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(54) **TOOTHBRUSH COMPRISING A RESILIENT FLEX REGION**

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(75) Inventors: **Hans Halm**, Baleares Espana (DE);
Hans Kramer, Buhl (DE)

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Correspondence Address:

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**FINNEGAN, HENDERSON, FARABOW,
GARRETT &
DUNNER LLP**
1300 I STREET, NW
WASHINGTON, DC 20005 (US)

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(73) Assignee: **SmithKline Beecham Consumer
Healthcare GmbH**

(57) **ABSTRACT**

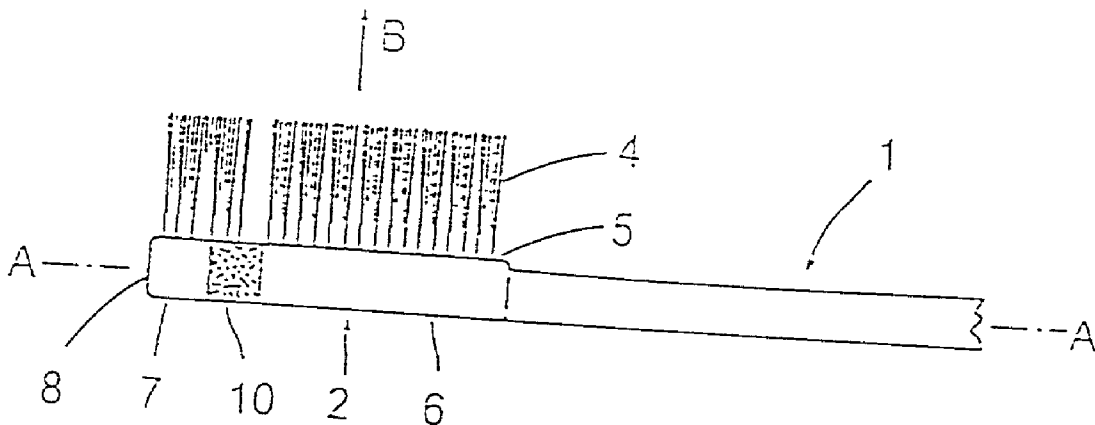
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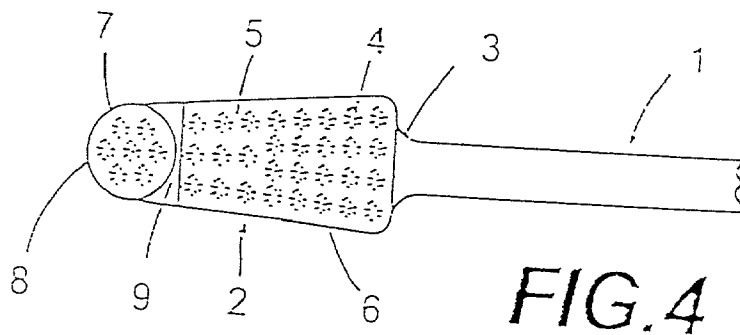
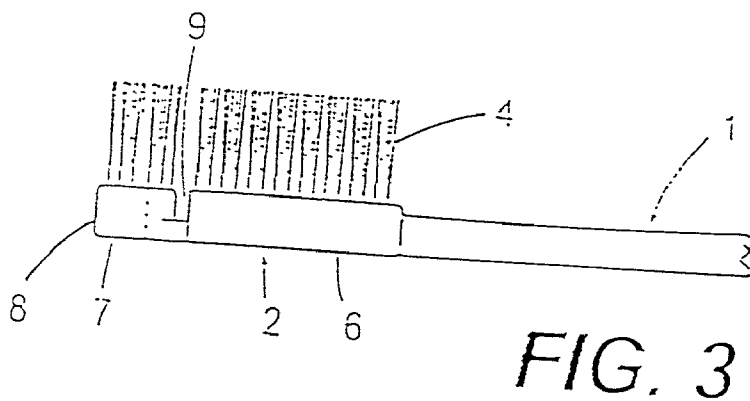
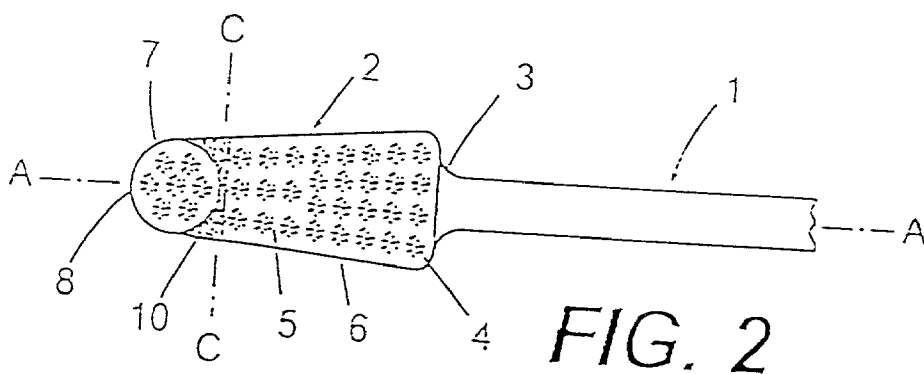
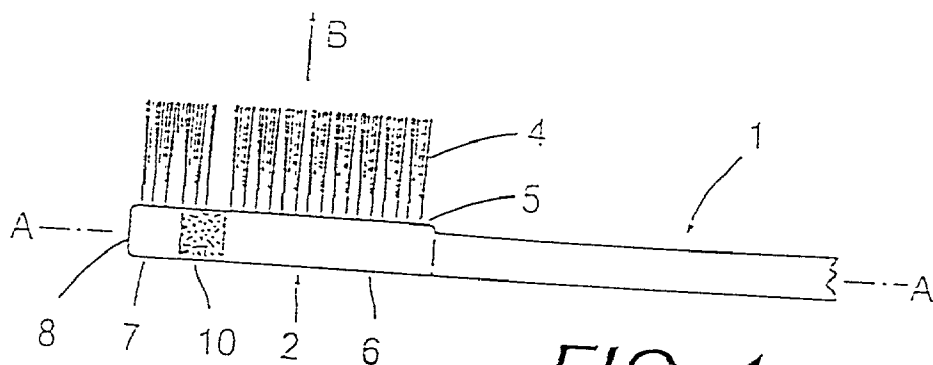
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Related U.S. Application Data

(60) Division of application No. 09/029,274, filed on May 26, 1998, now Pat. No. 6,178,582, which is a continuation-in-part of application No. 08/437,759, filed on May 9, 1995, now Pat. No. 5,651,158, which is a continuation of application No. 08/306,842, filed on Sep. 14, 1994, now abandoned, which is a continuation of application No. 08/122,408, filed on Sep. 27,

A toothbrush comprising a handle with a head includes a base end facing the handle in a tip end remote from the base end. The head adjoins the handle at the base end of the head, and the head and the handle are disposed along the longitudinal toothbrush axis. The head also includes a substantially rigid base region joining the toothbrush handle and extending from the base end of the head to a link region situated between the base end and the tip end. The head further includes a tip region extending from the tip end of the head to the link region, such that the tip region is flexibly and resiliently linked at the link region to the base region and the base region extends for at least 60% of the distance between the base end of the head and the tip of the head.





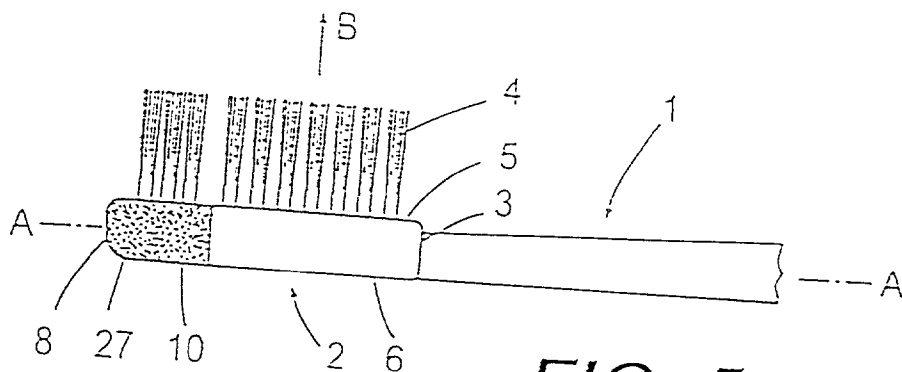


FIG. 5

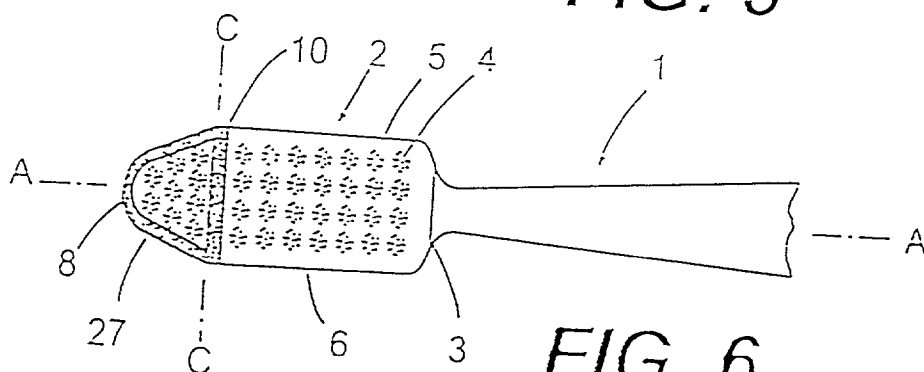


FIG. 6

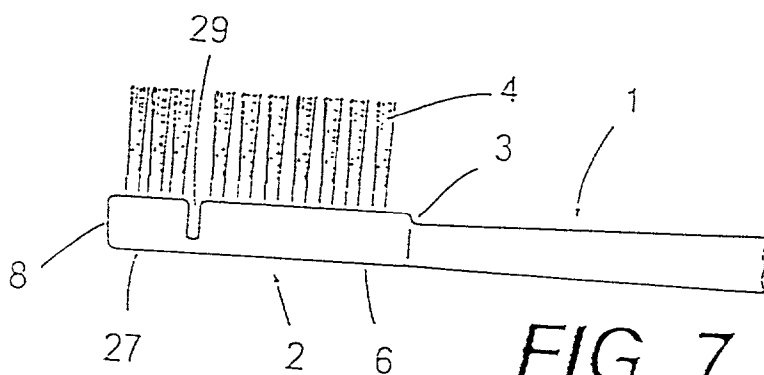


FIG. 7

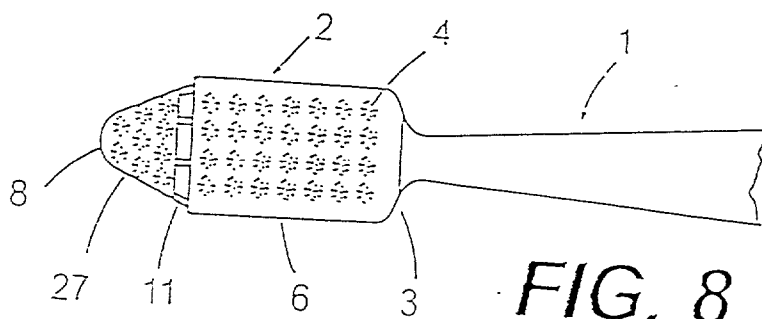
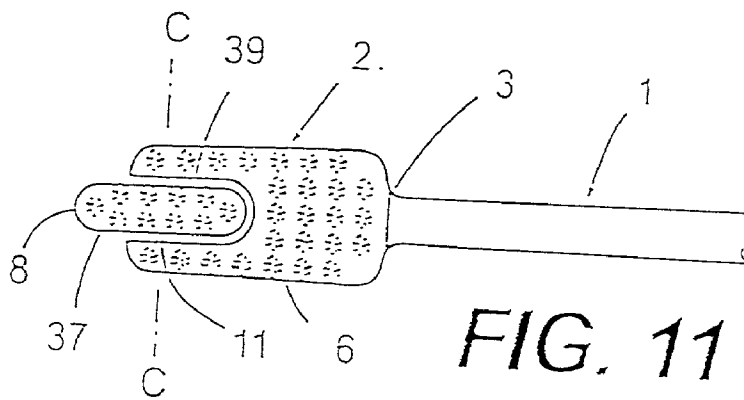
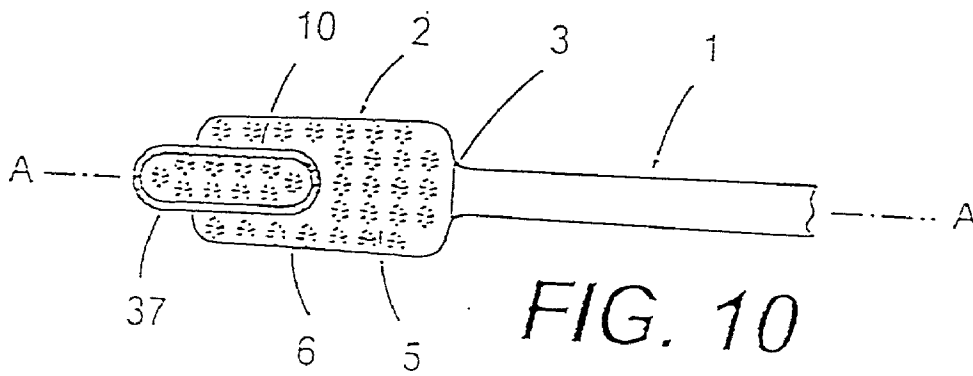
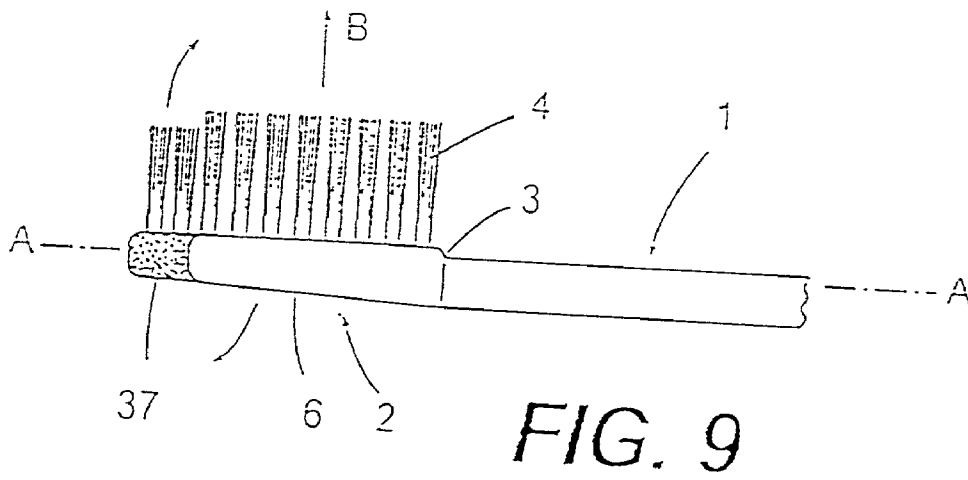
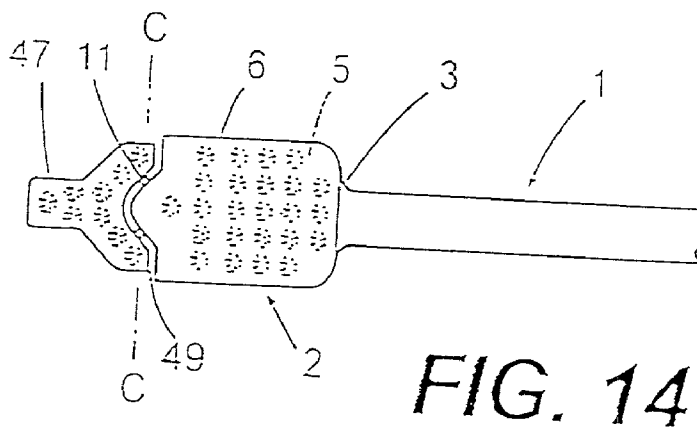
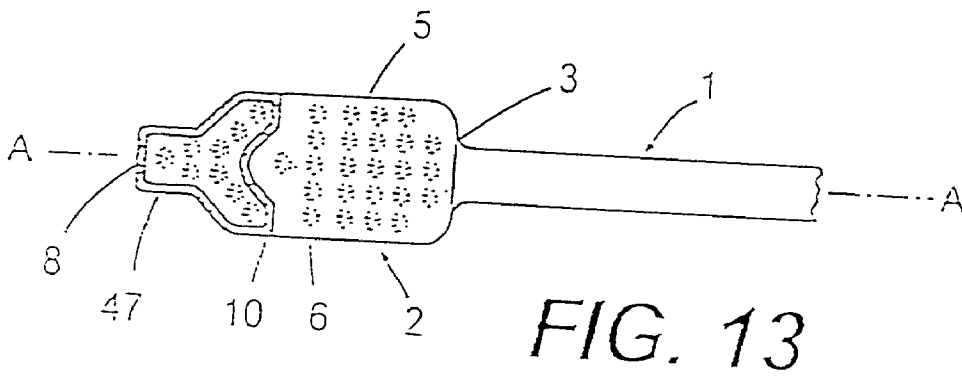
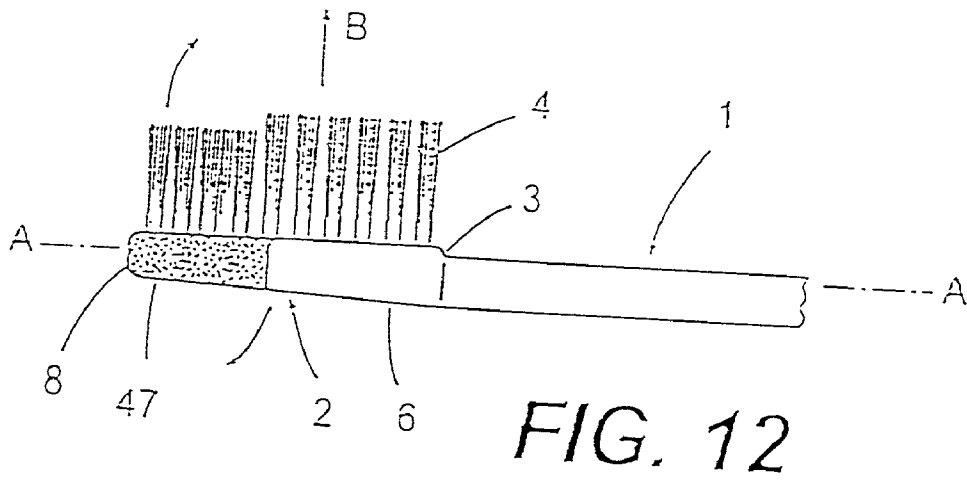


FIG. 8





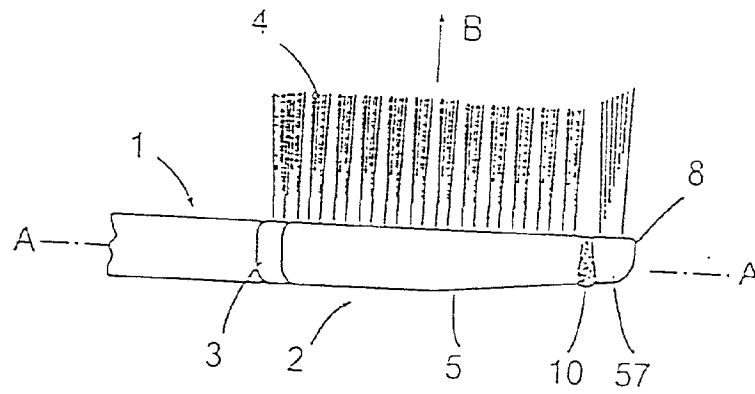


FIG. 15

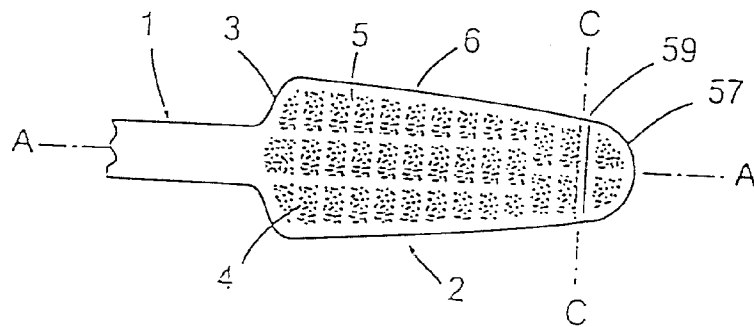


FIG. 16

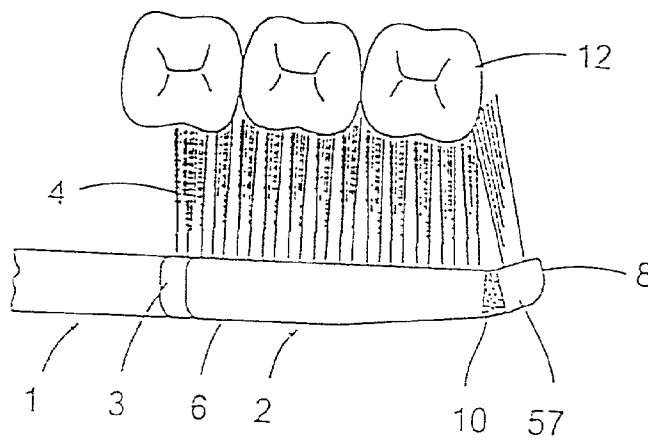
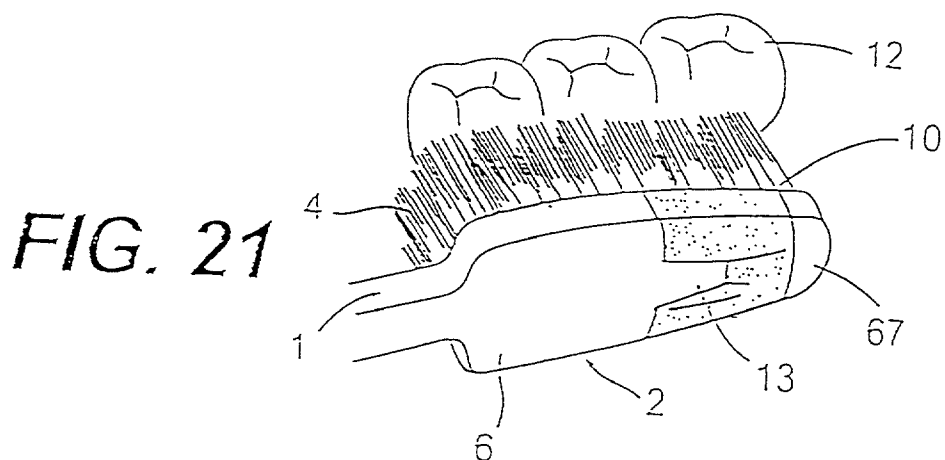
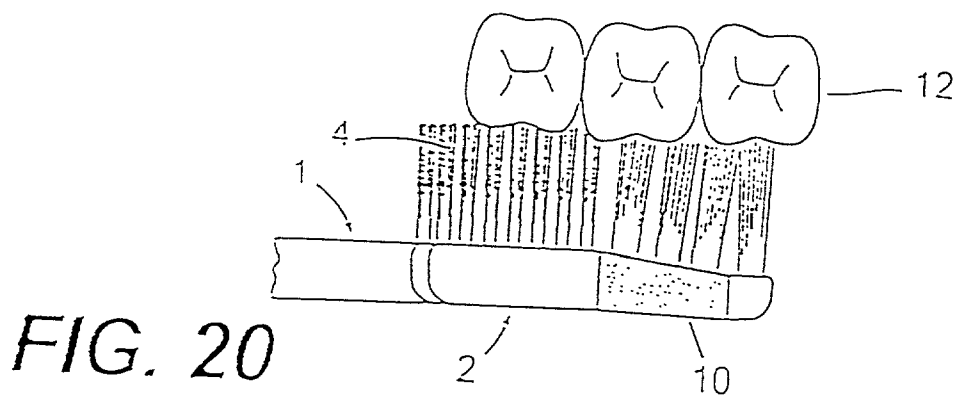
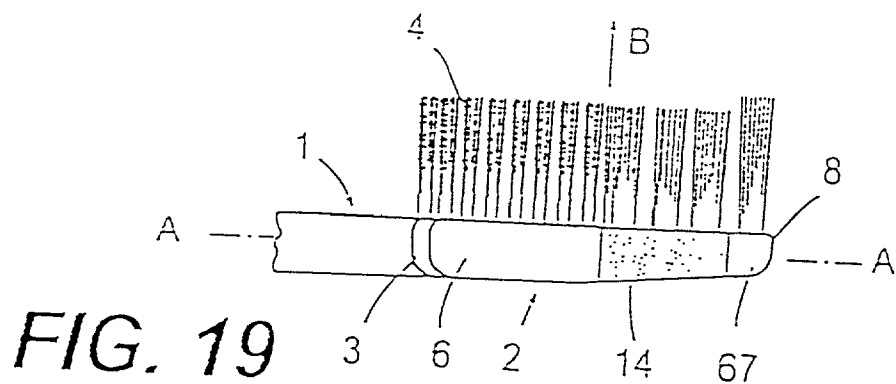
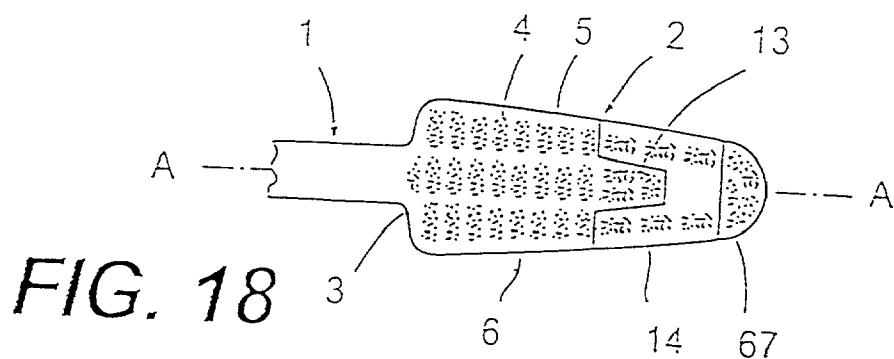
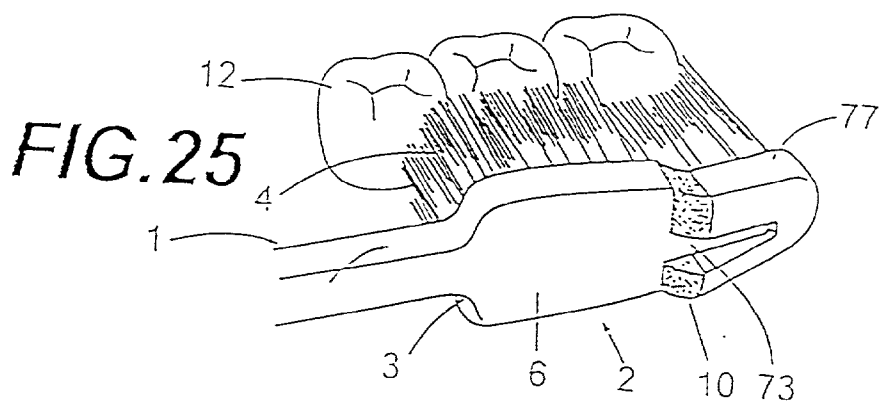
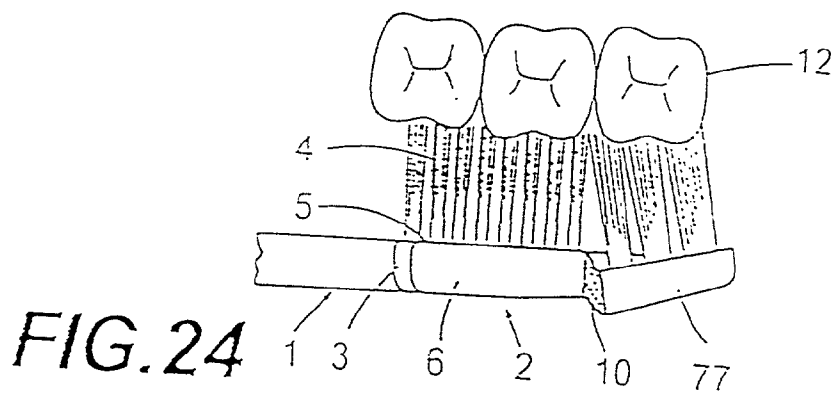
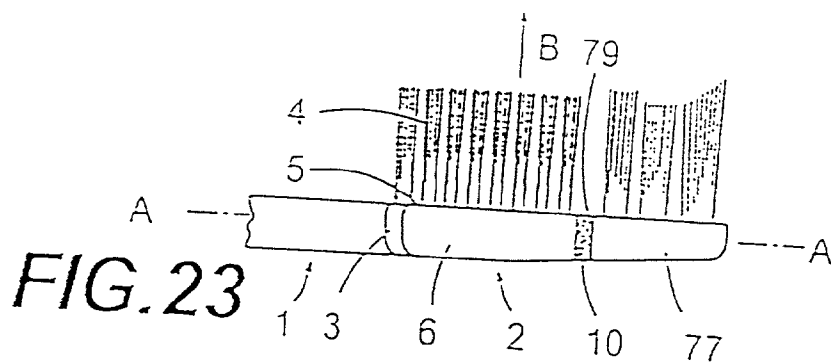
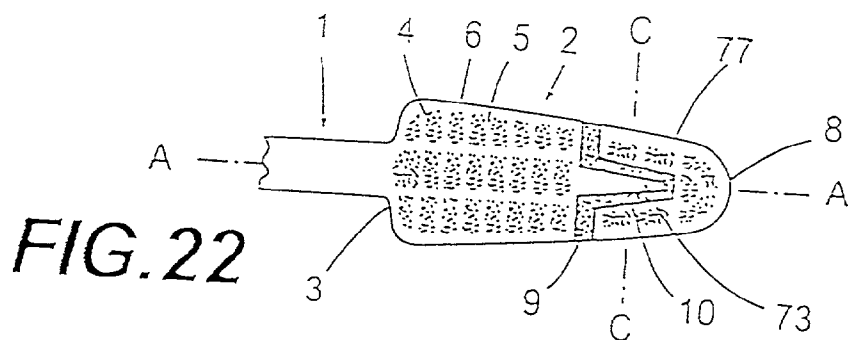
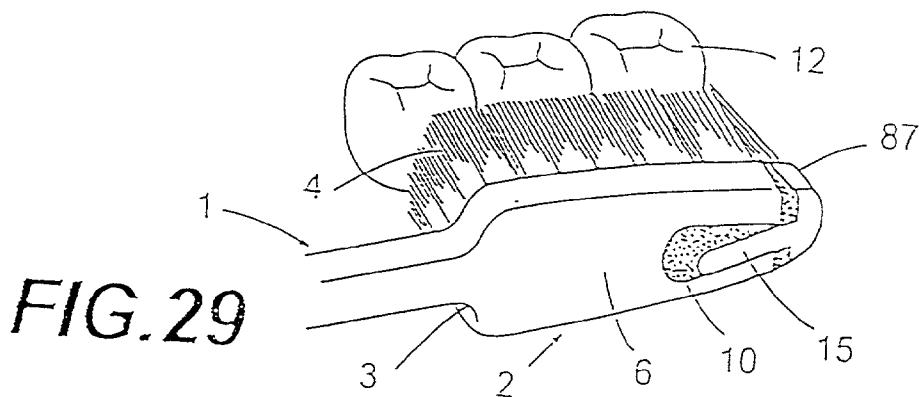
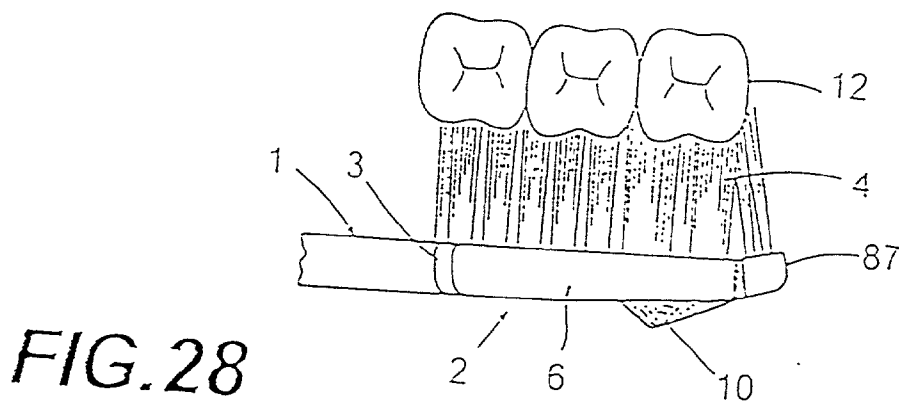
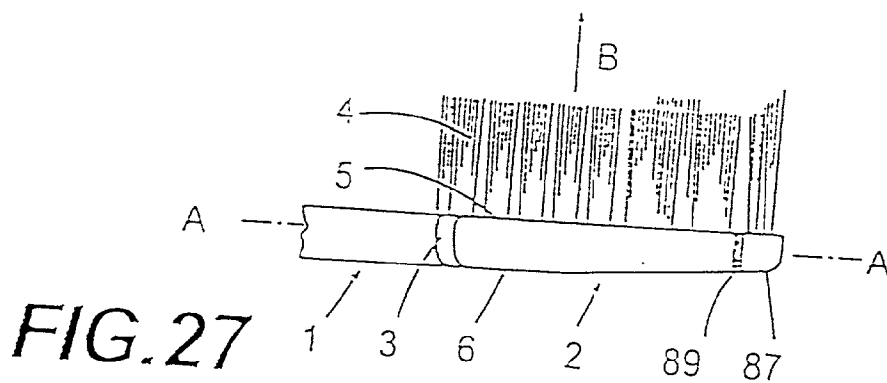
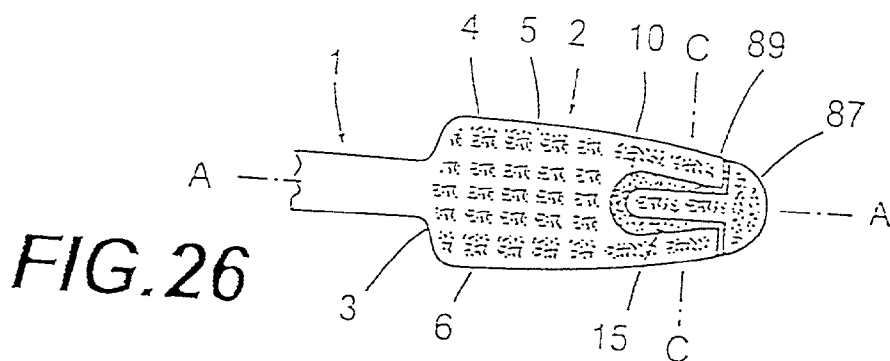


FIG. 17







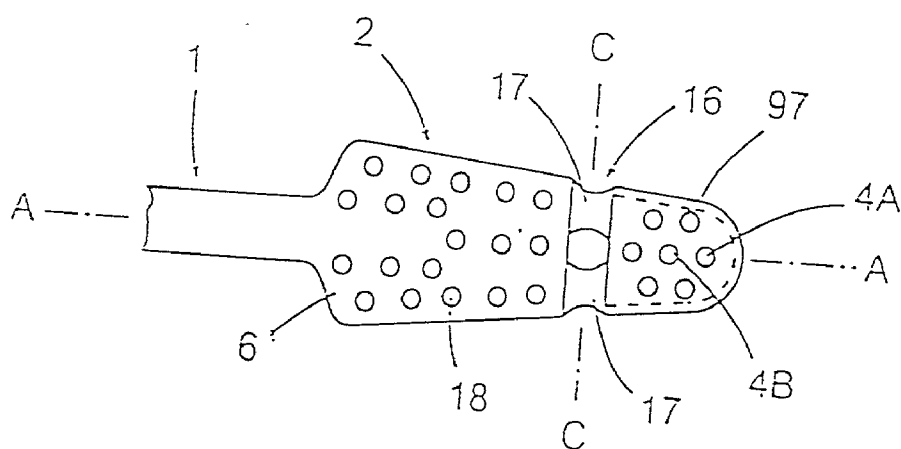


FIG. 30

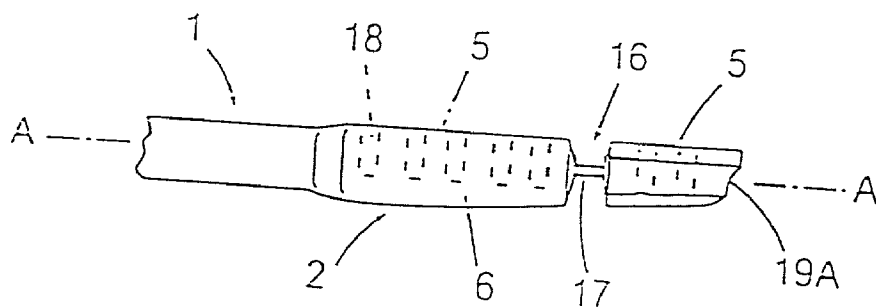


FIG. 31

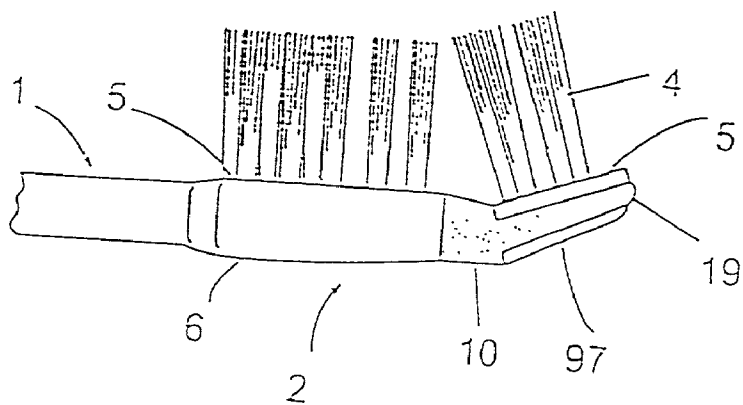
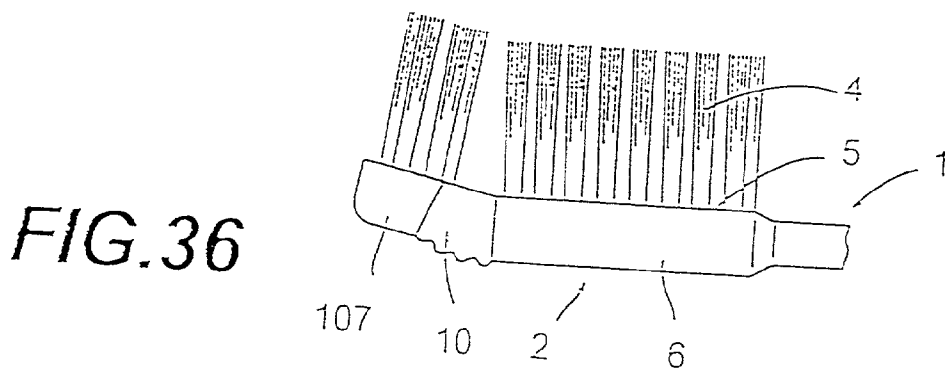
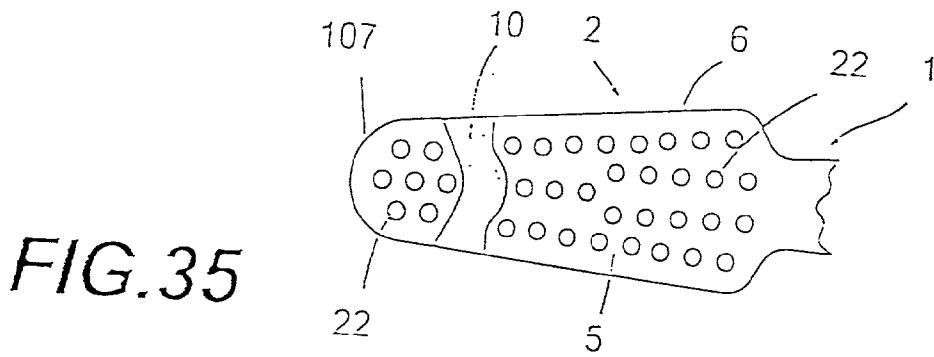
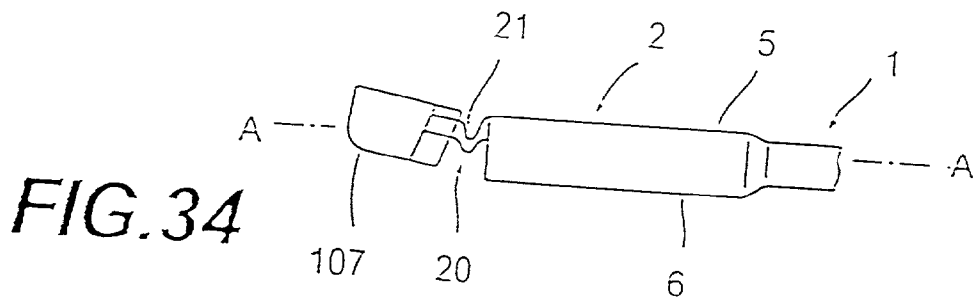
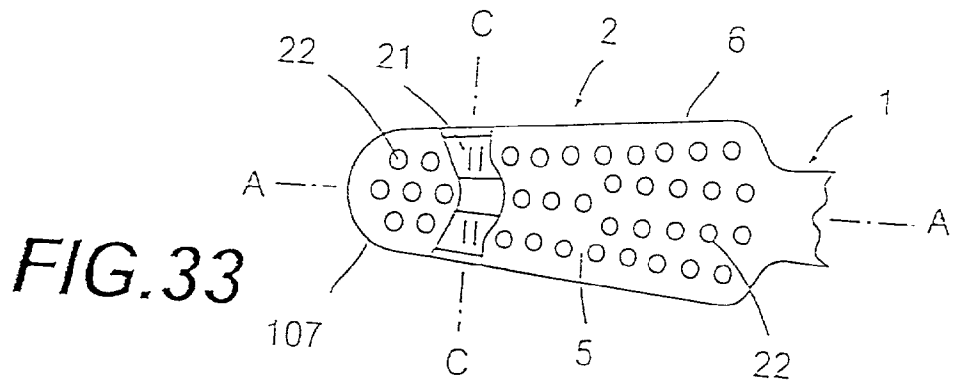


FIG. 32



TOOTHBRUSH COMPRISING A RESILIENT FLEX REGION

[0001] This invention relates to toothbrushes, in particular to toothbrushes having a flexibly linked region in their head.

[0002] Toothbrushes having a flexibly linked region in their head are known. For example WO 92/17093 discloses a toothbrush in which the head is divided into two or more segments which are flexibly and resiliently linked to each other and/or to the handle of the toothbrush. A particular form of the toothbrush of WO 92/17093 has a head which has grooves in the reverse face of the head from which the bristles extend, these grooves being filled with an elastomeric material to modulate the flexibility. The embodiments disclosed in have their grooves distributed in a generally uniform distribution over the reverse face of the head, or around the longitudinal mid point of the head, so as to enable the whole head to accommodate itself to the curved shape of the teeth. WO 96/02165 discloses toothbrushes with flexible heads similar in construction to those of WO 92/17093, and having a generally concave profile of bristle ends. DE-G 87 05 474.4 discloses a toothbrush in which the tip region of the head is hinged to a base region of the head and an operating button on the handle allows the tip region to fold relative to the base region.

[0003] It is an object of this invention to provide a toothbrush in which the flexibility of the head is concentrated in the tip of the head remote from the handle, so as to improve the ability of the toothbrush to clean surfaces of the teeth which face the back of the mouth.

[0004] According to this invention a toothbrush comprises a handle with a head, the head having a base end facing the handle and a tip end remote from the base end, the head adjoining the handle at the base end of the head, the head and handle being disposed along a longitudinal toothbrush axis, the head having bristles extending from a bristle face to the head, characterised in that the head comprises a substantially rigid base region adjoining the toothbrush handle and extending from the base end of the head to a link region situated between the base end and the tip end, and a tip region extending from the tip end of the head to the link region, both the base region and tip region being bristle bearing, the tip region being flexibly and resiliently linked at the link region to the base region.

[0005] The above-described construction of toothbrush concentrates flexibility of the head at the tip end of the toothbrush, the linking of the tip region and base region is preferably in a manner which enables the tip region to fold or pivot resiliently relative to the base region during toothbrushing. The link provided at the link region between the tip region and the base region allows the tip region to fold or pivot during use about a fold or pivot axis which is in the plane of the bristle face and generally transverse to the longitudinal toothbrush axis such that bristles on the tip region can lean backwards, i.e. so that the free ends of bristles in the tip region swing toward the handle, assisting the bristles to clean surfaces of the teeth which face the back of the mouth. The flexible linking also helps to prevent excessive brushing pressure from being applied during toothbrushing.

[0006] Normally the head of the toothbrush will adjoin the handle of the toothbrush via a neck region between the base of the toothbrush head and the part of the handle which is held during use.

[0007] The base region is substantially rigid, that is, during the operation of brushing the teeth the base region does not significantly flex beyond the usual limits of flexing of a plastics material toothbrush head.

[0008] The link region is preferably in the longitudinal half of the head furthest from the base of the head. Suitably the base region extends for at least 60%, for example at least 75% of the distance between the base end of the head and the tip of the head.

[0009] The tip region may also be substantially rigid, so that the tip region does not itself significantly flex apart from its folding or pivoting relative to the base region. The tip region may be of a variety of shapes accommodated to the shape of the tip of the head, e.g. circular, triangular (including ogival), rectangular, elongate, lozenge shape etc.

[0010] In its non-stressed condition, i.e. when not being used, the bristle face of the tip region and base region of the toothbrush of this invention may be substantially coplanar, i.e. with a substantially 180° angle between them. In a preferred embodiment of the toothbrush of this invention the bristle face of the tip region forms an angle of less than 180° with the bristle face of the base region, e.g. 150°-179°, suitably 155°-170°. A suitable angle is one in which the free ends of the bristles on the handle side of the tip portion are in close proximity to, e.g. touching, the free ends of bristles on the tip side of the base region.

[0011] The link region between the tip region and the base region in one embodiment of this invention comprises an aperture, space or chasm in the head material between the tip and base regions which is bridged by means of one or more thin links of flexible and resilient plastics material. In this construction the head is effectively in two regions linked by such links. Such links may comprise thin spines, thin strips, or a continuous thin membrane, made of a both flexible and resilient plastics material. These spines, thin strips or membrane may be in the same plane as a substantially planar head, or may slope or may be curved out of planarity. The plastics material may be the same plastics material as the tip and base regions but being flexible by virtue of thinness, e.g. the tip, base and bridge(s) may be integrally moulded.

[0012] In another embodiment of this invention the link region between the tip region and the base region may comprise a composite region between the tip region and base regions, the composite region having structural elements made of both plastics material and an elastomeric material. For example the composite region may comprise an aperture, space or chasm in the head material between the tip and base regions which is bridged by means of a combination of thin spines, strips or a continuous membrane of a both flexible and resilient plastics material, e.g. integral with the head, and also by an elastomeric material in the aperture, space or chasm. These spines, thin strips or membrane may be in the same plane as a substantially planar head, or may slope or may be curved or folded out of planarity. In this construction the head is effectively in two regions linked by such links, and the links are embedded in a covering layer of rubber.

[0013] Such a composite region may for example comprise a net, ladder, latticework, cellular or trellis structure of plastics material integral with the material of the head, with interstices containing the elastomeric material. Such a com-

posite region may for example comprise one or more, for example two, strips of a plastics material integral with the material of the head, the strips being thinner than the thickness of the head, and extending between the tip region and base region to bridge an aperture, space or chasm between the tip region and the base region, the aperture, space or chasm also containing an elastomeric material, suitably bonded to the sides of the space and to the strips and suitably substantially filling the aperture, space or chasm, optionally also bulging above the surface of the surrounding plastics material of the head. Relative to the thickness of the toothbrush head the strips in such a construction may be closer to the bristle face than to the back of the head. The plastics material parts in such a composite region may be thick enough to contribute materially to the flexibility and resilience of the link region, or alternatively they may be so thin as to contribute little to the flexibility and resilience of the link region, and may thus serve simply to retain the tip and head regions together before the elastomer is added.

[0014] In another embodiment of this invention the link region between the tip region and the base region may comprise an aperture, space or chasm in the head material between the tip and base regions which is bridged solely by means of a complete or partial filling of an elastomeric material. In this construction the head is effectively in two regions with a gap between them containing the elastomer. This elastomeric material is preferably bonded to the tip region and base region on opposite sides of the aperture, space or chasm so as to hold the tip region and base region together.

[0015] The above-mentioned apertures or spaces may comprise a slot, chasm or cut out across the width of the head, dividing the base region from the tip region. Such an aperture may be open at the bristle face of the head and/or at the opposite face of the head, and may pass completely through the head. Such apertures, spaces or chasms may be of various shapes, for example widthways slots. These may in plan be substantially straight aligned widthways, curved or angular, e.g. generally "C", "U" or "V" shaped. In such a construction the convex bulge of the "U" or "C" or the apex of the "V" may point either toward the handle or toward the tip of the head away from the handle. Alternatively such aperture, space or chasms may be narrow at the edges of the head and widen toward the centre of the head or vice versa.

[0016] Suitably for example the aperture, space or chasm may comprise one or more, preferably one, grooves with a depth of part of the thickness of the head such that the remaining plastics material at the bottom of the groove forms a thin link of plastics material. The groove may then be filled wholly or partly with elastomeric material to form a composite region.

[0017] Alternatively the aperture, space or chasm may pass, in places at least, completely through the thickness of the head, for example leaving bridges of head material crossing the aperture, space or chasm between places where the aperture, space or chasm passes completely through the thickness of the head. Such an aperture, space or chasm may be wholly or partly filled with elastomeric material to thereby form a composite region. When the aperture, space or chasm pass completely through the thickness of the head for the whole of their length they may be wholly or partly filled with an elastomeric material.

[0018] The aperture, space or chasm may extend widthways to the sides of the toothbrush head, and elastomeric material therein may be extended around the tip region of the head and/or around the base region of the head to form an elastomeric buffer around the toothbrush head to soften any impact of the toothbrush head with the gums of the user, and also to gently massage the gums. Alternatively elastomeric material may be provided around the tip region of the head to form an elastomeric buffer in a known manner e.g. as in FR 442832 and DE 36 28 722.

[0019] When the aperture, space or chasm contains an elastomeric material the outer surface of this elastomeric material may have a corrugated surface, which may further help to control the flexibility of the link region.

[0020] In one embodiment of the toothbrush of this invention, the head is constructed such that the tip region may fold backwards resiliently relative to the base region, during toothbrushing, about a widthways oriented fold axis that crosses the head in the link region. The fold axis may cross the head in or on the edge of an aperture, space or chasm as described above. In such a construction, the aperture, space or chasm may be shaped such that the widthways oriented fold axis crosses the head of the toothbrush entirely within the aperture, space or chasm. When the link region is a composite region as described above, the folding may occur by bending of the above described plastic material parts, or bending at the point where such a part meets the edge of the aperture, space or chasm.

[0021] Such a construction can cause the entire tip region to fold in the bristle direction away from the plane which lies between the bristle face and the opposite face of the head, so that the tip region in effect folds backwards towards the base region during use in toothbrushing. This folding can facilitate tooth cleaning, for example enabling the toothbrush head to accommodate itself better to the curved shape of the row of the teeth.

[0022] In an alternative embodiment of the toothbrush of this invention, the tip region and/or link may be constructed and positioned such that the tip region can pivot resiliently relative to the base region during toothbrushing, about a widthways oriented pivot axis that crosses the tip region intermediate between its tip end and its base end.

[0023] Such a construction causes pivoting of the tip region about this axis intermediate along its length, i.e. causes the tip region to have a "see-saw" action in which during toothbrushing part of the tip region toward the tip of the head pivots in the bristle direction away from the plane which lies between the bristle face and the opposite face of the head, and the part of the tip region toward the base region of the head pivots in a direction opposite to the bristle direction away from the plane which lies between the bristle face and the opposite face of the head, or vice versa.

[0024] In this embodiment such pivoting may for example be achieved in a construction of head in which the tip end of the base region is in the form of two limbs which partly surround a part of the tip region which extends in the base direction between them, with the link between the tip region and the base region. For example the tip end of the base region may be made in the shape of a two pronged fork-like frame, with a part of the tip region between the two prongs of the fork, and a link between the tip region and base region.

[0025] In an alternative construction of the head of this embodiment the base end of the tip region may be in the form of two limbs which partly surround a part of the base region which extends in the tip direction between them, with the link between the tip region and the base region. For example the base end of the tip region may be made in the shape of a two pronged fork-like frame, with a part of the base region between the two prongs of the fork, and a link between the tip region and base region.

[0026] For example the tip region may be made generally "C", "U" or "V" shaped with its limbs toward the base region, or "Y" shaped with the upper limbs of the Y towards the base region. The part of the base region which extends in the tip direction may lie between the said limbs.

[0027] In a construction of head in which the tip end of the base region is in the form of two limbs which partly surround a part of the tip region which extends in the base direction between them, with an aperture between the tip region and the base region, thin links of flexible and resilient plastics material as described above may be provided between the said limbs and the respective tip region. In a construction of head in which the base end of the tip region is in the form of two limbs which partly surround a part of the base region which extends in the tip direction between them, with an aperture between the tip region and the base region, such bridges may be provided between the said limbs and the base region. Suitably in such toothbrushes such bridges may be provided at points widthways diametrically opposite each other to define a pivot axis and to encourage pivoting in a plane in which the longitudinal axis lies. Additionally or alternatively such bridges may be provided at other points in the aperture to encourage pivoting about other axes.

[0028] The elastomeric material may be an elastomeric material as commonly used in two-component toothbrushes, e.g. that described in EP 0336641, which can be bonded to plastics materials used for toothbrush handle manufacture. Such an elastomeric material can be injected into the toothbrush mould shortly after injection moulding of the plastics material parts of the toothbrush so that the hot plastics material fuses and bonds with the elastomeric material. This is a generally known process.

[0029] In the base region the bristles may be disposed in discrete generally circular section tufts in patterns which are generally known in the field of toothbrushes, for example in longitudinal or widthways rows at a generally conventional spacing. If fused in, the bristles may additionally or alternatively be disposed in "mats" of a cross section which may be circular or other than circular.

[0030] In the tip region the bristles may be disposed in discrete generally circular section tufts, or if fused in, the bristles may additionally or alternatively be disposed in "mats" of a cross section which may be circular or other than circular. In the tip region it is preferred to dispose the bristle tufts in either (i) a pattern of discrete tufts arranged in a generally circular or polygonal pattern, or (ii) a single tuft of generally rounded cross section perpendicular to the bristle face, or (iii) a tuft of generally "C" or "U" shaped cross section perpendicular to the bristle face having at least one of the limbs of the "C" or "U" aligned generally parallel to the longitudinal toothbrush axis and with the rounded bend of the "C" or "U" facing the end of the bristle face remote from the handle.

[0031] The ends of the bristles remote from the bristle face may be substantially coplanar. Alternatively the ends may undulate about a plane to accommodate the ends of the bristles to the undulating profile of the teeth or to lie in a "battlemented" shape to help clean the interdental spaces. Such undulating surface bristles are known. Additionally or alternately the ends of the bristles remote from the bristle face on the tip region may lie in a different plane to the ends of the bristles remote from the bristle face on the base region of the head. For example the plane of the said ends on the tip region may slope upwards away from the bristle face in the direction away from the handle. This may for example be achieved in the preferred embodiment of the toothbrush of the invention in which the bristle face of the tip region forms an angle of less than 180° with the bristle face of the base region.

[0032] The handle may be of generally conventional construction, and may for example include a folded flexible region, and grip pads of elastomeric material, as exemplified in EP 0336641. Elastomeric grip pads may alternatively or additionally be located on other parts of the toothbrush handle as convenient.

[0033] The toothbrush of the invention may be made by generally conventional injection moulding techniques, for example in which a plastics material "skeleton" is first made by injection moulding, then elastomer parts if present, are introduced by a subsequent injection moulding step, in which the elastomer is injected as a hot fluid and bonds to the plastics material. Such techniques, and suitable plastics materials and elastomer materials, are well known. If the link region includes an elastomer material then this may be injected with the same injection step as is used to inject elastomer grip pads, and these various regions of elastomeric material may be connected by moulding channels in a known manner.

[0034] In the embodiment of the invention in which the bristle face of the tip region forms an angle of less than 180° with the bristle face of the base region, when the link region comprises the above-described composite region between the tip region and base regions, the composite region having structural elements made of both plastics material and an elastomeric material, the toothbrush is preferably made as follows. Firstly the plastics material skeleton is made by injection moulding, with the bristle face substantially flat, then the tip region is folded to the desired angle with the base region, then the elastomer is injected into the link region.

[0035] The bristles may also be of generally conventional construction and materials, and may be fastened into the bristle face by generally known techniques. For example small metal clips around the ends of bristles to be fixed into the head, which are then wedged into sockets in the bristle face. Alternatively the bristles may be fused into the head material, again using known techniques.

[0036] The invention will now be described by way of example only with reference to the accompanying figures in which

[0037] FIGS. 1 to 36 show various plan, side and perspective views of toothbrush heads of the invention, and views without the elastomeric material, thereby showing the underlying construction of the head.

[0038] Referring to FIGS. 1 to 4, a toothbrush in which the tip region is constructed to fold resiliently relative to the

base region, during toothbrushing, about a widthways oriented fold axis that crosses the head at the edge of the tip region which faces the base region is shown.

[0039] This toothbrush comprises a handle **1** with a head **2** integrally adjoining the handle at a base end **3** of the head, the head **2** and handle **1** being disposed along a longitudinal toothbrush axis A-A, the head **2** having bristles **4** extending from a bristle face **5** of the head in a general bristle direction B.

[0040] The head **2** comprises two regions. A substantially rigid base region **6** integral with the toothbrush handle **1** extends from the base end **3** of the head **2** to a distance in the longitudinal half of the head **2** furthest from the base **3** of the head. A tip region **7** extends from the extreme tip **8** of the head **2** toward the base region **6**. Both the base region **6** and tip region **7** are bristle **4** bearing.

[0041] The tip region **7** is flexibly and resiliently linked to the base region **6** by a flexible link which comprises an aperture **9** in the head **2** material between the tip region **7** and the base region **8**. The aperture **9** is in the form of a groove, open at the bristle face **5** of the head **2**, and extending transversely across the entire width of the head **2**. The groove **9** contains a resilient elastomeric material **10**. The flexible link between the tip region **7** and the base region **8** consequently is provided by the composite region comprising the thinned plastics material at the base of the groove **9**, combined with the elastomeric material **10**. The flexible link enables the tip region **7** to fold resiliently relative to the base region **6** backwards towards the handle **1** during toothbrushing, in the direction shown by the arrow in **FIG. 1**.

[0042] The tip region **7** is of a substantially circular shape, bounded by the curved perimeter of the tip **8** of the head **2** over part of its perimeter, and by a curved edge of the aperture **9** over the part of the perimeter of the tip region **7** facing the base region **6**. The opposite edge of the aperture **9**, on the side nearest the base **3**, extends in a straight edge across the width of the head **2**, and the tip region can fold about the axis C-C, which crosses the head **2** transversely in the aperture **9** between the tip region of the head **2** and the base region, so that the tip end of the tip region **7** moves in the bristle direction B.

[0043] In the tip region **7** the bristles **4** are arranged in a generally polygonal pattern of tufts which comprises a central tuft surrounded by a regular hexagonal pattern of tufts symmetrically arranged, such that there are equal numbers of tufts i.e. three of the surrounding tufts disposed on either side of the longitudinal axis A-A of the toothbrush.

[0044] As shown more clearly in **FIGS. 3 and 4** which show the head **2** without the elastomeric material **10** in the groove **9**, the aperture **9** is in the form of a groove which extends part way through the thickness of the head **2**, so as to leave a thinned region of the plastics material of the head **2** of the toothbrush at the bottom of the groove.

[0045] Referring to **FIGS. 5, 6, 7 and 8**, an alternative construction of the head **2** of a toothbrush of this invention in which the tip region **7** is constructed to fold resiliently relative to the base region **6**, during toothbrushing, about a widthways oriented fold axis C-C that crosses the head at the edge of the tip region which faces the base region is shown in plan views and a side view.

[0046] In **FIGS. 7 and 8** the head **2** is shown without elastomeric material. Parts corresponding to those of **FIGS. 1 to 4** are numbered correspondingly. The tip region **7** is generally triangular in shape. The aperture **9** is in the form of a straight line shaped slot extending widthways across the head **2** of the toothbrush and entirely through its thickness, but incorporating thin integral bridges **11**. The tip region **7** can fold about the axis C-C, which crosses the head **2** transversely in the aperture **9**.

[0047] The elastomeric material **10** is extended around the tip **8** of the head **2** to form an external buffer around the tip **8** of the head **2**.

[0048] Referring to **FIGS. 9, 10 and 11** a toothbrush in which the tip region is constructed to pivot resiliently relative to the base region, during toothbrushing, about a widthways oriented pivot axis that crosses the tip region intermediate between its tip end and its base end, is shown. In **FIG. 10** the toothbrush head is shown without the elastomeric material. In **FIGS. 10 and 11** bristles are omitted from the base region **6** for clarity. Parts corresponding to **FIGS. 1 to 8** are correspondingly numbered.

[0049] The head **2** comprises two regions. A substantially rigid base region **6** integral with the toothbrush handle **1** extends from the base end **3** to the head **2** to a distance in the longitudinal half of the head **2** furthest from the base **3** of the head. A tip region **7** extends from the extreme tip **8** of the head **2** toward the base region **6**. Both the base region **6** and tip region **7** are bristle **4** bearing.

[0050] The tip region **7** is flexibly and resiliently linked to the base region **6** by a flexible link which comprises an aperture **9** in the head **2** material between the tip region **7** and the base region **8**. The aperture **9** is in the form of a groove, open at the bristle face **5** of the head **2**, and extending transversely across the entire width of the head **2**. The groove **9** contains a resilient elastomeric material **10**, which extends around the tip end of the tip region **7** to form a buffer. The base region **8** integrally extends in the tip direction in the form of two limbs forming a two pronged fork which partly surrounds the tip region **7** which lies between the limbs. The aperture **9** partly surrounds the tip region **7** both on the side which faces the base region **8**, and around part of the longitudinal sides of the tip region **7**, e.g. a generally crescent shaped aperture.

[0051] The aperture **9** is in the form of a slot extending widthways across the head **2** of the toothbrush and entirely through its thickness, but incorporating thin integral bridges **11**, shown in **FIG. 10**, which are provided at points widthways diametrically opposite each other on either longitudinal side of the tip region, and which provide pivot points about which the tip region **7** can pivot, as shown by the arrows in **FIG. 9**, about the axis C-C shown in **FIG. 11**.

[0052] Referring to **FIGS. 12, 13 and 14** a toothbrush in which the tip region is constructed to pivot resiliently relative to the base region, during toothbrushing, about a widthways oriented pivot axis that crosses the tip region intermediate between its tip end and its base end, is shown. In **FIG. 13** the toothbrush head is shown without the elastomeric material. In **FIGS. 13 and 14** the bristles are omitted from the base region for clarity. Parts corresponding to **FIGS. 1-11** are numbered correspondingly.

[0053] The head **2** comprises two regions. A substantially rigid base region **6** integral with the toothbrush handle **1**

extends from the base end 3 of the head 2 to a distance in the longitudinal half of the head 2 furthest from the base 3 of the head. A tip region 7 extends from the extreme tip 8 of the head 2 toward the base region 6. Both the base region 6 and tip region 7 are bristle 4 bearing.

[0054] The tip region 7 is flexibly and resiliently linked to the base region 6 by a flexible link which comprises an aperture 9 in the head 2 material between the tip region 7 and the base region 6. The aperture 9 is open at the bristle face 5 of the head 2, and extends widthways across the entire width of the head 2, and entirely through its thickness, but incorporates thin integral bridges 11, shown in FIG. 13, which are provided at points widthways diametrically opposite each other on either longitudinal side of the tip region. The aperture 9 contains a resilient elastomeric material 10 which is continued around the tip end of the tip region to form a buffer. The aperture 9 is essentially "V" shaped in plan, with its apex pointing toward the tip 8 of the toothbrush head.

[0055] The base end of the tip region 7 is in the form of two limbs which partly surround the tip end of the base region 6 which integrally extends in the tip direction. The tip region 7 is thereby of generally a "Y" shape with the tip end of the base region 6 lying between the upper limbs of the Y.

[0056] The tip region 7 can pivot about the axis C-C, about the pivot points provided by the bridges 11, so that as the tip end of the tip region 7 moves in the direction of the bristle direction B the base end of the tip region 7 moves downwards in the opposite direction as shown by the arrows in FIG. 12, i.e. in a see-saw action.

[0057] Referring to FIGS. 15, 16 and 17 a variant of the toothbrush of FIGS. 1-8 is shown, corresponding parts being numbered correspondingly. Bristles 4 are shown in the form of rectangular or polygonal "mats", but may equally well be round tufts. In the toothbrush of FIGS. 15, 16 and 17 the aperture 9 extends all the way through the thickness of the head material. An elastomeric material 10 wholly fills the aperture 9 and is bonded to the opposite edges of the base region 6 and tip region 7 so as to hold the base region 6 and tip region 7 resiliently together. In FIG. 17 the folding of the tip region 7 during toothbrushing to clean the rearward facing surfaces of teeth 12.

[0058] Referring to FIGS. 18, 19, 20 and 21 a variant of the toothbrush of FIGS. 1 to 17 is shown, corresponding parts being numbered correspondingly.

[0059] The bristles 4 are located in "mats" of generally rectangular shape in the base region 6 and accommodated to the shape of the tip region 7 but could equally well be round tufts. The base end of the tip region 7 is in the form of two limbs, the tip region 7 being generally in a "V" shape which partly surround a part 13 of the base region 6 which extends in the tip direction between them, with an aperture 9 between the tip region 7 and the base region 6, extending between the limbs and the part 13, the aperture containing an elastomeric material 10. The elastomeric material 10 wholly fills the aperture 9 and is bonded to the opposite edges of the base region 6 and tip region 7 so as to hold the base region 6 and tip region 7 resiliently together. The elastomeric material 10 is extended along the outer edge 14 of the composite region to assist in massaging the gums and in protecting the gums against impact with the toothbrush. In

use as shown in FIG. 17 the tip region 7 can fold relative to the base region 6 to accommodate itself to the teeth as shown in FIG. 20.

[0060] Referring to FIGS. 22, 23, 24 and 25 another variant of the toothbrush of FIGS. 1 to 20 is shown, with corresponding parts being numbered correspondingly.

[0061] The bristles 4 are located in "mats" of generally rectangular shape in the base region 6 and accommodated to the shape of the tip region 7, but could equally well be round tufts. The base end of the tip region 7 is in the form of two limbs, the tip region 7 being generally in a "V" shape which partly surround a part 13 of the base region 6 which extends in the tip direction between them, with an aperture 9 between the tip region 7 and the base region 6, extending between the limbs and the part 13, the aperture containing an elastomeric material 10. The elastomeric material 10 wholly fills the aperture 9 and is bonded to the opposite edges of the base region 6 and tip region 7 so as to hold the base region 6 and tip region 7 resiliently together such that the tip region 7 can pivot about axis C-C during use. This pivoting may be directed by the provision of plastics material bridges (not shown) between the base region 6 and tip region 7 aligned in the axis C-C. In use the tip region 7 can pivot about the axis C-C relative to the base region 6 to accommodate itself to the teeth as shown in FIGS. 24 and 25.

[0062] Referring to FIGS. 26, 27, 28 and 29 a toothbrush in which the tip region 7 is constructed to pivot resiliently relative to the base region 6, during toothbrushing, about a widthways oriented pivot axis C-C that crosses the tip region 7 intermediate between its tip end and its base end, is shown. Parts corresponding to FIGS. 1-25 are numbered correspondingly.

[0063] The head 2 comprises two regions. A substantially rigid base region 6 integral with the toothbrush handle 1 extends from the base end 3 of the head 2 to a distance in the longitudinal half of the head 2 furthest from the base 3 of the head. A tip region 7 extends from the extreme tip 8 of the head 2 toward the base region 6. Both the base region 6 and tip region 7 are bristle 4 bearing.

[0064] The tip region 7 is flexibly and resiliently linked to the base region 6 by a flexible link which comprises an aperture 9 in the head 2 material between the tip region 7 and the base region 6. The aperture 9 is in the form of a groove, open at both the bristle face 5, and the opposite face, of the head 2. The groove 9 contains a resilient elastomeric material 10. The base region 6 integrally extends in the tip direction in the form of two limbs forming a two pronged fork which partly surrounds a part 15 of the tip region 7 which extends towards the base region 6 and which lies between the limbs.

[0065] The elastomeric material 10 wholly fills the aperture 9 and is bonded to the opposite edges of the base region 6 and tip region 7 so as to hold the base region 6 and tip region 7 resiliently together such that the tip region 7 can pivot about axis C-C during use. This pivoting may be directed by the provision of plastics material bridges (not shown) between the base region 6 and tip region 7 aligned in the axis C-C, and thereby accommodate itself to the shape of the teeth during toothbrushing.

[0066] Referring to FIGS. 30, 31 and 32, an alternative construction of the head 2 of a toothbrush of this invention

in which the tip region 7 is constructed to fold resiliently relative to the base region 6, during toothbrushing, about a widthways oriented fold axis C-C that crosses the head is shown on plan and in side views.

[0067] In FIGS. 30 and 31 the head 2 is shown without elastomeric material. Parts corresponding to those FIGS. 1 to 4 are numbered correspondingly. The tip region 7 is generally triangular in shape with a rounded tip. A link region is provided by a chasm 16 between the tip region 7 and the base region 6 which is bridged by two strips 17 of a plastics material integral with the material of the head, the strips being thinner than the thickness of the head 2, and extending between the tip region 7 and base region 6 to bridge the chasm 16. Relative to the thickness of the toothbrush head 2 the strips are closer to the bristle face 5 than to the back of the head. The bristle face 5 of both the tip 7 and base region 6 are provided with socket holes 18 for the insertion of bristles 4. As shown in FIG. 31, in the tip region 7 the holes 18 are disposed to arrange bristles 4 in a pattern of discrete tufts 4A arranged in a generally circular or polygonal pattern, around a central tuft 4B.

[0068] As shown in FIG. 31 the "skeleton" consisting of just the plastic material parts of the head has been made by an injection moulding process, with the bristle face 5 substantially planar.

[0069] As shown in FIG. 32, the "skeleton" so formed has been folded about the axis C-C so that an obtuse angle of about 165° is formed between the bristle face 5 of the tip region 7 and of the base region 6. An elastomeric material 10 has been injected into the chasm 16, whilst the head is in its folded state, and is bonded to the sides of the chasm 16 and to the strips 17, filling the chasm 16 and covering the strips 17. Thereby the toothbrush head is retained in its folded state, and the tip region 7 is flexibly and resiliently linked to the base region 6.

[0070] The bristles 4 have been inserted by a conventional process, and the angle between the bristle face 5 of the tip region 7 and the base region 6 is such that the free ends of the bristles on the handle side of the tip portion are in close proximity to the free ends of bristles on the tip side of the base region. As shown in FIG. 32 the plane of the ends of bristles 4 on the tip region 7 slope upwards away from the bristle face 5 of the base region 6 in the direction away from the handle.

[0071] The elastomeric material 10 is extended around the tip 8 of the head 2 to form an external buffer 19 around the tip 8 of the head 2. For this purpose a moulding groove 18 is provided in the outer surface of the tip region 7.

[0072] Referring to FIGS. 33, 34, 35 and 36, another alternative construction of the head 2 of a toothbrush of this invention in which the tip region 7 is constructed to fold resiliently relative to the base region 6, during toothbrushing, about a widthways oriented fold axis C-C that crosses the head is shown on plan and in side views.

[0073] In FIGS. 33 and 34 the head 2 is shown without elastomeric material. Parts corresponding to those of FIGS. 1 to 4 are numbered correspondingly. The tip region 7 is generally triangular in shape with a rounded tip. A link region is provided by a chasm 20 between the tip region 7 and the base region 6 which is bridged by two strips 21 of a plastics material integral with the material of the head, the

strips being thinner than the thickness of the head 2, and extending between the tip region 7 and base region 6 to bridge the chasm 20. The chasm 20 is essentially "V" shaped in plan looking down onto the bristle face 5, with the apex of the "V" pointing toward the handle 2. Relative to the thickness of the toothbrush head 2 the strips are closer to the bristle face 5 than to the back of the head. The strips 21 are not planar, but are curved in and out of the plane of the base region 6 and tip region 7.

[0074] The bristle face 5 of both the tip 7 and base region 6 are provided with socket holes 22 for the insertion of bristles 4. As shown in FIGS. 33-36, in the tip region 7 the holes 22 are disposed to arrange bristles 4 in a pattern of discrete tufts arranged in a generally circular or polygonal pattern, around a central tuft.

[0075] As shown in FIGS. 33 and 36 the "skeleton" consisting of just the plastic material parts of the head has been made by an injection moulding process, with the bristle face 5 folded about the axis C-C so that an obtuse angle of about 165° is formed between the bristle face 5 of the tip region and of the base region 6.

[0076] An elastomeric material 10 has been injected into the chasm 20, whilst the head is in its folded state, and is bonded to the sides of the chasm 20 and to the strips 21, filling the chasm 20 and covering the strips 21. Thereby the toothbrush head is retained in its folded state, and the tip region 7 is flexibly and resiliently linked to the base region 6. The outer surface of the elastomeric material 10 has a corrugated surface as seen in FIG. 36.

[0077] The bristles 4 shown in FIG. 36 have been inserted by a conventional process, and the angle between the bristle face 5 of the tip region 7 and the base region 6 is such that the free ends of the bristles on the handle side of the tip portion are in close proximity to the free ends of bristles on the tip side of the base region. As shown in FIG. 36 the plane of the ends of bristles 4 on the tip region 7 slope upwards away from the bristle face 5 of the base region 6 in the direction away from the handle.

1. A toothbrush comprising a handle with a head, the head having a base end facing the handle and a tip end remote from the base end, the head adjoining the handle at the base end of the head, the head and handle being disposed along a longitudinal toothbrush axis, the head having bristles extending from a bristle face of the head, characterised in that the head comprises a substantially rigid base region adjoining the toothbrush handle and extending from the base end of the head to a link region situated between the base end and the tip end, and a tip region extending from the tip end of the head to the link region, both the base region and tip region being bristle bearing, the tip region being flexibly and resiliently linked at the link region to the base region.

2. A toothbrush according to claim 1 characterised in that the link region is in the longitudinal half of the head furthest from the base of the head.

3. A toothbrush according to claim 2 characterised in that the base region extends for at least 60% of the distance between the base end of the head and the tip of the head.

4. A toothbrush according to claim 1, 2 or 3 characterised in that in its unstressed state the bristle face of the tip region forms an angle of less than 180° with the bristle face of the base region.

5. A toothbrush according to any preceding claim characterised in that the link region comprises an aperture, space or chasm in the head material between the tip and base regions which is bridged by means of one or more thin links of flexible and resilient plastics material.

6. A toothbrush according to claim 5 characterised in that the link region comprises a composite region between the tip region and base regions, the composite region having structural elements made of both plastics material and an elastomeric material.

7. A toothbrush according to claim 6 characterised in that the composite region comprises an aperture, space or chasm in the head material between the tip and base regions which is bridged by means of a combination of thin spines, strips or a continuous membrane of a both flexible and resilient plastics material and also by a partial (to the extent that the aperture, space or chasm is not completely filled by the said plastics material parts) filling of an elastomeric material.

8. A toothbrush according to any one of claims 1 to 4 characterised in that the link region between the tip region and the base region comprises an aperture, space or chasm in the head material between the tip and base regions which is bridged solely by means of a complete or partial filling of an elastomeric material.

9. A toothbrush according to any of the preceding claims characterised in that the head is constructed such that tip region may fold backwards resiliently relative to the base region, during toothbrushing, about a widthways oriented fold axis that crosses the head in the link region.

10. A toothbrush according to any one of claims 1 to 10 characterised in that the tip region and/or link are constructed and positioned such that the tip region can pivot resiliently relative to the base region during toothbrushing, about a widthways oriented pivot axis that crosses the tip region intermediate between its tip end and its base end.

11. A toothbrush according to claim 10 characterised in that said pivoting is achieved by a construction of head in which the tip end of the base region is in the form of two limbs which partly surround a part of the tip region which extends in the base direction between them, with the link between the tip region and the base region.

12. A toothbrush according to claim 10 characterised in that the base end of the tip region is in the form of two limbs which partly surround a part of the base region which extends in the tip direction between them, with the link between the tip region and the base region.

13. A toothbrush according to any preceding claim characterised in that in the tip region the bristles the bristle tufts are disposed in either (i) a pattern of discrete tufts arranged in a generally circular or polygonal pattern, or (ii) a single tuft of generally rounded cross section perpendicular to the bristle face, or (iii) a tuft of generally "C" or "U" shaped cross section perpendicular to the bristle face having at least one of the limbs of the "C" or "U" aligned generally parallel to the longitudinal toothbrush axis and with the rounded bend of the "C" or "U" facing the end of the bristle face remote from the handle.

14. A toothbrush according to any one of the preceding claims characterised in that the ends of the bristles remote from the bristle face on the tip region lie in a different plane to the ends of the bristles remote from the bristle face on the base region of the head.

15. A process for making the toothbrush as claimed in claim 3 characterised in that firstly a plastics material skeleton of only the plastics material parts is made by injection moulding, with the bristle face substantially flat, then the tip region is folded to the desired angle with the base region, then the elastomer is injected into the link region.

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