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Uchida et al.(10) **Pub. No.: US 2012/0233791 A1**(43) **Pub. Date: Sep. 20, 2012**(54) **BRUSH BODY AND TOOTHBRUSH**(30) **Foreign Application Priority Data**(75) Inventors: **Satoshi Uchida, Shiga (JP);**
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A46B 13/02 (2006.01)(52) **U.S. Cl.** **15/22.2; 15/167.1**(21) Appl. No.: **13/512,899**(57) **ABSTRACT**(22) PCT Filed: **Dec. 20, 2010**(86) PCT No.: **PCT/JP2010/072918**§ 371 (c)(1),
(2), (4) Date: **May 31, 2012**

Provided is a brush body for selectively applying localized currents, for oral care, to oral interstices such as periodontal pockets. Said brush body has a plurality of bristle bundles in a brush head. A bristle bundle contains a bristle having a core and a sheath. The core comprises a conductive member and the sheath comprises an insulating member that covers that core. At the tip portion of the bristle, the core protrudes further than the sheath and acts as an electrode.

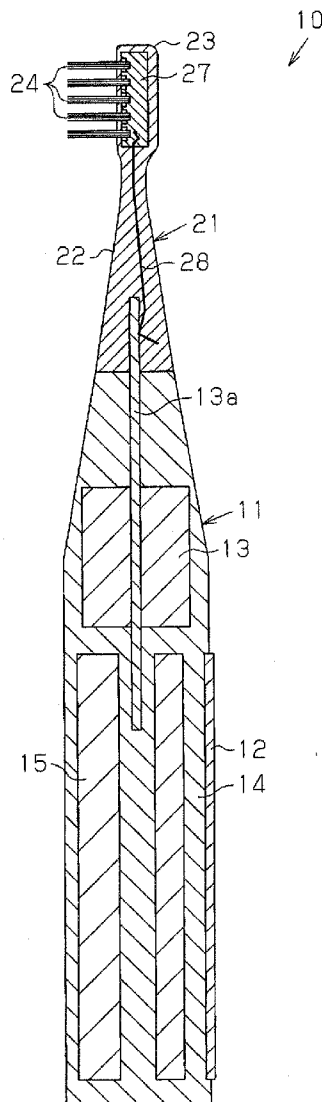


Fig.1

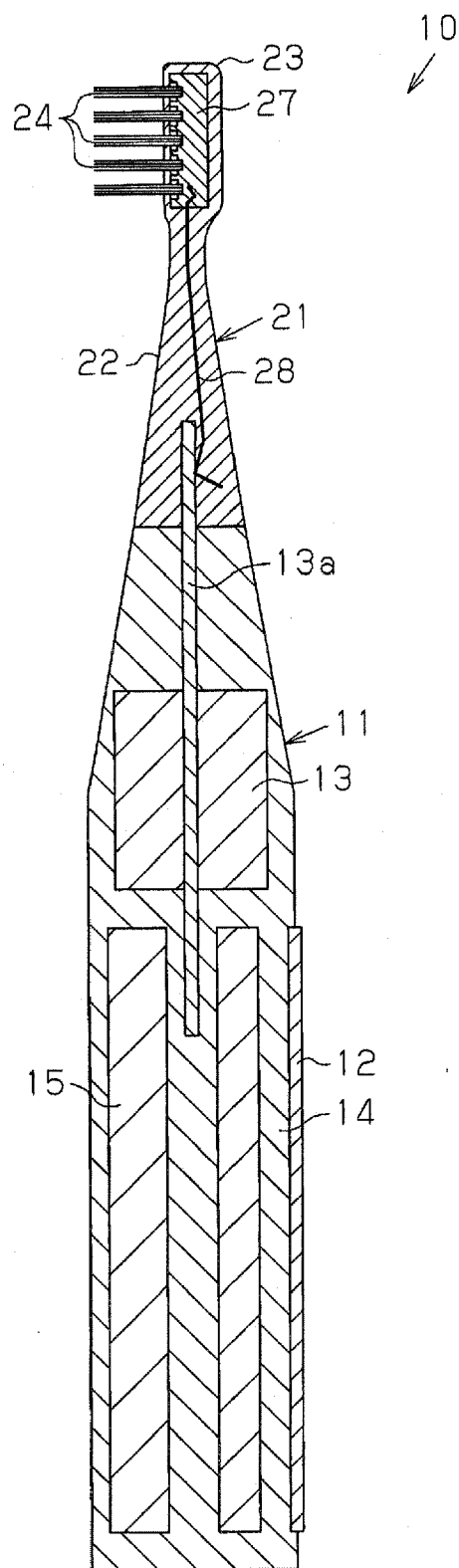


Fig.2B

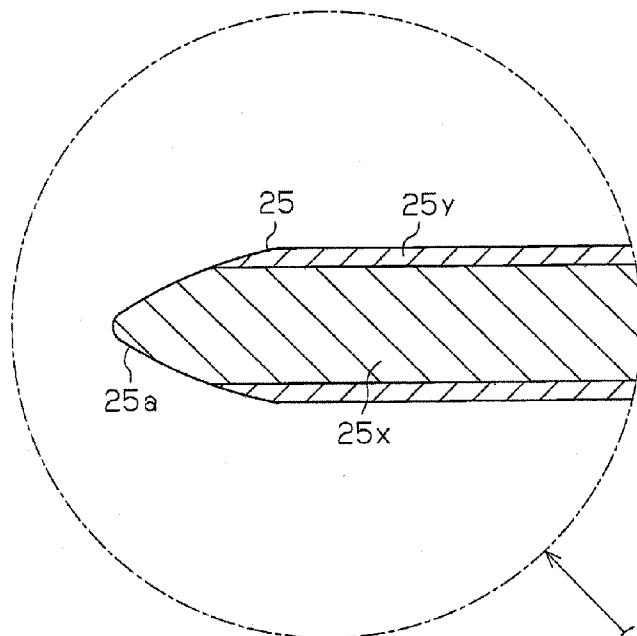
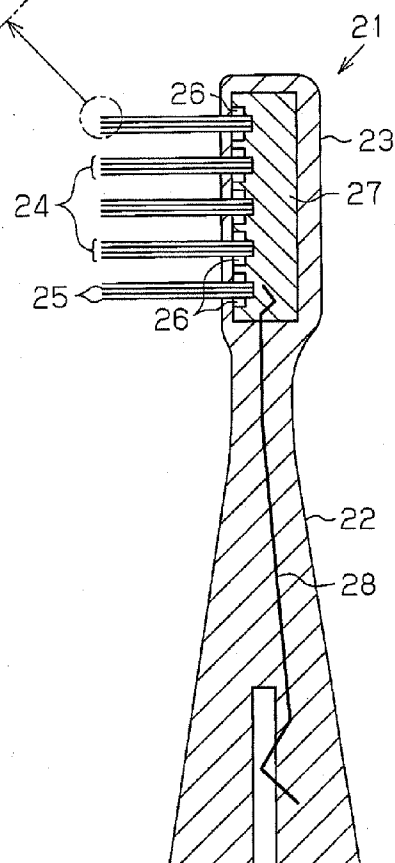


Fig.2A



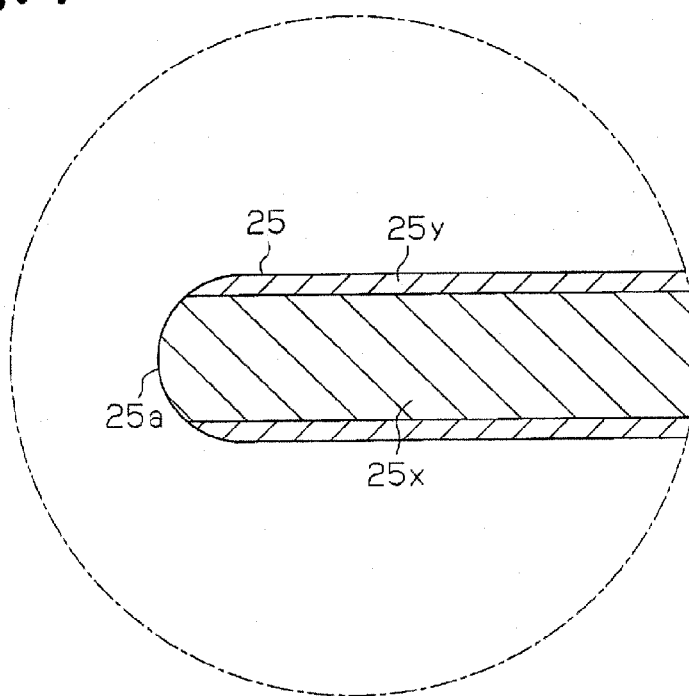
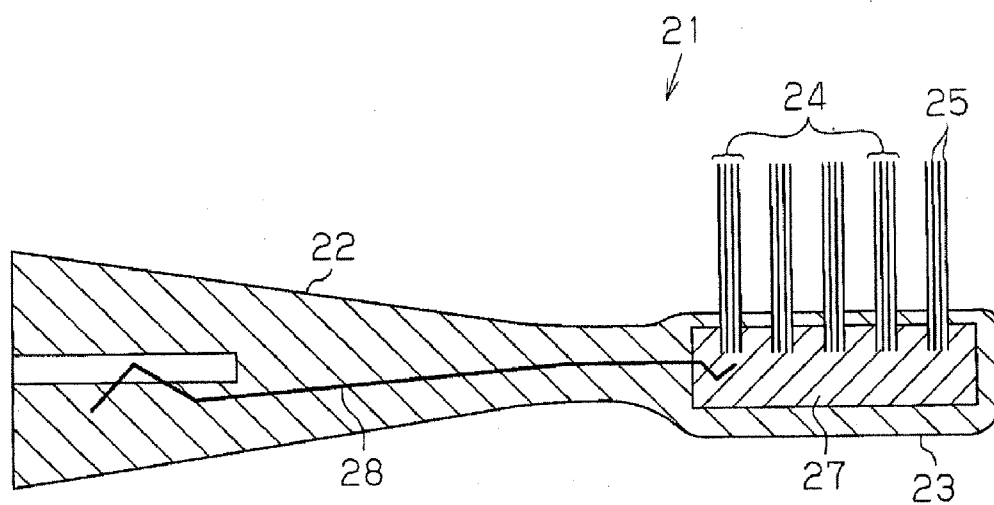


Fig.5



BRUSH BODY AND TOOTHBRUSH**TECHNICAL FIELD**

[0001] The present invention relates to toothbrushes for oral care provided with an energizing function and to brush bodies used for such toothbrushes.

BACKGROUND ART

[0002] Various types of toothbrushes for oral care provided with an energizing function have been proposed in the prior art. For example, patent documents 1 to 3 listed below disclose toothbrushes that generate chlorine, which has a sterilization effect, from chloride ions included in an oral cavity fluid, such as saliva.

[0003] In detail, the toothbrush of patent document 1 includes a first electrode, which is arranged proximal to a brush head where bristles (brush bristles) are embedded, and a second electrode, which is arranged in a grip of the toothbrush. During use of the toothbrush, the first electrode, the second electrode, the human body, and the oral cavity fluid form an electric circuit that generates chlorine through electrolysis of the oral cavity fluid near the first electrode of the brush head.

[0004] The toothbrushes illustrated in patent documents 2 and 3 each include first and second electrodes that are both arranged in a brush head where bristles (brush bristles) are embedded. During use of the toothbrush, an electric circuit formed in the oral cavity between the first and second electrodes generates chlorine through electrolysis of the oral cavity fluid near the first electrode of the brush head. FIG. 7 of patent document 1 discloses another example Paragraph 0033 of patent document 2 and paragraph 0041 of patent document 3 describe further examples in which the bristles are entirely used as electrodes.

[0005] Patent document 4 illustrates a toothbrush using parts of bristles as electrodes in the same manner as the structure shown in FIG. 7 of patent document 1. Each bristle has a double-layer structure including a conductive core and an insulative sheath. The electrodes of the bristles in patent document 4 detect plaque.

[0006] Patent document 5 discloses a toothbrush that energizes the oral cavity through a conductive body arranged in a brush head, which supports bristles, to perform sterilization and promote blood circulation in the gum.

[0007] Patent document 6 discloses an ion toothbrush including a conductive member partially exposed through a window in the brush head and having an electric effect that weakens the bonding of teeth surface and plaque to facilitate the removal of plaque.

[0008] Patent document 7 discloses an electronic toothbrush that supplies pulse current to bristles in order to draw fluorine ions into the teeth surface.

PRIOR ART LITERATURE**Patent Documents**

[0009] Patent Document 1: Japanese Laid-Open Patent Publication No. 6-90824

[0010] Patent Document 2: Japanese Laid-Open Patent Publication No. 2006-102095

[0011] Patent Document 3: Japanese Laid-Open Patent Publication No. 2006-180953

[0012] Patent Document 4: Japanese National Phase Laid-Open Patent Publication No. 2000-504605

[0013] Patent Document 5: Japanese Laid-Open Patent Publication No. 60-45362

[0014] Patent Document 6: Japanese Laid-Open Patent Publication No. 2001-309820

[0015] Patent Document 7: Japanese Laid-Open Patent Publication No. 2006-223369

SUMMARY OF THE INVENTION**Problems that are to be Solved by the Invention**

[0016] In narrow gaps formed in the oral cavity, such as periodontal pockets between the teeth and gum, bacteria easily breed. Thus, from the viewpoint of oral hygiene, concentrated oral care of such narrow gaps in the oral cavity is effective during normal brushing with a toothbrush.

[0017] In a toothbrush including an electrode in the brush head such as in patent documents 1 to 3, the electrode may not be sufficiently immersed in oral cavity fluid, which forms part of the electric circuit, and the generation of chlorine may become insufficient. Further, the electrode of the brush head is separated from periodontal pockets. Thus, chlorine cannot be directly supplied to the periodontal pockets, and effective sterilization of the periodontal pockets cannot be performed. For the electrode to be sufficiently immersed in oral cavity fluid and be arranged proximal to periodontal pockets, it is preferable that the bristles be used as the electrode like patent document 6 and the further examples of patent documents 1 to 3.

[0018] However, in the further examples of patent documents 2 and 3, the bristles are entirely used as electrodes. Thus, the bristles entirely diffuse current to the entire oral cavity through the oral cavity fluid. In this case, the odor of the large amount of generated chlorine becomes a problem. When changing settings to decrease the odor, sufficient chlorine may not be locally supplied to the periodontal pockets.

[0019] In the further examples of patent document 1, the flat distal end surface of each bristle functions as the electrode. However, each bristle is relatively thin. Thus, the exposed area of the flat distal end surface is insufficient for electrolysis, and sufficient chlorine may not be generated.

[0020] In patent document 4, the electrode exposed from the distal end surfaces of each bristle is used to detect plaque. Thus, the electrode is not suitable for being energized for oral care.

[0021] The toothbrushes of patent documents 5 and 6 include electrodes in the brush heads and that have the same problem as patent documents 1 to 3.

[0022] The object of the electronic toothbrush of patent document 7 is to supply fluorine ions to the teeth surface and is not intended for locally energizing periodontal pockets. Rather, in the case of the electronic toothbrush of patent document 7, it is preferable that the entire surface of each bristle function as an electrode so that contact occurs more frequently with the teeth surface.

[0023] The present invention solves the above problems. It is an object of the present invention to provide a brush body and a toothbrush that selectively performs localized energizing for oral care at gaps in the oral cavity such as periodontal pockets.

Means for Solving the Problem

[0024] One aspect of the present disclosure provides a brush body including a plurality of bristle bundles on a brush

head. The plurality of bristle bundles includes a bristle that includes a core, which is formed by a conductive member, and a sheath, which covers the core and is formed by an insulative member. The core projects from the sheath at a tip portion of the bristle and functions as an electrode that energizes an oral cavity.

[0025] In one example, a portion inserted into the oral cavity is at least partially covered by the insulative member.

[0026] In one example, the brush body includes a front surface on which the bristle bundles are embedded and a rear surface opposite to the front surface. The insulative member covers at least the rear surface.

[0027] In one example, the portion inserted into the oral cavity excluding the tip portion of the bristle is covered by an insulative member.

[0028] In one example, the tip portion of the bristle has a pointed shape, and at least part of the pointed shape is formed by the core.

[0029] In one example, the tip portion of the bristle has a semispherical shape, and at least part of the semispherical shape is formed by the core.

[0030] In one example, the sheath of the bristle is formed by a material having a lower hardness than a material that forms the core.

[0031] In one example, the electrode generates chlorine having a sterilization effect through electrolysis of oral cavity fluid that is proximal to the electrode.

[0032] A further aspect of the present disclosure provides a toothbrush including the brush body of the first aspect and an energizing means for supplying the electrode of the bristle with current for local energizing.

[0033] In one example, the toothbrush includes an oscillation actuator that oscillates the brush head, on which the bristle bundles are embedded.

Effect of the Invention

[0034] The present invention provides a brush body and toothbrush that selectively performs localized energizing for oral care at gaps in the oral cavity such as periodontal pockets.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] FIG. 1 is a schematic cross-sectional view showing the structure of a toothbrush in an embodiment;

[0036] FIG. 2 is a cross-sectional view showing a brush body of the toothbrush of FIG. 1;

[0037] FIG. 3 is a cross-sectional view showing a brush body in a further example;

[0038] FIG. 4 is a cross-sectional view showing a tip portion of a bristle in a further example; and

[0039] FIG. 5 is a cross-sectional view showing a brush body in a further example.

EMBODIMENTS OF THE INVENTION

[0040] One embodiment of the present invention will now be described with reference to the drawings.

[0041] As shown in FIG. 1, a toothbrush 10 of the present invention includes a main body, or grip 11, which can be held by a user, and a brush body 21, which can be attached in a removable manner to a distal portion of the grip 11. The brush body 21 includes a brush stem 22 and a brush head 23. Bristle bundles 24 are embedded on the brush head 23. An oscillation actuator 13 in the grip 11 drives and oscillates the brush head 23 in an axial direction (longitudinal direction) to electrically

perform brushing or the like. The brush stem 22 and the brush head 23 may also be referred to as insulative members.

[0042] The grip 11 of the toothbrush 10 may be generally cylindrical so that it is easy to hold. The grip 11 has an outer surface including a grip electrode 12, which comes into contact with the user who is holding the grip 11, and a switch (not shown). The oscillation actuator 13, a battery 14, which is formed by a rechargeable battery or a primary battery, and a control circuit (circuit substrate) 15, which controls the supply of power from the battery 14 to the oscillation actuator 13 based on the operation of the switch, are arranged in the grip 11. The oscillation actuator 13 includes an output shaft 13a, which projects out of the distal portion of the grip 11. The brush body 21 (basal portion of the brush stem 22) is attached to cover the projected output shaft 13a.

[0043] As shown in FIG. 2, the brush head 23 of the brush body 21 includes the bristle bundles 24 to remove plaque and the like. Each bristle bundle 24 includes a basal portion fixed to the brush head 23. In one example, filaments or bristles 25 are bundled. Each bundle is folded in a U-shaped manner so as to sandwich a metal holding plate 26. The folded portion of each bundle and the holding plate 26 are pressed together into brush head 23 to fix or embed the bristle bundles 24 to the brush head 23.

[0044] In the illustrated example, each bristle 25 has a double-layer structure including a core 25x, which is formed from a flexible conductive resin (for example, polyamide resin containing carbon or polybutylene terephthalate resin containing carbon), and a sheath 25y, which covers the core 25x and is formed from a flexible insulative resin (for example, polyamide resin that does not contain carbon or polybutylene terephthalate resin that does not contain carbon). The insulative resin forming the sheath 25y and the conductive resin forming the core 25x are both flexible materials (elastic materials). It is preferable that the resin forming the sheath 25y have a lower hardness than the resin forming the core 25x.

[0045] Each bristle 25 includes a generally conical or pointed tip portion 25a. The tip portion 25a is formed by the core 25x that projects from the sheath 25y. In other words, the core 25x includes a generally conical or pointed distal end that is not covered by the sheath 25y.

[0046] In one example, the projected length of the bristle 25 from the brush head 23 is preferable set to about 10 mm or greater, for example, about 20 mm. The length of the generally conical or pointed portion is set to about 2 mm, the diameter of each bristle 25 is set to about 0.2 mm, and the thickness of the sheath 25y is set to about 0.06 mm. In the drawing, the core 25x is illustrated with a slightly exaggerated diameter. The dimensions are not limited in the above-described manner.

[0047] When embedding the bristle bundles 24 in the brush head 23, each of the bristles 25 is electrically connected by the metal holding plate 26 to a conductive base 27 in the brush head 23. The base 27 is formed by a conductive resin, and the brush head 23, excluding the base 27, and the brush stem 22 are formed from an insulative resin. When attaching the brush body 21 to the grip 11, the conductive base 27 is electrically connected to the output shaft 13a of the oscillation actuator 13 by a connection terminal 28 that is arranged extending along the brush stem 22. This electrically connects the core 25x of each bristle 25 to the control circuit 15 via the holding plate 26, the base 27, the connection terminal 28, and the output shaft 13a. The grip electrode 12 of the grip 11 is also con-

nected to the control circuit 15. The core 25x of each bristle 25 functions as a first electrode, and the grip electrode 12 functions as a second electrode.

[0048] In the toothbrush 10 having such a structure, based on a switch operation performed by the user, the oscillation actuator 13 drives and oscillates the brush head 23. This improves the brushing capability and produces a massaging effect on the gum.

[0049] When using the toothbrush 10, while the user holds the grip 11 in contact with the grip electrode 12 (second electrode), the core 25x (first electrode) in the tip portion 25a of each bristle 25 comes into contact with oral cavity fluid, such as saliva. Accordingly, the control circuit 15, the grip electrode 12, the human body, the oral cavity fluid such as saliva, and the core 25x of the bristle 25 form an electric circuit. The control circuit 15 applies a DC voltage of, for example, 15 V. Based on the applied voltage, the tip portion 25a of the bristle 25 performs local energizing for oral care with the oral cavity fluid around the core 25x.

[0050] Bacteria easily breeds and plaque tends to remain in gaps in the oral cavity such as periodontal pockets between the teeth and gum or between teeth. The core 25x projects from the tip portion 25a of the bristle 25 and can thus enter gaps in the oral cavity. Thus, the brush body 21 can perform concentrated oral care at gaps in the oral cavity. The shape of the projection of the core 25x increases the energizing area and thus ensures sufficient energizing area for local energizing. Further, the conductive portion is only the core 25x at the tip portion 25a, and other parts of the brush body 21 excluding the core 25x at the tip portion 25a are covered by the insulative members. Thus, unnecessary current diffusion is prevented, and current can be concentrated at the core 25x of the tip portion 25a. The brush body 21 achieves these effects at the same time and can thus selectively perform local energizing for oral care in at least gaps in the oral cavity.

[0051] An energizing means of the toothbrush 10 includes, in particular, the control circuit 15 and the core 25x.

[0052] The present embodiment has the characteristic advantages described below.

[0053] (1) In the present embodiment, the bristles 25 embedded in the brush head 23 each includes the core 25x, which is formed by a conductive member, and the sheath 25y, which is formed by an insulative member that covers the core 25x. The core 25x projecting from the sheath 25y at the tip portion 25a of the bristle 25 functions as an electrode. That is, the core 25x projects from the sheath 25y at the tip portion 25a of the bristle 25. The distal end of the core 25x can enter gaps in the oral cavity, such as periodontal pockets. The distal end of the core 25x can perform concentrated local energizing for oral care in gaps in the oral cavity. Further, due to the projection shape of the core 25x, sufficient energizing area is ensured for local energizing during oral care. Further, in at least the portion of the brush body 21 inserted into the oral cavity, the exposed conductive portions are only the cores 25x in the tip portion 25a. The other parts of the tip portion 25a excluding the cores 25x are covered by the insulative member. This prevents the diffusion of unnecessary current and concentrated current at the core 25x in the tip portion 25a. The brush body 21 achieves these effects at the same time. Thus, local energizing for oral care can be performed further effectively at gaps in the oral cavity such as periodontal pockets.

[0054] The cores 25x in the tip portion 25a directly contact the teeth surface and the gum. Thus, the brush body 21 can separately and locally energize various portions in the oral

cavity such as the teeth surface and the gum. Accordingly, the brush body 21 selectively obtains a desirable oral care effect for the user at portions in the oral cavity intended by the user. The oral care effect of the local energizing achieves one or more, preferably, all of sterilization, blood circulation promotion of the gum, the drawing of ions into the teeth surface, and the promotion of plaque removal.

[0055] (2) In the present embodiment, the brush body 21 is covered by an insulative member excluding the tip portions 25a of the bristles 25. This ensures prevention of unnecessary current diffusion from the brush body 21 and further increases efficiency of local energizing for oral care.

[0056] (3) In the present embodiment, the tip portion 25a of the bristle 25 has a pointed structure, and the core 25x is projected from the sheath 25y. Thus, the core 25x of the tip portion 25a can perform local energizing by deeply entering gaps in the oral cavity such as periodontal pockets. The shape of the core 25x is effective for sterilizing bacteria in gaps in the oral cavity.

[0057] (4) In the present embodiment, the sheaths 25y of the bristles 25 are formed by a flexible material having a lower hardness than the cores 25x. This softens contact of the bristles 25 with the gum or the like and lessens the stimuli received by the user.

[0058] (5) In the present embodiment, the brush body 21 is applied to the toothbrush 10 that includes the oscillation actuator 13. This improves the brushing capability and produces a massaging effect on the gum.

[0059] The embodiment of the present invention may be modified as described below.

[0060] In the above embodiment, the bristles 25 (bristle bundles 24) embedded in the brush head 23 all have a double-layer structure of an electrode, or the core 25x, and the sheath 25y. Such bristles 25, which include electrodes, may be selectively used for only predetermined bristle bundles 24 or be selectively used as predetermined bristles 24 in a bristle bundle 24.

[0061] In the above embodiment, the entire brush body 21 excluding the tip portions 25a of the bristles 25 is covered by insulative members. However, the brush head 23 and the brush stem 22 may partially be covered by insulative members to prevent unnecessary current diffusion.

[0062] For example, in the form of FIG. 3, the brush body 21 includes a front surface (also referred to as brush surface), on which the bristle bundles 24 are embedded, and a rear surface, which is opposite to the front surface. The rear surface is covered by a rear surface coating 21y, which is formed from an insulative resin. The rear surface of the brush body 21 is apt to coming into contact with the wall surface of the oral cavity during use. Thus, by covering at least the rear surface with the rear surface coating 21y, which is an insulative member, unnecessary current diffusion may be prevented in a preferable manner while decreasing the area and used amount of the insulative member. This also contributes to increasing the efficiency of local energizing. In the form of FIG. 3, the shape of the base 27, which is formed from conductive resin and connected to the bristle bundles 24, is enlarged.

[0063] In the above embodiment, the tip portion 25a of each bristle 25 has a pointed shape, and the core 25x projects from the sheath 25y. However, the shape of the tip portion 25a of the bristle 25 may be changed as required.

[0064] For example, as shown in FIG. 4, the tip portion 25a of the bristle 25 may be semispherical, and the core 25x may project from the sheath 25y. This softens contact of the tip

portion **25a** of the bristle **25** with the gum or the like and lessens the stimuli during use.

[0065] Further, the core **25x** projecting from the sheath **25y** may simply be cylindrical.

[0066] In the above embodiment, the sheath **25y** of the bristle **25** has a lower hardness than the core **25x** but is not limited in such a manner. For example, the sheath **25y** and the core **25x** may have about the same hardness.

[0067] In the above embodiment, the bristle bundles **24** are folded in a U-shaped manner so as to sandwich the metal holding plates **26**. However, for example, as shown in FIG. 5, basal ends of the bristle bundles **24** may be embedded in the brush head **23** without bending the bristle bundles **24** (without using the holding plates **26**).

[0068] In the above embodiment, saliva is illustrated as one example of oral cavity fluid. However, the oral cavity fluid may be a solution other than saliva such as a solution including chloride ions or an oral cavity care solution. In a non-restrictive example, the electrode may generate chlorine, which has a sterilization effect, through electrolysis of the oral cavity fluid near the electrode.

[0069] In the toothbrush **10** of the above embodiment, the brush body **21** is supported so that it can be attached in a removable manner to the grip **11**. However, the brush body **21** may be formed integrally with the grip **11**. The oscillation actuator **13** may be eliminated.

DESCRIPTION OF THE REFERENCE CHARACTERS

[0070] **10**: toothbrush, **13**: oscillation actuator, **15**: control circuit (energizing means), **21**: brush body, **21y**: rear surface coating (insulative member), **22**: brush stem (insulative member), **23**: brush head (insulative member), **24**: bristle bundle, **25**: bristle, **25a**: tip portion, **25x**: core (electrode, energizing means), **25y**: sheath (insulative member).

1. A brush body comprising a plurality of bristle bundles on a brush head, wherein:

the plurality of bristle bundles includes a bristle that includes a core, which is formed by a conductive member, and a sheath, which covers the core and is formed by an insulative member; and

the core projects from the sheath at a tip portion of the bristle and functions as an electrode that energizes an oral cavity.

2. The brush body according to claim **1**, wherein a portion inserted into the oral cavity is at least partially covered by the insulative member.

3. The brush body according to claim **2**, wherein the brush body includes a front surface on which the bristle bundles are embedded and a rear surface opposite to the front surface, wherein the insulative member covers at least the rear surface.

4. The brush body according to claim **2**, wherein the portion inserted into the oral cavity excluding the tip portion of the bristle is covered by an insulative member.

5. The brush body according to claim **1**, wherein the tip portion of the bristle has a pointed shape and at least part of the pointed shape is formed by the core.

6. The brush body according to claim **1**, wherein the tip portion of the bristle has a semispherical shape, and at least part of the semispherical shape is formed by the core.

7. The brush body according to claim **1**, wherein the sheath of the bristle is formed by a material having a lower hardness than a material that forms the core.

8. The brush body according to claim **1**, wherein the electrode generates chlorine having a sterilization effect through electrolysis of oral cavity fluid that is proximal to the electrode.

9. A toothbrush comprising:

the brush body according to claim **1**; and
an energizing means for supplying the electrode of the bristle with current for local energizing.

10. The toothbrush according to claim **9**, further comprising an oscillation actuator that oscillates the brush head.

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