



(51) International Patent Classification:

A46B 9/04 (2006.01) A46D 3/00 (2006.01)
A46B 9/06 (2006.01) B29C 45/14 (2006.01)
A46D 1/00 (2006.01)

(21) International Application Number:

PCT/US2013/066297

(22) International Filing Date:

23 October 2013 (23.10.2013)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

12191225.7 5 November 2012 (05.11.2012) EP

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(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,
SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM,
ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))

(54) Title: TOOTHBRUSH COMPRISING ELASTOMERIC CLEANING ELEMENTS OVER-MOLDED WITH A HARDER
PLASTIC AND METHOD FOR PRODUCING THE SAME

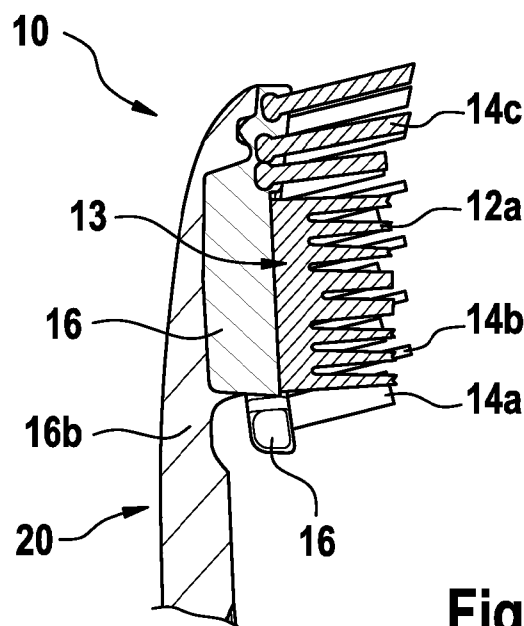


Fig. 4B

(57) Abstract: Brush heads, in particular toothbrush heads comprising both elastomeric cleaning elements and bristle tuft cleaning elements can be produced by injection molding. In order to achieve high design flexibility regarding the arrangement of the elastomeric cleaning elements and regarding the material choice, the elastomeric cleaning elements may be manufactured first by injecting a first plastic material. Then the elastomeric cleaning elements together with the bristle tuft cleaning elements may be over-molded with a second plastic material in order to form the brush head or a part thereof. Thereby, the second plastic material may show a greater Shore hardness than the first plastic material used to manufacture the elastomeric cleaning elements.

TOOTHBRUSH COMPRISING ELASTOMERIC CLEANING ELEMENTS OVER-MOLDED WITH A HARDER PLASTIC AND METHOD FOR PRODUCING THE SAME

FIELD OF THE INVENTION

A method for producing a brush head, in particular a toothbrush head or a part thereof is disclosed. Using said method toothbrush heads can be produced which comprise elastomeric cleaning elements and bristle tuft cleaning elements with high design flexibility. Due to the method shown less requirements regarding the arrangement of the elastomeric cleaning elements and the material used for the elastomeric cleaning elements have to be met. Elastomeric cleaning elements are manufactured by injection molding of a first plastic material. Then the elastomeric cleaning elements together with the bristle tuft cleaning elements are over-molded with a second plastic material in order to form the brush head or a part thereof. The second plastic material shows a greater Shore hardness than the first plastic material used to manufacture the elastomeric cleaning elements.

BACKGROUND OF THE INVENTION

Several manufacturing techniques are known in order to produce brushes, in particular toothbrushes. A key issue is how to fasten the cleaning elements in the brush head. Conventionally, brush heads were produced by injection molding providing a plurality of blind ended tuft holes wherein the bristle tufts were fastened in a U-shape form by metal anchors. Anchor-free or hot-tufting methods fasten the cleaning elements in the brush head by means of a forming technique. Usually, the bristle tufts are melted at their ends to form thickenings in order to increase the pull-out resistance of the tufts. These thickenings can be over-molded with a plastic material to form a brush head or part thereof.

Nowadays, cleaning element fields of brush heads, in particular toothbrush heads comprise elastomeric elements. These elastomeric elements might be produced completely from elastomeric material or they might comprise a core from a hard plastic material (US2012/0246857A1). Usually, the elastomeric elements are formed by injection molding techniques and might be mounted to the brush head using stapling (US2012/0246857A1), clipping or any other snap and fit connection (US2011/0000041A1). Alternatively, the elastomeric cleaning elements are formed together with other elastomeric parts on the surface of the brush or the brush head itself (US2011/0061189). For example, a brush head can be

over-molded with an elastomeric material forming a tongue cleaner on the backside of the brush head and elastomeric cleaning elements on the front side, i.e. the brushing side of the brush head. However, due to adhesion and geometric requirements the design flexibility for said kind of cleaning element fields is relatively low. Elastomeric cleaning elements have to be made from the same material as the tongue cleaner or other elastomeric elements on the brush, namely the gripping faces or some design elements in the area of the brush neck or the handle. Further, the elastomeric cleaning elements are arranged at the outer surface of the cleaning element field due to the geometric restriction during the over-molding process. Thus, there is a need for a method of manufacturing toothbrushes comprising elastomeric cleaning elements with greater design flexibility, regarding the arrangement of the elastomeric cleaning elements and the material which can be used.

SUMMARY OF THE INVENTION

According to one aspect there is provided a toothbrush comprising a brush head providing one or more cleaning element(s), a handle and a neck connecting the brush head and the handle, wherein the one or more cleaning element(s) comprise at least one or more elastomeric cleaning element(s) consisting of a first plastic material and one or more bristle tuft cleaning element(s), wherein the at least one or more cleaning element(s) are embedded into a second plastic material by over-molding, wherein the Shore hardness of the second plastic material is greater than the Shore hardness of the first plastic material and wherein the brush head is formed from the second plastic material during over-molding of the one or more cleaning elements at least partially.

According to another aspect there is provided a method for producing a brush head, in particular a toothbrush head, or a part thereof as disclosed herein.

According to another aspect the method provided for producing a brush head, in particular a toothbrush head, or a part thereof comprises the steps of

- providing a cleaning element carrier comprising one or more cavity(ies) suitable to receive one or more cleaning element(s), wherein the one or more cavity(ies) represent one or more first molding cavity(ies) suitable to form an elastomeric cleaning element therein and wherein the cleaning element carrier represents a first half of a second molding cavity suitable to form the brush head or the part thereof therein;
- providing one or more bristle tuft(s) in at least one of the one or more cavity(ies);

- injecting a first plastic material into at least one of the one or more cavity(ies) to form the at least one elastomeric cleaning element therein, wherein the at least one cavity receiving the injected first plastic material is different from the at least one cavity providing the one or more bristle tuft(s);
- 5 - providing a second half of the second molding cavity and combining the second half of the second molding cavity with the cleaning element carrier to form the second molding cavity;
- injecting a second plastic material into the second molding cavity to form the brush head or the part thereof, wherein the one or more bristle tuft(s) and the at least one elastomeric cleaning element are over-molded with the second plastic material and wherein the Shore
- 10 hardness of the second plastic material is greater than the Shore hardness of the first plastic material.

BRIEF DESCRIPTION OF THE DRAWINGS

- Figure 1 shows a schematic side view of an injection mold forming a cavity for a first plastic mold part which is over-molded with a second plastic material to form a multi- component plastic mold part;
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- Figure 2 shows a schematic side view of an injection mold forming a cavity for a first plastic mold part comprising a protrusion which is over-molded with a second plastic material to form a multi- component plastic mold part;
- Figure 3 shows a schematic side view of an injection mold forming a cavity for a first plastic mold part which is over-molded with a second plastic material to form multi-component plastic mold part comprising undercuts;
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- Figure 4A shows a schematic top view of the cleaning side of an example toothbrush head having several types of cleaning elements comprising at least one elastomeric cleaning element;
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- Figure 4B shows a schematic longitudinal cross-sectional representation of the toothbrush head shown in Fig. 4A;
- Figure 4C shows a schematic perspective representation of the toothbrush head shown in Fig. 4A;
- Figure 5A shows a schematic top view of the cleaning side of another example toothbrush head having several types of cleaning elements comprising at least one elastomeric cleaning element;
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Figure 5B shows a schematic longitudinal cross-sectional representation of the toothbrush head shown in Fig. 5A;

Figure 5C shows a schematic perspective representation of the toothbrush head shown in Fig. 5A.

5 DETAILED DESCRIPTION OF THE INVENTION

The following is a description of numerous embodiments of a method for producing toothbrushes having elastomeric cleaning elements and the toothbrushes produced thereby. The description is to be construed as exemplary only and does not describe every possible embodiment since describing every possible embodiment would be impractical, if not impossible, and it will be understood that any feature, characteristic, structure, component, step or methodology described herein can be deleted, combined with or substituted for, in whole or in part, any other feature, characteristic, structure, component, product step or methodology described herein.

The brush head and the method for the production thereof as disclosed herein allow design flexibility, for example, in the positioning of the elastomeric cleaning elements and the choice of the material used for the elastomeric cleaning elements as well as the material used to form the brush head.

There is provided a method for producing such a brush head, in particular such a toothbrush head or a part thereof, wherein elastomeric cleaning elements are produced and are overmolded with the material used for the brush head or a part thereof. The toothbrush comprises a brush head providing one or more cleaning element(s), a handle and a neck connecting the brush head and the handle to each other, wherein the one or more cleaning element(s) comprise at least one elastomeric cleaning element consisting of a first plastic material and at least one bristle tuft cleaning element.

“Elastomeric cleaning element(s)” as used herein shall be understood as any type or form of cleaning element(s) made from a first plastic material, wherein the first plastic material shows elastomeric properties. Suitable first plastic materials showing elastomeric properties which may be used to form said elastomeric cleaning element(s) are for example rubber, polypropylene (PP) or thermoplastic elastomers (TPE). In one embodiment a thermoplastic elastomer is used as first plastic material. The Shore A hardness of the first plastic material may be in the range from about 10 to about 80, or in the range from about 20 to about 70, or

in the range from about 30 to about 50, or in the range from about 30 to about 40. In one embodiment the first material may be a thermoplastic elastomer having a Shore A hardness of about 35. The Shore a hardness chosen for the elastomeric cleaning elements depends on the geometry used. Thinner elastomeric cleaning elements can be produced from an elastomer having a greater Shore A hardness compared to thicker elastomeric cleaning elements. The choice of the elastomeric material also depends on the length of the elastomeric cleaning elements. In principle, longer elastomeric cleaning elements may be manufactured from an elastomer having a greater Shore A hardness compared to shorter elastomeric cleaning elements. In addition or alternatively, the elastomeric cleaning element(s) may have any geometric form. An elastomeric cleaning element may be for example, a nub, a pin, a fin, a wall, a bar, a gutter, a curve, a circle, a lamella, a textured element, a polishing element such as, for example, a polishing cup, or a tongue cleaning element or a combination thereof. More than one elastomeric cleaning element(s) can be combined to a plurality of elastomeric cleaning elements. The plurality of elastomeric cleaning elements may comprise a common base to which all elastomeric cleaning elements are connected. The common base comprises one surface comprising the elastomeric cleaning elements and one surface to be over-molded with the second plastic material. The surface comprising the elastomeric cleaning elements may be mainly unstructured in order to achieve a hygienic and easy to clean surface. The surface to be over-molded may be mainly unstructured or structured. In addition or alternatively, the surface to be over-molded may comprise protrusions, projections, hooks, depressions, or any other geometric form which may increase the bonding strength between the first and the second plastic material. These geometric forms may be formed in such that under-cuts are formed during the over-molding of the first plastic material with the second plastic material. In addition or alternatively, the common base may be a layer made from the first plastic material to which the plurality of elastomeric cleaning elements is attached. The common base and the elastomeric cleaning elements may be produced together in one common injection step or may be produced separately and combined afterwards to form one elastomeric cleaning structure.

The at least one elastomeric cleaning element is over-molded with a second plastic material, wherein the Shore hardness of the second plastic material is greater than the Shore hardness of the first plastic material. The Shore hardness of the second plastic material may be significantly greater than the Shore hardness of the first plastic material. The shore D hardness of the second plastic material may be in the range from about 30 to about 90, or in

the range from about 40 to about 80, or in the range from about 50 to about 80, or in the range from about 65 to about 75. Suitable materials which may be used as second plastic material may be for example polypropylene (PP), polyethylene (PE), polyoxymethylene (POM), polyethyleneterephthalate (PET), a polyamide (PA), or a blend or a mixture
5 comprising polypropylene, polyethylene, polyoxymethylene, polyethyleneterephthalate or a polyamide.

As disclosed herein the brush head of the toothbrush is formed at least partially during over-molding of the first plastic material with the second plastic material. That means the at least one elastomeric cleaning element is connected to the brush head via the second plastic
10 material. The second plastic material may be injected into any geometric form as long as it is smaller or identical to the geometric form of the toothbrush head. For example, the part of the toothbrush head formed from the second plastic material may be a plate having the outline of the brush head, a plate having a similar, but smaller outline of the brush head or any other form fitting into the outline of the brush head.

More than one elastomeric cleaning element(s) may comprise a common base which shows a contact surface to the second plastic material or the elastomeric cleaning elements may be embedded into the second plastic material individually. If the elastomeric cleaning elements are embedded individually into the second plastic material, each elastomeric cleaning element may comprise a material thickening at the end to be over-molded. The thickenings may be
20 embedded and represent a mechanical barrier against extraction force or the thickening may provide material which can be molten during the over-molding process to form a mixed contact zone comprising the first and the second plastic material. If the elastomeric cleaning elements are embedded into the second plastic material by a common base the contact surface of the common base may be molten during injection of the second plastic material. Due to the
25 over-molding of the softer/less hard first plastic material with the harder second plastic material small toothbrush heads can be formed without losing the adhesive strength between the elastomeric cleaning element(s) and the brush head itself. The toothbrush as disclosed herein may show a brush head thickness of less than 5mm, or less than 4mm, or less than 3mm, or less than 2mm.

The toothbrush as disclosed herein may comprise in addition to the elastomeric cleaning element(s) one or more cleaning element(s) comprising one or more bristle tuft(s). "Bristle tuft" as used herein shall be understood as any type, form or arrangement comprising individual bristle filaments. Bristle filaments may consist of natural materials, plastics or
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plastic mixtures. A plastic which can be used to form bristle filaments is for example a polyamide (PA), a polybutylterephthalate (PBT), a polyethylterephthalate (PET), or mixtures thereof. More than one bristle filaments are grouped to form a bristle tuft. The bristle tuft may comprise a thickening at one tuft end, wherein the thickening can be formed by melting the
5 bristle ends. The tuft end opposite to the thickening is the end to be intended to clean the teeth. The ends of the bristles intended to clean may be cut into a special profile, may be tapered, may be end-rounded and may be polished in order to provide a safe and comfortable bristle tuft, which does not hurt the soft tissue in the mouth. The bristle tuft(s) may be embedded into the second plastic material. Thereby the second plastic material flows around
10 the thickening at the tuft end thereby fastening the bristle tuft(s) into the second material securely.

The toothbrush as disclosed herein may comprise in addition to the elastomeric cleaning element(s) and/or the bristle tuft(s) one or more cleaning element(s) comprising mixed tufts. "Mixed tuft" as used herein shall be understood as any type, form or arrangement of cleaning
15 elements comprising elastomeric cleaning element(s) and bristle (tuft) filaments. Thereby, the bristle filaments may be arranged around and/or inside an elastomeric element. An example for an arrangement around an elastomeric element may be an elastomeric nub, an elastomeric pin, an elastomeric fin, an elastomeric wall, an elastomeric bar, an elastomeric gutter, an elastomeric curve, an elastomeric circle, an elastomeric lamella, an elastomeric textured
20 element or an elastomeric polishing element which outline is surrounded by a corresponding outline made by bristle filaments or bristle tufts. The outline of the elastomeric cleaning element may be surrounded completely or partially by the bristle filament(s) or bristle tuft(s). An example for an arrangement inside of an elastomeric element may be an elastomeric cup or other open structure, wherein in the cavity of the cup bristle filament(s) or bristle tuft(s)
25 are arranged. In addition or alternatively, the mixed tuft(s) may comprise both bristle filaments or bristle tufts being arranged inside of the elastomeric cleaning element and bristle filaments or bristle tufts being arranged at the outline of the elastomeric cleaning element.

In addition or alternatively, there is provided a method for producing a toothbrush as disclosed herein. The method comprises the step of providing one end of one or more bristle
30 tuft(s) in one or more cavity(ies) of a cleaning element carrier, wherein the one or more cavity(ies) represent one or more molding cavity(ies) which are suitable to form elastomeric cleaning element(s) therein. That means the one or more cavity(ies) of the cleaning element carrier are used to provide bristle tuft(s) or are used to form elastomeric cleaning element(s)

therein using injection molding. The bristle tuft(s) may be provided into the cavities of the cleaning element carrier before the elastomeric cleaning elements are formed in the remaining cavities not providing bristle tuft(s) or after injecting the elastomeric cleaning elements. If the elastomeric cleaning elements are injected first, the cavities intended to provide bristle tufts have to be covered against the first plastic material. In addition, the cleaning element carrier itself represents a first part of a second molding cavity to form the brush head or the part thereof therein.

The cleaning element carrier may provide the end(s) of the one or more bristle tuft(s) in such that the ends to be embedded into the brush head or the part thereof protrude from the cavities of the cleaning element carrier and the ends intended to clean are covered by the cleaning element carrier. The distance from the surface of the cleaning element carrier to the ends to be embedded by over-molding is adjusted big enough to fasten the bristle tuft(s) securely into the brush head. In addition, the surface of the cleaning element carrier providing the bristle tuft(s) represents a part of the molding cavity of the brush head. The surface of the brush head providing the cleaning elements is the negative of the surface of the cleaning element carrier providing the cleaning elements into the molding cavity.

The cavities of the cleaning element carrier may be blind holes into which the first plastic material may be injected directly in order to produce the elastomeric cleaning elements. Thus, the method for producing a toothbrush head further comprises the step of injecting a first plastic material into the molding cavity(ies) intended to comprise the at least one elastomeric cleaning element. Thereby, the blind hole(s) represent molding cavity(ies) for the elastomeric cleaning element(s), wherein the shape of the blind hole(s) defines the outer surface of the elastomeric cleaning element(s). In one embodiment, the elastomeric cleaning element(s) are injected into the cleaning element carrier before the bristle tuft(s) are inserted into it. In another embodiment, the elastomeric cleaning element(s) are injected into the cleaning element carrier after the bristle tuft(s) are inserted into it. In addition or alternatively, the elastomeric cleaning element(s) may be injected in a first cleaning element carrier and may be transferred to a second cleaning element carrier, wherein the bristle tuft(s) may be inserted into said second cleaning element carrier before the elastomeric cleaning element(s), simultaneously or afterwards. Any geometric form of elastomeric cleaning element(s) may be produced by the method disclosed herein as long as the geometric form can be produced by injection molding.

The method for producing a toothbrush head further comprises the step of injecting a second plastic material to form the brush head or a part of it. Thereby the one or more bristle tuft(s) and the at least one elastomeric cleaning element are over-molded with the second plastic material wherein the Shore hardness of the second plastic material is greater than the Shore hardness of the first plastic material. Thereby a multi-component plastic part is formed showing an excellent bonding. The good adhesion between the first and the second plastic material is achieved without assembling, activating of the contact surfaces or the need of undercuts to connect both components. That allows a high material flexibility, in particular as also material combinations can be bonded which would not adhere to each other in reverse injection molding order. Thus, the geometry of the molded article, in particular the toothbrush, does not comprise any bonding restrictions.

During the over-molding of the first plastic material with the second plastic material the first plastic material may be partially molten. Due to the partial melting the bonding strength of the two plastic components is further increased. In addition or alternatively, the first and the second plastic material may be mixed at the contact surface at least partially. The mixed contact surface allows bonding of plastic components which do not adhere to each other otherwise.

In addition or alternatively, the first and the second plastic material are injected from the same site of the molding device. In particular, the nozzle for injecting the first and the second plastic material may be arranged at an identical position of the molding device. Such an arrangement may reduce costs for the molding tool.

According to the method as disclosed herein the first plastic material having a minor Shore hardness is injected first and over-molded with the second plastic material having a greater Shore hardness. Thereby, a short cooling time can be chosen between the first and the second injection step. For example, the first plastic material must not be hardened completely, but it is sufficient if the first plastic material hardens enough so that it does not change the geometric outline during the over-molding with the second plastic material. For example the cooling time between the injection of the first and the second plastic material may be less than 10 sec, or less than 5 sec, or less than 2 sec.

The bristle tuft(s) may be inserted into the cleaning element carrier as a fused tuft or as a plurality of filaments. For combining the filament ends the latter may be subjected to heat in order to molten the filaments partially. Thereby a round thickening is formed. Then, the

molten ends may be subjected to any kind of plunger to form a flat and even structure. Melting and flattening may be performed in one step using a heated plunger. Thus, the method may comprise the step of heating the ends of bristle filaments to form a thickening and flattening the thickening by pressing a flattening tool, for example a plunger, against the thickening. Thereby, a gap between the thickening and the cleaning element carrier has to be remained so that the second material may flow around the thickenings during injection molding. If the thickening comes in direct contact with the surface of the cleaning element carrier the surface of the cleaning element carrier may be moved away from the thickening in order to re-establish the gap needed for embedding the thickenings securely into the brush head.

Brush heads, toothbrush heads or parts thereof or toothbrushes produced by the method as disclosed herein can be used for manufacturing any kind of manual or electric toothbrushes. The method as disclosed herein can also be used for sealing or packaging or may be used in composites and many other multi-component industrial injection molding appliances.

In the following, a detailed description of several example embodiments will be given. It is noted that all features described in the present disclosure, whether they are disclosed in the previous description of more general embodiments or in the following description of example embodiments, even though they may be described in the context of a particular embodiment, are of course meant to be disclosed as individual features that can be combined with all other disclosed features as long as this would not contradict the gist and scope of the present disclosure. In particular, all features disclosed for either one of the method of producing the brush head or the brush head itself may also be applied to the other one, if applicable.

Fig. 1 shows an example embodiment of a molding tool 30, wherein a multi-component plastic part, in particular a toothbrush head may be molded. The molding cavity is formed from a first molding half 32 and a second molding half 34. Into the cavity formed a first plastic material 12 is injected and over-molded with a second plastic material 16, wherein the Shore hardness of the second plastic material is greater than the Shore hardness of the first plastic material. At the contact surface 18 the first and the second plastic material are mixed at least partially. The contact surface 18 is an essentially unstructured flat layer.

Fig. 2 shows another example embodiment of a molding tool 30, wherein a multi-component plastic part, in particular a toothbrush head may be molded. Features that are in common with the molding tool shown before in Fig. 1 are designated with the same reference numerals.

The molding cavity is formed from a first molding half 32 and a second molding half 34. Into the cavity formed a first plastic material 12 is injected, wherein the first plastic material 12 is injected in such that a protrusion 19 is formed which reaches into the cavity formed by the second molding half 34. Then the first plastic material 12 is over-molded with a second plastic material 16, wherein the Shore hardness of the second plastic material is greater than the Shore hardness of the first plastic material. At the contact surface 18 the first and the second plastic material are mixed at least partially. Due to the protrusion 19 formed in the first molding step the contact surface 18 is not located completely in the contact plane of the first 32 and second 34 molding half, but is located partially in the cavity formed by the second molding half 34.

Fig. 3 shows another example embodiment of a molding tool 30, wherein a multi-component plastic part, in particular a toothbrush head may be molded. Features that are in common with the molding tool shown before in Figs. 1 and 2 are designated with the same reference numerals. The molding cavity is formed from a first molding half 32 and a second molding half 34. Into the cavity formed a first plastic material 12 is injected, wherein the first plastic material 12 is injected in such that a protrusion 19 is formed which reaches into the cavity formed by the second molding half 34. The protrusion 19 is formed in such that under-cuts 17 are formed during the over-molding of the first plastic material 12 with a second plastic material 16, wherein the Shore hardness of the second plastic material is greater than the Shore hardness of the first plastic material. At the contact surface 18 the first and the second plastic material are mixed at least partially. Due to the under-cut 17 formed the bonding force between the first plastic material 12 and the second plastic material 16 is increased by a mechanical retention force.

If the multi-component plastic part formed in a molding tool according to Figs. 1 to 3 is a toothbrush head, elastomeric cleaning elements may be formed from the first plastic material 12 and the brush head may be formed from the second plastic material 16. The first plastic material 12 may be a thermoplastic elastomer having a Shore A hardness in the range from 35 to 45 and the second plastic material may be a polypropylene having a Shore D hardness in the range from 40 to 80.

Figures 4 and 5 show toothbrush heads 10 or sections thereof that are connectable with any toothbrush neck 20 and any toothbrush handle to form a toothbrush. These heads 10 are equally suitable for purely manual toothbrushes and electrically powered ones. Each of the features of the toothbrush heads 10 shown in these embodiments can be designed in reduced

form or in a different combination than those represented. The cleaning elements comprise at least one elastomeric cleaning element 12a which is made from the first plastic material 12 and which is over-molded with the second plastic material 16. Thereby the at least one elastomeric cleaning element 12a is embedded into the second plastic material 16.

5 Fig. 4A shows a schematic top view of the cleaning side of an example toothbrush head 10 having several types of cleaning elements comprising at least one elastomeric cleaning element 12a in combination with bristle tuft cleaning elements 14a, 14b, 14c. The cleaning elements may protrude rectangular from the brush head 10 or may be inclined with respect to the surface of the brush head 10 in any direction. The bristle tuft cleaning elements 14a, 14b,
10 14c show different tuft geometries, namely round tufts 14a, elongated rectangular tufts 14b or oval shaped tufts 14c. The bristles in the bristle tufts 14a, 14b, 14c are made, for example, from polyamid. The elastomeric cleaning element 12a is made from the first plastic material 12 by injection molding. The first plastic material 12 may be a thermoplastic elastomer having a Shore A hardness of 25-35, wherein the Shore A hardness chosen depends on the
15 geometrie of the elastomeric cleaning elements. The bristle tuft cleaning elements 14a, 14b, 14c may be introduced before or after the injection of the first plastic material 12 into the mold. Then the mold carrying the bristle tuft cleaning elements and the elastomeric cleaning elements is used to provide the cleaning elements to the molding cavity during injection of the brush head material. The brush head 10 is formed by injection molding from the second
20 plastic material 16 thereby over-molding the bristles tuft cleaning elements 14a, 14b, 14c and the elastomeric cleaning element 12a. The second plastic material 16 may be a polypropylene having a Shore D hardness in the range of about 50 to about 60.

Fig. 4B shows a schematic longitudinal cross-sectional representation of the toothbrush head 10 shown in Fig. 4A. The bristle tuft cleaning elements 14a, 14b, 14c are embedded into the
25 second plastic material 16 forming the toothbrush head 10. The elastomeric cleaning element 12a comprises a base area 13 from which the elastomeric cleaning elements 12a protrude. The base area 13 was over-molded with the second plastic material 16 so that the elastomeric cleaning element 12a is securely connected with the second plastic material 16. The toothbrush head 10 shown in Fig. 4B comprises two parts 16, 16a. The material 16 used to
30 embedd the bristle tufts 14 and the elastomeric cleaning element 12a may be also used to form the neck 20. In addition or alternatively, a slightly different second material 16b may be used to form the neck of the brush head 10. For example the second palstic material 16 may be a polypropylene having a Shore D hardness in the range of about 50 to about 60 and the

material 16b may be a polypropylene having a different Shore hardness or a polypropylene having the same Shore hardness, but another colour or a different plastic material.

Figure 4C shows a schematic perspective representation of the toothbrush head 10 shown in Fig. 4A. The elastomeric cleaning element 12a and the bristle tuft cleaning elements 14a, 14b, 14c are over-molded with the second material 16 to form the toothbrush head 10. The toothbrush head 10 may be connected to a handle (not shown) by the neck portion 20.

Fig. 5A shows a schematic top view of the cleaning side of another example toothbrush head 10 having several types of cleaning elements comprising two elastomeric cleaning elements 12a, 12b in combination with bristle tuft cleaning elements 14a, 14b. The cleaning elements may protrude rectangular from the brush head 10 or may be inclined with respect to the surface of the brush head 10 in any direction. The bristle tuft cleaning elements 14a, 14b show different tuft geometries, namely round tufts 14a and elongated rectangular tufts 14b. The bristles in the bristle tufts 14a, 14b are made, for example, from polyamid. The elastomeric cleaning elements 12a, 12b are made from the first plastic material 12 by injection molding. The first plastic material 12 may be a thermoplastic elastomer having a Shore A hardness in the range of about 40 to about 50. The bristle tuft cleaning elements 14a, 14b may be introduced before or after the injection of the first plastic material 12 into the mold. Then the mold carrying the bristle tuft cleaning elements and the elastomeric cleaning elements is used to provide the cleaning elements to the molding cavity during injection of the brush head material. The brush head 10 is formed by injection molding from the second plastic material 16 thereby over-molding the bristles tuft cleaning elements 14a, 14b and the elastomeric cleaning elements 12a, 12b. The second plastic material 16 may be a polypropylene having a Shore D hardness in the range of about 55 to about 65.

Fig. 5B shows a schematic longitudinal cross-sectional representation of the toothbrush head 10 shown in Fig. 5A. The bristle tuft cleaning elements 14a, 14b are embedded into the second plastic material 16 forming the toothbrush head 10 and the neck 20. The elastomeric cleaning element 12a comprise a base area 13 from which the elastomeric cleaning elements 12a protrude. The base area 13 was over-molded with the second plastic material 16 so that the elastomeric cleaning element 12a is securely connected with the second plastic material 16. The elastomeric cleaning elements 12b protrude individually from the brush head 10. Thus, the elastomeric cleaning elements 12b were over-molded individually with the second plastic material 16 so that the elastomeric cleaning elements 12b are securely connected in the second plastic material 16.

Figure 5C shows a schematic perspective representation of the toothbrush head 10 shown in Fig. 5A. The elastomeric cleaning elements 12a, 12b and the bristle tuft cleaning elements 14a, 14b are over-molded with the second material 16 to form the toothbrush head 10. The toothbrush head 10 may be connected to a handle (not shown) by the neck portion 20.

- 5 The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as “40 mm” is intended to mean “about 40 mm.”

CLAIMS

What we claim is:

1. A toothbrush comprising a brush head (10) providing one or more cleaning element(s) (12a, 12b, 14a, 14b, 14c), a handle and a neck (20) connecting the brush head (10) and the handle, wherein the one or more cleaning element(s) (12a, 12b, 14a, 14b, 14c) comprise at least one or more elastomeric cleaning element(s) (12a, 12b) consisting of a first plastic material (12) and one or more bristle tuft cleaning element(s) (14a, 14b, 14c), wherein the at least one or more cleaning element(s) (12a, 12b, 14a, 14b, 14c) are embedded into a second plastic material (16) by over-molding, wherein the Shore hardness of the second plastic material (16) is greater than the Shore hardness of the first plastic material (12) and wherein the brush head (10) is formed from the second plastic material (16) during over-molding of the one or more cleaning element(s) (12a, 12b, 14a, 14b, 14c) at least partially.
2. The toothbrush according to Claim 1, wherein the Shore A hardness of the first plastic material (12) is in the range from about 10 to about 80, or in the range from about 20 to about 70, or in the range from about 30 to about 50.
3. The toothbrush according to Claim 2, wherein the first plastic material (12) is a thermoplastic elastomer.
4. The toothbrush according to anyone of the preceding claims, wherein the Shore D hardness of the second plastic material (16) is in the range from about 30 to about 90, or in the range from about 40 to about 80, or in the range from about 50 to about 80..
5. The toothbrush according to Claim 4, wherein the second plastic material (16) is polypropylene, polyethylene, polyoxymethylene, polyethyleneterephthalate, a polyamide, or a blend or a mixture comprising polypropylene, polyethylene, polyoxymethylene, polyethyleneterephthalate or a polyamide.
6. The toothbrush according to anyone of the preceding claims, wherein the one or more elastomeric cleaning element(s) (12a, 12b) is a nub, a pin, a fin, a wall, a bar, a gutter,

a curve, a circle, a textured element, a polishing element, a tongue cleaning element or a combination thereof.

7. The toothbrush according to anyone of the preceding claims, wherein more than one elastomeric cleaning element(s) (12a, 12b) are positioned on a layer made from the first plastic material (12).
5
8. The toothbrush according to anyone of the preceding claims, wherein the part of the brush head (10) formed from the second plastic material (16) is a plate having the outer surface of the brush head (10).
9. The toothbrush according to anyone of the preceding claims, wherein the thickness of brush head (10) is less than 5mm, or less than 4mm, or less than 3mm, or less than 2mm.
10
10. A method for producing a brush head (10), in particular a toothbrush head, or a part thereof comprising the steps of
 - providing a cleaning element carrier comprising one or more cavities suitable to receive one or more cleaning element(s) (12a, 12b, 14a, 14b, 14c), wherein the one or more cavities represent one or more first molding cavity(ies) suitable to form an elastomeric cleaning element (12a, 12b) therein and wherein the cleaning element carrier represents a first half of a second molding cavity suitable to form the brush head (10) or the part thereof therein;
15
 - providing one or more bristle tuft(s) (14a, 14b, 14c) in at least one of the one or more cavities;
20
 - injecting a first plastic material (12) into at least one of the one or more cavity(ies) to form the at least one elastomeric cleaning element (12a, 12b) therein, wherein the at least one cavity receiving the injected first plastic material (12) is different from the at least one cavity providing the one or more bristle tuft(s) (14a, 14b, 14c);
25
 - providing a second half of the second molding cavity and combining the second half of the second molding cavity with the cleaning element carrier to form the second molding cavity;
 - injecting a second plastic material (16) into the second molding cavity to form the brush head (10) or the part thereof, wherein the one or more bristle tuft(s) (14a, 14b,
30

14c) and the at least one elastomeric cleaning element (12a, 12b) are over-molded with the second plastic material (16) and wherein the Shore hardness of the second plastic material (16) is greater than the Shore hardness of the first plastic material (16).

- 5 11. The method according to Claim 10, wherein the first plastic material (12) is partially molten during the over-molding with the second plastic material (16).
12. The method according to Claims 10 or 11, wherein the first plastic material (12) and the second plastic material (16) are mixed at the contact surface at least partially.
- 10 13. The method according to anyone of Claims 10 to 12, wherein the step of providing the one or more bristle tuft(s) (14a, 14b, 14c) in at least one of the one or more cavity(ies) is performed before or after injection of the first plastic material (12).
14. The method according to anyone of Claims 10 to 13, wherein the cooling time between the injection of the first plastic material (12) and the second plastic material (16) is less than 10 sec, or less than 5 sec, or less than 2 sec.
- 15 15. The method according to anyone of Claims 10 to 14, wherein the nozzle for injection of the first plastic material (12) and the nozzle for injection of the second plastic material (16) is arranged at an identical position of a molding device.

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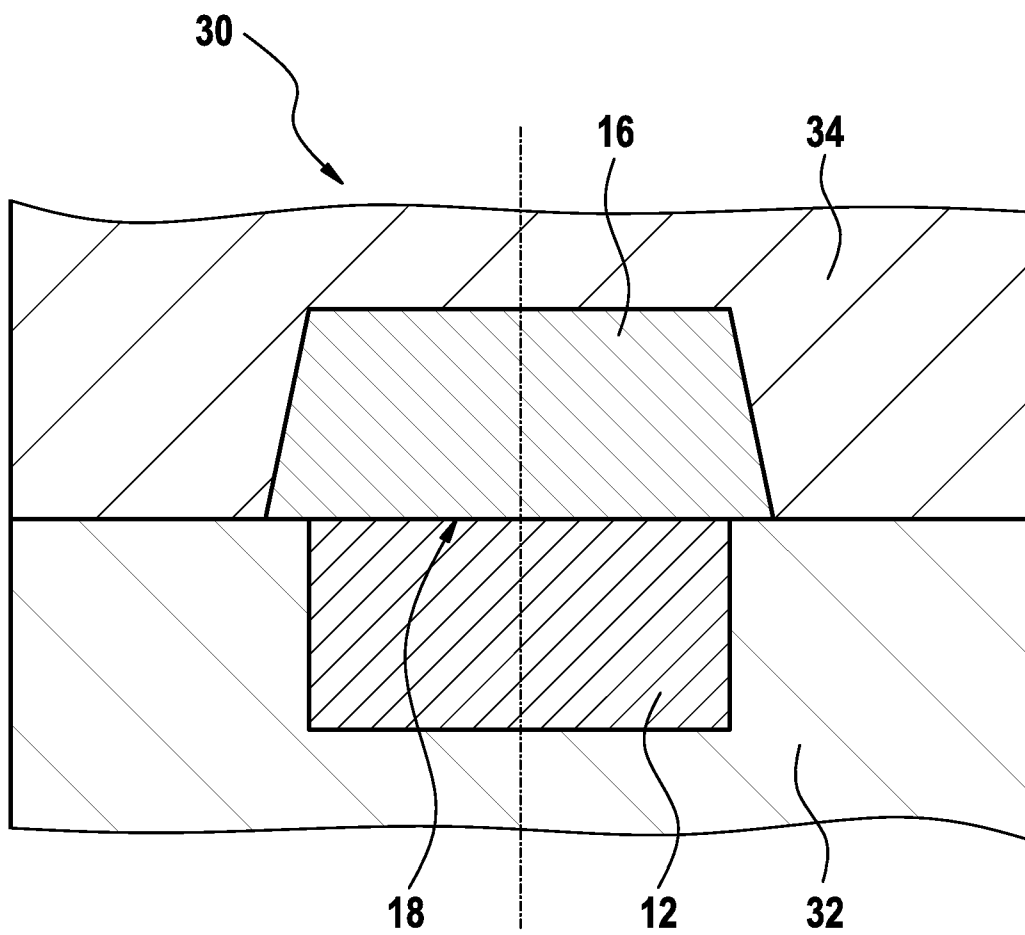


Fig. 1

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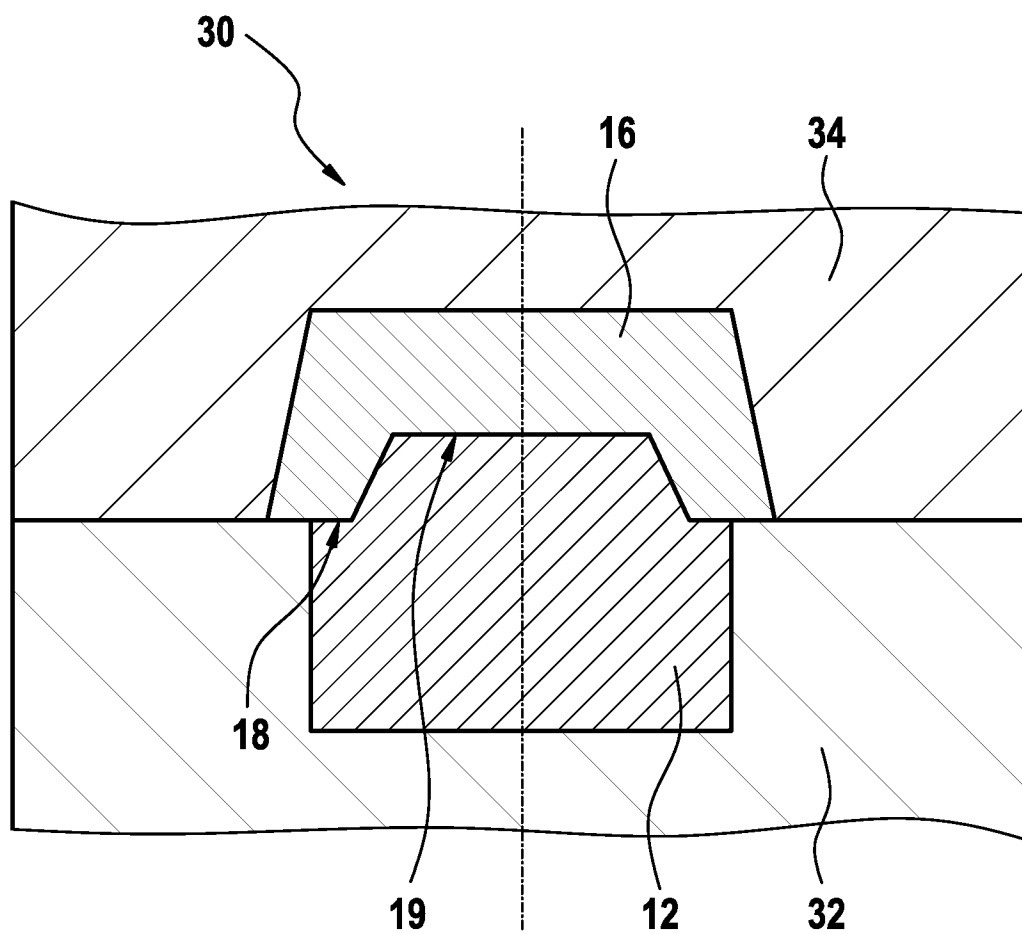


Fig. 2

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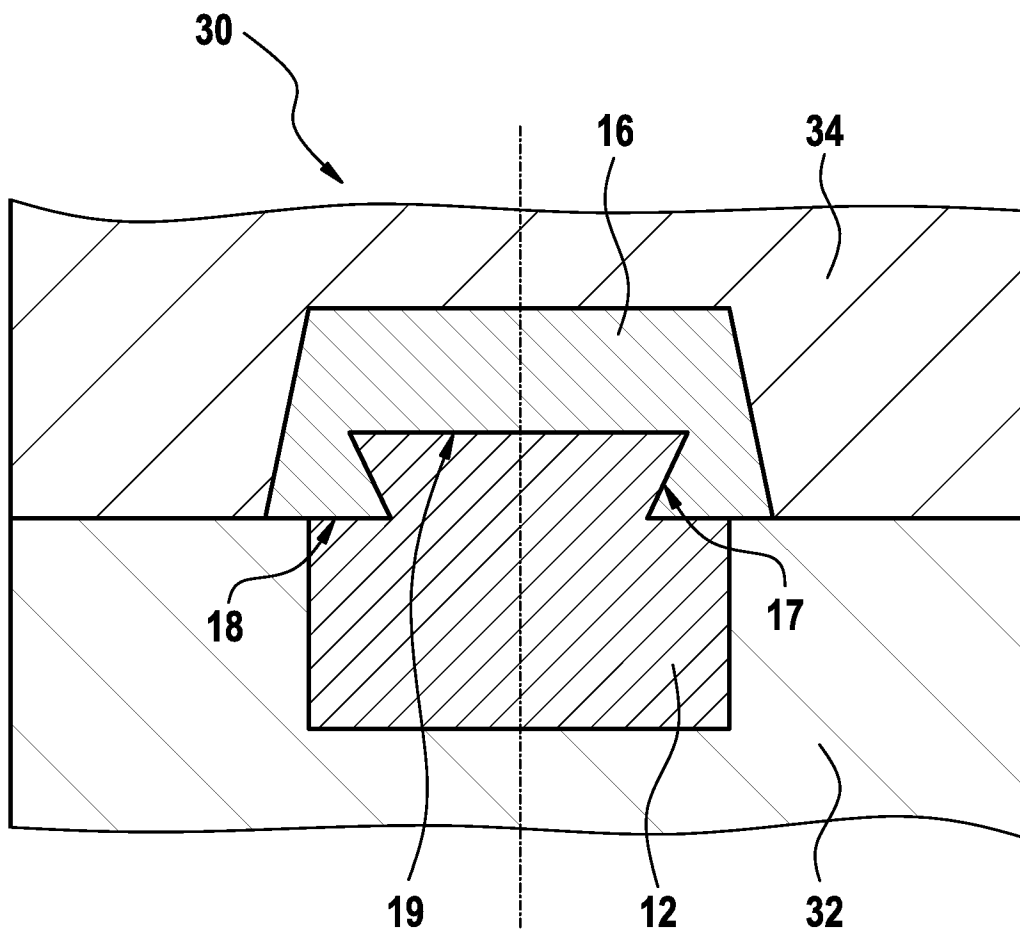


Fig. 3

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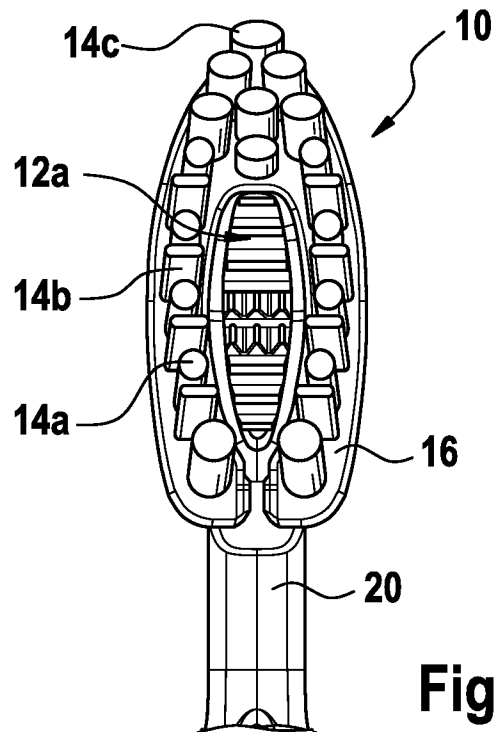


Fig. 4A

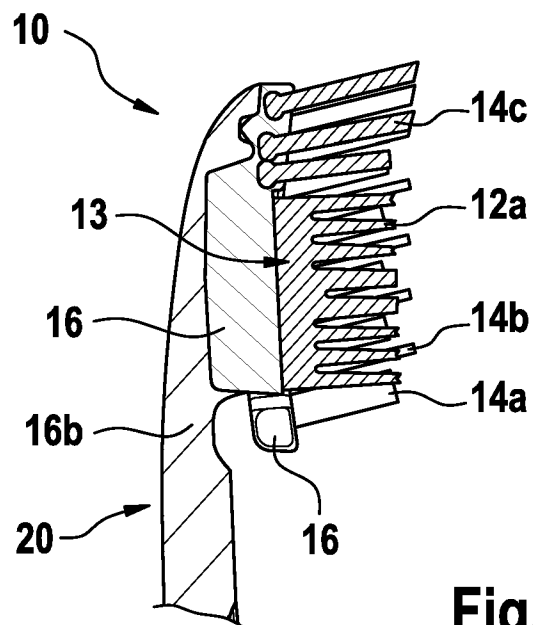


Fig. 4B

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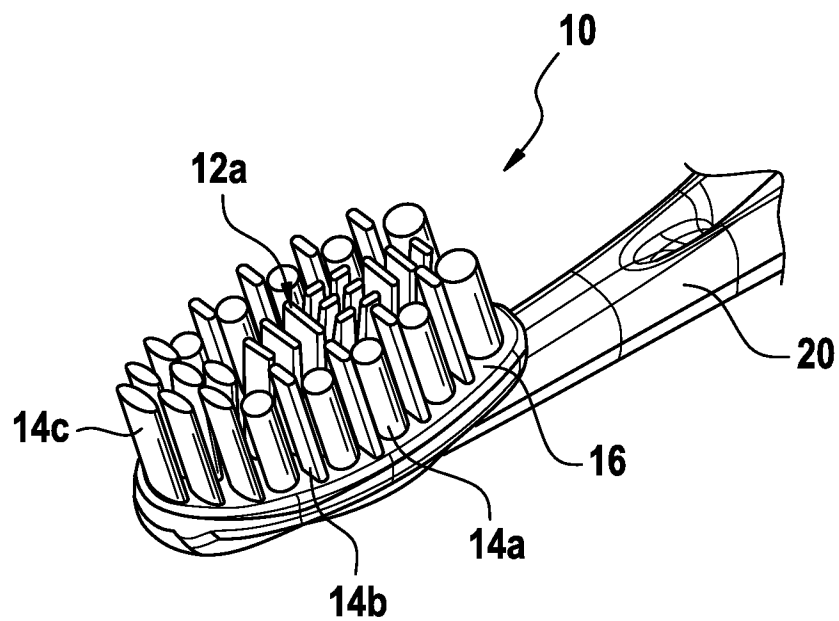


Fig. 4C

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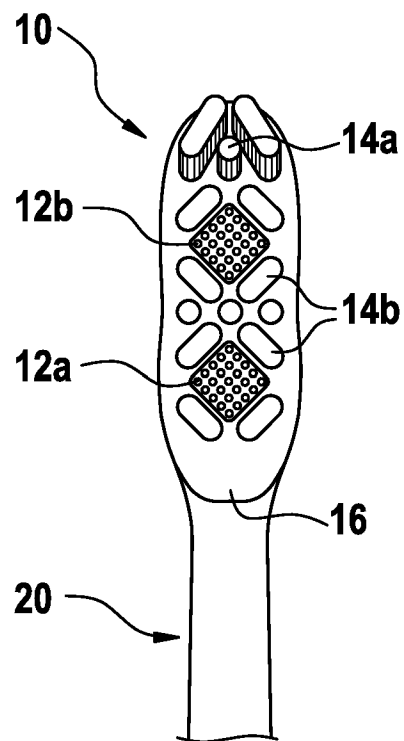


Fig. 5A

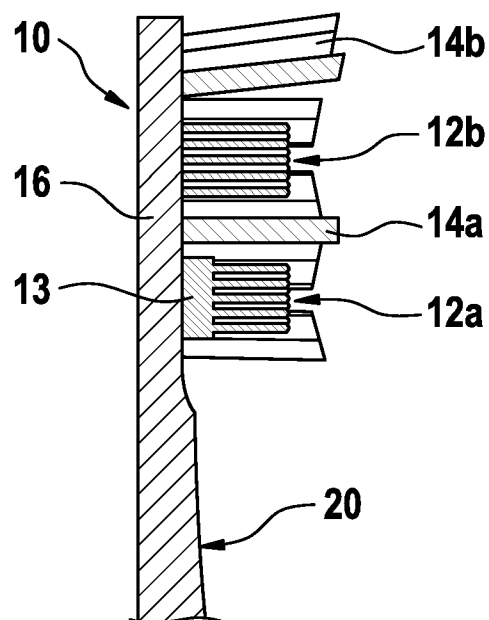


Fig. 5B

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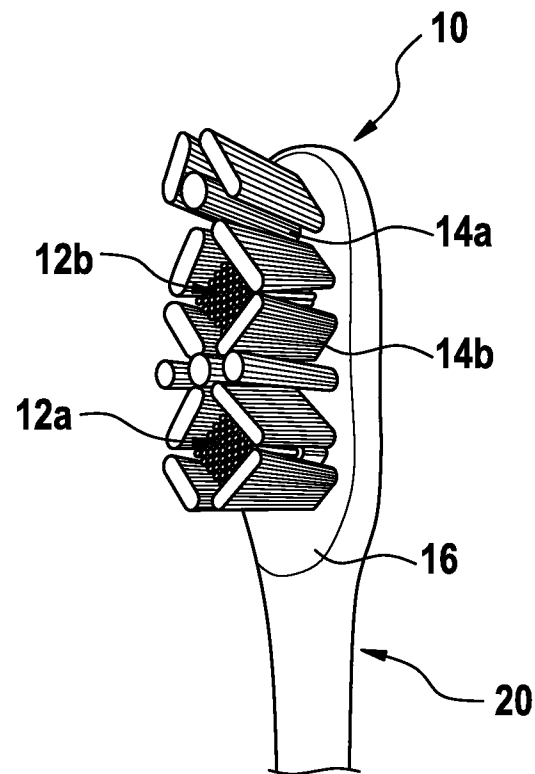


Fig. 5C

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/066297

A. CLASSIFICATION OF SUBJECT MATTER INV. A46B9/04 A46B9/06 A46D1/00 A46D3/00 B29C45/14 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) A46B A46D		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012/246857 A1 (KATO ET AL.) 4 October 2012 (2012-10-04) cited in the application	10-15
Y	abstract paragraph [0014] paragraph [0037] paragraphs [0046] - [0051] table 4	1-9
Y	----- US 2011/061189 A1 (MEADOWS ET AL.) 17 March 2011 (2011-03-17) cited in the application paragraphs [0084] - [0087] -----	1-9
A	US 2011/000041 A1 (VITT ET AL.) 6 January 2011 (2011-01-06) cited in the application paragraphs [0027] - [0028] -----	1-15
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 14 February 2014		Date of mailing of the international search report 24/02/2014
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Raybould, Bruce

INTERNATIONAL SEARCH REPORT

Information on patent family members

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			WO 2008128684 A1 30-10-2008