° and 150° to an axis of the handle (1) so that the
5 brush (4) is offset laterally by a distance (L3) of at least 20mms from the handle to facilitate access to lingual surfaces of the user's teeth (5,6).
2. A toothbrush according to any preceding Claim characterised in that the angle (θ) is between 125 and 140 degrees.
- 10 3. A toothbrush according to Claim 1 or 2 characterised in that there is a distinct bend between the extension (2) and the handle (1).
4. A toothbrush according to Claim 2 characterised in that the said length
15 of the extension (2) is between 25 and 60mms.
5. A toothbrush according to Claim 4 characterised in that the length is between 35 and 50mms.
- 20 6. A toothbrush according to any preceding Claim characterised in that the dimension (L5) of the brush (4), as measured in the direction (Y-Y) of the extension (2), is between 5mms and 20 mms.

7. A toothbrush according to any Claim 6 characterised in that the said dimension (L5) of the brush (4) is not substantially greater than 12 mms.
8. A toothbrush according to any preceding Claim characterised in that a
5 second, larger, brush (3) carried by the opposite end of the handle (1).
9. A toothbrush according to any preceding Claim characterised by a
nodule (12) at the free end of the extension (2) so that, when the toothbrush is
stored upright, with that free end resting on a horizontal surface (11), the brush
10 is held above that surface (11) by the nodule (12).
10. A toothbrush having a supporting body and a brush associated with each
end of the supporting body, characterised by a nodule (12) at one end of the
body (1, 2) such that, when the toothbrush is stored in an upright position on a
15 horizontal surface (11), the brush (4) closest at the bottom of the supporting
body is held spaced above any contaminants on that surface.
11. A toothbrush according to any preceding Claim characterised in that the
extension (2) carries a number of rubbery filaments (4A) which aid to dislodge
20 plaque.

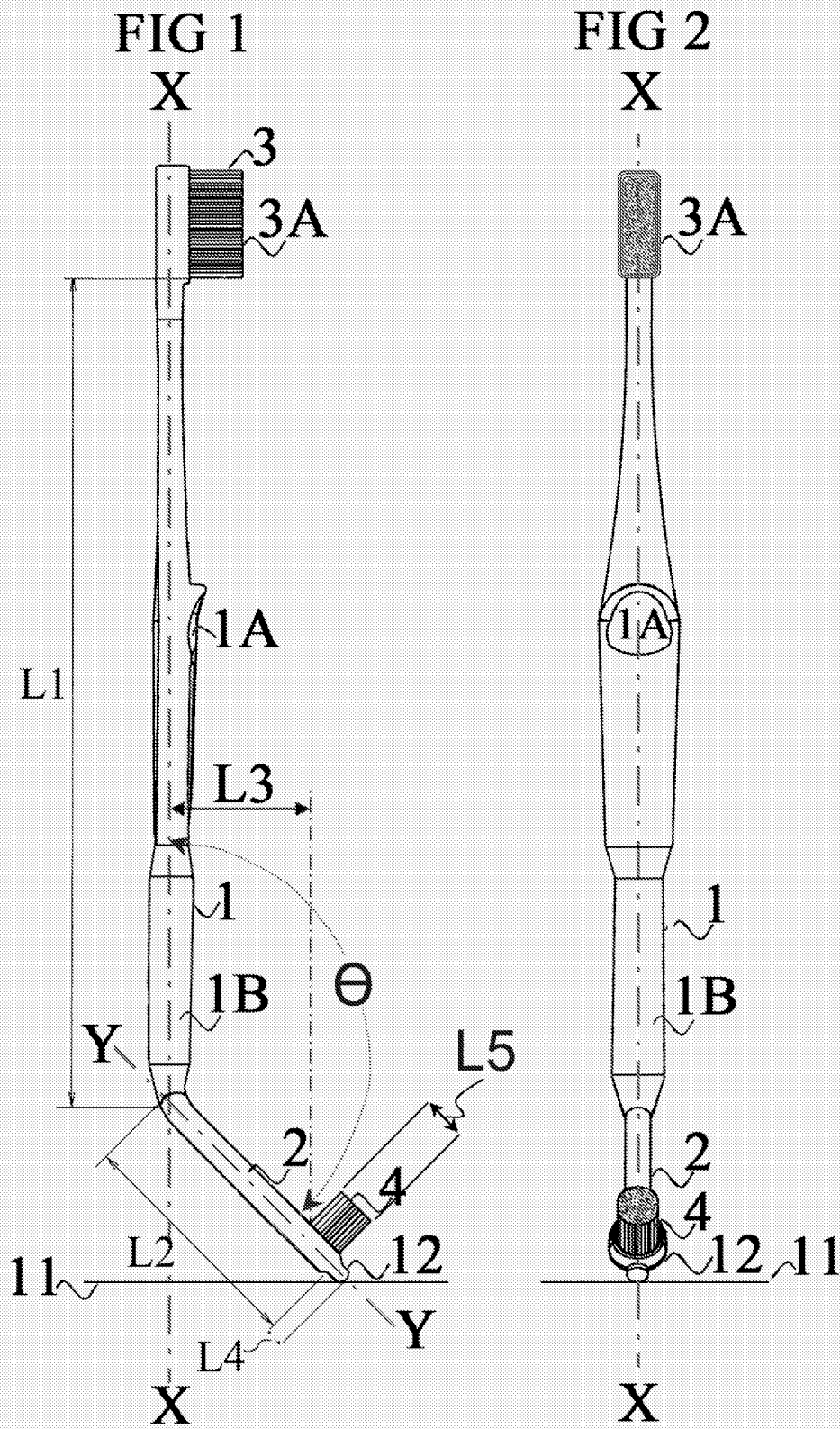


FIG 3

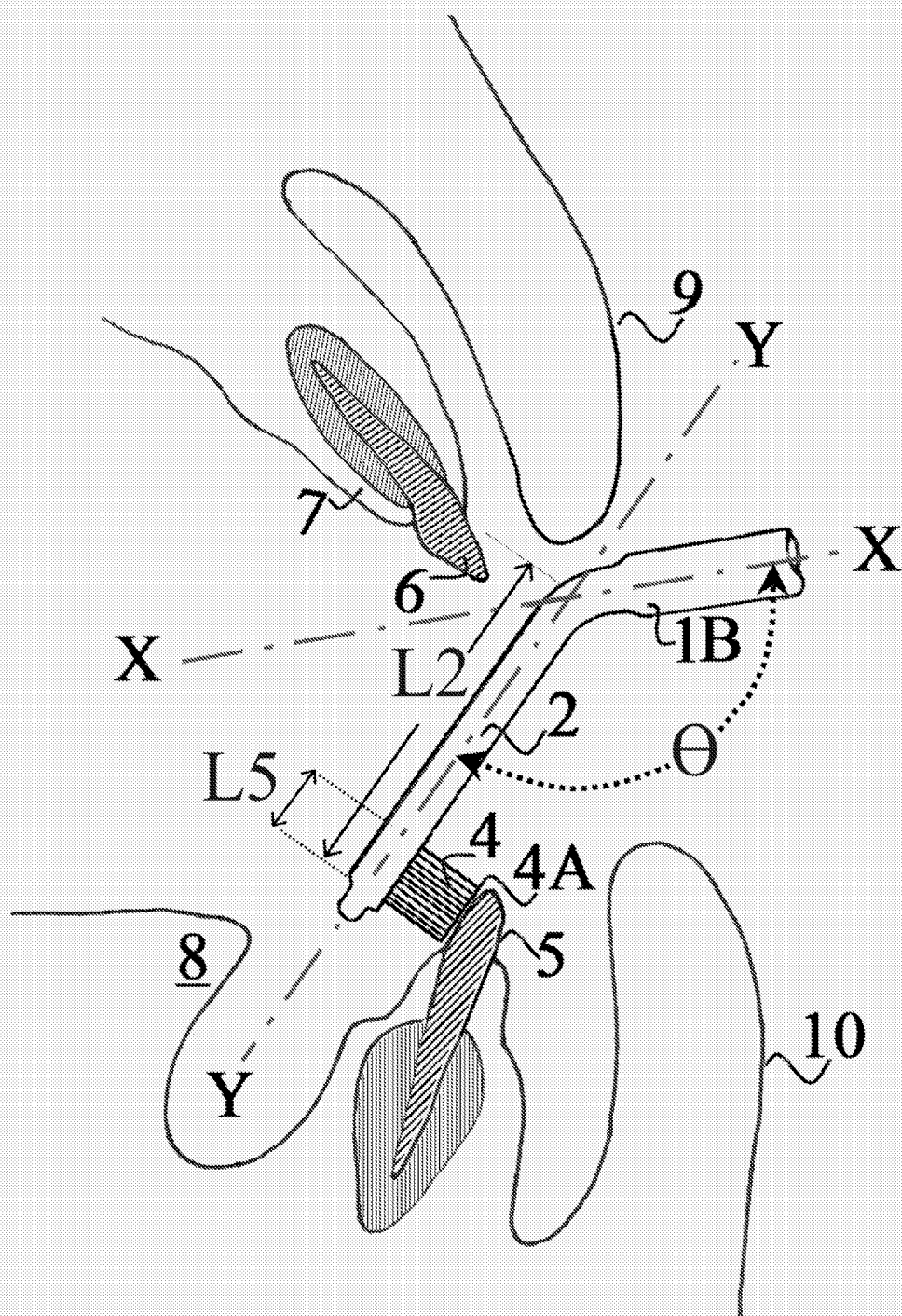


FIG 4

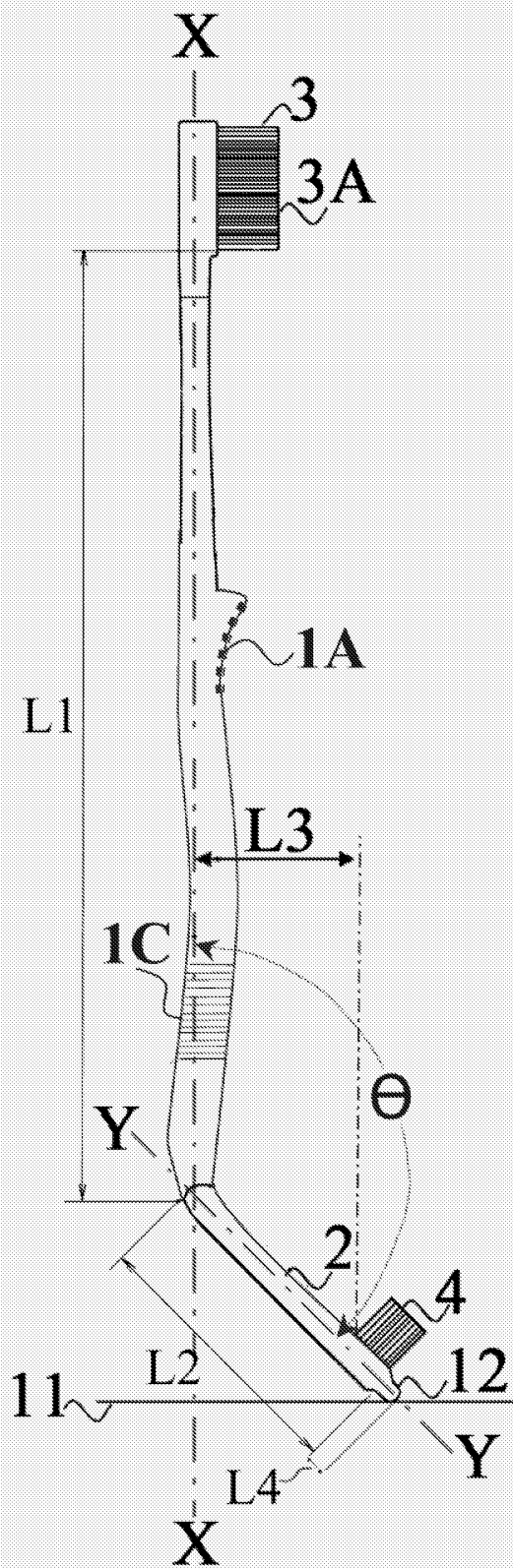


FIG 5

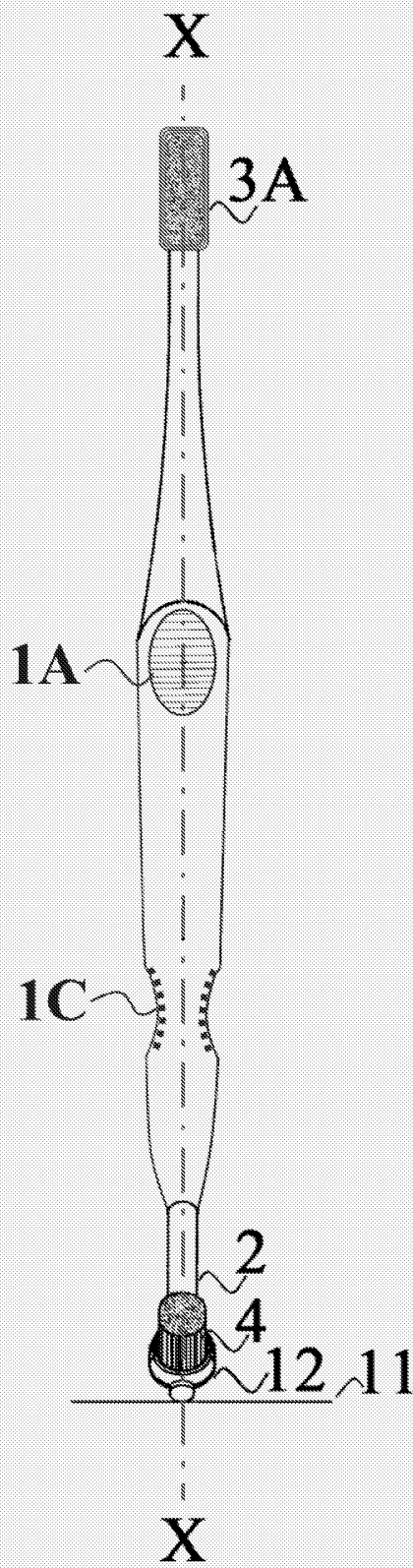


FIG 6

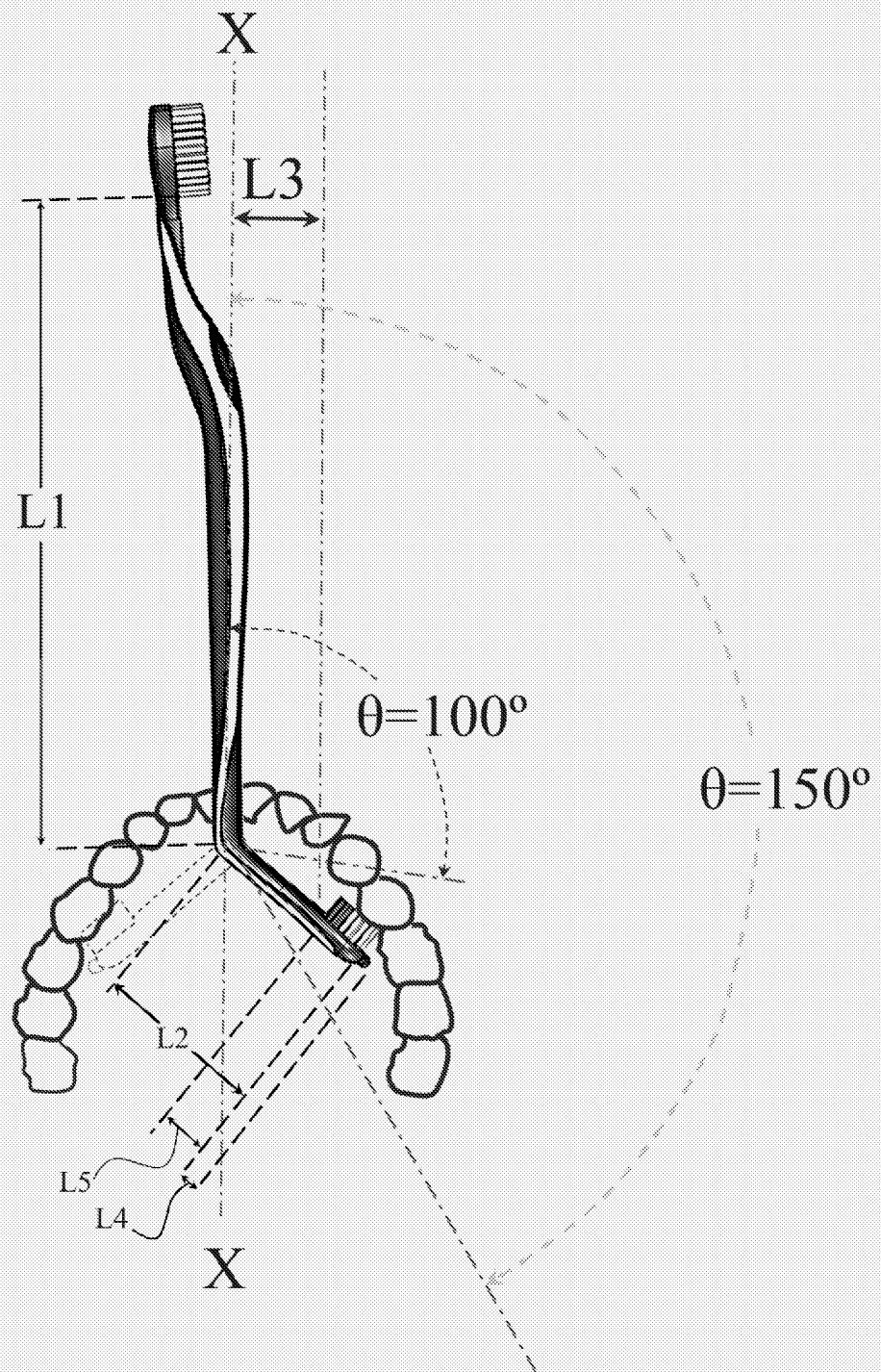


FIG 7

