(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
10 December 2009 (10.12.2009)

PCT

(10) International Publication Number
WO 2009/146498 A1

(51) International Patent Classification:
A46B 5/00 (2006.01) *A46B 9/04* (2006.01)

(21) International Application Number:
PCT/AU2009/000705

(22) International Filing Date:
3 June 2009 (03.06.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2008100507 3 June 2008 (03.06.2008) AU

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,

[Continued on next page]

(54) Title: TOOTHBRUSH

(57) Abstract: A toothbrush comprising a body having at one end a head and at an opposite end a handle. The head includes on one surface an array of bristles for cleaning teeth and gums. At least the handle is manufactured from a composite of plastics materials which combine to provide sufficient flexibility to allow bending displacement of the handle as a user applies load to the bristles via the handle during use. The flexibility of the composite handle is such that during use of the toothbrush the handle dissipates at least part of the load applied to the toothbrush thereby relieving loading on the bristles during teeth and gum cleaning to delay splaying of bristles until a predetermined load is applied by the user.

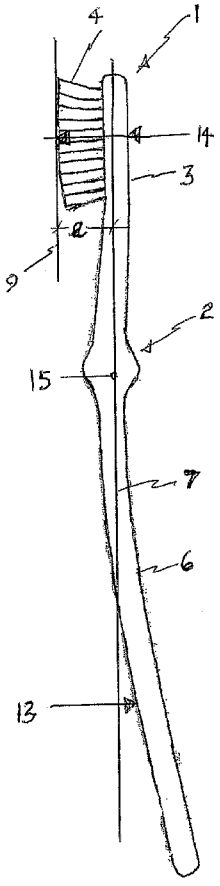

FIGURE 6

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NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, 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, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

TOOTHBRUSH

BACKGROUND

The present invention relates to toothbrush technology and more particularly relates to improvements in toothbrushes to improve cleaning of teeth and gums. More particularly, the present invention relates to a toothbrush capable of reacting to excessive user force by deflection of a handle to transfer loading away from bristles to maintain bristles in an optimal attitude relative to teeth or gums for cleaning.

The invention further provides a toothbrush manufactured from a plastics composite having flexibility in the handle sufficient to allow deflection of the handle to transfer loading away from bristles to maintain bristles in an optimal attitude relative to teeth or gums for cleaning up to a predetermined applied load. The invention further relates to a toothbrush which allows a user to learn by feel to apply the correct pressure for optimal brushing to achieve healthy gums.

PRIOR ART

There are in existence a variety of tooth brushes

There are already in existence a variety of toothbrush designs with variations in bristle geometry, configuration, stiffness tuft sizes and number. In addition there are in existence toothbrushes having in addition to the aforesaid bristle variations, handle variations. Handles have been designed to create variations in stiffness using different materials and ergonomic geometry to improve gripability.

The known toothbrushes suffer from a number of attendant disadvantages. Some are too stiff, some have bristles to soft, some have bristles to hard, some are ergonomically unsatisfactory, some have unsatisfactory head shape.. The

general objective in cleaning teeth is to provide a toothbrush which has optimal head size and shape and a bristle stiffness to optimize teeth and gum cleaning.

The performance of a toothbrush is largely dictated by head size, bristle stiffness, material of construction of the body of the toothbrush, body geometry and a combination of any one or more of the above.

Toothbrushes which are too stiff in the body can cause the user to apply too much load to the ends of bristles causing the bristles to splay or collapse which reduces their effectiveness in cleaning. This is more pronounced where the bristles are soft.

Toothbrushes which have a stiff body cause user loads to be almost fully transmitted through the bristles as there is no flexibility in the handle. Much of the design development of toothbrushes has concentrated either on their physical appearance or on improving geometry of the brush so that it feels more comfortable in the hand of the user. Adjustments have also been made to the stiffness of bristles, the number of bristles in a tuft an to the diameter of each bristle enabling reduction of bristle numbers in tufts an consequently tuft numbers. Toothbrush design has largely been a compromise between material selection for the toothbrush body, bristle type and stiffness, head size and overall flexibility. This compromise allows a number of design choices but a toothbrush design is preferred which optimizes performance of its primary function which is to clean teeth and gums. Some manufacturers have placed abrasive surfaces on the back side of the head for gum cleaning, but it is ideal if the bristles can be employed in both gum and teeth cleaning.

Recent research has shown that gum disease, or more correctly the immune response to gum disease, is a major cause of Ateriosclerosis (considered the most important underlying cause of strokes, heart attacks, various heart diseases

including congestive heart failure and most cardiovascular diseases) and diabetes.

Toothbrush manufacturers have been aware of the importance of toothbrush design to optimal results from brushing teeth and particularly gums. Over the years a variety of toothbrushes have been manufactured with the objective of preventing excessive brushing pressure from damaging the teeth and gums. The problem has been addressed, although not satisfactorily, by inclusion of a flexing or deforming neck portion or providing bristles which retract into the head of the toothbrush. The retraction is intended to dissipate excessive force while maintaining bristles in an optimal attitude (normal) relative to teeth and gums. Brushing too hard is generally regarded as a force equal to 1kg weight applied to gums by the bristles. Research shows that the effectiveness of plaque removal can decline when a force around or equal to 750 grams weight is applied to the gums by the bristles.

There is a long felt want in the industry to provide a toothbrush which allows a user to know by feel of the toothbrush when a brushing load on the toothbrush exceeds an optimal load for efficient cleaning of teeth and gums and which is relatively economic to manufacture.

INVENTION

The present invention seeks to ameliorate the disadvantages of the prior art toothbrushes by providing improvements in toothbrushes to improve cleaning of teeth and gums. The invention provides a toothbrush capable of reacting to excessive user force by deflection of a handle to transfer loading away from bristles to maintain bristles in an optimal attitude relative to teeth or gums for cleaning.

The invention further provides a toothbrush manufactured from a plastics composite having flexibility in the handle sufficient to allow deflection of the

handle to transfer loading away from bristles to maintain bristles in an optimal attitude relative to teeth or gums for cleaning up to a predetermined applied load.

In its broadest form the present invention comprises:
a toothbrush comprising a body having at one end a head and at an opposite end a handle;
the head including on one surface an array of bristles for cleaning teeth and gums;
wherein, at least the handle is manufactured from a composite of plastics materials which combine to provide sufficient flexibility to allow bending displacement of the handle as a user applies load to the bristles via the handle during use; and wherein the flexibility of the composite handle is such that during use of the toothbrush the handle dissipates at least part of the load applied to the toothbrush thereby relieving loading on the bristles during teeth and gum cleaning to delay splaying of bristles until a load of 450g is applied by the user.

The toothbrush has a stiffness which allows a flexibility which indicates to the user that the applied cleaning force is at a predetermined (built in) threshold beyond which cleaning efficiency is sub optimal. Preferably the built in threshold force is less than or equal to 400 grams weight to the bristles to maximise the bristles effectiveness at removing plaque and bacteria from the gums. Brushing with a force less than or equal to 400 grams stimulates blood supply and lymphatic system in the gums. The toothbrush according to the invention allows the user to learn and feel the correct pressure to apply to the handle when brushing, for healthy gums by learning to brush with a load application around the point at which the toothbrush handle flexes. A composite of plastics provides the necessary in built

The toothbrush according to the invention enables a parent brushing a child's teeth to also know a optimal pressure to apply for optimal brushing efficiency with the correct pressure for healthy gums. The toothbrush is also enables correct brushing pressure for healthy gums in people who wear full or partial dentures. Less pressure may be applied to the handle to reach a force equal to 1kg weight being applied to the bristles than a standard toothbrush.

Preferably the bending displacement of the handle provides a user with an indication that an axial load on the bristles for optimal teeth and gum cleaning is close to or at a load to induce splaying of the bristles. Preferably the bristles are capable of resisting an applied axial load up to 450grams without splaying but a user knows that this threshold load is approaching as the handle displaces relative to a longitudinal axis through the handle of the tooth brush .

In its broadest form the present invention comprises:
a toothbrush comprising a body having at one end a head and at an opposite end a handle;
the head including on one surface an array of bristles for cleaning teeth and gums;
wherein, at least the handle is manufactured from a composite of plastics materials which combine to provide sufficient flexibility to allow bending displacement of the handle as a user applies load to the bristles via the handle during use; and wherein the flexibility of the composite handle is such that during use of the toothbrush the handle dissipates at least part of the load applied to the toothbrush thereby relieving loading on the bristles during teeth and gum cleaning and to indicate an approaching threshold load for maintaining said bristles at an attitude normal to the plane of teeth or gums being cleaned.

Preferably said handle and said bristles are of a stiffness which results in splay of said bristles when a user load applied to the toothbrush body is equal to or exceeds 450g; wherein bending of the handle provides a user with an indication

that an axial load on the bristles for optimal teeth and gum cleaning is close to or at said load which results in playing of the bristles.

Preferably there are at least two bristles per tuft and at least 40 tufts on the head of the toothbrush. It will be appreciated that alternative bristle numbers per tuft and tufts per head can be varied depending upon requirements such as changes in head size. Preferably the handle is manufactured from at least two plastics materials, wherein, the two materials of construction of the flexible handle are polypropylene and acetylene. Other suitable plastics may be used to form the composite handle. The handle is according to one embodiment integrally formed with the head of the toothbrush. When a load of approximately 450grams is applied to the toothbrush the handle is displaced approximately 10mm off the longitudinal axis at the end of the handle. Preferably the handle is approximately two thirds of the length of the toothbrush and there is provided a neck portion between the head and handle. The head is preferably sized to accommodate between 40 – 48 tufts of bristles extending from the head and the tuft diameter falls within the range of 1.5mm – 2.5mm.

The present invention provides an alternative to the known prior art and the shortcomings identified. The foregoing and other objects and advantages will appear from the description to follow. In the description reference is made to the accompanying representations, which forms a part hereof, and in which is shown by way of illustration specific embodiments in which the invention may be practiced. These embodiments will be described in sufficient detail to enable those skilled in the art to practice the invention, and it is to be understood that other embodiments may be utilized and that structural changes may be made without departing from the scope of the invention. In the accompanying illustrations, like reference characters designate the same or similar parts throughout the several views.

The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is best defined by the appended claims.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 shows a side elevation view of a toothbrush according to a preferred embodiment prior to handle deflection.

Figure 2 shows a side elevation view of the toothbrush of figure 1 with handle displaced during optimal use.

Figure 3 shows a side elevation view of the toothbrush of figure 2 with handle displaced and where bristles have splayed in response to excessive force by a user.

Figure 4 shows a loading regime which is typically exerted by a user.

Figure 5 shows an abbreviated elevation view of a toothbrush with an enlarged head

Figure 6 shows an abbreviated elevation view of a toothbrush with an enlarged head and splayed bristles.

DETAILED DESCRIPTION

The embodiments referred to herein are illustrative and are not to be regarded as limiting the scope of the invention. While various embodiments of the invention have been described herein, it will be appreciated that these are capable of modification, and therefore the disclosures herein are not to be construed as limiting of the precise details set forth, but to avail such changes and alterations as fall within the scope of the description .

Optimal teeth and gum cleaning occurs when bristles of a toothbrush are presented normally to the surface of teeth and gums. Cleaning induces a sweeping action with the ends of the bristles abrading the surfaces of the teeth and gums. Splaying of a bristle away from a normal attitude comprises optimal cleaning as the bristles are at presented an angle or non linear to the surfaces of the teeth or gums. If bristles are subjected to an axial force beyond that which

would not effect linearity of the bristles or tufts, the bristles will splay or bend in which case cleaning efficiency is rendered sub optimal. Accordingly, it is desirable to ensure that the axial loading placed on the bristles is retained at or below a threshold force above which would cause the bristles to splay to a non linear attitude.

Figure 1 shows a side elevation view of a toothbrush 1 according to a preferred embodiment prior to handle deflection. Toothbrush 1 comprises a body 2 including head 3 which retains on one surface an array of bristles 4 forming a series of tufts 5. Handle 6 is integral with head 3 and is according to one embodiment manufactured from composite plastics which provides an inbuilt flexibility allowing the handle 6 in use to elastically or plastically displace relative to a longitudinal axis 7 through the body 2 of the tooth brush 1. According to one embodiment plastics materials which are suitable for the composite are polypropylene and acetyl. Other suitable plastics may be used provided they have the requisite flexibility characteristic.

Figure 2 shows a side elevation view of the toothbrush of figure 1 with handle 6 displaced relative to axis 7 during optimal use. In this configuration, handle is displaced rearward of head 3 transmitting some of a maximum applied load to bristles 4. Bristles are shown stiff and linear and normally presented to surface 9 which is an optimal attitude to tooth or gum surface 9. In figure 2 the distance between gum (or tooth) surface 9 and axis 7 is d. This shows bristles stiff and extending maximum distance from surface 10 of head 3.

Figure 3 shows a side elevation view of the toothbrush 1 of figure 2 with handle 6 displaced further and where bristles 4 have splayed in response to excessive force by a user. The splaying or crushing of bristles 4 causes them to approach surface 9 at an increased an angle other than normal to surface 9 thereby reducing distance d as shown in figure 2 to distance e as shown in figure 3. this occurs when handle 6 is displaced further from axis 7 than is shown in

figure 2. It will be appreciated that with this versatility integrated into the toothbrush a designer has wide capacity to adjust the configuration and geometry as required.

Figure 4 shows with corresponding numbering an abbreviated elevation view of toothbrush 1 as would be seen facing the bristles and with head 3 enlarged. The arrangement of bristles 4 correspond to that shown in figures 1 and 2 whereby the bristles 4 are not splayed or crushed. The distance from axis 7 to toothbrush edge 11 is shown as f. **Figure 5** shows the abbreviated elevation view arrangement of figure 4, this time with the bristles 4 splayed. The distance from axis 7 to edge of splayed bristles 12 is shown as distance g. Distance g is greater than distance f. The splaying occurs when a brushing force exceeds an optimal force.

Figure 6 shows with corresponding numbering a loading regime on toothbrush 1 which is typically exerted by a user on a toothbrush according to one embodiment of the present invention. Load 13 is exerted on handle 6 which tends to flex or displace away from axis 7. Part of load 13 is transferred through body 2 to head 3 applying load 14 on surface 9 about fulcrum point 15. Figure shows load 14 as exceeding an optimal loading sine bristles have splayed

In one embodiment the toothbrush is considered hard when the bristle monofilaments fall within the range 0.29mm -0.32mm. In another embodiment, the toothbrush is considered medium when the diameter of each bristle monofilament falls within the range 0.24mm -0.29mm. In another embodiment, the toothbrush is considered soft when the diameter of each bristle monofilament falls within the range 0.0.19mm -0.24mm. In a further embodiment, the toothbrush is extra soft when the diameter of each bristle monofilament falls within the range 0.16mm -0.19mm.

It will be appreciated by persons skilled in the art that the parameters of the toothbrush may be changed without compromising the function of the toothbrush to indicate to a user by handle flexure that a load at which the bristles will splay and provide sub optimal performance has been reached or exceeded. The actual load at which this will occur will depend upon the design of each toothbrush with respect to the bristle stiffness and handle flexure. For instance in a child's tooth brush will flex at a lower load than an adult's toothbrush. A child's toothbrush may have a handle of greater flexure and tufts of bristles of lesser stiffness such that upon deflection of the handle the bristles begin to splay when a user load applied to the toothbrush body is equal to or exceeds 200g. Bristle stiffness may be influenced by numbers of bristles in a tuft or by the thickness or diameter of each bristle. Handle stiffness may be influenced by the plastics or plastics composite chosen for the handle. Child's toothbrush may for instance have 12 tufts on the head. By definition a child's toothbrush will have a smaller head than an adult's toothbrush. The threshold load at which the bristles will splay may differ from toothbrush to toothbrush. Once the bristles splay the handle will normally stop flexing.

It will be recognised by persons skilled in the art that numerous variations and modifications may be made to the invention broadly described herein without departing from the overall spirit and scope of the invention.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1 A toothbrush comprising a body having at one end a head and at an opposite end a handle;
the head including on one surface an array of bristles for cleaning teeth and gums;
wherein, at least the handle is manufactured from a composite of plastics materials which combine to provide sufficient flexibility to allow bending displacement of the handle as a user applies load to the bristles via the handle during use; and wherein the flexibility of the composite handle is such that during use of the toothbrush the handle dissipates at least part of the load applied to the toothbrush thereby relieving loading on the bristles during teeth and gum cleaning and to indicate an approaching threshold load for maintaining said bristles at an attitude normal to the plane of teeth or gums being cleaned.

2 A toothbrush according to claim 1 wherein bending of the handle provides a user with an indication that an axial load on the bristles for optimal teeth and gum cleaning is close to or at a predetermined load which results in splaying of the bristles.

3 A toothbrush according to claim 2 wherein the handle is integrally formed with the head of the toothbrush.

4 A toothbrush according to claim 3 wherein there are at least ten tufts on the head of the toothbrush.

5 A toothbrush according to claim 4 wherein, there are at least ten bristles per tuft.

6 A toothbrush according to claim 5 wherein the handle is manufactured from at least two plastics materials.

7 A toothbrush according to claim 6 wherein, the two materials of construction of the flexible handle are polypropylene and polypropylene rubber.

8 A toothbrush according to claim 7 wherein the handle is approximately two thirds of the length of the toothbrush.

9 A toothbrush according to claim 8 wherein there is provided a neck portion between the head and handle.

10 A toothbrush according to claim 9 wherein the head is sized to accommodate between 40 – 48 tufts of bristles extending from the head.

11 A toothbrush according to claim 10 wherein a tuft diameter falls within the range of 1.5mm – 2.5mm.

12 A toothbrush according to claim 11 wherein said handle and said bristles are of a stiffness such that upon deflection of the handle the bristles begin to splay when a user load applied to the toothbrush body is equal to or exceeds 450g.

13 A toothbrush according to claim 12 wherein, when a load of approximately 450grams is applied to the toothbrush the handle is displaced approximately 10mm off the longitudinal axis at the end of the handle.

14 A toothbrush according to claim 13 wherein the bristle monofilament is hard when the diameter of each bristle monofilament falls within the range 0.29mm -0.32mm.

15 A toothbrush according to claim 13 wherein the bristle monofilament is medium when the diameter of each bristle monofilament falls within the range 0.24mm -0.29mm.

16 A toothbrush according to claim 13 wherein the bristle monofilament is soft when the diameter of each bristle monofilament falls within the range 0.0.19mm -0.24mm.

17 A toothbrush according to claim 13 wherein the bristle monofilament is extra soft when the diameter of each bristle monofilament falls within the range 0.16mm -0.19mm.

18 A toothbrush according to claim 11 wherein said handle and said bristles are of a stiffness such that upon deflection of the handle the bristles begin to splay when a user load applied to the toothbrush body is equal to or exceeds 200g.

19 A toothbrush having a composite plastics handle with built in flexibility and bristles of a particular stiffness so that in use the handle flexure indicates to a user that a brushing load applied normally via the bristles at the teeth or gums will cause splay of bristles and that sub optimal cleaning performance of the bristles has been reached or exceeded.

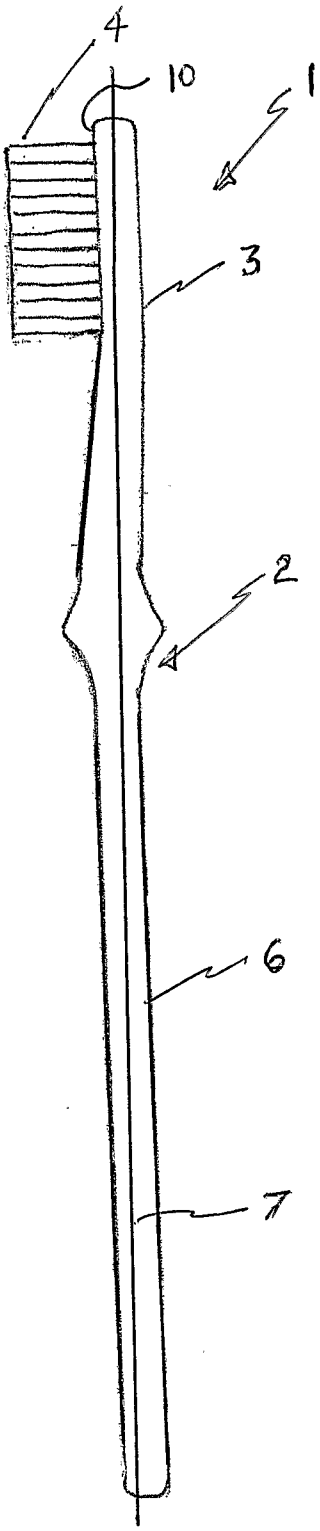

FIGURE 1

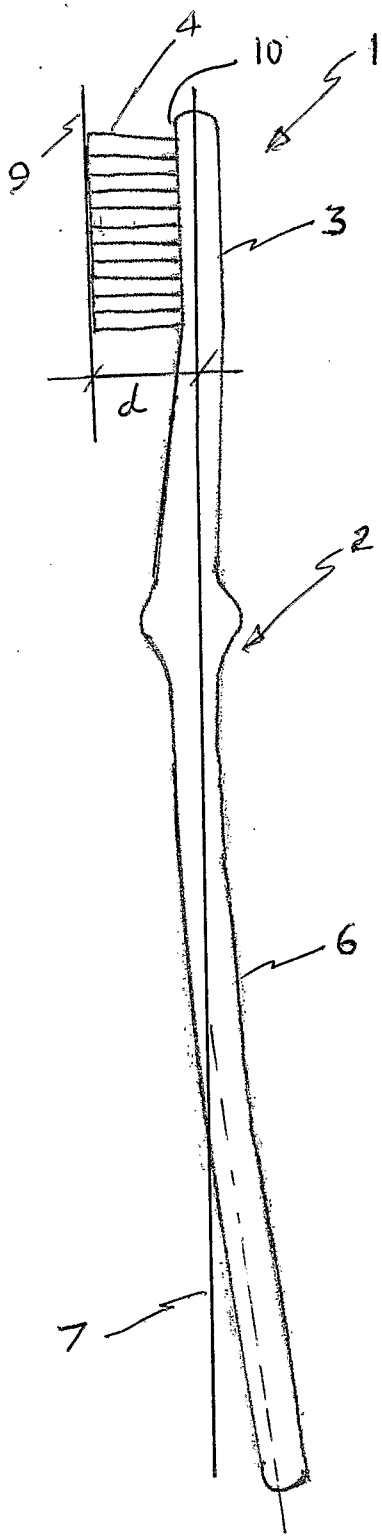

FIGURE 2

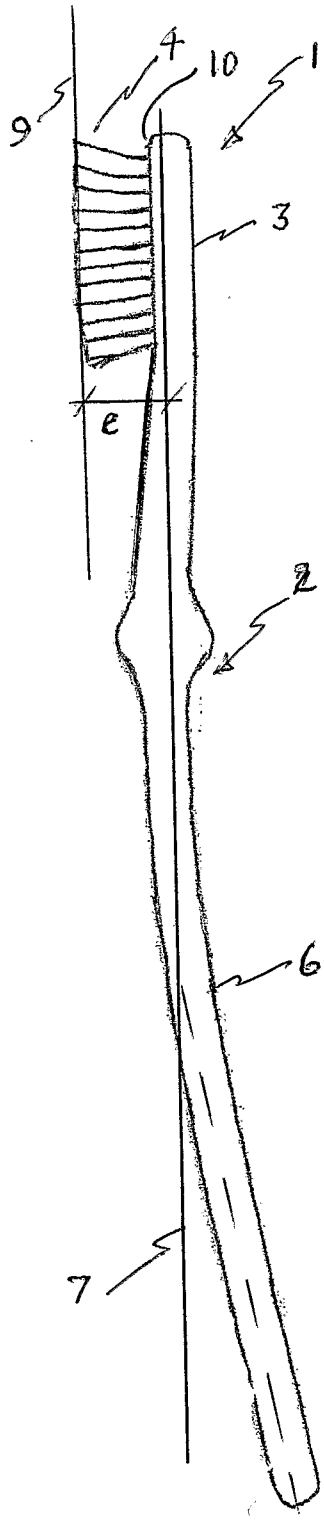

FIGURE 3

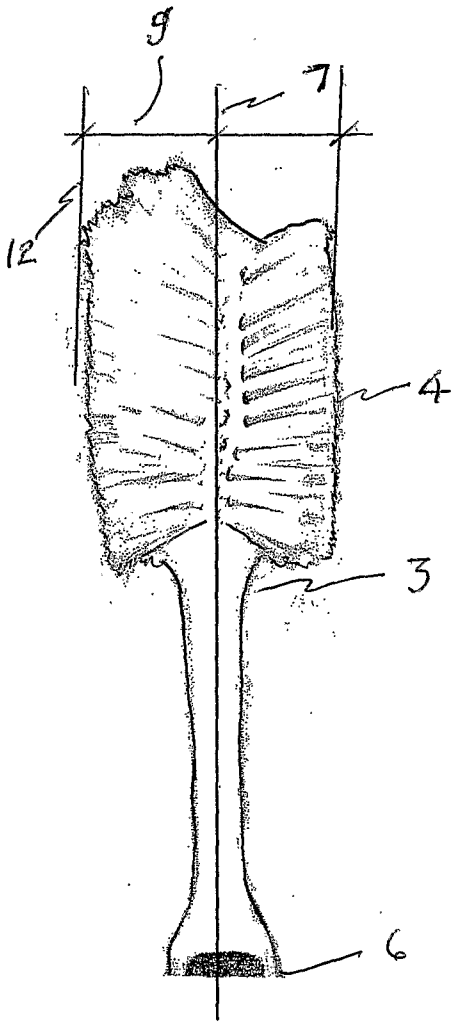

FIGURE 5

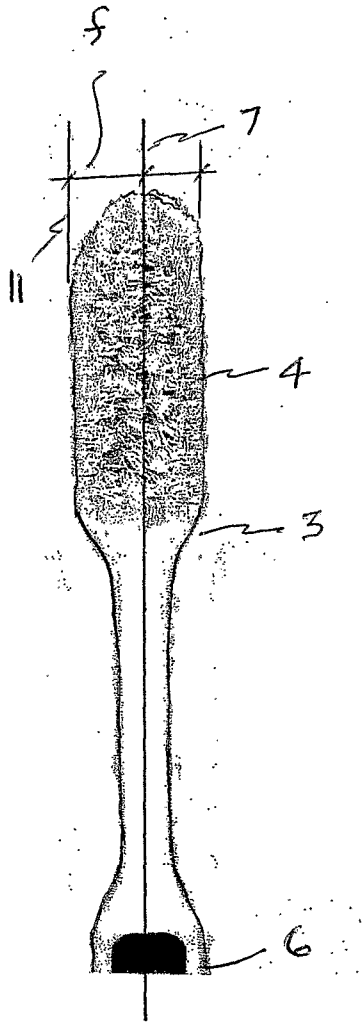

FIGURE 4

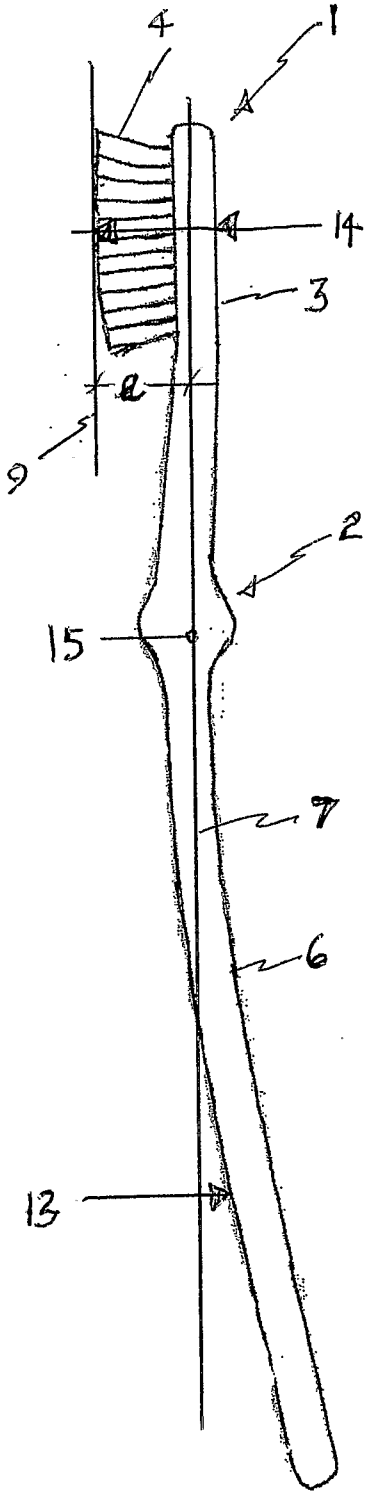

FIGURE 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2009/000705

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

A46B 5/00 (2006.01) ***A46B 9/04*** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

1. WPI, EPODOC: Keywords(Toothbrush, handle, deflect, load, force, dissipate, bristle, tuft, plastic) and like terms
2. USPTO & ESP@CE: Keywords(Toothbrush, composite, deflect, load, bristle, hard, medium, soft, plastic, diameter) and like terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	AU 13665/88 (618528) B (BLENDAX-WERKE R SCHNEIDER GMBH & CO.) 2 January 1992	
X	Figures 1-8 ; page 2, lines 4-21; page 5, lines 8-11	1-5, 8-11, 19
Y	Figures 1-8	6, 7
	US 6502272 B1 (FOX et al.) 7 January 2003	
X	Figures 1-6; column 3, lines 51-60; column 2, lines 2-6	1-5, 8-11, 19
Y	Figures 1-6	6, 7
	US 5146645 A (DIRKSING) 15 September 1992	
X	Figures 1-2; column 5, lines 52-54; column 7, line 58; column 4, lines 39-43; column 2, lines 43-52	1-5, 8-11, 19
Y	Figures 1-2	6, 7

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

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Date of the actual completion of the international search
24 July 2009

Date of mailing of the international search report 07 AUG 2009

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	EP 0371293 B1 (PROCTER & GAMBLE GMBH) 31 January 1996	
X Y	Figures 1-4; column 1, lines 12-22; column 1, lines 52-57; column 2, lines 47-52; column 3, lines 9-18	1-5, 8-11, 19 6, 7
	WO 2001/043582 A1 (JORDAN AS) 21 June 2001	
X Y	Figures 1-3; page 2, lines 12-19; page 3, lines 27-29; page 1, lines 19-23; page 2, lines 8-19	1-5, 8-11, 19 6, 7
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X Y	Figures 1-5; column 2, lines 18-25; column 1, lines 11-14; column 4, lines 22-27	1-5, 8-11, 19 6, 7
	EP 0648448 B1 (PONZINI S.P.A) 2 September 1998	
Y	column 5, lines 12-16	6, 7
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A	Whole document	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU2009/000705

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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		NO	894524				
WO	2001/043582	AU	20317/01	EP	1237439	NO	996303
US	5765254	AU	10866/97	BR	9611829	EP	0955832
		MX	9804170	WO	1997/019616		
EP	0648448	IT	MI932179				
US	4520526	NONE					

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX