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(54) **ORAL CARE DEVICE WITH A FUNCTION ELEMENT**

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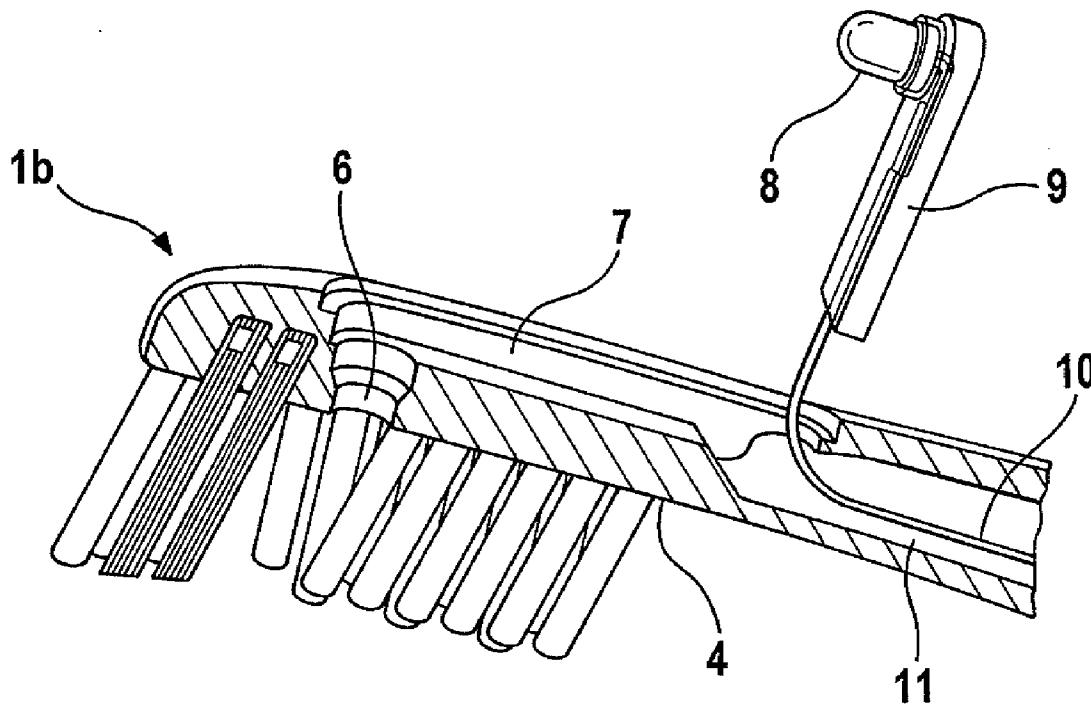
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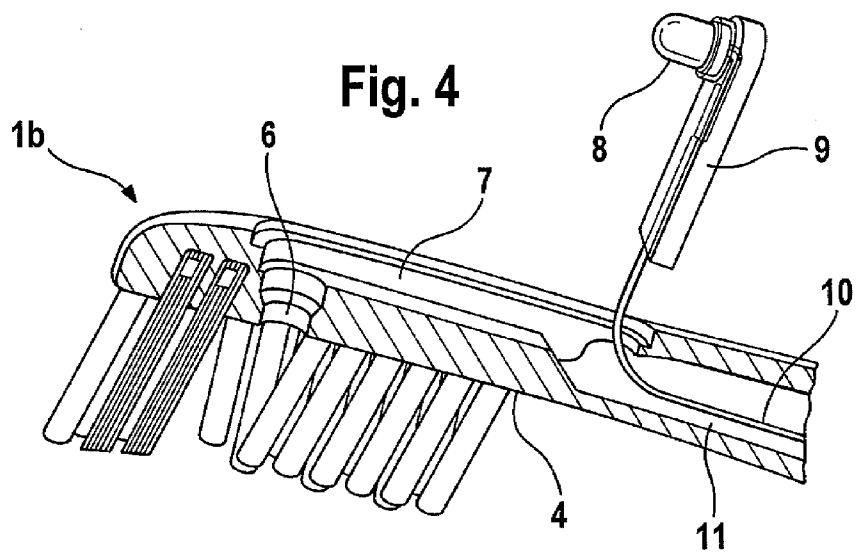
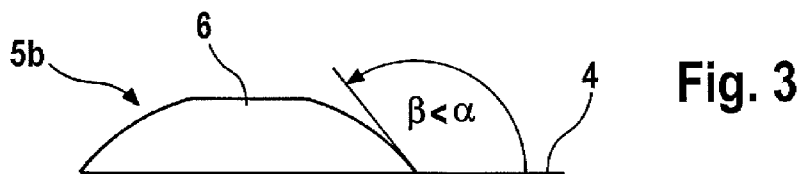
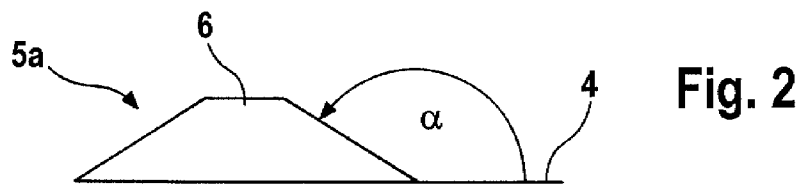
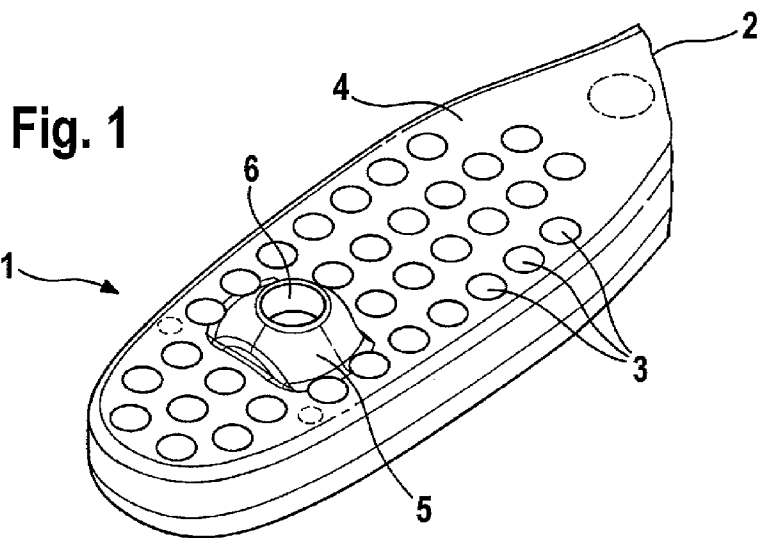
(57) **ABSTRACT**

An oral care device having a handle and a head connectible thereto, on which oral care elements are provided along with a function element. The device also includes a ramp disposed adjacent the function element.

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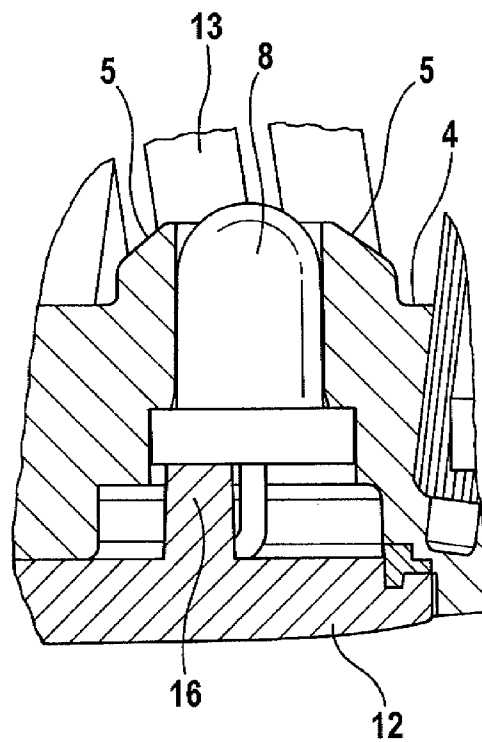
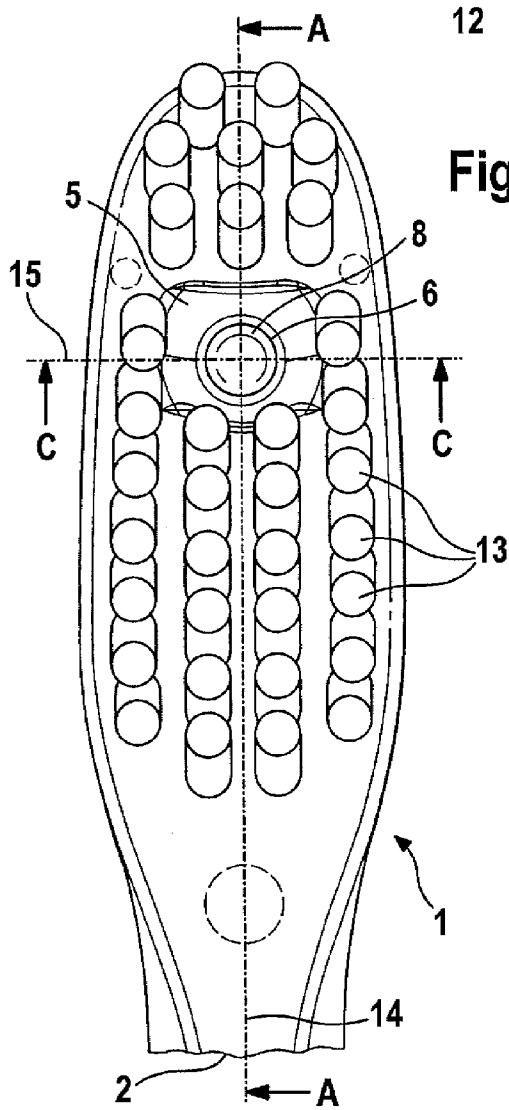
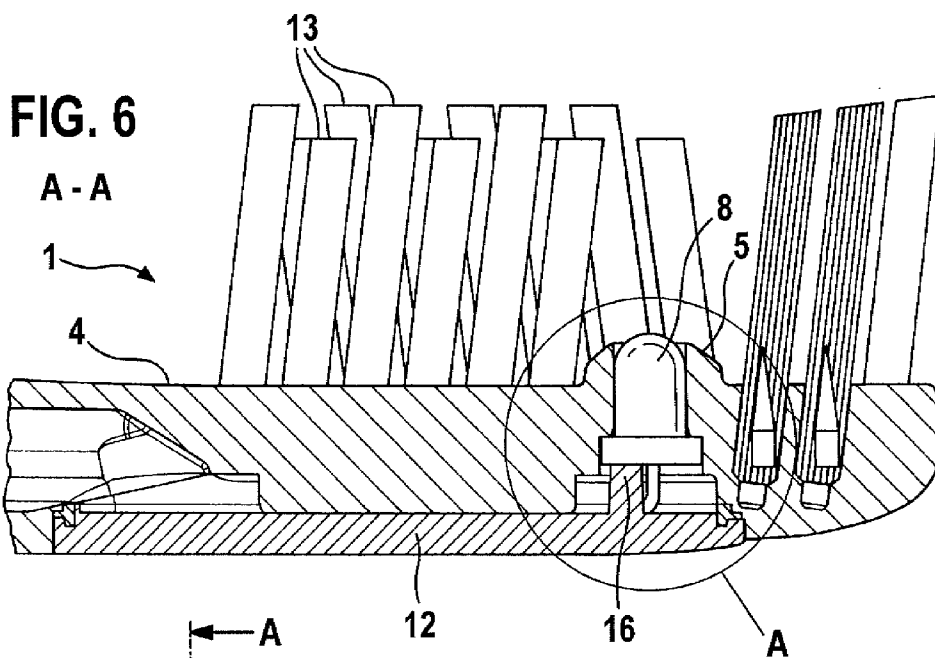


Fig. 7

FIG. 8
C - C

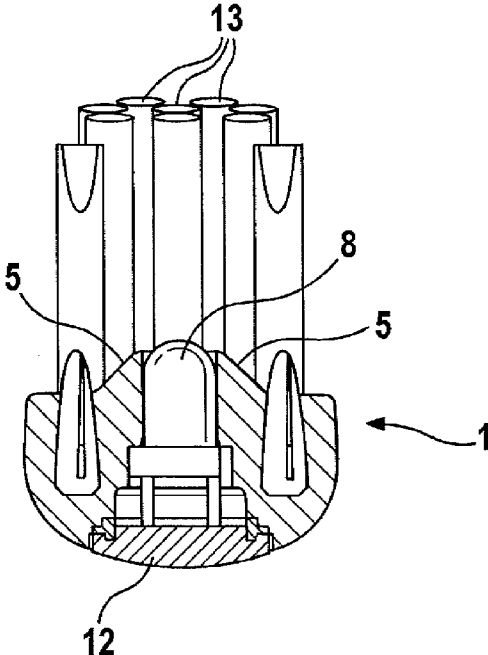
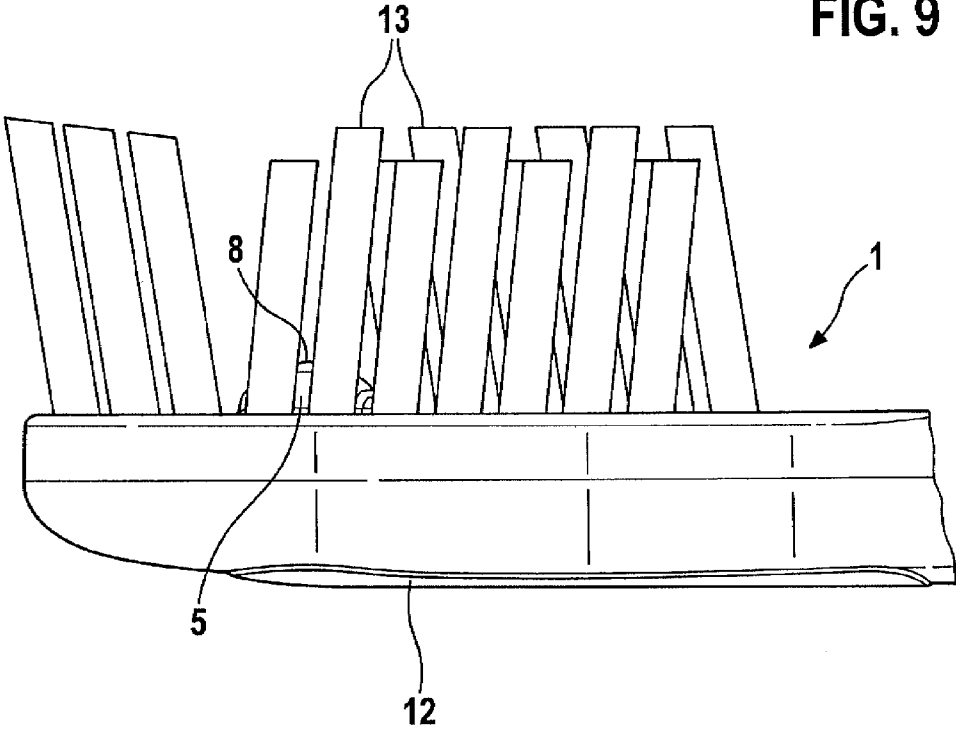


FIG. 9



ORAL CARE DEVICE WITH A FUNCTION ELEMENT

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation-in-part application of prior copending International Application No. PCT/US2009/053812, filed Sep. 1, 2009, designating the United States.

FIELD OF THE INVENTION

[0002] This invention relates to an oral care device such as a toothbrush and a method of manufacturing such a toothbrush.

BACKGROUND OF THE INVENTION

[0003] Known from the prior art are various oral care devices which are constructed in particular as toothbrushes and have an electrically operable function element such as an LED emitting light. In some of these cases efforts are made to arrange the LED within the toothbrush head so that the electrically operable function element is fully encapsulated in the toothbrush plastic and hence no moisture-related problems are encountered.

[0004] Efforts to arrange the function element as near as possible to the teeth to be cleaned, however, can lead to handling problems during oral care.

[0005] It would thus be desirable to provide an oral care device which enables an arrangement of an electrically operable function element on the head as near as possible to the oral care site while providing safe and user-friendly handling.

[0006] Further, advantages, features and application possibilities of the present invention will become apparent from the subsequent description of embodiments with reference to the accompanying drawings. It will be appreciated that any feature described and/or represented by illustration, when used singularly or in any meaningful combination, forms the subject-matter of the present invention, irrespective of their summary in the claims or their back-reference.

SUMMARY OF THE INVENTION

[0007] An oral care device that has a handle and a head connectible thereto on which oral care elements are provided. The head further includes an electrically operable function element being arranged on an outer surface of the head, and a ramp disposed adjacent the function element.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a perspective view of the head of an oral care device, shown devoid of certain oral care elements, according to an embodiment of the invention;

[0009] FIG. 2 is a schematic representation of a first ramp;

[0010] FIG. 3 is a schematic representation of a second ramp;

[0011] FIG. 4 is a longitudinal sectional view of a head of an oral care device with electrically operable function element;

[0012] FIG. 5 is a top plan view of the head of the oral care device of FIG. 1 showing oral care elements and LED;

[0013] FIG. 6 is a longitudinal sectional view taken along the line A-A of FIG. 5;

[0014] FIG. 7 is a view of an enlarged detail within the circle A of FIG. 6;

[0015] FIG. 8 is a cross-sectional view of the head taken along the line C-C of FIG. 5; and

[0016] FIG. 9 is a side view of the head of FIG. 5.

DETAILED DESCRIPTION OF THE INVENTION

[0017] FIG. 1 shows a perspective plan view of the head of an oral care device, which according to this embodiment is part of a manual toothbrush. As is customary with manual toothbrushes, the schematically represented breakaway line 2 leads into a neck portion and a handle portion. Electric leads may be disposed in the neck portions for operating an electric function element. The leads may lead to an ON/OFF switch of a power supply and to other devices in the handle. The oral care elements provided for this embodiment may include tufts of cleaning bristles which can be fastened in apertures 3 in the head 1 in any manner known in the art. According to the present embodiment, the tufts of cleaning bristles are anchored in the head using the anchor tufting method. Other oral care elements, for example, elastomer cleaning elements, which are fastened in or molded on the head, can be provided as an alternative or in addition. FIG. 1 shows only the head without these oral care elements, such as when it leaves the die after the injection-molding process. The outer surface 4 of the head, on which the oral care elements can be fastened, may include in the front half of the head or in the front third of the distal end of the head a ramp 5 which is constructed such that it protrudes from the plane level of the outer surface in the direction of the bristle ends. Provided inside the ramp 5 is a mounting hole 6 for the electrically operable function element.

[0018] FIGS. 2 and 3 show schematically two of numerous possible embodiments of the ramp 5. The ramp 5a of FIG. 2 is equipped with circumferential inclined surfaces such as to produce a truncated cone as the ramp. A user's tooth surface, which through pressing down of the surrounding bristles comes into contact with the outer surface 4 and the ramp 5a, slides from the outer surface 4 to the ramp along the obtuse angle α which equals between about 110° and about 170° . By comparison, FIG. 3 shows an obtuse convex configuration on which the outer surfaces of the ramp are arched outwardly. The initial angle β between the outer surface 4 and a tangent applied to the ramp 5b at the starting point of said ramp through the outer surface is smaller than the angle α with inclined surfaces according to FIG. 2. Although an obtuse angle significantly greater than about 90° is also provided in this case with the angle β of FIG. 3, a user's tooth flank will slide less comfortably along this ramp than along a ramp with a larger obtuse angle α according to FIG. 2. Hence, an obtuse angle over the ramp surface or a gradual transition from the outer surface 4 to the ramp 5 may be desired. The ramps presented schematically in FIGS. 2 and 3 are suitable for use in a typical toothbrush. For example, the ramp is generally not flat and the angle α or β are typically not obtuse with nearly 180° because then a tufting of bristles in a large plane region of the outer surface 4 of the head 1 would be difficult. Also, a role is played in the specific construction of the ramp by the tufting direction of the bristles or inclination of the bristle tufts toward the head and the user's intended cleaning direction.

[0019] FIG. 4 shows a longitudinal section through a head 1b. The ramp 5 may also be provided for this head, although it is not shown in this Figure. FIG. 4 shows the installation of

the electrically operable function element in the head *1b* schematically. The electrically operable function element provided may be an LED **8** whose connection wires with a wire connection **10** are equipped separately with an encapsulation **9** so that the electric connection wires of the LED **8** are protected from moisture ingress. The LED **8** may be inserted from the rear through the brush head and a larger cavity **7** so that there is also space for accommodating the encapsulation **9** in the cavity **7**. The electric wire **10** may be passed through a hollow space in the toothbrush neck which connects the head to the handle. The LED **8** may be pressed into the mounting hole **6**, such as, for example, with a press fit.

[0020] According to this embodiment, both the LED **8** and the head *1b* (or **1**) is made from a hard plastic material so that a slightly smaller dimensioning of the mounting hole **6** compared to the outer diameter of the LED **8** is suitable for the press fit. Alternatively, the LED **8** or the head may be formed at least partly from a soft plastic material such as TPE. The head material can be optionally transparent or translucent. The head may be sealingly closed from the rear with a cover **12** (see FIG. 6) following insertion of the LED and the encapsulation **9**. The LED can be fastened in the head by any other method. An alternative production method involves, for example, injection-molding around the LED in the die in which the head is injection-molded. As other alternatives, the LED can be welded in, fitted in, adhesive-bonded or cast in. Also, the LED (or the function element) can be installed from above the bristle plane or between halves of the head.

[0021] The cover **12** has in the interior of the head **1** on a section facing the LED rear side a region **16** which is in direct contact with the LED rear side. This region may be constructed as a rod-shaped protrusion on the inner side of the cover **12**. This may help prevent the LED **8** from being pressed into the interior of the head **1**. Lateral shoulders on the side opposite the LED provide for its positive engagement with inner sections of the head so that said positive engagement also makes it impossible for the LED **8** to project out beyond the head.

[0022] Variants are possible for the construction of the ramp **5**. For example, the ramp **5** may be injection-molded in one integral piece with the head **1**. Alternatively, the ramp **5** may be manufactured in an additional injection molding step, adhesive-bonded, joined, welded or snap-fitted. The ramp **5** can be made from a hard or a soft plastic material.

[0023] FIG. 5 shows a top plan view of the head of the toothbrush of FIG. 1, in which the LED **8** is inserted in the mounting hole **6** and the bristle tufts **13** are secured in the apertures **3**. In this representation, only the head **1** of the toothbrush is shown, the neck adjoining the breakaway line **2**. The neck connects in turn the handle to the head of the toothbrush. As becomes apparent from this top plan view, the region above the LED is devoid of oral care elements or bristle tufts **13**. A large amount of light, obtained from the light intensity and the area to be illuminated, thus passes unhindered directly onto the teeth or the area of teeth provided with toothpaste. It is easier therefore to activate certain activating agents in a toothpaste provided specifically for this application. When there are no oral care elements on the ramp **5**, a sufficiently large region forms at the bristle ends for light to pass through unhindered even though, as proposed in this embodiment, bristle tufts are arranged at an inclination (see FIG. 5 and the side view of FIG. 9). A region with a diameter of about 2 to about 6 mm, or about 3 to about 4 mm, above the

LED thus remains free of bristle ends. The light emitted from the LED can thus emerge unhindered in a light cone of about 5 to about 20°.

[0024] FIG. 6 shows a longitudinal section through the head **1** along the line A-A of FIG. 5. As becomes apparent from this representation, the LED is positioned with its vertical optical main axis perpendicular to the longitudinal axis **14** of the toothbrush. Alternatively, the LED can be positioned in the head at an angle, in particular to the longitudinal axis **14** of the toothbrush.

[0025] FIG. 7 shows an enlarged detail inside the circle A of FIG. 6 in order to present the region of the ramp **5** and the LED on an enlarged scale.

[0026] FIG. 8 shows a section through the head **1** along the line C-C, which forms a transverse axis to the main axis **14** of the toothbrush. The LED **8** protrudes approximately 2 mm beyond the plane tufting surface or outer surface **4**. In this embodiment, the ramp protrudes between about 1.5 and about 2 mm beyond the plane tufting surface or outer surface **4**. The angle of inclination of the ramp amounts to between about 30 and about 50° or about 20 and about 60° (=about 180°- α or about 180°- μ) relative to the outer surface **4**. These dimensional values can be varied. The ramp **5** according to the views of FIGS. 7 and 8 thus has oblique sides (see the schematic example in FIG. 2). The exact dimensions of the ramp **5** may be constructed to be different or asymmetric in the four radial directions around the LED in order to enable the area directly adjacent to the ramp to be tufted with bristles. Although the ramp **5** along the longitudinal axis **14**, as shown in FIG. 7, does not extend down to the outer surface **4** of the fastening plane of the bristle tufts **13**, a sufficient protective function for the teeth can be maintained. By comparison, the ramp **5** extends in the transverse direction of the head with its inclined surfaces as far as the lower level of the outer surface **4** so that the protective effect in relation to the teeth is greater in this embodiment in the transverse direction than the protective effect in the longitudinal direction along the longitudinal axis **14**. This is owed, among other things, to the fact that fewer supporting bristle tufts **13** are provided next to the ramp **5** in the transverse direction than in the longitudinal direction along the axis **14**.

[0027] As becomes further apparent from FIG. 7, the LED projects up by a few tenths of a millimeter beyond the level of the ramp **5**. Through the rounded form of the LED **8** this has no negative effects for the user. In one variant, the LED **8** is vertically positioned relative to the mounting hole **6** such that no gap is formed between the mounting hole **6** and the LED inside the ramp **5**. Accordingly, the LED **8** can be positioned vertically along the optical longitudinal axis of the LED **8** such that it protrudes farther beyond the ramp **5** or is embedded deeper into the ramp **5** or has its top flush with the ramp **5**. The optical radiation angle of the LED is thus varied. In this arrangement, the mounting hole **6** can be used as a light-reflecting or light-guiding duct for the light emitted from the LED. This effect can be amplified by lending a white color or more intensely reflecting properties to the plastic surrounding the mounting hole **6** for the LED **8**. In this way the fraction of diffused light can be increased.

[0028] FIG. 9 shows a side view of the head **1** of FIG. 5. The tufting pattern of this head is evident from FIG. 9 in combination with FIG. 5. Two outer rows of bristle tufts are inclined towards the handle, two inner rows are inclined towards the distal head end, and one front group of bristles is inclined likewise towards the distal head end. The ramp **5** can be

combined with any other tufting pattern. Also possible is a combination of the ramp with a tongue scraper (on the rear side of the head).

[0029] By constructing a ramp directly adjacent to the function element it helps ensure that the function elements work as desired without otherwise disturbing the user. If the toothbrush exerts excessive pressure against the teeth, the tooth is thus able to slide over the ramp without this leading to any interference along the variously protruding teeth while they are being cleaned.

[0030] The support taken by oral care elements is particularly little if a free space is provided above the function element. In addition, the electrically operable function element may be arranged as near as possible to the teeth to be cleaned while at the same time the thickness of the head carrying the oral care elements is kept as small as possible, thus enabling an agreeable cleaning of the teeth even with a small space between the inside of the cheek and the outer surface of the tooth.

[0031] The function element may be arranged adjacent to and/or between the oral care elements. It is thus assured that the properties of the function element take effect in the immediate vicinity of the oral care elements. Alternatively, the function element may be arranged on a different outer side of the head on which no oral care elements are arranged.

[0032] The function element may be constructed as a light emitting source, in particular as an LED (light emitting diode), as a toothpaste conveyor, a sensor or an actuator for, for example, a sound or a movement or a vibration. The LED can be used, for example, as a supplier of energy for activating a substance in the toothpaste. Other energy-emitting function elements may also be contemplated. If the function element is constructed as a toothpaste conveyor, then particularly the toothpaste outlet is arranged adjacent to the ramp while the toothpaste conveying device is arranged as a rule inside the head or an adjacent region. If the function element is constructed as a sensor, then this can be, for example, a motion sensor which detects the 3D motion of the head by means of an inclination sensor, a speed sensor or an acceleration sensor. A contact force sensor may also be contemplated.

[0033] The oral care elements may be connected on a first-lower-level to the outer surface of the head or are tufted or injection-molded in the head. The function element extends to a second level which differs from the first level, in particular is raised relative to it. In this arrangement, the ramp is intended to bridge at least part of the difference in height between said first and said second level. Thus, no abrupt difference in height exists between the second level of the raised surface of the function element and the first level of the head.

[0034] The first and the second level may be bridged by a surface ascending or descending in an oblique or arched configuration. The oral care elements are arranged or fastened on a plane of the head and the ramp is constructed to ascend or descend in an oblique or arched configuration relative to said plane. If the oral care elements are not arranged on a uniformly flat plane, then the first lower level is the level from which the ramp begins to extend from a foot region in the direction of the bristle ends.

[0035] The function element may be arranged partly in the head and partly projecting therefrom. The ramp thus prevents a 90° angle from being formed between the outer surface of the head and the projection of the function element and

bridges this region in direct adjacency to the function element by an oblique or arched or otherwise curved surface.

[0036] The ramp and the head may be injection-molded from the same plastic component. This affords particular ease of manufacture because an additional plastic component would add to the complexity of the production process. This single-component construction of the ramp relative to the head notwithstanding, other plastic components may be provided on the head or be injection-molded onto it. Alternatively, the ramp may be injection-molded from a different plastic component than the head.

[0037] The ramp may be constructed from a soft plastic material, in particular an elastomer such as TPE (thermoplastic elastomer), and the head from a hard plastic material, in particular PP or PE.

[0038] The ramp is arranged directly around the function element at least in a radial direction. Hence at least one ramp is arranged in one direction in direct contact with and adjacent to the function element. In one variant, provision is made for one ramp each in two opposing directions on either side of the function element. In another variant, one ramp is arranged around the function element radially in all directions, in which arrangement the ramp can be constructed in a variously oblique or arched configuration in the different radial directions. The place at which the ramp is provided depends directly on the intended movement for cleaning the teeth so that a ramp is provided adjacent to the function element according to the intended cleaning direction. The number of ramp geometries required around the function element can also be provided dependent on the geometry of the rest of the head. Given an outer surface of the head on which the oral care elements are arranged and which already represents at least two different levels, it suffices in one variant for only one ramp to be provided between these two height levels

[0039] The function element may be secured in the head by a press fit. The external diameter or the external geometry of the function element is therefore larger than its receiving opening provided in the head. An encapsulating solution against the ingress of liquid/moisture is thus obtained in simple manner. Other types of securing the function element in the head, for example injection-molding, welding, adhesive-bonding or snap-fitting, are likewise possible.

[0040] The oral care device may be constructed as a manual or electric toothbrush and/or the function element as an LED which is arranged in protruding fashion in the cleaning region. This protrusion formed by the function element in the outer surface of the head is thus filled or bridged by the ramp. An outer surface is considered to be the fastening level of the oral care elements, hence, for example, the tufting surface.

[0041] The oral care elements may be arranged on the head above and spaced from the function element, such that a free region devoid of oral care elements is provided above the function element—approximately on a height with the ends of the oral care elements. If the function element is constructed as an LED, then it is assured that, for example, a light cone with an opening angle of at least 5 to 30° illuminates the tooth and the toothpaste largely unobstructed by cleaning bristles or elastomer cleaning elements. If the function element is constructed as a toothpaste conveyor, then an unhindered supply of the toothpaste to the tooth should be available.

[0042] The function element and the ramp may be integrally made of one piece. In particular the function element and the ramp are formed of the same material. In one variant,

the function element and the ramp form a prior assembled one-piece unit. In another variant, the ramp and the function element are manufactured separately, but as the result of being made from the same material they become one piece after being joined together.

[0043] A tangent applied to the oblique or curved or arched ramp forms an obtuse angle with the outer surface of between about 110° and about 170° . In an alternative variant, the obtuse angle lies between about 120° and about 150° . In this arrangement, the tangent in a sectional representation of the ramp is applied against said ramp, whereby in the case of an oblique-plane surface of the ramp the tangent has several points of contact with the ramp. This results conversely in a gradient angle for the ramp 5 which lies between about 10° and about 70°, or between about 30° and about 60°.

[0044] The toothbrush head may be manufactured using the following steps. The brush head 1 may be injection-molded with the ramp 5 and the rest of the head geometry being formed from a hard plastic component. The head 1 may be tufted with bristles by any suitable tufting method. In one embodiment, the anchor tufting method is selected. The bristle ends are cut to the proper length and end-rounded. The LED 8 is installed through the mounting hole 6, and the inner cavity in the head 7 is closed off by the cover 12. The cover 12 is caused to fuse with the surrounding material, for example, by laser welding, heated tool welding, ultrasonic welding or other thermal melting methods in order to obtain a sealing joint. Other closing methods such as snap-locking or adhesive-bonding are also possible.

[0045] In an alternative approach, a ramp may be inserted into the mounting hole 6 after the head is injection-molded and tufted. Alternatively, the ramp may be inserted after the injection-molding operation and then the head is tufted. In this case the ramp may be constructed from a different material than the head. Then the LED is inserted through the hole 6.

[0046] The brush head may be injection-molded together with the LED and the wiring and then equipped with bristles or other cleaning elements. Alternatively, the ramp and the remaining brush head 1 may be manufactured by a two-component or multi-component injection molding method. In such cases the ramp can be made from, for example, a soft plastic material and the head from a hard plastic material.

[0047] 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.”

[0048] Every document cited herein, including any cross referenced or related patent or application, is hereby incorporated herein by reference in its entirety unless expressly excluded or otherwise limited. The citation of any document is not an admission that it is prior art with respect to any invention disclosed or claimed herein or that it alone, or in any combination with any other reference or references, teaches, suggests or discloses any such invention. Further, to the extent that any meaning or definition of a term in this document conflicts with any meaning or definition of the same term in a

document incorporated by reference, the meaning or definition assigned to that term in this document shall govern.

[0049] While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

what is claimed is:

1. An oral care device having a handle and a head connectible thereto, on which oral care elements are provided, the head further including an electrically operable function element being arranged on an outer surface of the head, and a ramp disposed adjacent the function element.

2. The oral care device according to claim 1, wherein the function element is arranged adjacent the oral care elements.

3. The oral care device according to claim 1 wherein the function element is a light emitting source, a toothpaste conveyor, a sensor or an actuator.

4. The oral care device of claim 1, wherein the oral care elements have a first height, the function element extends to a second height which differs from the first height, and that the ramp bridges at least part of the difference in height between the first height and the second height.

5. The oral care device of claim 1, wherein the oral care elements are arranged on a plane of the head and the ramp ascends or descends in an oblique or arched configuration relative to the plane.

6. The oral care device of claim 1, wherein the function element is arranged so as to be partly in the head and partly projecting therefrom.

7. The oral care device of claim 1, wherein the ramp and the head are injection-molded from the same plastic component.

8. The oral care device of claim 1, wherein the ramp is injection-molded from a different plastic component than the head.

9. The oral care device of claim 8, wherein the ramp is constructed from a soft plastic material, and the head is constructed from a hard plastic material.

10. The oral care device of claim 1, wherein the ramp is disposed around the function element at least in a radial direction.

11. The oral care device of claim 1, wherein the function element is secured in the head by a press fit.

12. The oral care device of claim 1, wherein said oral care device is a manual or electric toothbrush and/or the function element is an LED protruding from the cleaning region.

13. The oral care device of claim 1, wherein the oral care elements are arranged on the head at a distance from the function element, such that a free region devoid of oral care elements is provided above the function element.

14. The oral care device of claim 1, wherein the function element and the ramp are integrally made of one piece.

15. The oral care device of claim 1, wherein the function element is disposed adjacent the distal end of the head.

16. The oral care device of claim 1, wherein a tangent applied to the ramp forms an obtuse angle (α, β) with the outer surface of between about 110° and about 170° .

* * * * *