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Schamber et al.

(54) **DEVICE FOR CLEANING TEETH AND/OR MOUTH**

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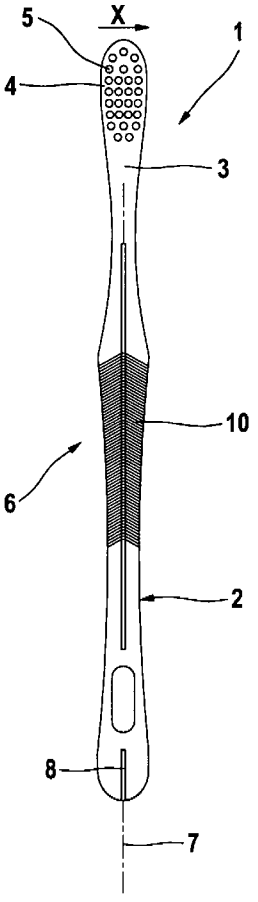
(57) **ABSTRACT**

The invention relates to a device for dental and/or oral care, especially a toothbrush, comprising a preferably rod-shaped tool support to which a cleaning tool, especially a bristle field, can be fastened. The tool support is configured as a composite body that comprises an enveloping body from a first material, preferably plastic material, and a functional body from a second material, preferably metal, which is embedded in the enveloping body. The dental and/or oral care device is characterized in that the functional body is configured in at least some sections thereof as a trelliswork girder frame that has longitudinal girders substantially extending in the longitudinal direction of the tool support and a plurality of cross-girders. The enveloping body is especially transparent so that the functional body is visible through the enveloping body.



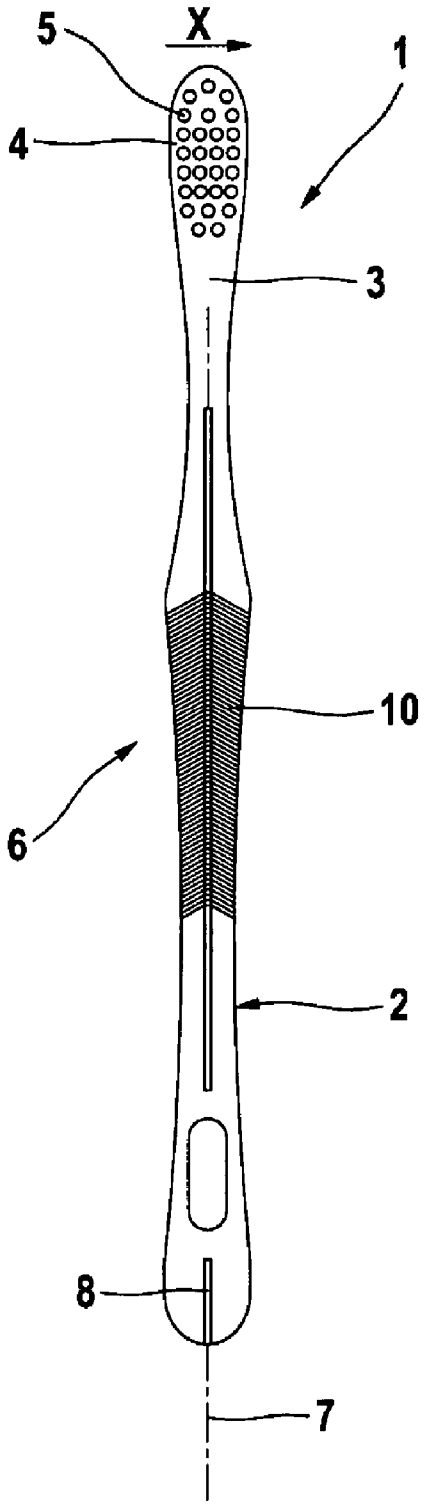


Fig. 1

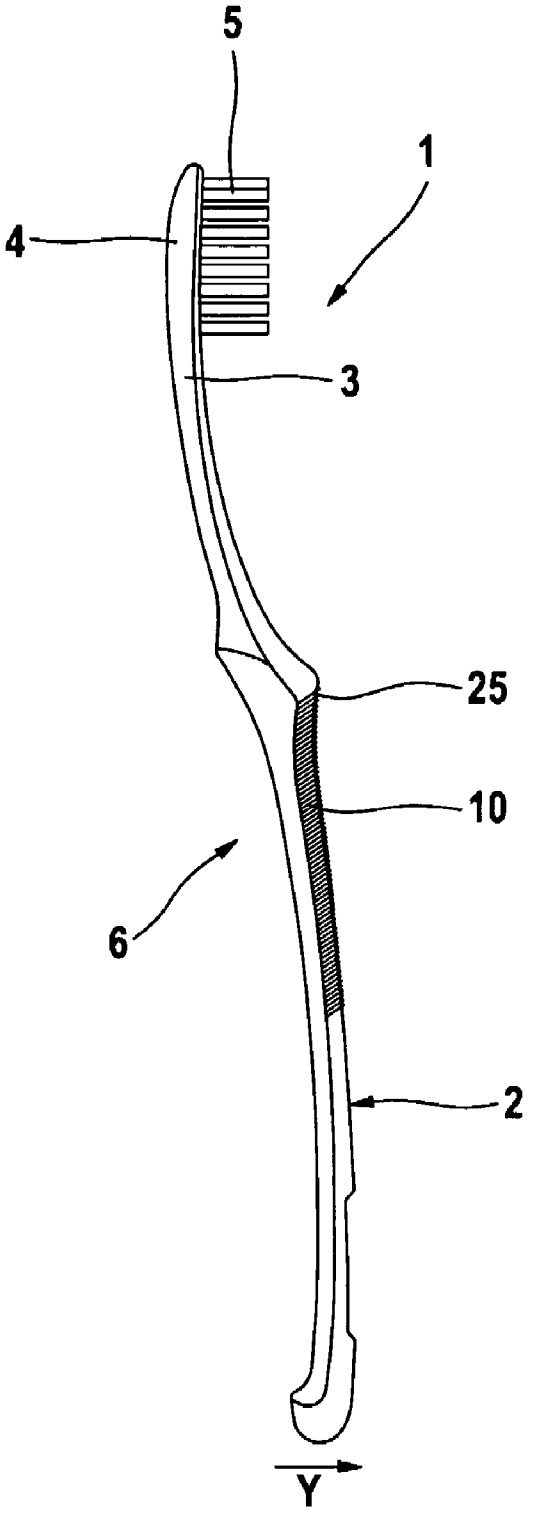


Fig. 2

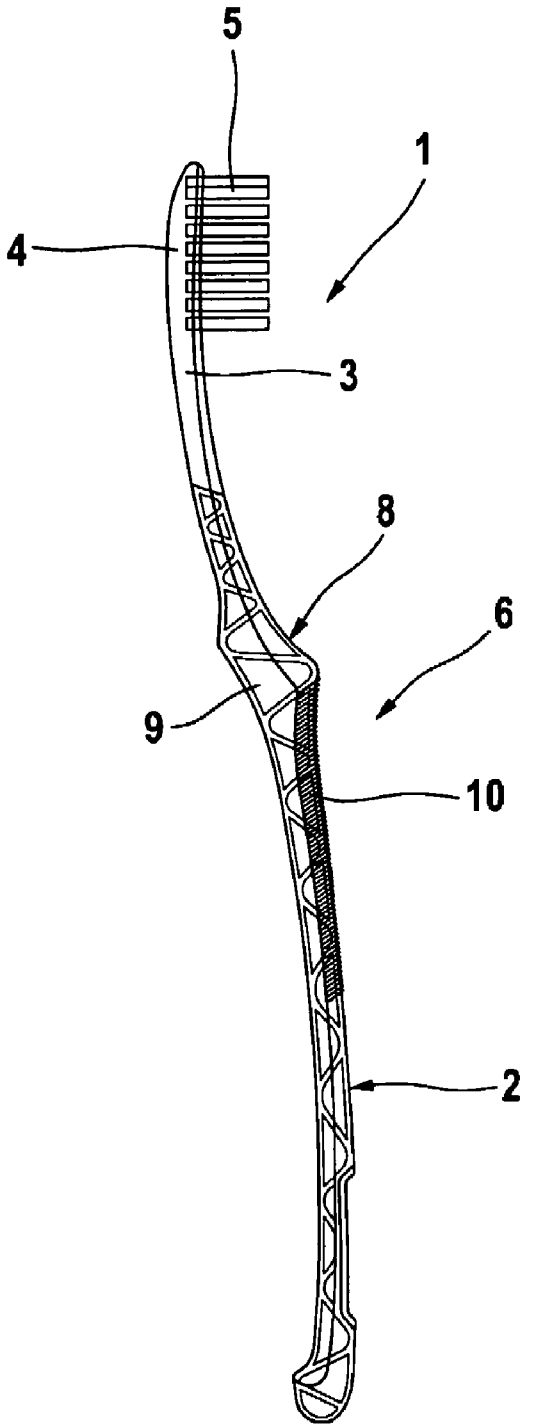


Fig. 3

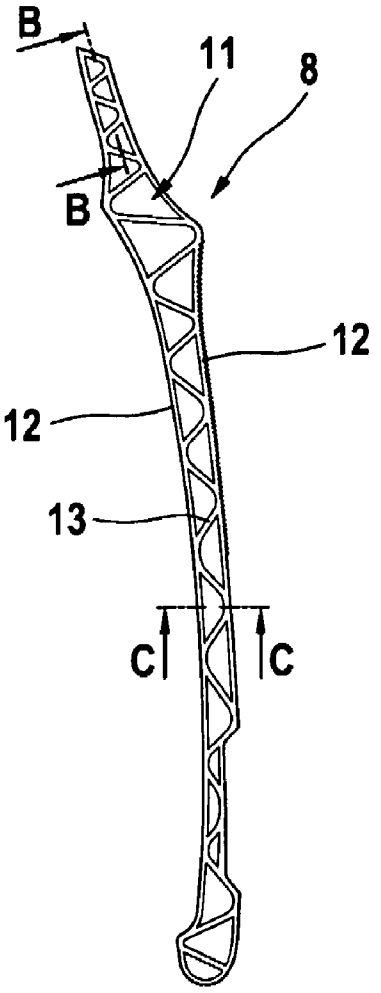
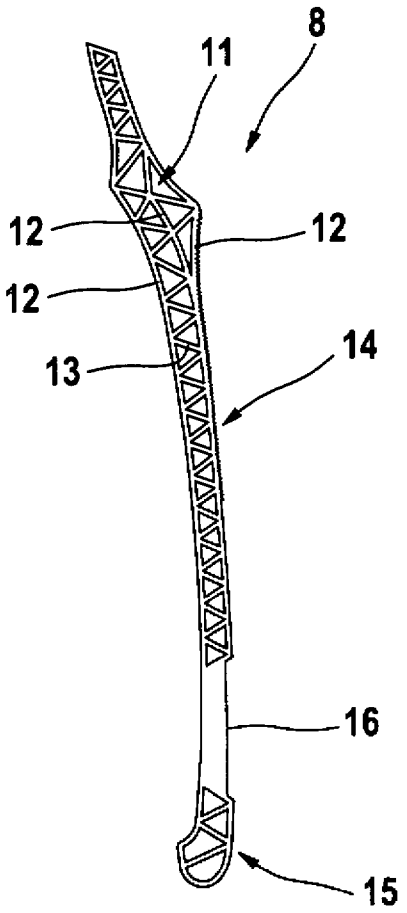


Fig. 4



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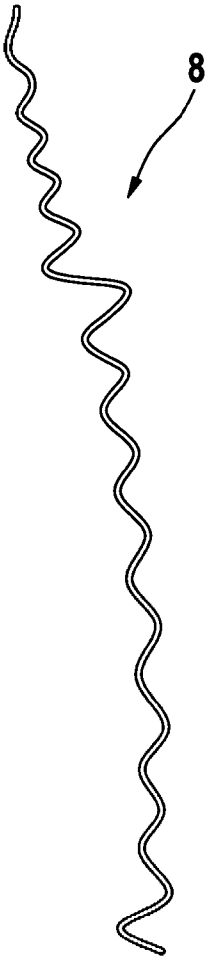


Fig. 6

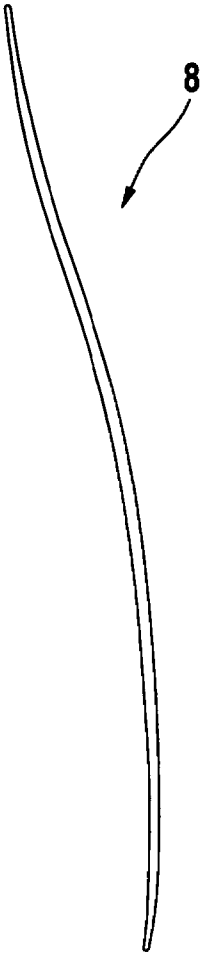


Fig. 7

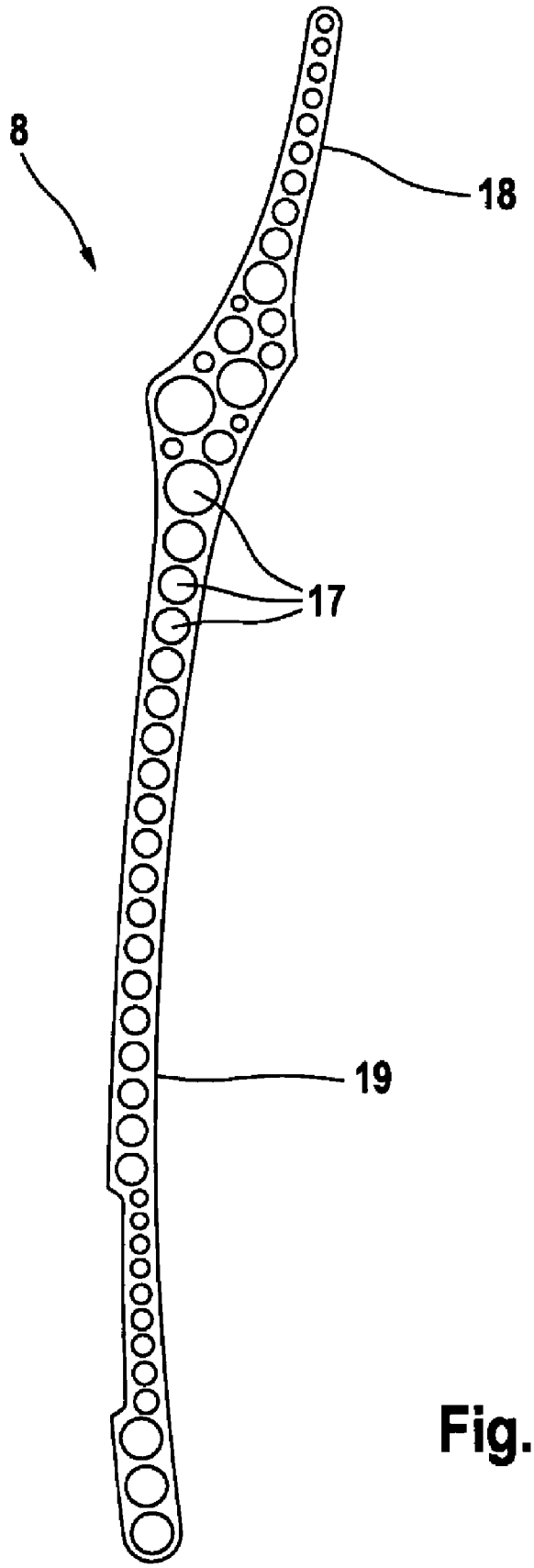


Fig. 8

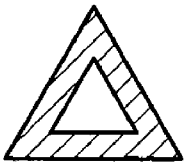
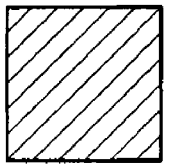


Fig. 10.1



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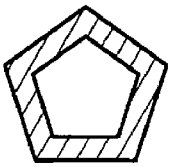
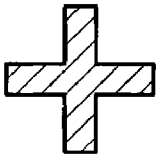


Fig. 10.3



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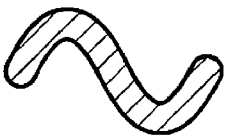

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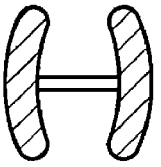

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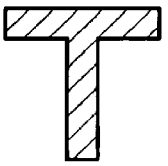

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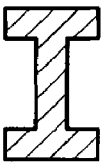

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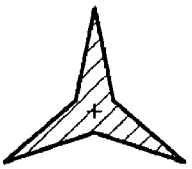
Fig. 10.9



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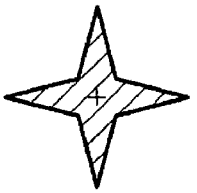

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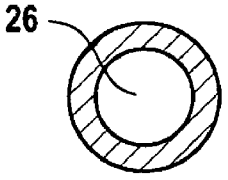

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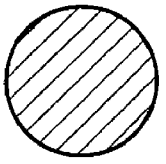

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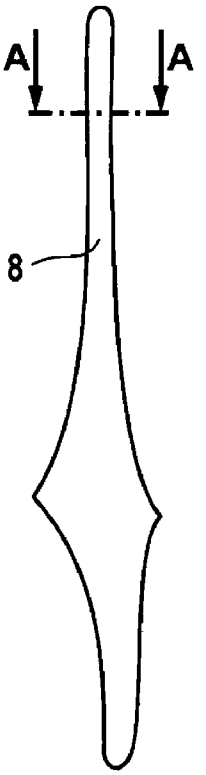


Fig. 9

Fig. 11.1

Fig. 11.2

Fig. 11.3

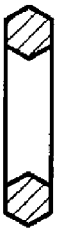
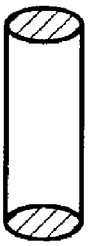


Fig. 11.4

Fig. 11.5



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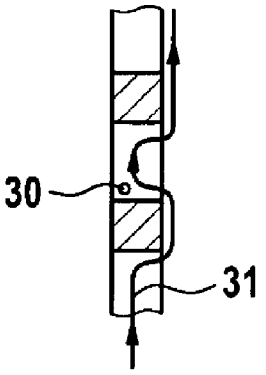
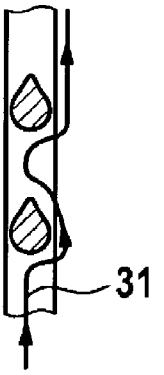


Fig. 12.1



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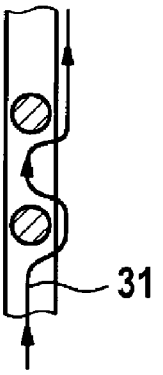

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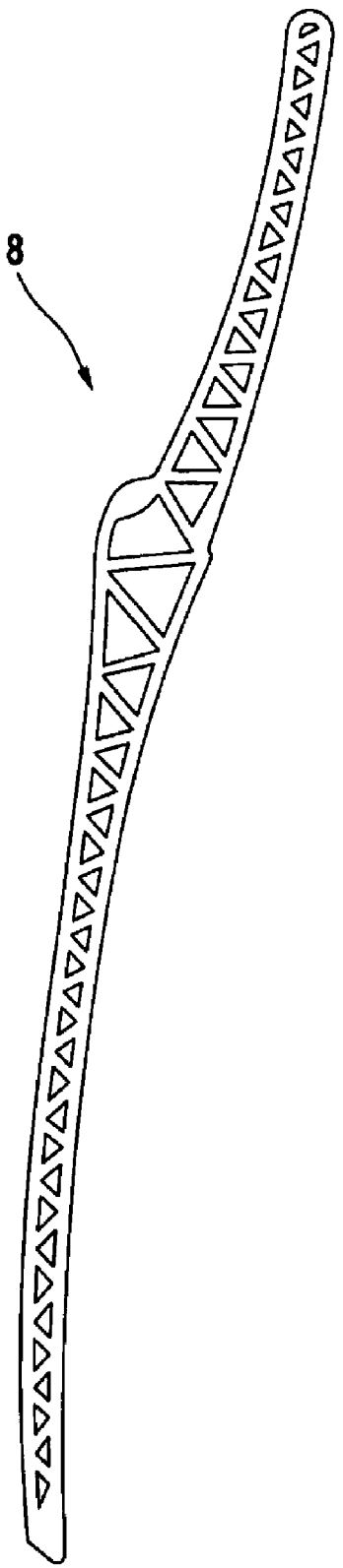

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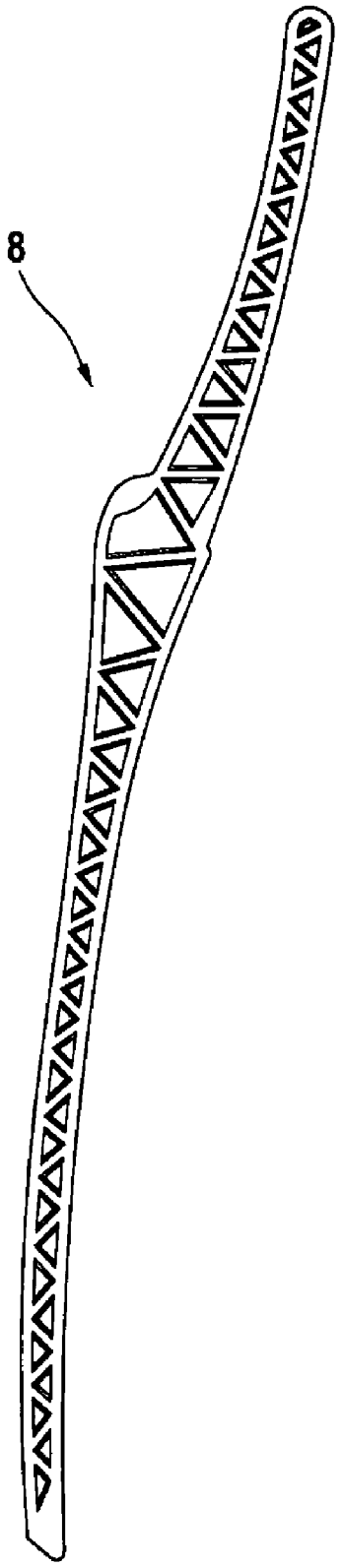

Fig. 14

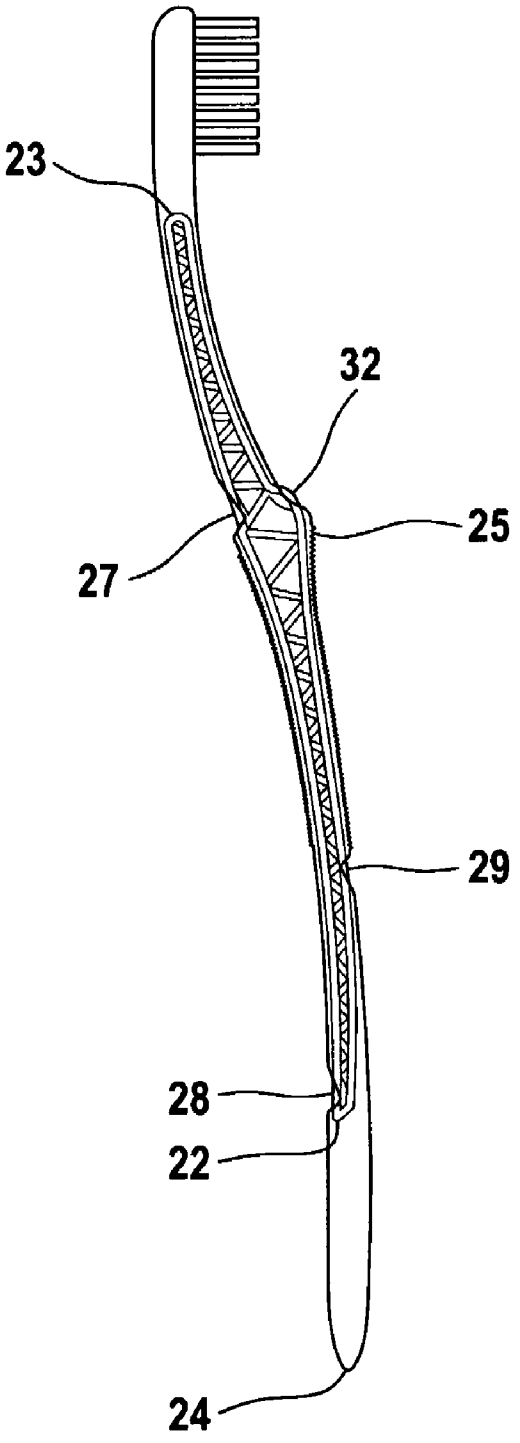

Fig. 15

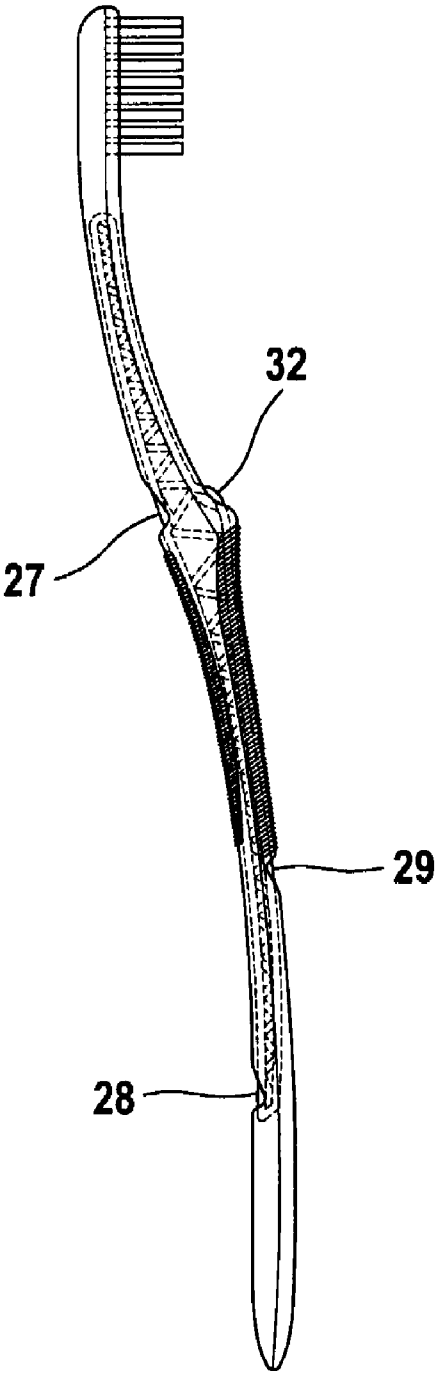

Fig. 16

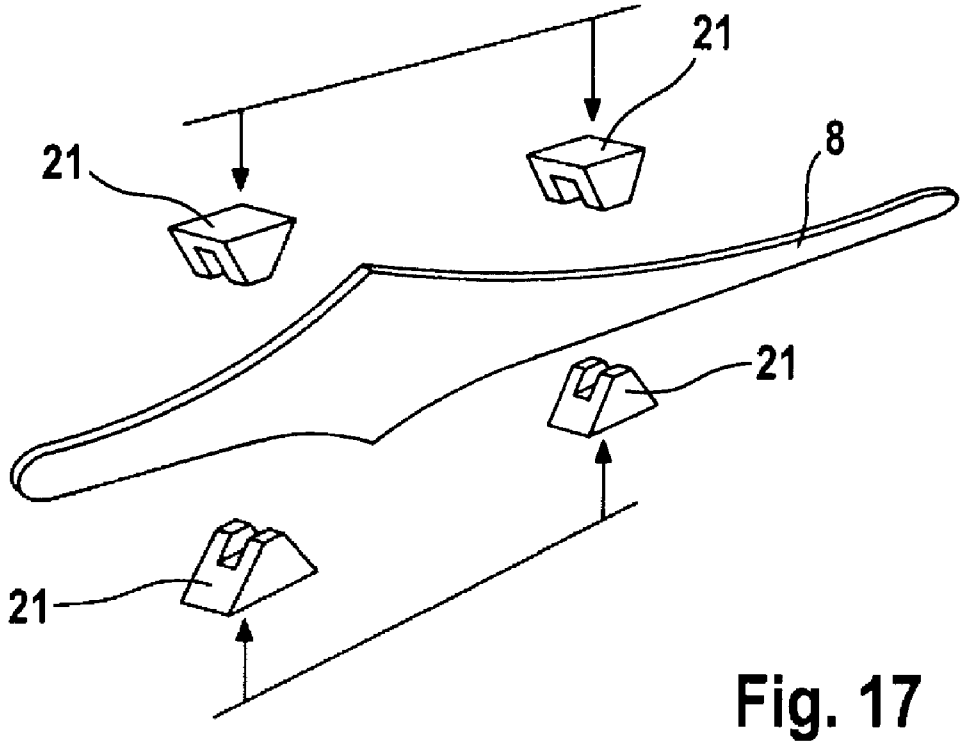

Fig. 17

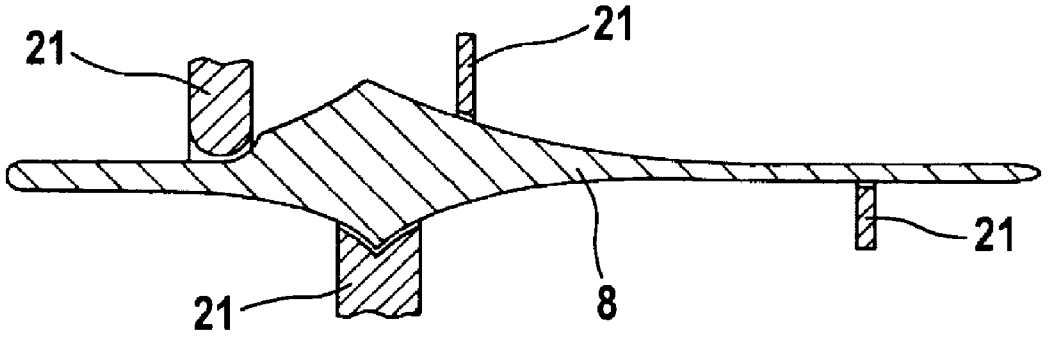

Fig. 18

DEVICE FOR CLEANING TEETH AND/OR MOUTH

[0001] The present invention relates to a device for dental and/or oral care, especially a toothbrush, comprising a preferably rod-shaped tool support to which a cleaning tool, especially a bristle field, can be fastened, wherein the tool support is configured as a composite body that comprises an enveloping body from a first material, preferably plastic material, and a functional body from a second material, preferably metal, which is embedded in the enveloping body.

[0002] In the case of toothbrushes the handles thereof, or the bristle tubes or bristle head supports of brush attachments of electric toothbrushes, regularly form elongated, preferably approximately rod-shaped tool supports that are subjected to a greater or lesser degree to especially bending stresses due to the forces that are applied during the cleaning process. Other tooth and/or oral care devices, such as interdental cleaners, floss handles, or tongue cleaners also have such elongated tool supports, which are subjected to stresses in similar ways. In so far as such dental and/or oral care devices must be inserted into the oral cavity the aforementioned tool supports must be configured slim and are limited in terms of their possible cross section, and curved or angularly bent profiles must be implemented as well. In order to nonetheless achieve the necessary strength, especially bending strength, it was already proposed to configure the tool support as a composite body, in which a strength-increasing reinforcement is embedded in an enveloping body. Many different embodiments of the reinforcing body have been proposed to this effect.

[0003] Patent application GB 20 50 156 A1 proposes a hand-held toothbrush in which a metal strip is provided in the handle as a reinforcement, which is embedded in an enveloping body of hard plastic. The metal strip extends into the bristle head, where it serves also for fastening the bristle tufts. However, the bond between the metal strip and the hard plastic envelope can cause problems; moreover the attainable increase in strength with respect to a brush deflection in the longitudinal center plane of the brush is limited.

[0004] U.S. Pat. No. 4,829,621 proposes a hand-held toothbrush having a reinforcing body in the region of the toothbrush neck that is intended to permit deflections of the toothbrush neck in the center longitudinal plane of the brush and quasi fix the bristle head in place in various deflected positions, so as to be able to work with various angular bends of the brush head. The reinforcing body is configured substantially rod-shaped.

[0005] U.S. Pat. No. 3,857,134 proposes, in FIG. **4**, a toothbrush, the bristle support section of which has a reinforcing plate of a stiff material such as steel or fiber-reinforced plastic embedded in an enveloping body of plastic, and the reinforcing body is used for fastening the bristle tufts here as well.

[0006] Furthermore, from US 2004/170464, a toothbrush is known in which stiffening ribs are integrally formed in the regions of the toothbrush neck and rear of the bristle support, so as to increase the bending strength of the toothbrush.

[0007] Furthermore, GB 231,753 describes a hand-held toothbrush in which a peripheral metal wire is embedded in the handle as a reinforcement.

[0008] Furthermore, from GB 304,459 a toothbrush is known, the handle of which is sandwiched and has a plate-like reinforcement that is embedded in an enveloping body of celluloid, with a wire mesh being proposed as the reinforcement.

[0009] Lastly, US 2004/060138 describes a toothbrush, the handle of which is configured as a composite body having body sections of a softer material and body sections of a harder material serving to provide a stiffening, wherein the handle is to consist of a transparent plastic material at least in some sections thereof.

[0010] The present invention has as its object to create an improved device for dental and/or oral care of the type mentioned at the outset that avoids the shortcomings of the prior art and advantageously improves upon the latter. Preferably, a light-weight, high-strength tool support is to be created for such a dental and/or oral care device that is able to better withstand the typical cleaning forces but does not interfere with the functionality of the toothbrush, permitting especially a targeted elasticity and having a visually improved design.

[0011] In accordance with the invention, this object is achieved with a device according to claim **1**. Preferred embodiments of the invention are the subject of the dependent claims.

[0012] In order to be able to specifically control the contact pressure of the bristle field onto the teeth to be cleaned, but on the other hand also prevent the gum irritations that are caused by the oftentimes clumsy cleaning movements along the tooth flanks onto the gums, the functional body that is embedded in the enveloping body may be configured in accordance with a further aspect of the present invention such that its areal moment of inertia with respect to an axis perpendicular to the center longitudinal or symmetry plane of the tool support is a multiple, for instance at least double or also more than five-fold, of its areal moment of inertia with respect to an axis located in said center longitudinal or symmetry plane of the tool support. This increases in a targeted manner the bending stiffness of the handle or bristle tube against deflections in said center longitudinal or symmetry plane, while transverse deflections are permitted in a targeted manner and/or the elasticity in the transverse direction is virtually not impacted at all. This enables the perpendicular contact pressure of the bristle field onto the tooth flanks to be controlled in a targeted manner, while the bristle head is able to deflect away during up and down wiping movements along the lateral flanks of the teeth in cases in which there is excessive resistance, for example along the gum line.

[0013] According to an advantageous embodiment of the invention, the embedded reinforcing body may be configured substantially plate-like and/or planar and advantageously arranged substantially raised on edge in the handle or bristle tube of a toothbrush, i.e. the reinforcing body has a maximum extension in the longitudinal center or symmetry plane of the toothbrush that is a multiple of its extension crosswise to said longitudinal center plane or symmetry plane.

[0014] However, in order to avoid an overly rigid embodiment of the tool support and to permit in a targeted manner a yielding deflection of the tool support that carries the cleaning tool, especially bristle field, provision may be made according to an advantageous embodiment of the invention that the reinforcing body ends in front of a tool fastening section and/or the tool fastening section is configured reinforcement-free. If the tool support is a toothbrush tube or toothbrush handle, provision may advantageously be made that the reinforcing body ends in front of the bristle field. More particu-

larly, the reinforcing support may extend from the end opposite the bristle field to approximately the toothbrush neck.

[0015] The enveloping body of the tool support can basically have a single embedded functional body, with the functional body preferably having a main plane that is coplanar to the longitudinal center or symmetry plane of the tool support. Alternatively, however, a plurality of functional bodies may be embedded in the enveloping body as well, for example two plate-like reinforcement bodies may be embedded in a toothbrush handle to the right and left of the longitudinal center plane.

[0016] Alternatively or in addition to the above-described embodiment, the enveloping body of the tool support may be configured transparent in the region of the embedded functional body, at least in some sections thereof, so that the embedded functional body can be viewed through the enveloping body. On one hand, this can serve to monitor for cracks, so as to be able to detect a detaching of the embedded functional body from the material of the enveloping body or even cracks in the functional body itself. On the other hand, this allows for advantageous optical effects to be achieved. On one hand, this permits a transparent configuration of the enveloping body, at least in some sections thereof, with a substantially unchanged embodiment of the enveloping body and therefore in the case of an injection-molded embodiment a large product variety, especially visually different configurations of the toothbrush, without change to the injection molding process, in a simple manner All that is required is the insertion of different functional bodies.

[0017] Alternatively or additionally the enveloping body may advantageously also be configured so as to be optically image altering, especially distorting, blurring, magnifying or demagnifying in its transparent section. In an advantageous improvement of the invention the enveloping body may, for example, form in its transparent section an optical lens, in particular so as to attain a magnifying glass effect. Advantageously the enveloping body may also form an optical prism in its transparent section.

[0018] The embedded functional body and the enveloping body are advantageously configured different from each other such that one body is configured at least partly opaque and the other body is configured at least partly transparent. Especially the embedded functional body is opaque, such that it is visible through the enveloping body.

[0019] In order to be able to attain a high-strength and nonetheless light-weight reinforcing body on one hand and a good bond between the reinforcing body and the enveloping body on the other hand, the present invention proposes that the reinforcing body is configured at least in some sections thereof as a trelliswork girder frame having longitudinal girders substantially extending in the longitudinal direction of the tool support and a multiplicity of cross-connecting girders connecting the longitudinal girders to each other. In this manner a continuous discharge of tensile forces or compressive forces can be achieved via the longitudinal girders, moreover, such a girder frame is high-strength and stiff, especially deflection resistant, in relation to its weight. Moreover, the strength can be precisely controlled by means of the arrangement and layout of the girders, more particularly different degrees of rigidity and stiffness can be achieved in different planes. In comparison to wire fabrics, a diamond-shaped warping as it is common in wire fabrics with diagonally acting forces virtually does not occur. Furthermore, a good bond with the material of the enveloping body can be achieved, since the enveloping material penetrates through the girder frame openings. Alternatively, the functional body is provided with cutouts that are preferably configured in the form of through-holes. Here again, the cutouts provide a means for mechanical bonding to the enveloping body.

[0020] The longitudinal girders of the girder frame may basically extend straight. In an advantageous improvement of the invention, however, the longitudinal girders may be adapted in their profile to the outer contour of the enveloping body and deviate from the straight line at least in some sections thereof. Toothbrush handles often have, in particular for ergonomic reasons, a profile with multiple curved or angular bends so as to allow for a better grasping of the toothbrush and placement of the bristle field onto the teeth at a more favorable angle. Advantageously, the longitudinal girders of the girder frame are adapted to the outer contour—which is curved or angularly bent in the present case—of the enveloping body of the handle, such that they substantially follow the curvature or angular bends of the enveloping body.

[0021] In an advantageous improvement of the invention the longitudinal girders are arranged also at the edge of the girder frame and can form especially the outer contour of the girder frame, such that the same has a defined edge contour that is especially adapted to the outer contour of the enveloping body. Generally, additional longitudinal girders may be provided in addition to the longitudinal girders that are arranged along the edges, which likewise extend approximately in the longitudinal direction of the tool support. However, an advantageous embodiment of the invention may also consist in that longitudinal girders are provided exclusively along the edges of the girder frame.

[0022] The longitudinal girders and cross-connecting girders can basically be joined to each other in different ways. In accordance with a preferred embodiment of the invention the girders and cross-connecting girders may be integrally bonded. More particularly, the entire girder frame and/or the entire reinforcing body may be integrally formed as one piece.

[0023] The longitudinal girders may be arranged substantially parallel to each other. Alternatively, however, the longitudinal girders may also have a varying spacing between each other over their longitudinal extension. This permits the girder frame to be adapted to a cross section of the enveloping body that may vary in the longitudinal direction and the available cross section can be optimally utilized. Alternatively or additionally, however, a varying spacing between the longitudinal girders along the edges also can serve to control the strength and bending stiffness of the girder frame in a targeted manner and vary the strength and bending stiffness over its length.

[0024] Alternatively or additionally the girder frame may have cross-connecting girders of differing lengths, and/or cross-connecting girders may be provided at differently acute pitches relative to the longitudinal girders.

[0025] Alternatively or in addition to the above-mentioned configuration of the functional body in the form of a girder framework, the functional body may also have a meandering, wavy, stepped and/or zigzag profile that substantially follows a longitudinal extension of the tool support. The reinforcing body may consist especially of a profiled support having said profile and a substantially unchanging cross-section, however, alternatively it is also possible to vary the cross section over the profile of the reinforcing body. With the aid of such a meandering or wavy or otherwise oscillating profile of the

reinforcing body it is possible to enhance a targeted elastic configuration of the tool support; additionally a stress discharge can be achieved in various layers of the enveloping body, since the occurring bending stresses in the reinforcing body are discharged at different points of the enveloping body and reversed. Even so, a reinforcing body with such a meandering or wavy profile achieves a high degree of impact resistance of the tool support despite its potentially high degree of elasticity. This permits especially toothbrush necks to be designed sufficiently impact resistant to withstand being frequently knocked against the edge of the sink.

[0026] The above-mentioned meandering or wavy or optionally also zigzag-shaped profile of the reinforcing body is advantageously configured two-dimensional, i.e. planar. However, alternatively or additionally the reinforcing support may also have, at least in some sections thereof, alternating outward bulges in a third spatial axis. For example, the reinforcing support may consist of a helical profile, for example in the form of a helically twisted wire.

[0027] The aforementioned oscillating, especially meandering or wavy profile of the reinforcing body may, in an improved embodiment of the invention, have an amplitude that varies over its longitudinal extension, i.e. the profile of the outward bulges crosswise to the longitudinal direction of the reinforcing support may vary, i.e. become more or less pronounced over the length thereof. In this manner, a targeted control of the strength and stiffness can be achieved on one hand, and an adaptation of the reinforcing body to potentially varying cross-sections of the tool support can be provided on the other hand.

[0028] Additional features, advantages, objects and applications of the present invention or special embodiments thereof will become apparent from the following description of the illustrative embodiments. All of the described or depicted features constitute the subject matter of the present invention, by themselves or in any combination and subcombination thereof and irrespective of their condensation in the claims or reference of claims to other claims. In the drawings:

[0029] FIG. **1** shows a side view of a hand-held toothbrush, the handle of which is configured as a composite body and has a reinforcement in the form of a girder frame,

[0030] FIG. **2** shows a side view of the toothbrush of FIG. **1**,

[0031] FIG. **3** shows a side view of a toothbrush similar to the preceding figures, the handle of which is likewise configured as a composite body and has a reinforcement in the form of a girder frame, wherein the enveloping body is configured transparent and the embedded functional body is visible through the enveloping body,

[0032] FIG. **4** shows a side view of the embedded functional body of the toothbrush of FIG. **3**,

[0033] FIG. **5** shows a side view of an embedded functional body according to an alternative embodiment for a toothbrush of FIGS. **1** through **3**,

[0034] FIG. **6** shows a side view of an embedded functional body according to an alternative embodiment for a toothbrush of FIGS. **1** through **3**,

[0035] FIG. **7** shows a side view of an embedded functional body according to an alternative embodiment for a toothbrush of FIGS. **1** through **3**,

[0036] FIG. **8** shows a side view of an embedded functional body according to an alternative embodiment for a toothbrush of FIGS. **1** through **3**,

[0037] FIG. **9** shows a schematic side view of a functional body for a toothbrush according to FIG. **1**,

[0038] FIGS. **10.1** through **10.13** show schematic cross-sectional views along the section line A-A in FIG. **9** for alternative embodiments of the functional body,

[0039] FIGS. **11.1** through **11.6** show schematic sectional views through the section C-C in the functional body according to FIG. **4**

[0040] FIGS. **12.1** through **12.3** show schematic sectional views along the section B-B in the functional body according to FIG. **4**,

[0041] FIG. **13** shows a side view of an alternative embodiment of the functional body for a toothbrush according to FIG. **1** or **15**,

[0042] FIG. **14** shows a side view according to an additional alternative embodiment of a functional body for a toothbrush according to FIG. **1** or **15**,

[0043] FIG. **15** shows a side view of a toothbrush with a functional body according to FIG. **14** or **15**,

[0044] FIG. **16** shows a side view of a toothbrush with a functional body according to FIG. **14** or **15**,

[0045] FIG. **17** shows a schematic depiction of the mold support means for supporting the functional body during the injection molding process, for a toothbrush according to any of the above figures, and

[0046] FIG. **18** shows a sectional side view of the functional body with the mold support means according to FIG. **17**.

[0047] FIGS. **1** and **2** show a toothbrush **1** depicted as a hand-held toothbrush having an overall rod-shaped handle **2** that transitions into a brush neck **3** and is connected via the same to a brush head **4** to which a bristle field **5** is fastened, optionally in a manner so as to be replaceable. The handle **2** and bristle neck **3** together thus form a tool support **6** that forms a tool fastening region in the region of the brush head **4**, to which tool fastening section the bristle field **5** is fastened.

[0048] The handle **2** is curved in a slight arc shape and has a cross section that varies over its longitudinal extension so as to be more comfortable to hold. In the transitional region between the handle **2** and the brush neck **3**—especially adjoining behind the thumb rest **25** of the handle **3**—a slight angular bend is provided. Said brush neck **3** is curved slightly arc-shaped in the direction opposite to that of the handle **2**, such that the aforementioned tool support **6** has an overall slightly S-shaped contour. The tool support **6** is configured overall symmetrical, such that the drawing plane of FIG. **2** forms a longitudinal center plane and symmetry plane **7** of the toothbrush **1**. The toothbrush is arched outward in the handle region on the bottom side, and on the top side—which is the same side on which the thumb rest and the bristle field on the head are provided—it has planar surfaces, preferably surfaces that are arranged in a roof shape.

[0049] The handle **2** and a section of the bristle head **4** are configured as composite bodies. A functional body **8** in the interior, which is configured as a reinforcing body in the depicted embodiment, is embedded in an enveloping body **9**, especially connected to the same by means of a material or a non-positive or a positive connection, wherein the aforementioned functional body **8** is advantageously composed of a harder, stiffer and/or more sturdy material, such as metal or plastic, and the enveloping body **9** is composed of a softer, more impact-absorbing and/or more damping material. For example, the functional body may be composed of a rust resistant metal, in particular steel, or of plastic materials such as POM or liquid crystal polymer (LCP). In the case of a

metal-based solution, the functional body is produced by means of die-cutting or laser-cutting or by means of a chemical or electro-chemical process, especially if cutouts are required. In the case of a plastic-based solution for the functional body, the same can be produced also by means of die-cutting or by means of injection molding. The melting point of a functional body made from plastic is preferably above that of the enveloping body. For example, the enveloping body **9** may be injection-molded from a plastic material, i.e. preferably from a plastic component such as polypropylene or a copolyester (transparent) or—in a variant, in combination with the hard component PP or other component or without such a component—with an (optionally transparent) elastomer (such as TPE). In the depicted embodiment the enveloping body **9** is not configured of a homogeneous material but composed of a plurality of material sections and layers. A hard plastic layer can have a soft plastic layer applied onto the same in some sections, for example in a two-component injection molding process. In the depicted embodiment the soft plastic section **10**, which is situated on the surface, has a surface corrugation. Alternatively the section **10** may be composed of the same component as the remainder of the plastic enveloping body, such that the entire enveloping body is formed of one component.

[0050] As shown in FIG. **1**, the embedded functional body **8** may advantageously be configured plate-like or have a plate-like enveloping surface and be arranged raised on edge in the handle **2**, with the functional body **8** in the depicted embodiment of FIG. **1** extending substantially coplanar with the aforementioned longitudinal center plane **7** of the toothbrush **1**. The embedded functional body **8** extends from the end of the handle **2** facing away from the bristle field **5** to approximately the center of the bristle neck **3** or to the bristle head **4**; there, however, the functional body **8** ends, such that a portion of the bristle holder **3** adjoining the bristle head **4** and said bristle head **4** itself are configured reinforcement-free. The variant of the functional body **8** according to FIG. **8** (which is optionally possible also for the other alternatives of the functional body) extends from preferably the entire handle section **19** into the entire neck region **18** (up to the bristle head) or into part of the neck region **18** of the toothbrush.

[0051] The aforementioned functional body **8** is depicted separately in FIG. **4** in a side view. In the depicted embodiment the same forms a planar girder frame **4** in the style of a trelliswork, wherein two longitudinal girders or chord members **12**, which extend substantially in the longitudinal direction of the handle **2** or bristle neck **3**, are arranged along the edges of the girder frame **11** and/or form the edges of the girder frame **11** and a plurality of cross-connecting girders **13** are provided between said longitudinal girders **12**, connecting the same to each other. In the depicted embodiment the cross-connecting girders **13** are arranged at an acute angle to the longitudinal girders **12**, such that when viewed as a whole, a—roughly speaking—serpentine profile of the cross-girders **13** is created. The longitudinal girders **12** may advantageously be formed of the same material as the cross-connecting girders **13**, for example the girder frame **11** may be die-cut from a sheet of metal.

[0052] As shown in FIG. **4**, the longitudinal girders **12** are adapted in their profile to the outer contour of the handle **2** and brush neck **3**. The longitudinal girders **12** substantially follow the curved or angularly bent profile in the outer contour in the sectional view of said handle **2** and brush neck **3**. The longitudinal girders **12** thus vary in their spacing from each other over the longitudinal extension of the toothbrush. The cross-connecting girders **13** accordingly are configured so as to have different lengths at different longitudinal sections of the handle **2**, for example so as to be particularly long in the region of the angular bend between the handle **2** and brush neck **3**; see FIG. **4**.

[0053] An embedded functional body **8** of similar structure is shown in the embodiment of FIG. **5**. Here, too, the functional body **8** forms a girder frame **11**, but only in some sections thereof. More particularly, a section **16** in which the functional body **8** is configured as a solid strip or a solid plate without cutouts is provided between two sections **14** and **15** that are configured as a girder frame **11**. Additionally the embodiment according to FIG. **5** shows that the girder frame **11** may, at least in some sections thereof, have more than two longitudinal girders **12**. In the transitional region between the handle **2** and brush neck **3** three longitudinal girders **12** are provided in the depicted embodiment according to FIG. **5**.

[0054] As shown in FIG. **6**, the embedded functional body may be configured also in a meandering or wavy or oscillating serpentine shape. In the depicted embodiment the functional body **8** consists of a profiled support having a substantially unchanging cross section in the form of a wire that substantially follows the longitudinal extension of the handle **2** and brush head **3**, but bulges out in alternating fashion relative to said longitudinal extension, such that an oscillation profile is formed, the center line of which substantially follows the curved longitudinal extension of the handle **2** and brush neck **3**.

[0055] As in the depicted previous embodiments, the functional body **8** shown in FIG. **6** likewise substantially extends from the end of the handle **2** facing away from the brush head **4** to approximately the middle of the brush neck or to the brush head **3**.

[0056] An additional possible embodiment of the embedded functional body **8** is shown in FIG. **7**, according to which the functional body **8** substantially consists of a rod-shaped profiled support, the cross section of which, however, varies in the longitudinal direction. More particularly, the cross section decreases toward the ends while a middle section of the functional body **8** has an enlarged cross section relative to the end sections. The rod-like functional body **8** according to FIG. **7** has a curved profile that is overall slightly S-shaped and substantially follows the matching curved profile of the longitudinal extension of the handle **2** and brush neck **3**.

[0057] FIG. **8** shows an additional variant of the functional body **8**. The same is configured as a plate-like metal body having cutouts in the form of circular openings. Round cutouts can be produced more easily here (for tool-related reasons.)

[0058] The enveloping body **9** of the tool support **6** may advantageously be configured transparent, as illustrated by the embodiment of FIG. **3**. This makes the embedded functional body **8** visible through the enveloping body **9**, thereby permitting the embedded functional body **8** to be observed and special optical effects to be achieved. More particularly, a large variety of visually different products can be achieved without having to change the injection molds for the enveloping body **9**. All that is required is to insert differently configured functional bodies **8**, such as those shown in FIGS. **4** through **7**, for example. Because of the shaping of the handle cross section a magnifying-glass effect is advantageously created in this manner

[0059] FIG. **9** schematically shows a side view of a functional body **8** that can have any desired shape of cutouts or trelliswork layout, or also no cutouts.

[0060] FIGS. **10.1** to **10.13** show schematic variants of the cross-sectional area of the functional body at the site of the section A-A in FIG. **9**. It will be appreciated that these depicted cross sections according to FIGS. **10.1** through **10.13** are preferably provided along the entire length of the functional body **8** and not only at the site of the section A-A depicted in FIG. **9**, or they may vary over the length of the functional body **8**, like in the embodiment of FIG. **7**. Variances in the sectional view may occur in particular due to the type of cutouts in FIG. **9**, as these are not illustrated or taken into account in any detail in FIGS. **10.1** through **10.13**, even though they may be present. In FIGS. **10.1** through **10.3**, the cross-sectional shape of the functional body is configured as a polygon. The cross section may form a triangle, a quadrangle, especially a square, a pentagon or a polygon with additional corners. According to FIGS. **10.4** through **10.6** the cross-sectional area is configured in the form of specific geometrical shapes, such as a cross (FIG. **10.4**) or a wave (see FIG. **10.5**), or in the shape of two plate-like bars raised on edge that are connected to each other especially by a cross-connecting girder, such that the overall shape of an H is formed in the cross section. Alternatively, the cross-sectional geometry of the functional body is configured T-shaped according to FIG. **10.7**, I-shaped or double TT-shaped according to FIG. **10.8**, and V-shaped according to FIG. **10.9**. According to FIGS. **10.10** and **10.11** the cross-sectional geometry of the functional body is star-shaped with peaks wherein n (number of peaks)=2 to approximately 8, for example. Depicted is a star shape with three and with four peaks. Further, alternatively, the cross-sectional shape of the functional body according to FIGS. **10.12** and **10.13** is configured circular or elliptical, wherein a hollow space **26** may optionally be provided inside the circular shape. All of these depicted cross-sectional profiles of the functional body may be combined as desired with different cutout geometries of the functional body as seen from a side view. In all embodiments of the functional body the bending stiffness and/or an areal moment of inertia of the functional body **8** relative to an axis perpendicular to a longitudinal symmetry plane **7** of the tool support **6** is a multiple of a bending stiffness and/or an areal moment of inertia of the functional body **8** relative to an axis located in said longitudinal symmetry plane **7**. This ensures that an adequate bending stiffness or an adequate areal moment of inertia exists in the neck **3** and in the handle region **2**—despite an extremely low overall height of the tool support and without additional reinforcement measures in the tool support—when the brush head is stressed by forces toward the rear of the bristle field **5**, as they commonly occur during the tooth brushing process.

[0061] FIGS. **11.1** through **11.6** show various cross-sectional geometries of the functional body **8** along the section C-C in the functional body of FIG. **4**. Accordingly, the cross-sectional shapes of the functional body in a direction perpendicular to the direction of inflow of the plastic for the tool support **6** during the injection process may be different from the cornered configuration according to FIG. **11.1** and may be more of a rounded, circular, oval or more cornered cross-sectional shape. FIGS. **12.1** through **12.3** show cross-sectional shapes that are likewise configured circular, drop-shaped or otherwise rounded (see in particular FIGS. **12.2** and **12.3**), such that a turbulence-free injection and inflow are possible in the flow direction of the injected plastic for the enveloping body **9** also. The flow direction is indicated symbolically in FIGS. **12.1** through **12.3** by the direction of the arrow **31**. In FIG. **12.1** a blister or contraction cavity formation **30** is indicated because the cross-section profiles are not rounded here. The further optimized embodiments according to FIGS. **12.2** and **12.3** are therefore optimized so as to prevent the formation of blisters during the injection/inflow of the enveloping body **9**. The cross sections may be combined with any type of functional support with any possible cutouts or without cutouts and with any cross section according to FIGS. **10.1** through **10.13**.

[0062] FIG. **13** shows the side view of a functional body **8** with a trellis structure slightly modified from that in FIG. **4** in such a way that the cross sections of the trellis girders are configured as in FIGS. **11.1** and **12.1**. FIG. **14** shows an alternative embodiment to FIG. **13** of the functional body **8** in a side view, wherein the cross-sectional areas at the outer contours according to FIG. **11.1** and trellis girders in the inner region according to FIG. **12.3** are configured rounded off. This provides for an optimization against blister formation in the direction of the melt flow during the injection of the plastic component for the enveloping body **9** in the embodiment of FIG. **14**. The two examples according to FIGS. **13** and **14** also illustrate that any desired combination of the cross-sectional shapes according to FIGS. **11** and **12** is feasible. Therefore, sections of the functional body **8** that have a cross component and cutout relative to the longitudinal direction of the toothbrush (which also is mainly along the direction of melt flow) are preferably provided with rounded edges.

[0063] FIGS. **15** and **16** show toothbrushes in side views in which the functional bodies **8** are inserted for example either according to FIG. **13** or FIG. **14**. In the illustration according to FIG. **15** the functional body is shown as the visible part and in the illustration according to FIG. **16** the surrounding material of the enveloping body **9** is shown as the visible part. Especially from FIG. **15** it is therefore apparent that the rearward end **22** of the functional body does not necessarily need to extend to the rearward end **24** of the handle **2**, since bending forces in the rearward section do not play any significant role in the daily use of the toothbrush. The functional body **8** therefore extends over at least half or ⅔ of the handle **2** starting at the thumb rest **25** toward the rearward end of the enveloping body of the toothbrush. In the other longitudinal direction toward the bristle field the functional body extends with the front end thereof by at least one third from the thumb rest **25** to the neck section as shown, for example, in FIG. **3**. Alternatively, an extension to the bristle field, or in a variant also to underneath the bristle field into the head area (not depicted) is possible as well. Preferably, the functional body **8** extends with its front end **23** over the entire neck section **3** or at least over one third of the longitudinal extension.

[0064] The toothbrush having one of the above functional bodies is preferably produced as follows. Individual parts of the process or combinations of process features and device features, if applicable, may constitute an independent subject of the invention also. In a first step the functional body is produced in the form of a metal part or plastic part, in particular die-cut or injection molded as already described above. In a second step the functional body is placed into and secured in an injection mold. In a third step one or a plurality of plastic components of the enveloping body are injection-

molded around the functional body in the mold. Fastening of the bristles takes place beforehand or afterwards according to one of the known methods.

[0065] Securing of the functional body in the mold may take place in different ways. In a first variant the functional body has locating tabs projecting especially towards the contour, at which the securing takes place in the injection mold. These are later removed, e.g. at predetermined breaking points after the enveloping with the enveloping body by means of injection molding, or covered with an additional component by injection-molding. In a second variant the securing takes place at free areas **27**, **28**, **29** and **32** that are not enveloped by the enveloping body **9** in the injection molding process, but the contour of which largely extends or supplements the contour of the enveloping body. This variant is illustrated with the FIGS. **15** through **18**. The enveloping body **9** accordingly has cutouts that correspond to the free areas **27**, **28**, **29**, **32**, at which the functional body **8** emerges visible and graspable after injection-molding of the enveloping body **9** around the former has been completed. FIGS. **17** and **18** schematically show how the functional body **8** is clamped-in and secured—in this case—by two upper and two lower holding jaws **21**. The holding jaws are integrated into the injection molding process as a component of the injection mold. In a further subvariant a further component is injection-molded over and filled into the cutouts. In accordance with a third variant securing of the functional body **8** in the injection mold takes place by means of a lateral extension (not depicted) of the functional body **8** that permits a clamping or a rotation-proof and slide-proof placement of the functional body **8** in the mold. For example, the functional body **8** may be configured for this purpose, especially at its end sections, so as to not lie in the longitudinal symmetry plane **7** but support itself on both side regions of the enveloping body, e.g. wavy or meandering. The cross sections of FIGS. **10.1** through **10.13** also favor this type of support in the tool.

[0066] In the case of a functional body **8** made from plastic, the toothbrush may also be produced in a tool concept comprising immediately successive injection molding steps, e.g. using a rotating mold. In a further variant the functional body is provided largely raised on edge coplanar to the longitudinal symmetry plane in the neck **3** and handle region **2**, and rotated by **90** degrees in the head, so that it can be secured to the lateral surfaces of the head mold section.

[0067] The functional support shown in the figures is enveloped in a height extension Y (see FIG. **2**) in the longitudinal symmetry plane **7** by 0 to 2 mm, especially by 0.05 to 1.5 mm, especially by 0.1 to 1 mm and especially by 0.4 to 0.8 mm by the injection-molded enveloping body **9**. Accordingly, the functional body is covered just barely by the top side and bottom side of the toothbrush (except for potential free areas.) Preferably, the functional body **8** is enveloped or covered by means of injection molding toward the lateral surfaces or lateral edges and in its transversal extension X (see FIG. **1**) relative to the longitudinal axis of the toothbrush **6**—mostly, or almost completely, or entirely—at a distance of to 2 to 15 mm, especially 2 to 6 mm, per side. This means that nearly the entire extension or at least 80% thereof is used in the height from the top side to the bottom side of the toothbrush to ensure the necessary bending stiffness and safety against fracture in this direction. In the transverse direction X, however, the functional body extends only over especially less than 5 to 15% of the total extension from side to side of the toothbrush. It is therefore possible to implement unusual toothbrush geometries by means of the above-described embodiments that have an overall slim enveloping body that is predominantly slimmer in the Y extension in the handle region **2** than in the transverse direction X thereto. This enables even additional waistings in the handle region and/or in the neck region to be implemented in a manner that would otherwise not be feasible (see FIGS. **1** and **2**) without compromising the sturdiness of the toothbrush.

What is claimed is:

1. A device for dental and/or oral care, especially a toothbrush, comprising a preferably approximately rod-shaped tool support (**6**), to which a cleaning tool, especially a bristle field (**5**), can be fastened, wherein the tool support (**6**) is configured as a composite body that comprises an enveloping body (**7**) from a first material, preferably plastic material, and a functional body (**8**) from a second material, preferably metal, which is embedded in said enveloping body (**7**), characterized in that the functional body (**8**) is configured such that an areal moment of inertia of the functional body (**8**) with respect to an axis perpendicular to a longitudinal symmetry plane (**7**) of the tool support (**6**) is a multiple of an areal moment of inertia of the functional body (**8**) with respect to an axis located in said longitudinal symmetry plane (**7**).

2. A device as set forth in claim **1**, wherein the functional body (**8**) is substantially configured plate-like or planar and has in the longitudinal symmetry plane of the tool support (**6**) a maximum extension that is a multiple of the extension of the functional body (**8**) transversal to said longitudinal symmetry plane (**7**).

3. A device as set forth in any of the preceding claims, wherein the functional body (**8**) has a plate-like enveloping surface that is arranged raised on edge in the or parallel to the longitudinal symmetry plane (**7**) of the tool support (**6**).

4. A device as set forth in any of the preceding claims, wherein the tool support (**6**) forms a bristle tube and/or a handle (**2**) of a toothbrush (**1**), wherein the functional body (**8**) ends in front of a bristle field fastening section of the tool support (**6**) and/or the bristle field fastening section of the tool support (**6**) is configured reinforcement-free.

5. A device as set forth in any of the preceding claims, wherein the functional body (**8**) forms a reinforcing body and consists of a material having a higher strength and/or stiffness than the material of which the enveloping body (**9**) is made.

6. A device as set forth in the preamble of claim **1** or any of the preceding claims, wherein the enveloping body (**9**) is configured transparent in the region of the functional body (**8**) at least in some sections thereof, such that the functional body (**8**) can be viewed through the enveloping body (**9**).

7. A device as set forth in the preceding claim, wherein the enveloping body (**9**) is configured in its transparent section so as to be optically image-changing, particularly distorting, blurring, magnifying and/or demagnifying.

8. A device as set forth in any of the two preceding claims, wherein the enveloping body (**9**) in its transparent section forms an optical lens.

9. A device as set forth in any of the two preceding claims, wherein the enveloping body (**9**) in its transparent section forms an optical prism.

10. A device as set forth in any of the preceding claims, wherein the embedded functional body (**8**) is configured opaque.

11. A device as set forth in any of the preceding claims, characterized in that the functional body (**8**) is configured at least in some sections thereof as a girder assembly having

longitudinal girders (**12**) substantially extending in the longitudinal direction of the tool support and a multiplicity of cross-connecting girders (**13**), or that the functional body is configured with cutouts.

12. A device as set forth in claim **1**, wherein the girder assembly is configured as a girder frame (**11**).

13. A device as set forth in any of the preceding claims, wherein the longitudinal girders (**12**) are adapted in their profile to the outer contour of the enveloping body (**9**) and have at least in some sections thereof a profile deviating from the straight line.

14. A device as set forth in any of the preceding claims, wherein the longitudinal girders (**12**) form the outer contour of the girder frame (**11**) and/or are arranged along the edges thereof.

15. A device as set forth in any of the preceding claims, wherein the girder frame (**11**) is integrally formed as one piece of homogeneous material.

16. A device as set forth in any of the preceding claims, wherein the longitudinal girders (**12**) have a varying spacing from each other along the longitudinal extension thereof.

17. A device as set forth in any of the preceding claims, wherein the cross-connecting girders (**13**) are configured with different lengths, and/or at differently acute pitches relative to the longitudinal girders (**12**).

18. A device as set forth in the preamble of claim **1** or any of the preceding claims, wherein the functional body (**8**) has at least in some sections thereof a meandering or wavy profile along a longitudinal extension of the tool support (**6**).

19. A device as set forth in the preceding claim, wherein the meandering or wavy profile has an amplitude that varies over the longitudinal extension of the tool support (**6**).

20. A device as set forth in one of the two preceding claims, wherein the meandering or wavy profile is configured two-dimensional.

21. A device as set forth in any of the preceding claims, wherein the cutouts are configured continuous, particularly as circular openings.

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