



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
09.05.2001 Bulletin 2001/19

(51) Int Cl.7: **A46B 9/04**

(21) Application number: **00125873.0**

(22) Date of filing: **09.08.1996**

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB GR IE IT LI NL PT SE

(30) Priority: **22.08.1995 US 2026 P**
27.02.1996 US 5184 P

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
96931374.1 / 0 957 707

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Remarks:

This application was filed on 24 - 11 - 2000 as a divisional application to the application mentioned under INID code 62.

(54) **Toothbrushes**

(57) A toothbrush is disclosed having a handle portion and a head portion carrying or adapted to carry a bristle configuration. The handle has an end portion, a waist, a shoulder portion and a neck connecting the shoulder to the head. The waist is narrower, at least in plan view, than the end portion or the shoulder, and the end portion, preferably, is rounded. The bristle configuration is such that the teeth engaging ends of the bristles do not lie in a plane parallel to the surface of the head of the handle in which the bristles are embedded. In a first embodiment, the teeth engaging ends of at least a proportion of the bristles lie in a curved line when the toothbrush is viewed in side elevation. The curved line is provided by a mixture of concave groups of bristles and convex groups of bristles. In a second embodiment, the bristle configuration falls into at least two groups of bristles. The teeth engaging ends of the bristles of the first group, and the teeth engaging ends of the bristles of the second group, lie in curved lines when the toothbrush is viewed in side elevation. In a third embodiment, the teeth engaging ends of the bristles form a continuous wavy line. In a fourth embodiment, the teeth engaging ends of the bristles fall into two groups, a rearwardly

located group, the castellated group, made up of transversely extending rows of bristles, the rows alternating in height, and a forwardly located group having at least some bristles extending further from the surface of the toothbrush head than any of the bristles of the castellated group.

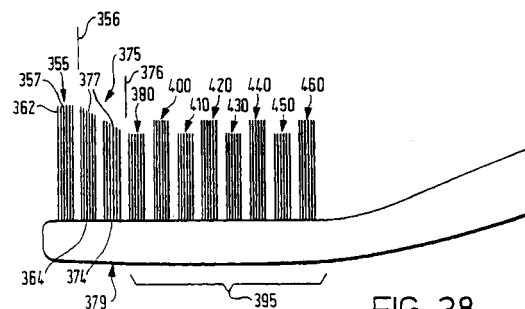


FIG. 38

Description

[0001] The present invention relates to novel handles and to novel bristle configurations for toothbrushes and to novel combinations thereof.

[0002] Disclosed herein are a number of independently useful aspects of the said handles and bristle configurations. It is to be understood that they can be combined together in any novel and useful combination and such combinations are disclosed herein.

[0003] The handle configurations have as their primary (but not sole) objective the provision of a toothbrush which is easier for the user to manipulate.

[0004] The bristle configurations have as their primary (but not sole) objective the provision of a toothbrush in which the bristles afford improved cleaning action and access to the teeth and gums.

[0005] According to a first aspect of the present invention a toothbrush handle having a head portion carrying or adapted to carry a bristle configuration is characterised in that the handle has an end portion, a waist, a shoulder portion and a neck connecting the shoulder to the head, the waist being narrower at least in plan view than the end portion or the shoulder, and the end portion preferably being rounded.

[0006] The handle is preferably curvilinear in plan view and in elevation. The end portion is preferably wider in plan view than the shoulder. The ratio of the maximum width of the end portion in plan view to the minimum width of the waist in plan view is preferably in the range 1.1:1 to 1.8:1. The ratio of the maximum width of the end portion in plan view to the maximum width of the shoulder in plan view is preferably in the range 1.2:1 to 1.5:1. The ratio of the maximum width of the shoulder in plan view to the minimum width of the waist in plan view is preferably in the range 1.05:1 to 1.5:1. The end portion is preferably thicker in side elevation than the waist. The ratio of the maximum thickness of the end portion in side elevation to the minimum thickness of the waist in side elevation is preferably in the range 1.2:1 to 2.0:1. The end portion is preferably thicker in side elevation than is the shoulder. The ratio of the maximum thickness of the end portion in side elevation to the maximum thickness of the shoulder in side elevation is preferably in the range 1.1:1 to 1.7:1. The shoulder is preferably thicker in side elevation than the waist. The ratio of the maximum thickness of the shoulder viewed in side elevation to the minimum thickness of the waist viewed in side elevation is preferably in the range 1.01:1 to 1.5:1.

[0007] The ratio of the length from the free end of the end portion to the location of the minimum width of the waist viewed in side elevation to the maximum width of the end portion viewed in side elevation is preferably not more than 10:1 and is more preferably in the range 4:1 to 7:1 e.g. about 5:1 to 6:1, especially about 5.6:1.

[0008] According to a second aspect of the present invention a toothbrush handle having a head portion carrying

or adapted to carry a bristle configuration is characterised in that the handle has a grip enhancing unitary mat providing grip enhancing surfaces on at least two separate locations of the handle.

5 **[0009]** The mat preferably provides the grip enhancing surfaces on at least the front and back of the handle or at at least two locations on the front or the back of the handle or at least one location at the front or back of the handle and at at least one side of the handle. Preferably
10 the mat provides grip enhancing surfaces at three or four separate locations on the handle. The grip enhancing surfaces of the mat may also afford grip enhancing configurations, for example ribs, preferably inclined diagonally to the handle.

15 **[0010]** Accordingly to a third aspect of the present invention a toothbrush handle having a head portion carrying or adapted to carry a bristle configuration is characterised in that the handle has grip enhancing configurations on at least two separate locations of the handle.

20 **[0011]** The grip enhancing configurations preferably are provided on at least the front and back of the handle or at at least two locations on the front or the back of the handle or at least one location at the front or back of the handle and at at least one side of the handle. The grip
25 enhancing configurations are preferably provided at three or four separate locations on the handle.

[0012] According to a fourth aspect of the present invention a toothbrush having a bristle configuration of which the teeth engaging ends of the bristles do not lie
30 in a plane parallel to the surface of the head of the handle in which the bristles are embedded is characterised in that the teeth engaging ends of at least a proportion of the bristles lying adjacent to each other lie in a curved line when the toothbrush is viewed in side elevation. Of
35 the total length of the bristle configuration, parallel to the surface in which the bristles are embedded, at least 10% of the length is preferably provided by bristles affording the said curved line, and more preferably at least 15% or at least 50% or more preferably 100%.

40 **[0013]** The curved line is preferably provided by a mixture of concave groups of bristles and convex groups of bristles. The percentage of the length of the curved line provided by concave bristles is preferably in the range 50% to 100%, preferably 50% to 75%.

45 **[0014]** According to a fifth aspect of the present invention a toothbrush having a bristle configuration of which the teeth engaging ends of the bristles do not lie in a plane parallel to the surface of the head of the handle in which the bristles are embedded is characterised in
50 that the bristles at or adjacent the head or toe end of the bristle configuration extend, when measured in a perpendicular direction, further from the said surface than do the bristles at the handle or heel end of the bristle configuration. The ratio of the height of the said longest
55 bristles at the head or toe end to the shortest bristles at the handle or heel end is at least 1.1:1 or more broadly 1.1:1 to 1.7:1 e.g., 1.2:1 to 1.6:1 or 1.25:1 to 1.5:1.

[0015] According to a sixth aspect of the present in-

vention a toothbrush having a bristle configuration of which the teeth engaging ends of the bristles do not lie in a plane parallel to the surface of the head of the handle in which the bristles are embedded is characterised in that the bristle configuration falls into at least two groups of adjacent bristles, the teeth engaging ends of the bristles of at least one group, a first group, lying in a curved line when the toothbrush is viewed in side elevation.

[0016] The teeth engaging ends of the bristles of at least one further group, a second group, preferably also lie in a curved line when the toothbrush is viewed in side elevation.

[0017] The teeth engaging ends of the bristles of at least one further group, a third group, preferably lie in a rectilinear line, e.g. a castellated line, when the toothbrush is viewed in side elevation.

[0018] The first and second groups preferably afford curved lines which are of different sense i.e. concave and convex or are of different curvature or are of the same sense and different curvature.

[0019] The teeth engaging ends of the bristles of the first and second groups preferably form a continuous wavy line.

[0020] The invention also extends to a toothbrush having a handle as set out in the first, second or third aspects above.

[0021] The invention also extends to a bristle configuration as set out in the fourth, fifth or sixth aspects above.

[0022] The invention also extends to a toothbrush having a handle set out in the first, second or third aspects and a bristle configuration as set out in the fourth, fifth or sixth aspects.

[0023] The invention has a number of aspects and may be put into practice in various ways and a number of specific embodiments will be described to illustrate the inventive aspects with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a first embodiment of a toothbrush embodying aspects of the present invention in respect of the handle and of the bristle configuration,

Figure 2 is a plan view of the embodiment of Figure 1 from the bristle side,

Figure 3 is a plan view of the embodiment of Figure 1 from the other side,

Figures 4 and 5 are side elevations from either side of the embodiment of Figure 1,

Figure 6 is an enlarged plan view of the tuft configuration of the bristles of the embodiment of Figure 1,

Figure 7 is an enlarged side elevation of the bristle head of Figures 4 and 5,

Figure 8 is an end elevation of the bristle head from the handle end of the embodiment of Figure 1,

Figure 9 is an end elevation from the head end of the bristle head of the embodiment of Figure 1,

Figure 10 is a perspective view of a second embodiment of a toothbrush embodying aspects of the present invention in respect of the handle and of the bristle configuration,

Figures 11 and 12 and 13 and 14 are views similar to Figures 2 and 3 and 4 and 5 but of the embodiment shown in Figure 10,

Figures 15 to 18 are views similar to Figures 6 to 9 but of the bristle configuration of the embodiment shown in Figure 10,

Figure 19 is a perspective view of a third embodiment of a toothbrush embodying aspects of the present invention in respect of the bristle configuration,

Figure 20 is a side elevation of the embodiment of Figure 19,

Figures 21 to 24 are views similar to Figures 6 to 9 but showing the bristle configuration of the embodiment of Figure 19,

Figure 25 is a perspective view of a fourth embodiment of a toothbrush embodying aspects of the present invention in respect of the bristle configuration,

Figure 26 is a side elevation of the embodiment of Figure 25,

Figures 27 to 30 are views similar to Figures 6 to 9 but showing the bristle configuration of the embodiment of Figure 25.

[0024] There follows a general discussion of the embodiments after which they will be described in detail.

[0025] It will be recognised that two embodiments of handle have been shown, the first in Figures 1 to 5 which has a mat entwined around the handle and the second, which does not have a mat, in Figures 10-14, 19, 20, 25 and 26.

[0026] A third embodiment is contemplated in which the ribs of the mat of Figures 1 to 5 are integrally moulded in the one piece handle shown in Figures 10-14, 19, 20, 25 and 26.

[0027] The handles embody a number of separate and separately usable inventive aspects including as a first aspect the mat wrapped around the handle, and as a second aspect the ratios of the widths of the palm engaging handle end, the finger engagable shoulder and the waist therebetween. This identification of two aspects does not exclude the possibility of the handle embodying yet other aspects.

[0028] It will be recognised also that four embodiments of bristle configuration have been shown and that each bristle configuration can be used in combination with any of the three handle configurations.

[0029] The first embodiment of bristle configuration is shown in Figures 1 to 9; the second embodiment in Figures 10 to 18; the third embodiment in Figures 19 to 24 and the fourth embodiment in Figures 25 to 30.

[0030] The four embodiments embody a number of separate and separately usable aspects including that

of having the teeth engaging ends of the bristles not lying in a plane parallel to the surface of the handle in which the bristles are embedded and the teeth engaging ends of at least a proportion of the bristles lying adjacent to each other occupying a curved plane when the toothbrush is viewed in side elevation. All four embodiments show this aspect.

[0031] An aspect shared by the second, third and fourth embodiments is that bristles at or close to the head end of the bristle configuration reach further from the surface of the handle in which the bristles are embedded than do the bristles at the handle end of the bristle configuration.

[0032] The first and third embodiments embody the aspect of the bristles falling into at least two groups of adjacent bristles, the teeth engaging ends of the bristles of a first group lying in a curved plane when the toothbrush is viewed in side elevation and the teeth engaging ends of the bristles of a second group also lying in a curved plane when the toothbrush is viewed in side elevation, the said curved planes preferably being different.

[0033] The curved planes may curve in opposite senses, e.g. one being concave and one convex, or may curve to different extents both being concave or convex or may be of the same sense and curvature. The first embodiment has two convex groups at the ends of the bristle configuration and one concave group between the convex groups.

[0034] These form a discontinuous wavy surface.

[0035] The third embodiment has five curved groups, three convex groups at the ends and the middle and two concave groups therebetween. These form a continuous wavy surface.

[0036] The fourth embodiment can be considered to have two curved groups. One nearest the head end being convex and flowing into a concave group to the rear of it (towards the handle end), providing a continuous wavy surface when viewed in elevation.

[0037] There now follows a detailed description of the embodiments with reference to the drawings.

[0038] Figure 1 shows a toothbrush having a handle 35 and a bristle head 50.

[0039] The handle is shown in Figures 1 to 5, the head in Figures 1 to 9 but in enlarged scale in Figures 6 to 9.

[0040] The handle (which is a first embodiment thereof) has a body portion having a palm engaging end portion 36 with a rounded free end 47, a waist 37, a finger engagable shoulder 38, a neck 39 and a head 40 for receiving the bristles of the bristle configuration 50, in a surface 46. A mat 41 of rubber like material (for example the rubber like material may be that sold under the Trade Mark SANTOPRENE) (to give a good wet grip for the user's fingers) is attached to the handle so as to wrap around the waist and provide a grip surface 42 on the shoulder 38 on the bristle face of the handle as well as a grip surface 43 on the back face of the shoulder of the handle and a grip surface 44 on the back face of the

palm engaging end portion 36 of the handle.

[0041] Each of the surfaces 42, 43 and 44 have ribs 45 moulded into their surfaces in such a way as to lie diagonally across the said surfaces when located on the handle. This wrapped unitary mat arrangement facilitates placement of the gripping surfaces on the handle.

[0042] The ratio of the maximum transverse width in plan view of the portion 36 (indicated by the line 36) to the minimum transverse width in plan view of the waist 37 (indicated by the line 37) is 1.4:0.9 i.e. 1.55:1 or more broadly 1.1:1 to 1.8:1 e.g. 1.2:1 to 1.7:1 more preferably 1.3:1 to 1.6:1. The ratio of the widest transverse width in plan view of the shoulder 38 (indicated by the line 38) to the minimum transverse width in plan view of the waist 37 is 1.1:0.9 i.e. 1.2:1 or more broadly 1.05:1 to 1.5:1 e.g. 1.1:1 to 1.3:1. The ratio of the widest transverse width in plan view of the end 36 to the shoulder 38 is 1.4:1.1 i.e. 1.25:1 or more broadly greater than 1:1 e.g. 1.2:1 to 1.5:1.

[0043] The end portion 36 is wider than the shoulder 38 which is wider than the waist 37.

[0044] The ratio of the maximum thickness in side elevation of the end portion 36 (see Figures 4 and 5) indicated by the line 80 in Figure 4 including the ribs 45 on the mat, namely 1.5 units to the minimum width of the waist 37 indicated by the line 81 namely 0.9 units is 1.7:1 or more broadly 1.3:1 to 2.0:1 or 1.5:1 to 1.9:1. The ratio of the maximum thickness in side elevation of the shoulder 38 indicated by the line 82 including the ribs 45 on the mat, namely 1.1 units to the minimum width of the waist 37 namely 0.9 units is 1.2:1 or more broadly 1.05:1 to 1.5:1 or 1.1:1 to 1.3:1.

[0045] The ratio of the maximum thickness of the end portion 36 to the shoulder 38 is 1.35:1 or more broadly 1.0:1 to 1.7:1 or 1.2:1 to 1.6:1.

[0046] The handle is also shown in a second embodiment in Figures 10 to 14, 19, 20, 25 and 26. The handle is the same as in the first embodiment except that the unitary mat is omitted.

[0047] In the second embodiment of the handle the ratio of the maximum thickness in side elevation of the end portion 36 (see Figures 13 and 14) indicated by the line 85 in Figure 13 namely 1.4 units to the minimum width of the waist 37 indicated by the line 86 namely 0.9 units is 1.55:1 or more broadly 1.2:1 to 1.8:1 or 1.4:1 to 1.7:1. The ratio of the maximum thickness in side elevation of the shoulder 38 indicated by the line 87 namely 1.0 units to the minimum width of the waist 37 namely 0.9 units is 1.1:1 or more broadly 1.0:1 to 1.3:1 or 0.5:1 to 1.2:1.

[0048] The ratio of the maximum thickness of the end portion 36 to the shoulder 38 is 1.4:1 or more broadly 1.0:1 to 1.7:1 or 1.2:1 to 1.6:1.

[0049] In a third embodiment not shown the handle of the second embodiment is provided with ribs akin to those 45 on the mat 41, though not necessary in the same numbers or the same inclination or on all of the surfaces 42, 43 and 44. However an arrangement which

has the same ribs 45 as in the first embodiment integrally moulded into the handle is preferred.

[0050] Turning now to the head 50 a first embodiment of bristle configuration is shown in Figures 1 to 9. As can be seen in Figure 7 the head has three groups of bristle tufts 55, 75 and 95. These are shown in plan view in Figure 6 delineated by the transverse lines 56 and 76. The group 55 affords a teeth engaging surface 57 which is convex with regard to the surface 46 of the head of the handle when the toothbrush is viewed in side elevation. The surface 46 is that in which the tufts of bristles axe embedded.

[0051] The group 75 affords a teeth engaging surface 77 which is concave with regard to the surface 46 when the toothbrush is viewed in side elevation.

[0052] The group 75 has a central front outer tuft 60, side tufts 61,62,63 and 64,65,66 on either side and two centre line tufts 67 and 68. The group 75 has five transverse rows of tufts 78,79,80,81,82. The first three rows 78, 79 and 80 having four tufts each and the last two rows 81 and 82 five tufts each.

[0053] The teeth engaging ends of the tufts 78 are further from the surface 46 than the ends of the tufts 63, 68 and 66 but come to about the same level as the tufts 67, 62 and 65.

[0054] The group 95 affords a teeth engaging surface 97 which is closely similar in profile to the surface 57. The group 95 has a first row of five tufts 98, a second row of four tufts 99 and two side tufts 100 and 101 and a central rear tuft 102. The tufts 98 are shorter than the tufts in row 82, but the tufts in row 99 are about the same height as those in row 82.

[0055] The teeth engaging surface afforded by the bristles as whole is thus wavy or sinusoidal but is not a continuous surface having breaks in level between the end tufts of adjacent groups, i.e. 63, 68, 66 of group 55 and row 78 of group 75 and row 82 of group 75 and row 98 of group 95.

[0056] Referring to Figure 6 the length of the bristle configuration in plan view or in side elevation, namely the length parallel to the surface 46 of the teeth engaging ends of the bristles in 8.8 units. 100% of this length is provided by bristles the teeth engaging ends of which lie in a curved line when the toothbrush is viewed in side elevation. The group 55 occupies 2.5 units, and the group 95 also occupies 2.5 units and both are convex. The group 75 occupies 3.5 units and is concave. The ratio of convex to concave is thus 5:3.5 or 1.4:1 or more broadly 1:1 to 2:1.

[0057] The second embodiment of bristle configuration is shown in Figures 10 to 18 with particular reference to Figures 15, 16 and 17.

[0058] The bristles fall into two groups 155 and 195 separated in Figure 15 by the line 156.

[0059] Each group affords a curved teeth engaging surface 157 and 197 respectively (see Figure 7) both of which are convex with regard to the surface 46.

[0060] The group 155 has an outer row of bristles

158-171 and two bristles 172 and 173 on the centre line which reach further from the surface 46 than do the remaining bristles of the group 155 and the bristles of group 195.

[0061] The bristles which are cross hatched in Figure 15 are the shorter bristles of the group 155, and have reference numbers 175 to 184.

[0062] The group 195 has a first transverse row 198 of five tufts, a second row 199 (bowed towards the front end) of five tufts, a third row 200 (more bowed towards the front end) of four tufts, a third transverse row 201 of three tufts and a fourth transverse row 202 of two tufts. The tufts 164 and 165 are longer than the tufts 202.

[0063] In this embodiment the curved surface 197 is continued forward into the group 155 by the inner tufts 175-184 (which carry crosses in Figure 15).

[0064] The free ends of these bristles follow the dotted line 197A shown in Figure 15. It can be observed that this curved surface 197A dips down slightly towards the surface 46 at the front end of this surface 197A, the row 198 being the longest bristles involved in the surface 197/197A.

[0065] In variants of this embodiment (not shown) the surface 197A can dip down more markedly or the surface 197 can have its highest point at the row 202 or the surface 197/197A can have its high point at the tufts 175, 176,

[0066] In another variant the tufts in the group 195 and in the array 175-184 can all be of the same length so that only a single curved surface is provided, namely by the bristles 158 to 171 and 172 and 173.

[0067] In addition in the four transverse rows at the handle end of the group 155, the outer bristles, namely tufts 161 and 168 are longer than tufts 175 and 176; tufts 160 and 169 are longer than tufts 177 and 178; tufts 159 and 170 are longer than tufts 179-181; and tufts 158 and 171 are longer than tufts 182-184.

[0068] Referring to Figure 16 the length of the bristle configuration in plan view or in side elevation, namely the length parallel to the surface 46 of the teeth engaging ends of the bristles in 9.2 units. 100% of this length is provided by bristles the teeth engaging ends of which lie in a curved line when the toothbrush is viewed in side elevation. The group 155 occupies 5.3 units, and the group 195 also occupies 3.6 units and both are convex.

[0069] The height of the bristles in the tufts 164 and 165 at the head end of the bristle configuration is 3.8 units when measured in a direction perpendicular to the surface 46. The height of the rearmost bristles in the row of tufts 202 is 2.6 units when measured in a direction perpendicular to the surface 46.

[0070] The ratio of the lengths of the longest bristles to the shortest bristles is thus 1.5:1.

[0071] The third embodiment of bristle configuration is shown in Figures 19 to 24 with particular reference to Figures 21, 22, 23 and 24.

[0072] The bristles can be considered to fall into five groups 215, 235, 255, 275 and 295 by reference to the

points of inflexion 216, 236, 256 and 276 in the sinusoidal continuous wave shape of the teeth engaging surface 207 of the bristles apparent when the toothbrush is viewed in side elevation.

[0073] The bristles in this configuration are not arranged so much in transverse rows as in a central axial row and in circumferential rows.

[0074] The group 215 has two tufts 218,219 side by side in a first transverse row, then two edge tufts 220,221 again in a transverse row, then a central tuft 222, then two edge tufts 223 and 224, then a central tuft 225, then two edge tufts 226,227. This group affords a convex tooth engaging surface 217.

[0075] The group 235 affords a concave tooth engaging surface 237. It is made up of a row 238 of four tufts (bowed to the front) and then two inwardly disposed tufts 239,240.

[0076] The group 255 affords a convex tooth engaging surface 257. It has two inwardly disposed transversely located tufts 258,259. Then a transverse row 260 consisting of two edge tufts and a central tuft. Then there are two inwardly disposed tufts 261 and 262. Then another 263 like the row 260.

[0077] The group 275 affords a concave surface 277. It has two more inwardly disposed tufts 264,265. Then a row 266 like that 260 but with the inner tuft slightly displaced to the front.

[0078] The group 295 affords a convex surface 297. It has two inwardly disposed tufts 267,268, then a row 269 like 266, then two more inwardly disposed tufts 270,271, then a row 272 like 266, then two side by side tufts 273,274 like 218 and 219.

[0079] The tufts 218,219 are longer than the tufts 273 and 274.

[0080] Referring to Figure 22 the length of the bristle configuration in plan view or in side elevation, namely the length parallel to the surface 46 of the teeth engaging ends of the bristles in 8.9 units. 100% of this length is provided by bristles the teeth engaging ends of which lie in a curved line when the toothbrush is viewed in side elevation. The group 215 occupies 2.7 units, the group 235 occupies 1.3 units, the group 255 occupies 1.9 units, the group 275 occupies 1.3 units and the group 295 occupies 1.6 units.

[0081] The groups 215, 255 and 295 are convex and occupy 6.2 units. The groups 235 and 275 are concave and occupy 2.6 units.

[0082] The ratio of convex to concave is thus 6.2:2.6 or 2.4:1 or more broadly 1.5:1 to 3:1.

[0083] The heights of the bristles in the tufts 222 and 220 and 224 close to the head end of the bristle configuration is 3.2 units when measured in a direction perpendicular to the surface 46. The height of the rearmost bristles in the row of tufts 273 and 274 is 2.1 units when measured in a direction perpendicular to the surface 46.

[0084] The ratio of the lengths of the longest bristles to the shortest bristles is thus 1.5:1.

[0085] The fourth embodiment of bristle configuration

is shown in Figures 25 to 30.

[0086] The bristles can be considered to fall into three groups 355, 375 and 395, separated by lines 356 and 376 in Figures 27 and 28 for ease of description. The ends of the bristles in the group 355 provide a convex curved surface 357 when the toothbrush is viewed in side elevation. The ends of the bristles in the group 375 provide a concave curved surface 377 when the toothbrush is viewed in side elevation. The curves 357 and 377 flow smoothly into each other and the line 356 is at the point of inflexion between the curves. The group 395 provides a castellated tooth engaging surface 397 afforded by alternating transverse rows of longer bristles 400, 420, 440, 460 and shorter bristles 380, 410, 430, 450, 470 and a single centre rearmost tuft 480.

[0087] In each of the four longer rows 400, 420, 440, 460 the bristles are of the same length which is slightly shorter than the longest bristles in the group 355 namely bristles in the tufts 361, 362 and 365.

[0088] Similarly the bristles in each of the shorter rows 380, 410, 430, 450 and 470 and the tufts 480 are all the same length.

[0089] The ratio of the bristle length (LL) from the surface 46 to the ends of the long bristles for the bristles in the rows 400, 420, 440, 460 to the bristle length (LS) for the short bristles in the rows 380, 410, 430, 450, 470 is 1.15:1. More broadly it is in the range 1.05:1 to 1.5:1 e.g. 1.1:1 to 1.4:1.

[0090] The group 355 has a central front tuft 360 and side tufts 361 and 363 on one side and 362 and 364 on the other side and a central tuft 365 between and slightly forwardly of the tufts 363 and 364. The rear of these tufts also afford part of the group 375.

[0091] As can be readily seen from Figures 29 and 30 tufts 363, 365 and 364 are the same height and are slightly longer than the tufts in the rows 400, 420, 440 and 460.

[0092] The ratio of the heights of these tufts 363, 364, 365 to the longer rows 400 etc is 1.04:1 or more broadly 1.02:1 to 1.3:1; whilst their ratio to the shorter rows 380, 410 etc. is 1.2:1 or more broadly 1.1:1 to 1.5:1.

[0093] The group 375 is made up of the rearmost portions of the tufts 363, 365 and 364 and a row 379 of three tufts which afford a concave rearwardly facing tooth engaging surface.

[0094] Referring to Figure 28 the length of the bristle configuration in plan view or in side elevation, namely the length parallel to the surface 46 of the teeth engaging ends of the bristles in 8.7 units. 16% of this length is provided by bristles the teeth engaging ends of which lie in a curved line when the toothbrush is viewed in side elevation the group 355 occupies 1.4 units, and the group 375 occupies 0.9 units, 355 being convex and 375 being concave. The ratio of convex to concave is thus 1.4:0.9 or 1.55:1 or more broadly 1:1 to 2:1.

[0095] The height of the bristles in the tufts 364, 365, 363 close to the head end of the bristle configuration is 3.6 units when measured in a direction perpendicular to

the surface 46. The height of the bristles in the tufts 380 is 2.9 units when measured in a direction perpendicular to the surface 46.

[0096] The ratio of the lengths of the longest bristles to the shortest bristles is thus 1.25:1.

[0097] The row 379 is made up of two side tufts 372 and 374 and a central tuft 373 which is positioned very slightly forwardly of the tufts 372 and 374. These tufts 372 and 374 are also positioned very slightly inwardly of the tufts 363 and 364.

[0098] The separation of the group of tufts 360-365 and row 379 from the castellated group 380 to 480 is as follows:

there is a gap (A) between row 379 and 380;

there is a gap (B) between row 380 and 400;

(B) is less than (A);

there is a gap (C) between row 400 and 410;

(C) is less than (A) or (B);

there is no gap between row 410 and 420, they touch;

there is a gap (D) between row 420 and 430;

(D) is similar to (A) and (B);

there is no gap between rows 430 and 440, they interdigitate;

there is no gap between rows 440 and 450, they touch;

there is no gap between rows 450 and 460, they interdigitate;

there is no gap between rows 460 and 470 or rows 470 and the rear bristle 480, they touch.

[0099] Figures 31 and 32 are views similar to Figures 6 and 7 but showing the bristle configuration of a first modification of the embodiment of Figure 25.

[0100] Figures 31 and 32 show plan view and side elevations of a first modification of the fourth embodiment of bristle configuration shown in Figures 25 to 30.

[0101] The bristles can be considered to fall into three groups 355, 375 and 395, separated by lines 356 and 376 in Figures 31 and 32 for ease of description. The ends of the bristles in the group 355 provide a convex curved surface 357 when the toothbrush is viewed in side elevation. The ends of the bristles in the group 375 provide a concave curved surface 377 when the toothbrush is viewed in side elevation. The curves 357 and 377 flow smoothly into each other and the line 356 is at the point of inflexion between the curves. The group 395 provides a castellated tooth engaging surface 397 afforded by alternating transverse rows of longer bristles 400, 420, 440, 460 and shorter bristles 380, 410, 430 and 450.

[0102] In each of the four longer rows 400, 420, 440, 460 the bristles are of the same length which is slightly shorter than the longest bristles in the group 355 namely bristles in the tufts 361, 362, 363 and 364.

[0103] Similarly the bristles in each of the shorter rows 380, 410, 430 and 450 are all the same length.

[0104] The ratio of the bristle length (LL) from the surface 46 to the ends of the long bristles for the bristles in the rows 400, 420, 440, 460 to the bristle length (LS) for the short bristles in the rows 380, 410, 430, 450 is 1.15:1. More broadly it is in the range 1.05:1 to 1.5:1 e.g. 1.1:1 to 1.4:1.

[0105] The group 355 has a pair of transversely disposed tufts 361 and 363 and three transversely disposed tufts 363, 364 and 365.

[0106] As can be readily seen from Figure 32 the longest bristles in the tufts 361 to 365 are the same height and are longer than the tufts in the rows 400, 420, 440 and 460.

[0107] The ratio of the heights of these bristles in the tufts 361, 365 to the longer rows 400 etc is 1.14:1 or more broadly 1.04:1 to 1.4:1; whilst their ratio to the shorter rows 380, 410 etc. is 1.28:1 or more broadly 1.2:1 to 1.6:1.

[0108] The group 375 is made up of a row 379 of three tufts 372, 373 and 374 which afford a concave rearwardly facing tooth engaging surface.

[0109] The modification of the bristle configuration is at the front end of the head.

[0110] The central bristle tuft 360 is omitted. The tufts 361 and 362 are retained. The tufts 363, 365 and 364 are aligned to form a transverse row at right angles to the longitudinal axis of the head. The tufts 372, 373 and 374 on the row 379 are aligned to form a transverse row at right angles to the longitudinal axis of the head. The tufts 372 and 374 are moved transversely outwardly so that relative to the longitudinal axis they are positioned outwardly of the tufts 363 and 364.

[0111] The bristles 361, 362, 363, 364, 372, 373 and 374 form a four sided figure.

[0112] The separation of the group of tufts 361-365 and 372-374 from the castellated group 380 to 480 is as follows:

there are clear gaps between each row;

there is a gap (A) between rows 379 and 380 of about 5.5 units;

the gap (B) between rows 380 and 400 is 5.5 units;

the gap (C) between rows 400 and 410 is 5 units as are the remaining gaps (D), (E), (F), (G) and (H).

[0113] Alternatively the gap (B) can be 5 units, when the ratio of A:B would be 1.1:1.

[0114] Referring to Figure 32 the length of the bristle configuration in plan view or in side elevation, namely the length parallel to the surface 46 of the teeth engaging ends of the bristles is 7.4 units. 24% of this length is provided by bristles the teeth engaging ends of which lie in a curved line when the toothbrush is viewed in side elevation. The group 355 occupies 1.1 units, and the group 375 occupies 0.8 units, 355 being convex and 375 being concave. The ratio of convex to concave is thus 1.4:1 or more broadly 1:1 to 2:1.

[0115] The height of the highest bristles in the tufts

361 - 365 close to the head end of the bristle configuration is 3.2 units when measured in a direction perpendicular to the surface 46. The height of the bristles in the tufts 380 is 2.9 units when measured in a direction perpendicular to the surface 46.

[0116] The ratio of the lengths of the longest bristles to the shortest bristles is thus 1.28:1.

[0117] Referring to Figures 33 and 34 this shows a second modification of H15RV1 the fourth embodiment. It is similar to the first modification. The bristle tuft configuration is the same and the difference is in the ends of the bristle tufts 361-365 and 372-374. The tufts 361 and 362 instead of being curved up from the front to a peak at their rear edges are inclined upwardly and backwardly affording a transverse forward facing flat surface 357A which is not curved.

[0118] The tufts 363, 365 and 364 instead of being curved down from a peak at the front to their rear edges are inclined downwardly and backwardly affording a transverse rearward facing flat surface 357B which is not curved. The tufts 361, 362 and 363 to 365 thus provide inverted V-shaped tooth engaging surfaces 357A and 357B, the angle of each of which is about 45° to the vertical or more broadly 30° to 60°.

[0119] The tufts 372-374 in the row 379 have inclined ends forming a transverse rearwardly facing flat surface 377 which is not curved. The flat surface 377 is a continuation of the surface 357B.

[0120] The front group 355 is now made up of the bristle tufts 361 and 362, the second group 375 is made up of the tufts 363, 364 and 365 and 372, 373 and 374, the line 356 lies between the first and second rows.

[0121] Referring to Figures 35 and 36 this shows a third modification of the fourth embodiment. It is similar to the first modification. The bristle tuft configuration is the same. The difference is in the ends of the bristle tufts 361-365 and 372-374.

[0122] The tufts 361 to 365 have flat tops all of the same height which is greater than the tufts 400 etc.

[0123] The tufts 372-374 in the row 379 have inclined ends forming a transverse rearwardly facing flat surface 377 which is not curved.

[0124] The front group 355 is now made up of the bristle tufts 361 and 362 and 363, 364 and 365, the second group 375 is made up of the tufts 372, 373 and 374, the line 356 lies between the second and third rows.

[0125] Referring to Figures 37 and 38 this shows a fourth modification of the fourth embodiment. It is similar to the first modification. The bristle tuft configuration is the same. The difference is in the ends of the tufts 361-365 and 372-379.

[0126] The tufts 361 and 362 have flat tops as in Figure 36 but the tufts 363-365 and 372 to 374 are as in Figure 34.

[0127] Figure 39 shows a modified bristle configuration on a much enlarged scale. In this modification (which can be used for each of the first to fourth modifications of the fourth embodiment) the gap (A) between

the rows 379 and 380 is greater than the gaps (B), (C), (D), (E), (F), (G) or (H) (which are all the same) between the rows 380 to 480.

[0128] The gap (A) is 7 units, B is 5 units i.e. the ratio is 1.4:1 or more broadly (A) is greater than (B) e.g. A:B is preferably 1.05:1 to 1.6:1 e.g. 1.1:1 to 1.5:1 or more preferably 1.1:1 to 1.4:1.

[0129] It will be noted that in the specific embodiments of bristle configurations shown in the drawings the ends of the bristles at any particular transverse location, i.e. along the line perpendicular to the longitudinal axis of the head, all lie at the same distance from the surface 46, i.e. in a straight line transverse to the head and parallel to the surface 46.

Claims

1. A toothbrush having a bristle configuration (50) of which the teeth engaging ends (57,77,97) of the bristles do not lie in a plane parallel to the surface (46) of the head of the handle in which the bristles are embedded when the toothbrush is viewed in side elevation, the teeth engaging ends of the bristles lying adjacent to each other lying in a curved line when the toothbrush is in side elevation, the curved line being provided by a mixture of at least one concave group (75) of bristles and at least one convex group (55,95) of bristles, characterised in that the ratio of the length of the curved line provided by convex bristles to that provided by the concave bristles is in the range 1:1 to 2:1, and in that the curved line is discontinuous

there being a group of bristles (a convex group) (55), the teeth engaging ends of which lie in a convex line (57) when the toothbrush is viewed in side elevation, located at the toe of the head of the brush,

and a group of bristles (a convex group) (95), the teeth engaging ends (97) of which lie in a convex line when the toothbrush is viewed in side elevation, located at the heel of the head of the brush and

a group of bristles (a concave group) (75), the teeth engaging ends (77) of which lie in a concave line when the toothbrush is viewed in side elevation, located between the two convex groups of bristles,

the tufts (78,82) at each end of a concave group (75) extending further from the surface (46) of the head of the brush in which the bristles are embedded than do the adjacent tufts of bristles (63,68,66 or 98) in the adjacent concave group, the said tufts (78) at one end of a concave group (75) extending to about the same level as the longest tufts (62,67,65) in the adjacent convex group (55),

and the said tufts (82) at the other end of a concave group (75) extending to about the same level as the longest tufts (99) in the adjacent convex group (95),

and in that the teeth engaging ends of the bristles in a transverse direction across the head of the toothbrush (e.g. the row 78) extend substantially the same length from the surface (46) of the head of the brush in which the bristles are embedded.

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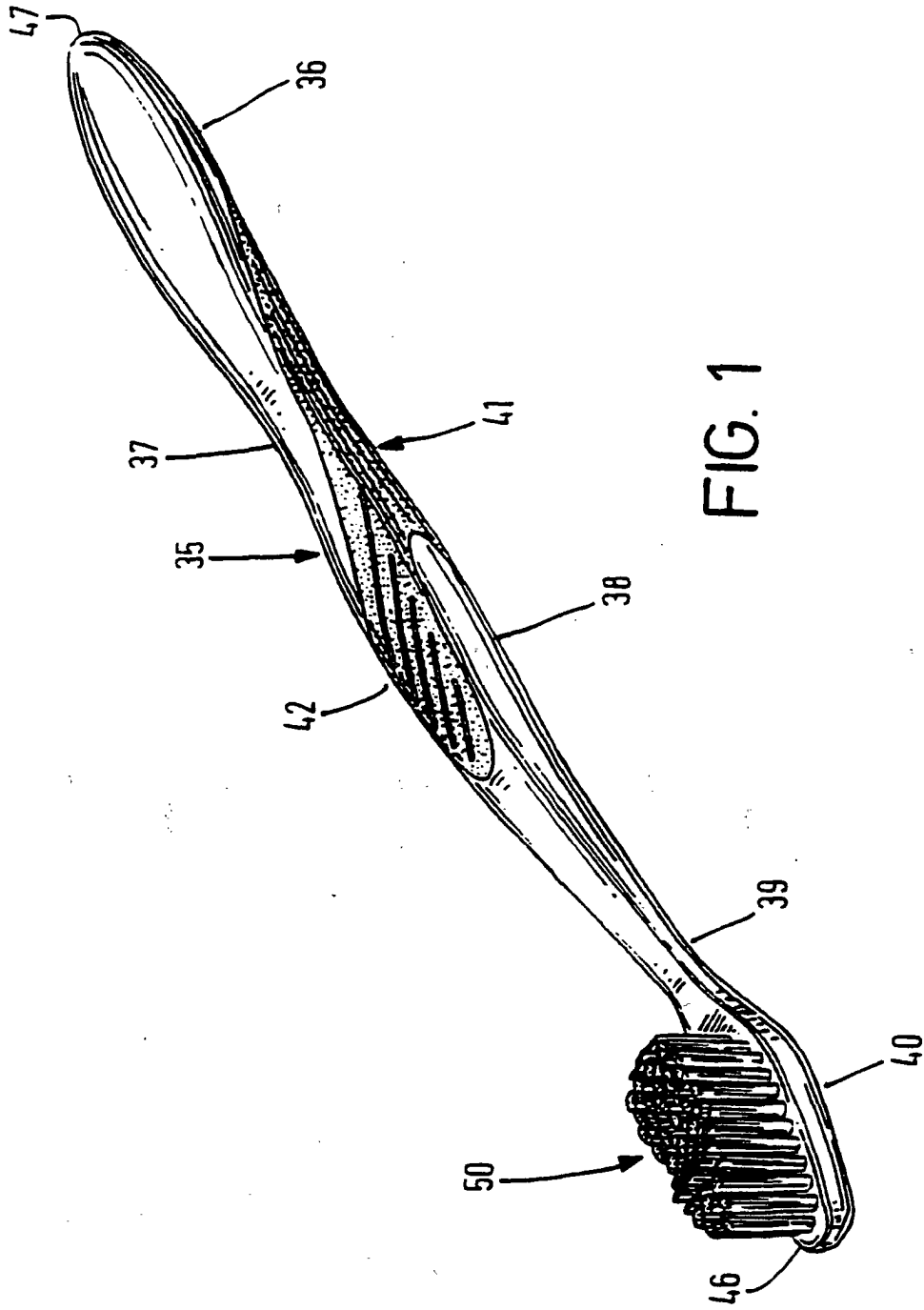


FIG. 1

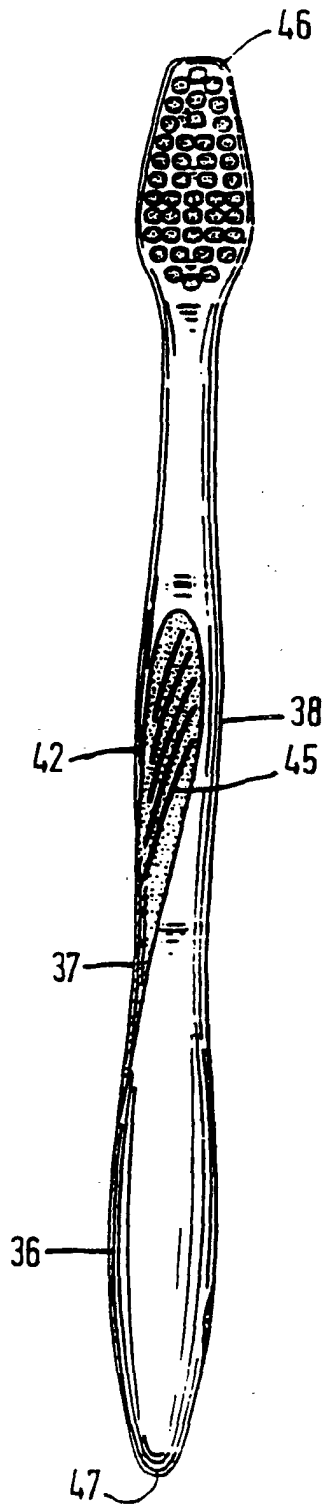


FIG. 2

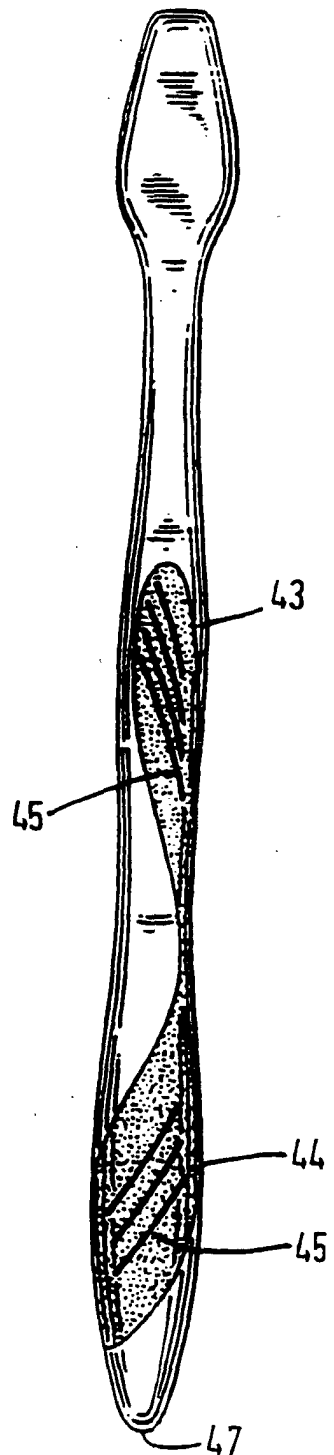


FIG. 3

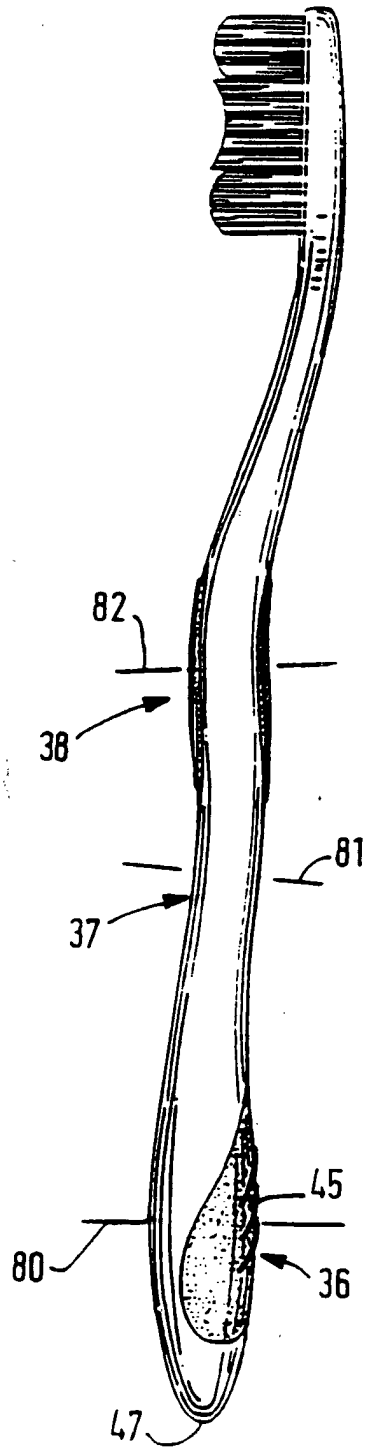


FIG. 4

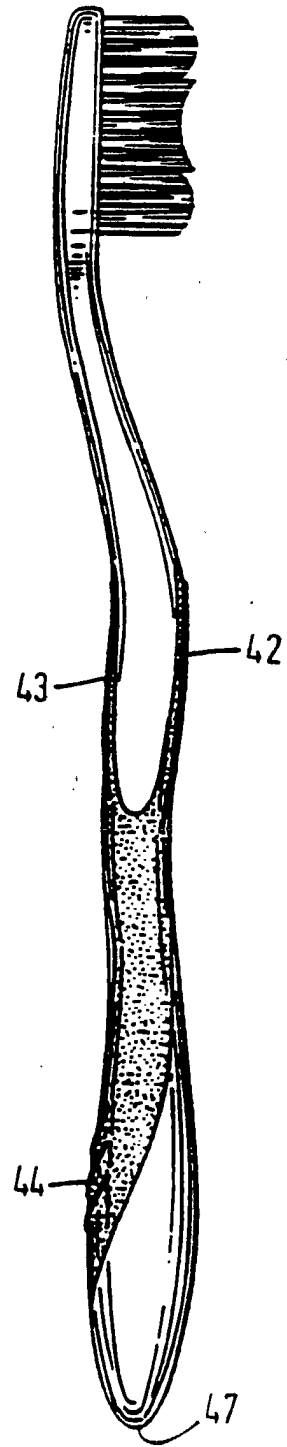
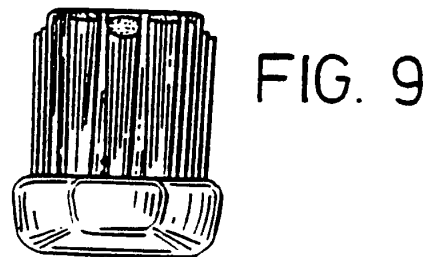
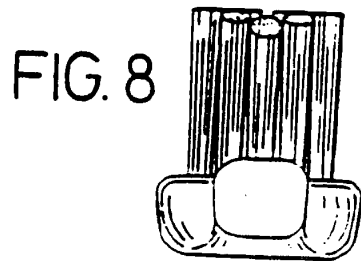
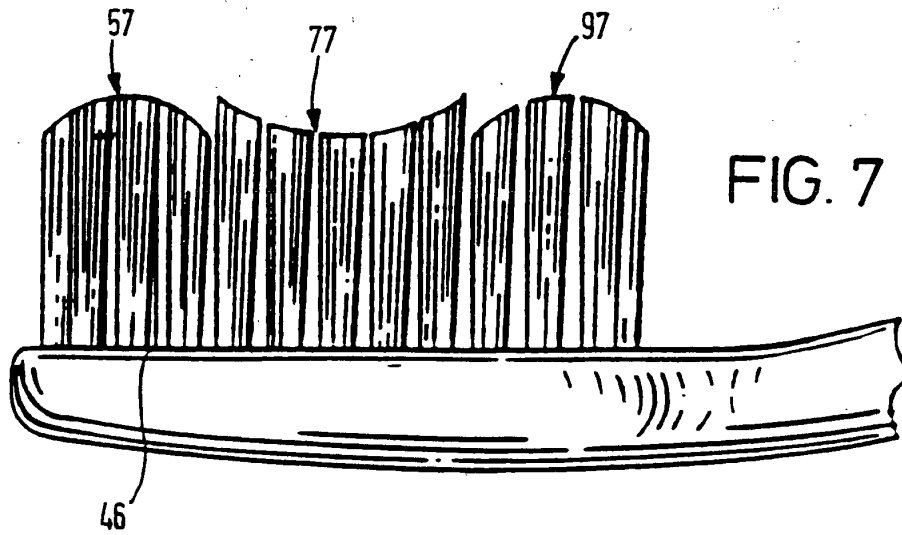
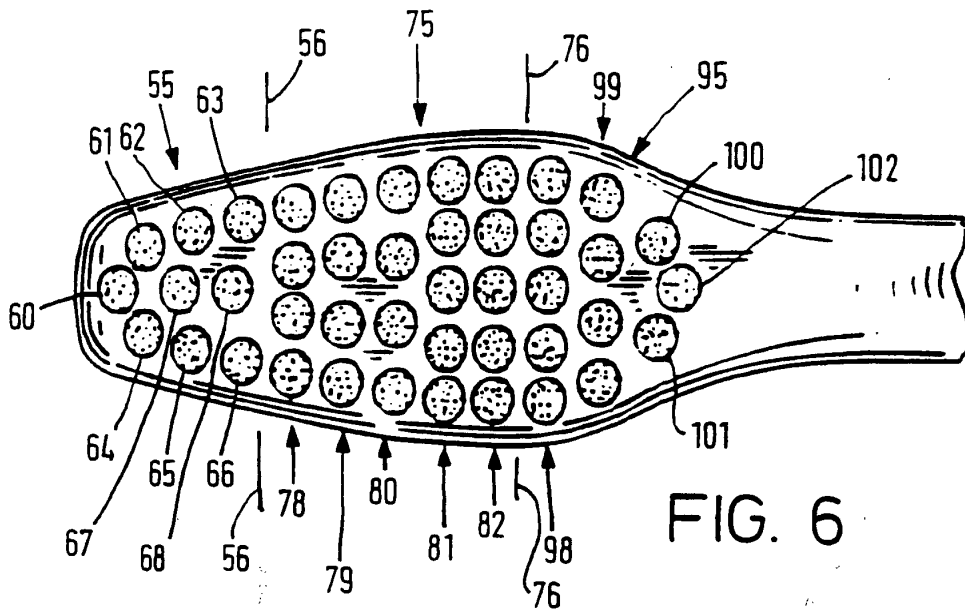


FIG. 5



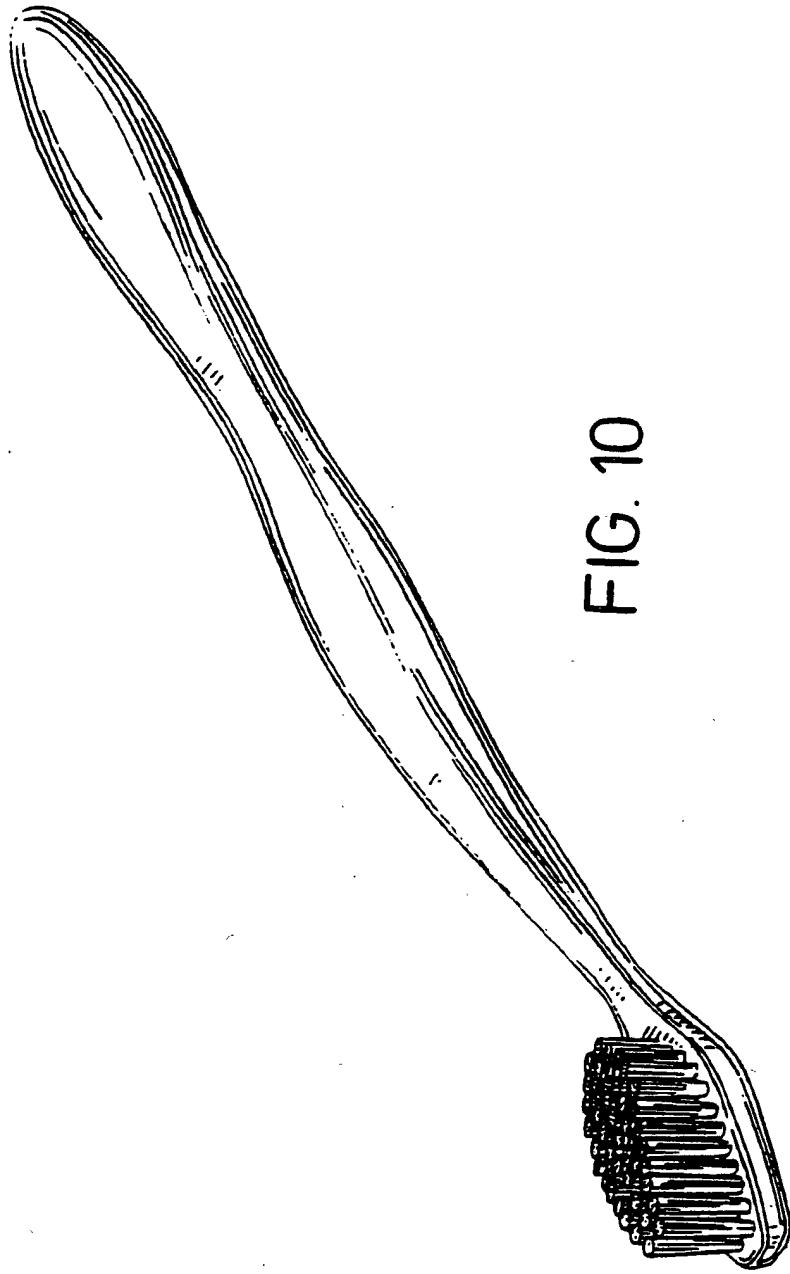


FIG. 10

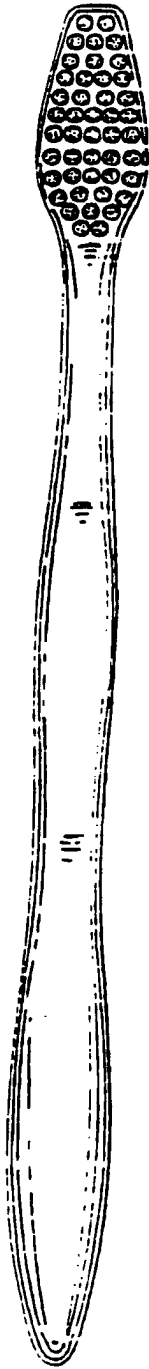


FIG. 11

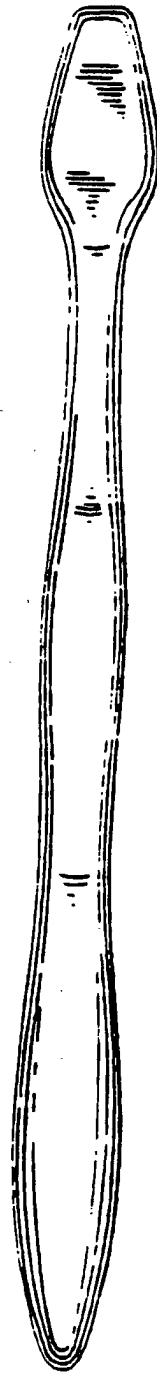


FIG. 12

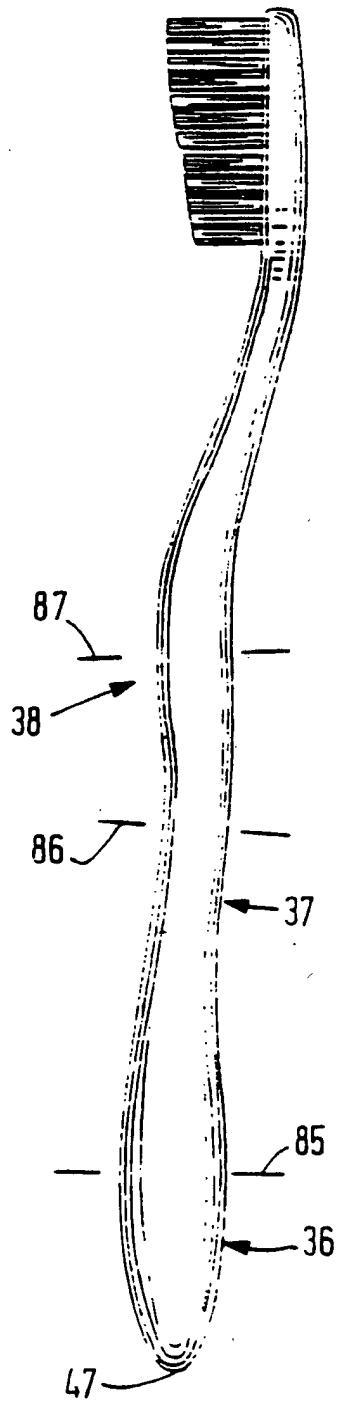
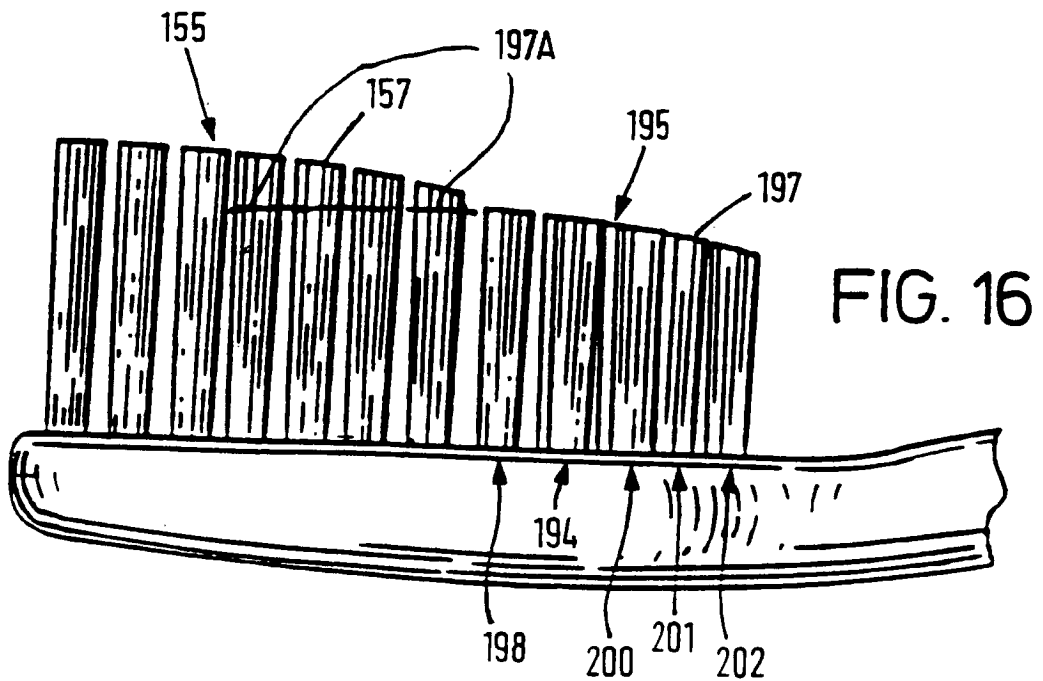
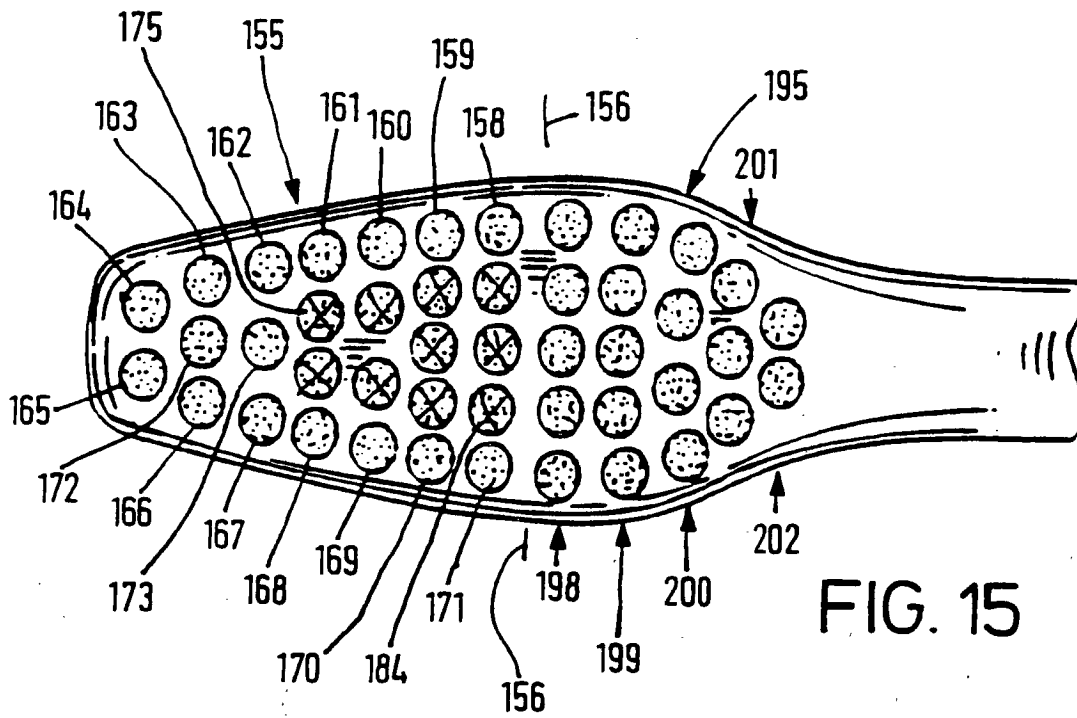


FIG. 13



FIG. 14



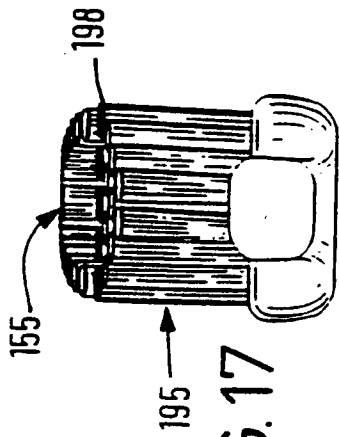


FIG. 17

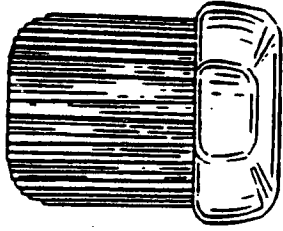


FIG. 18

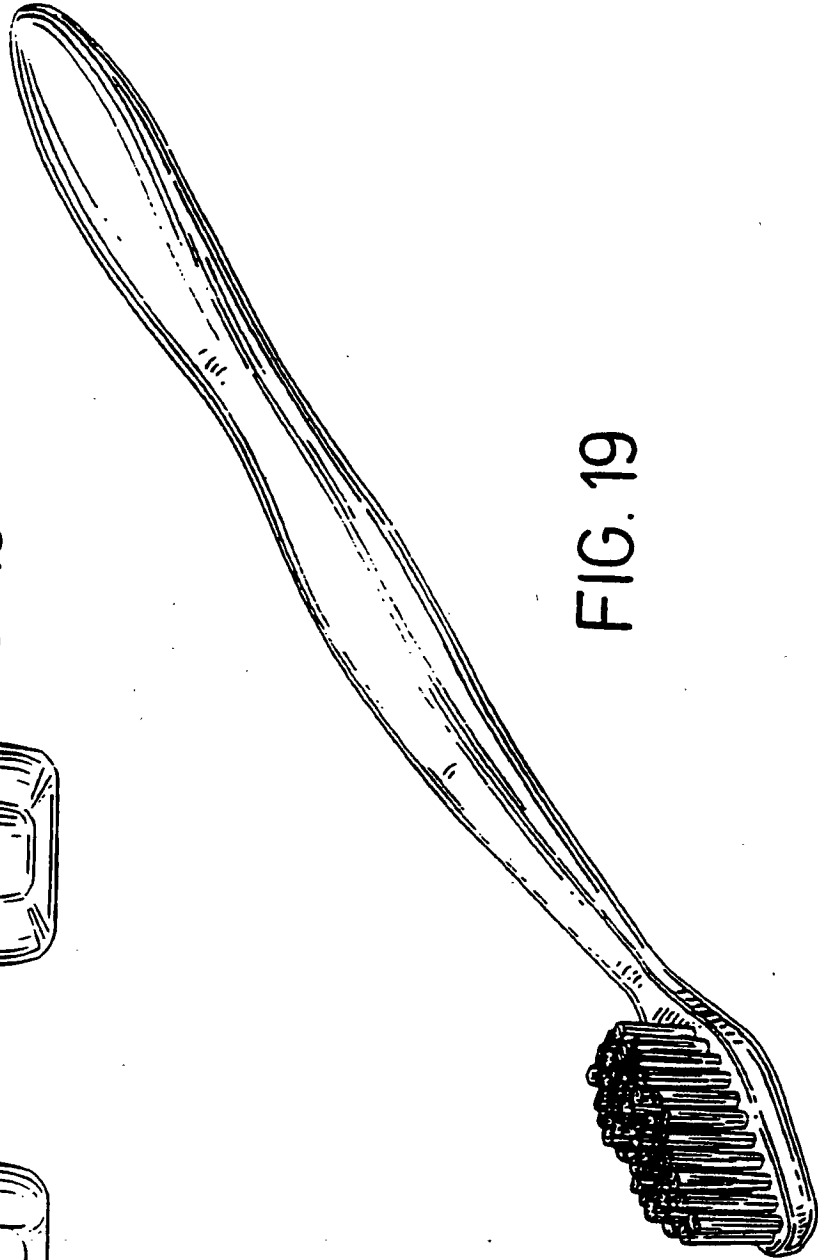
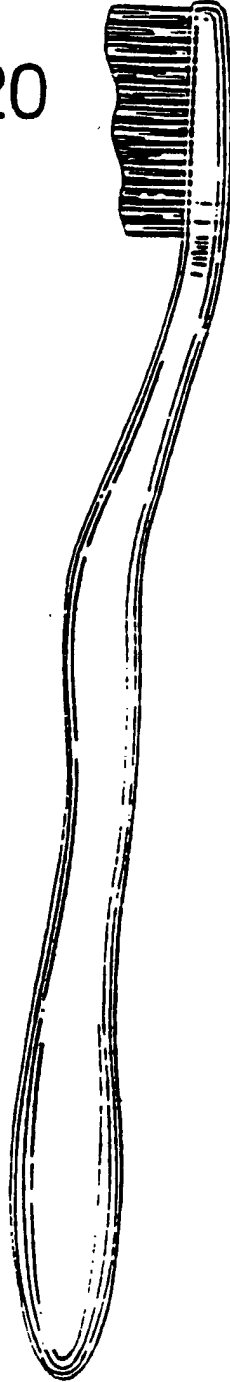
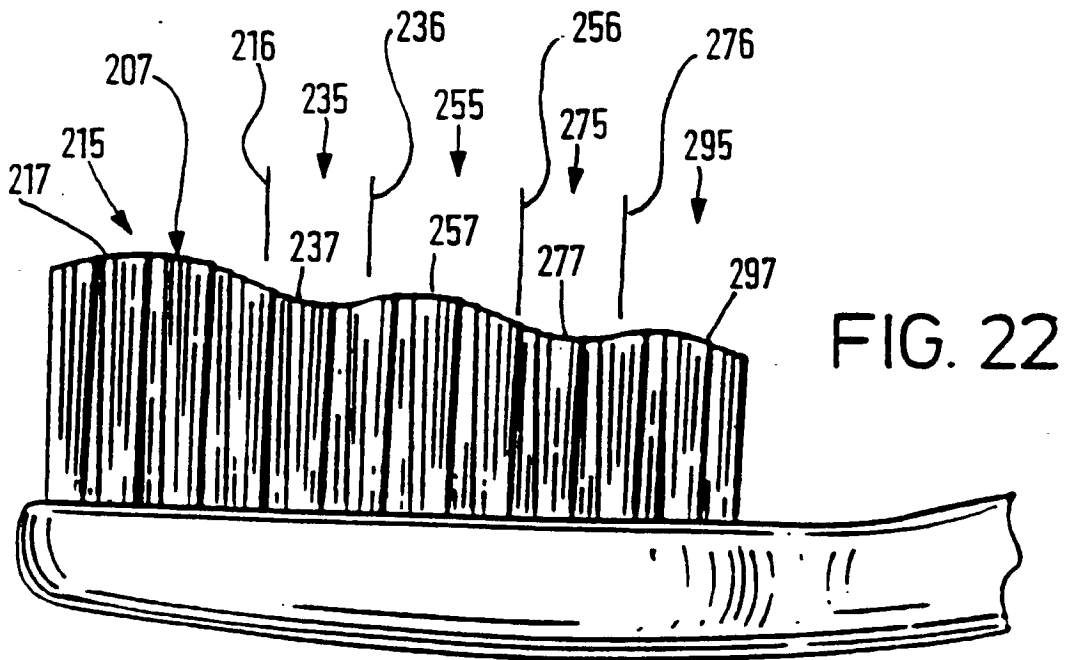
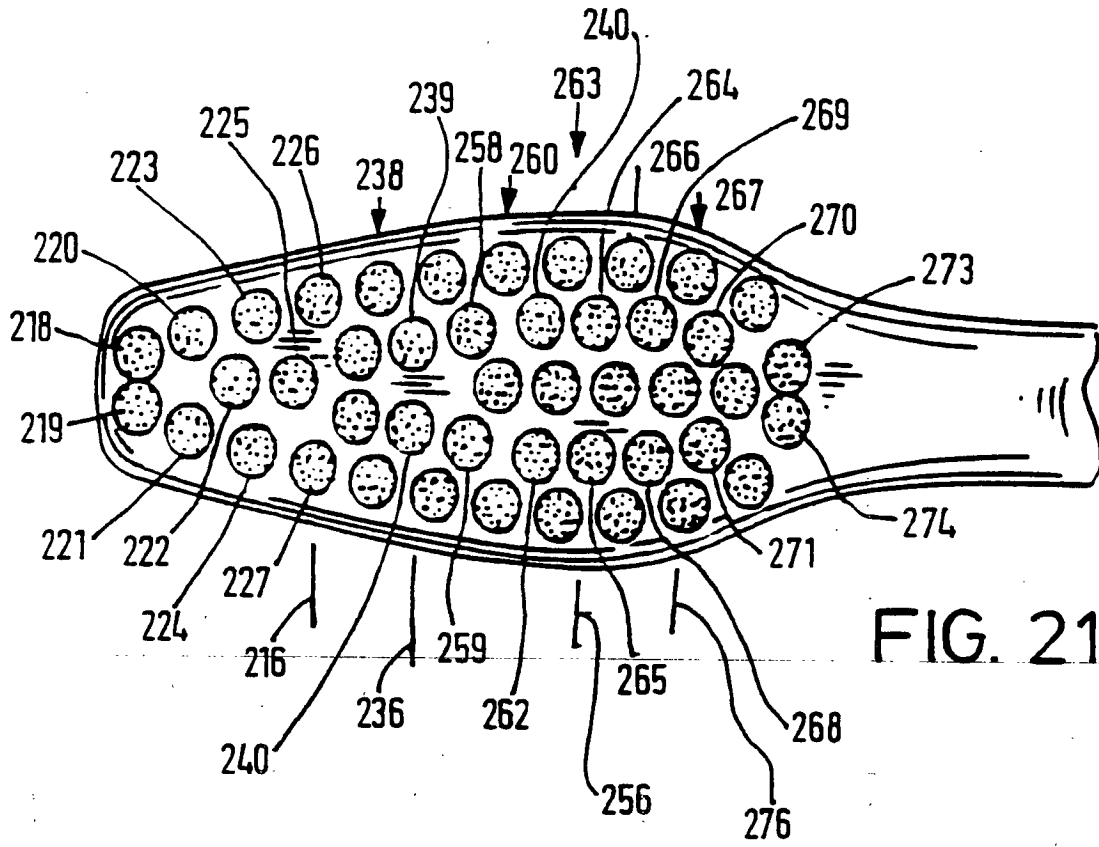


FIG. 19

FIG. 20





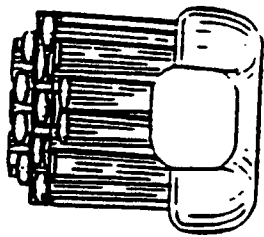


FIG. 23

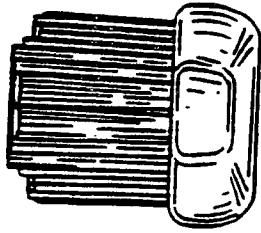


FIG. 24

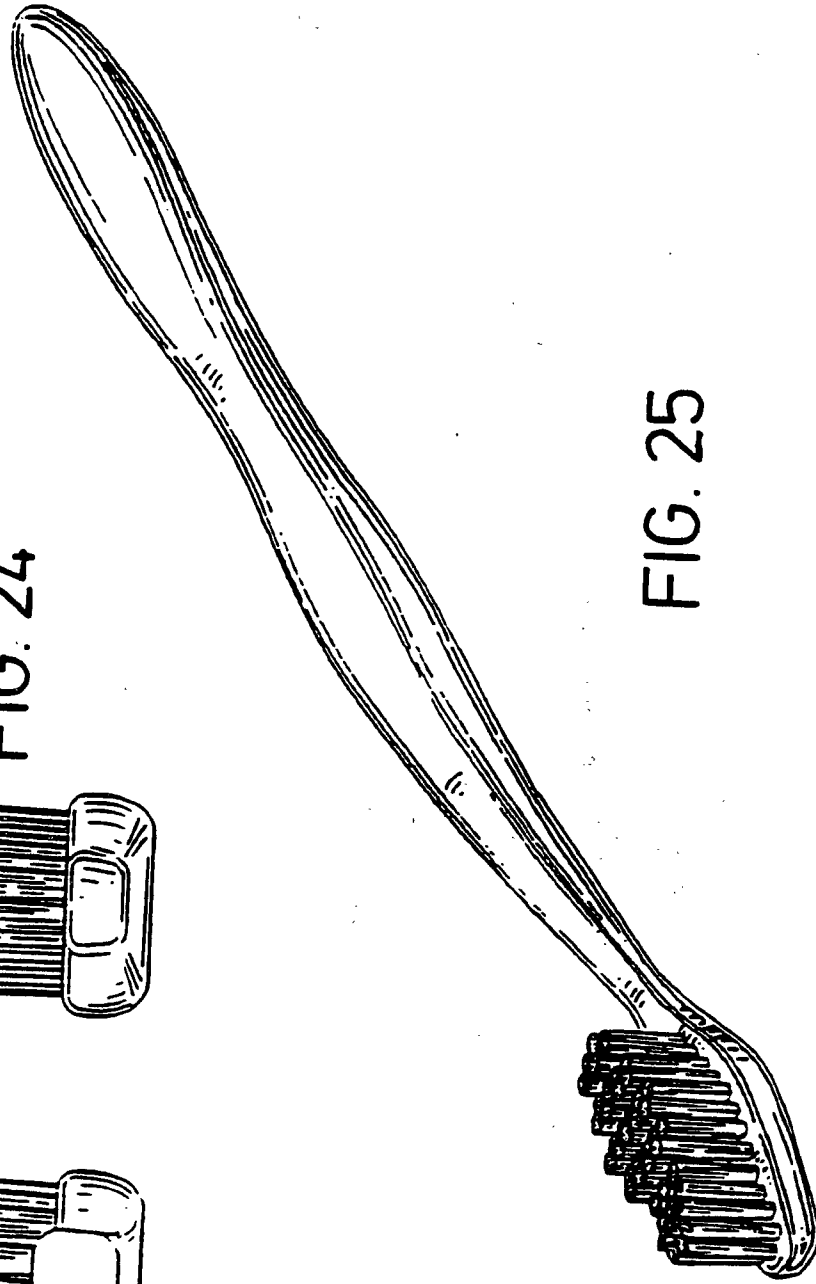
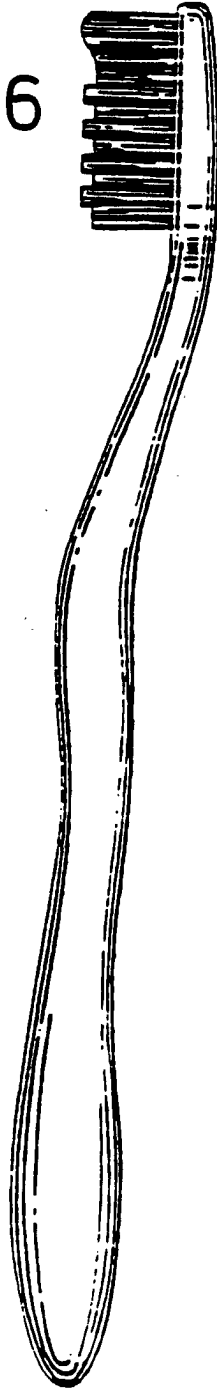


FIG. 25

FIG. 26



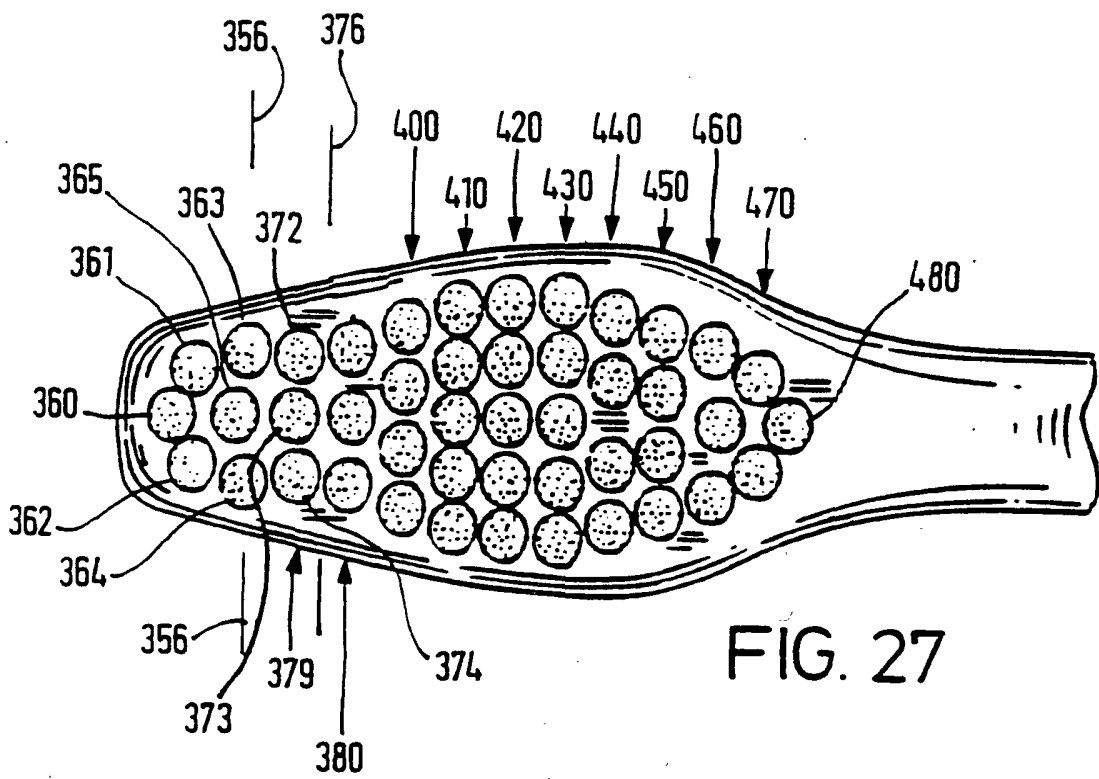


FIG. 27

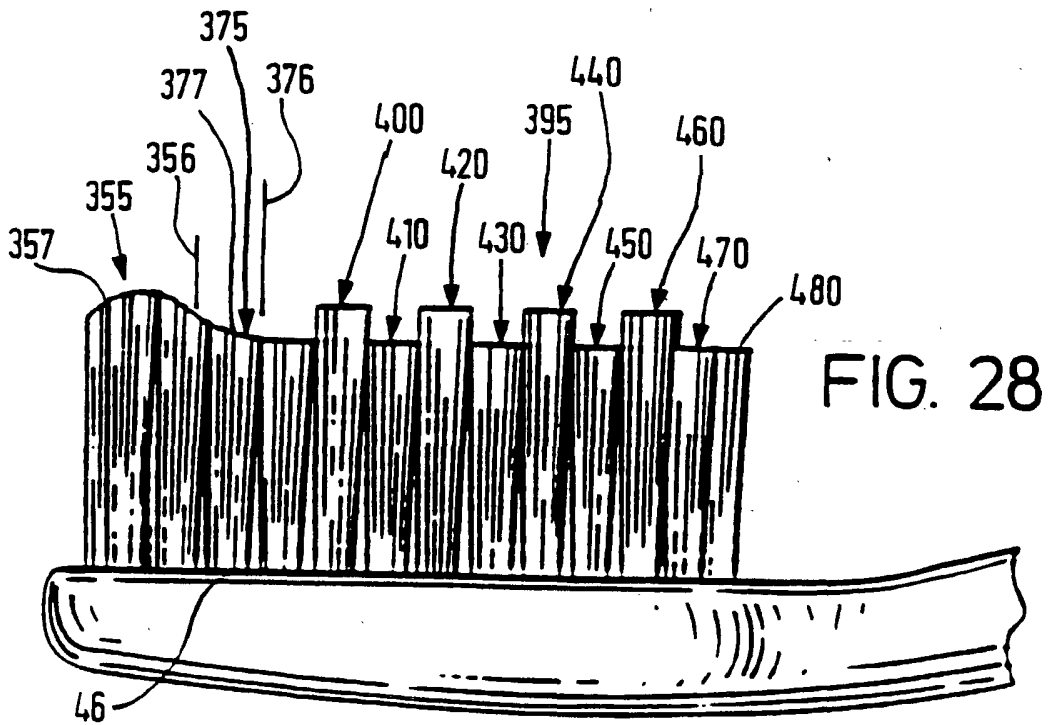


FIG. 28

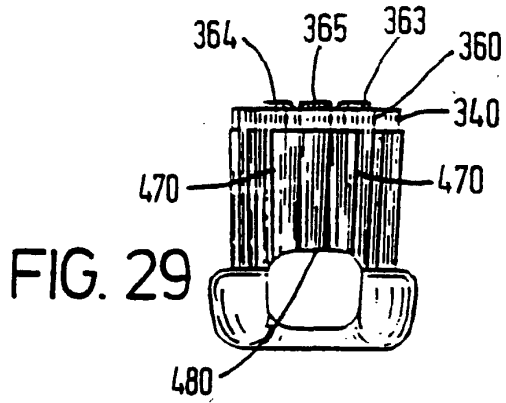


FIG. 29

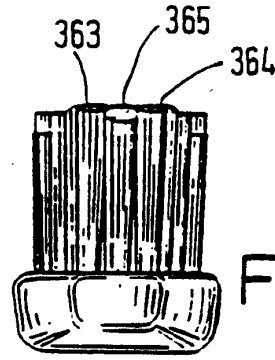


FIG. 30

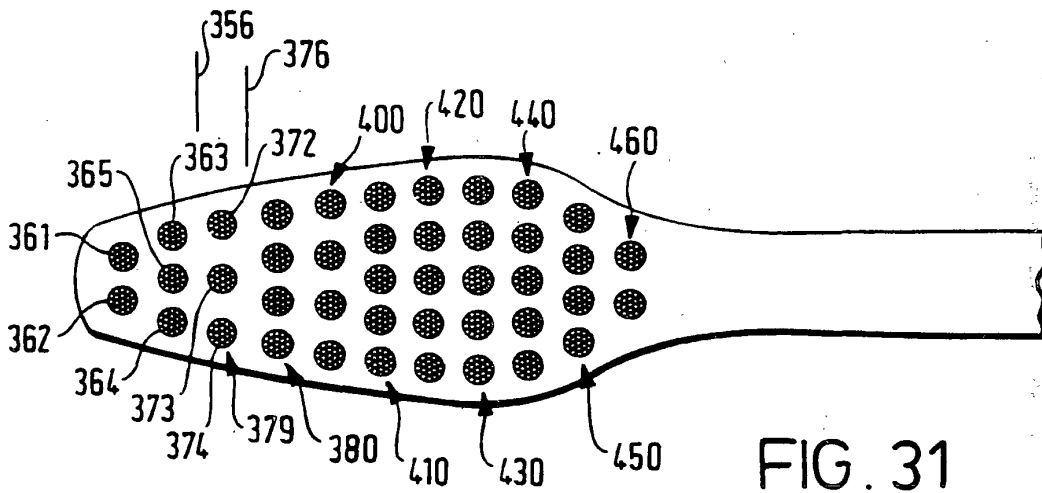


FIG. 31

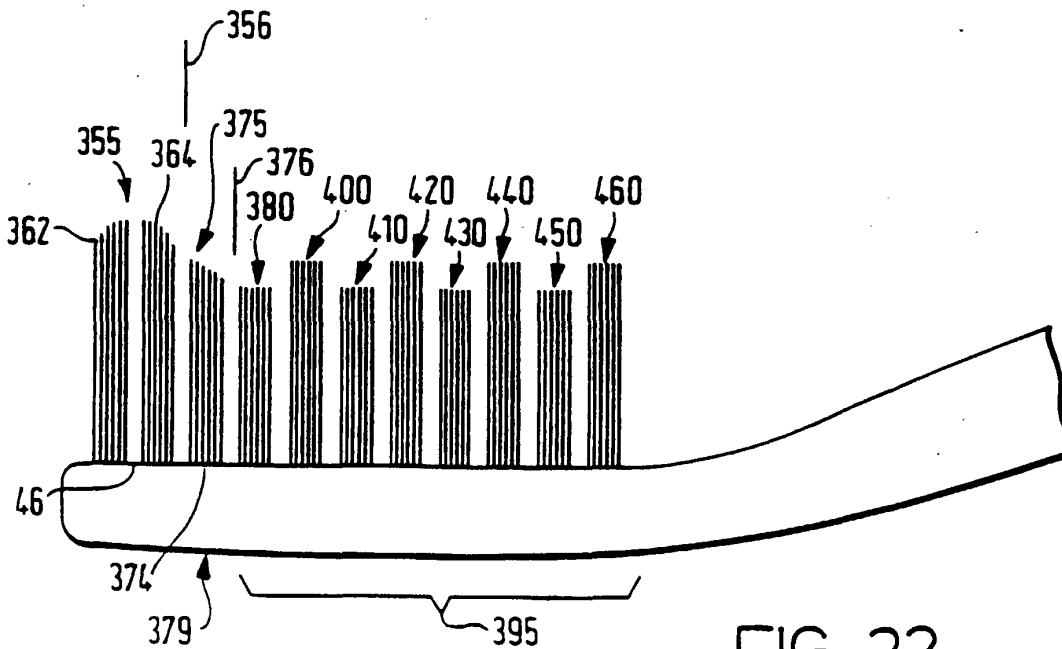
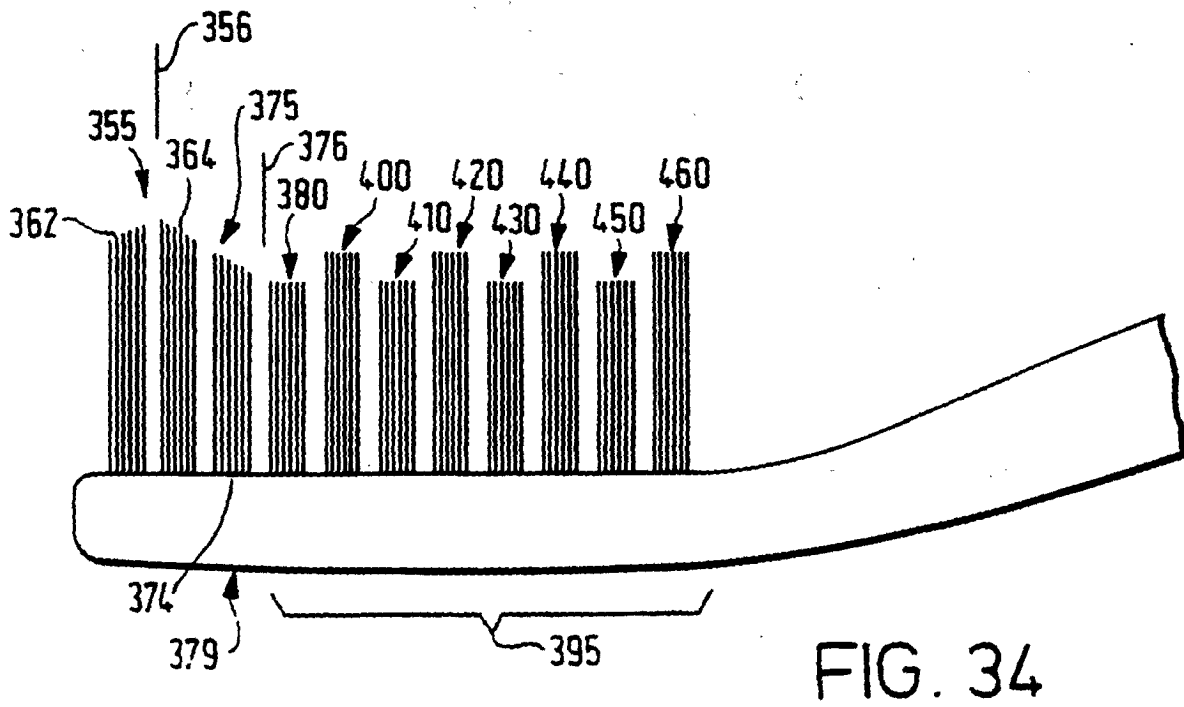
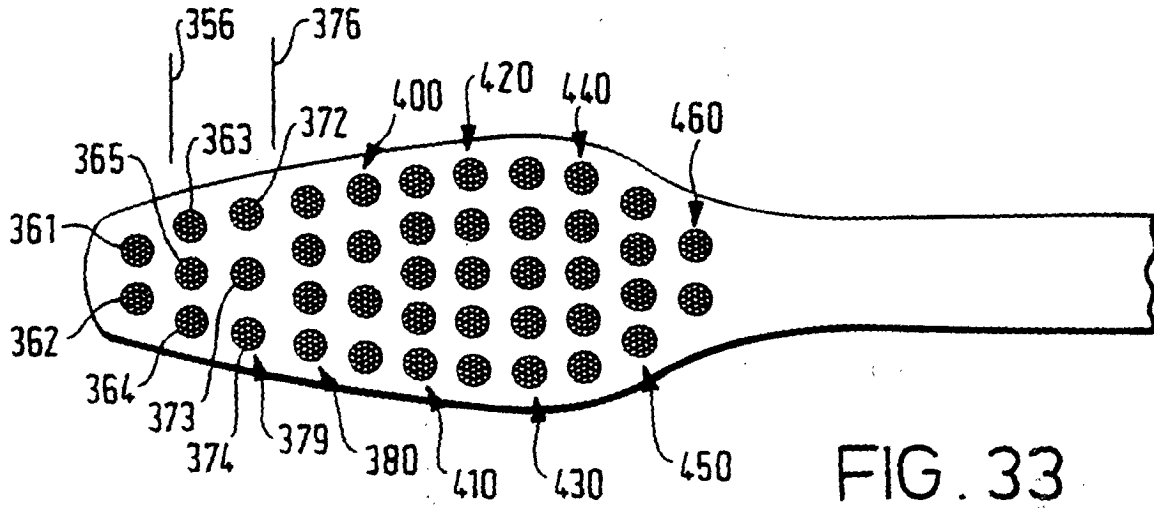
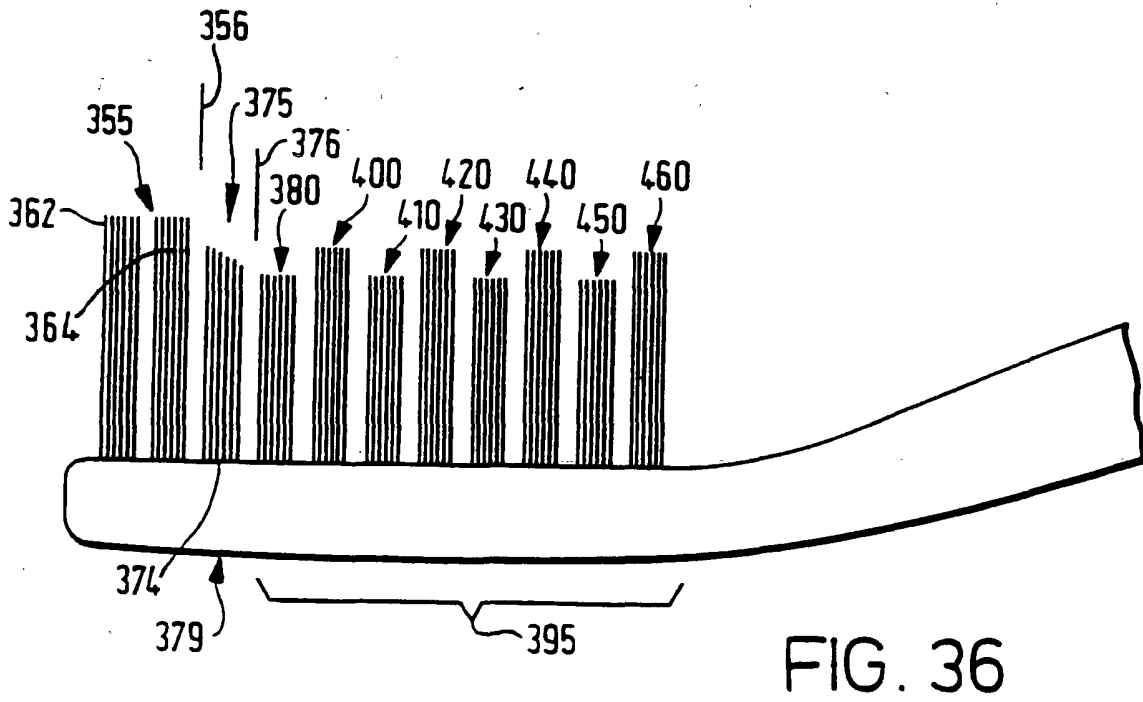
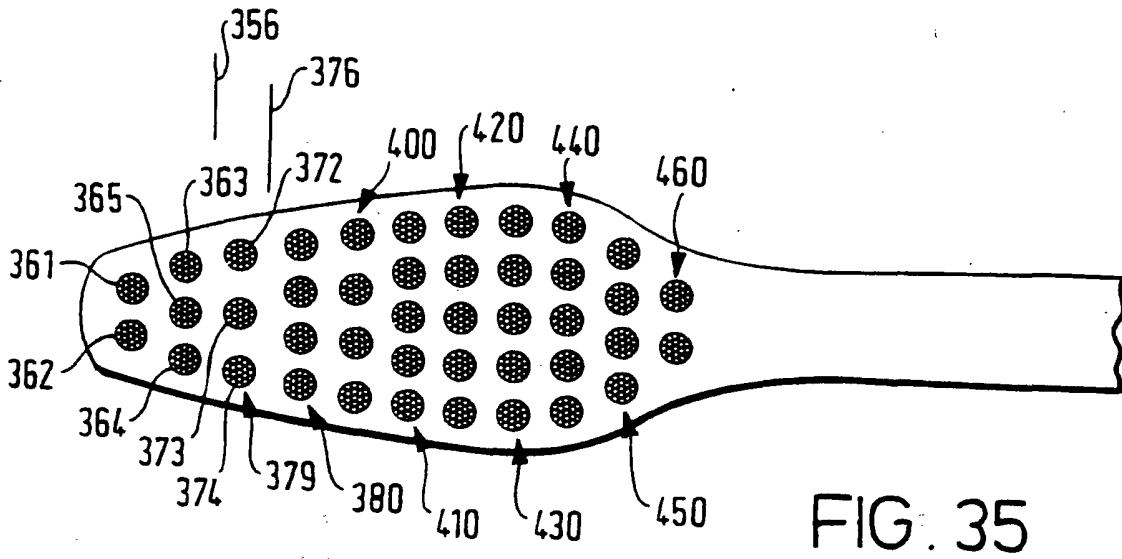
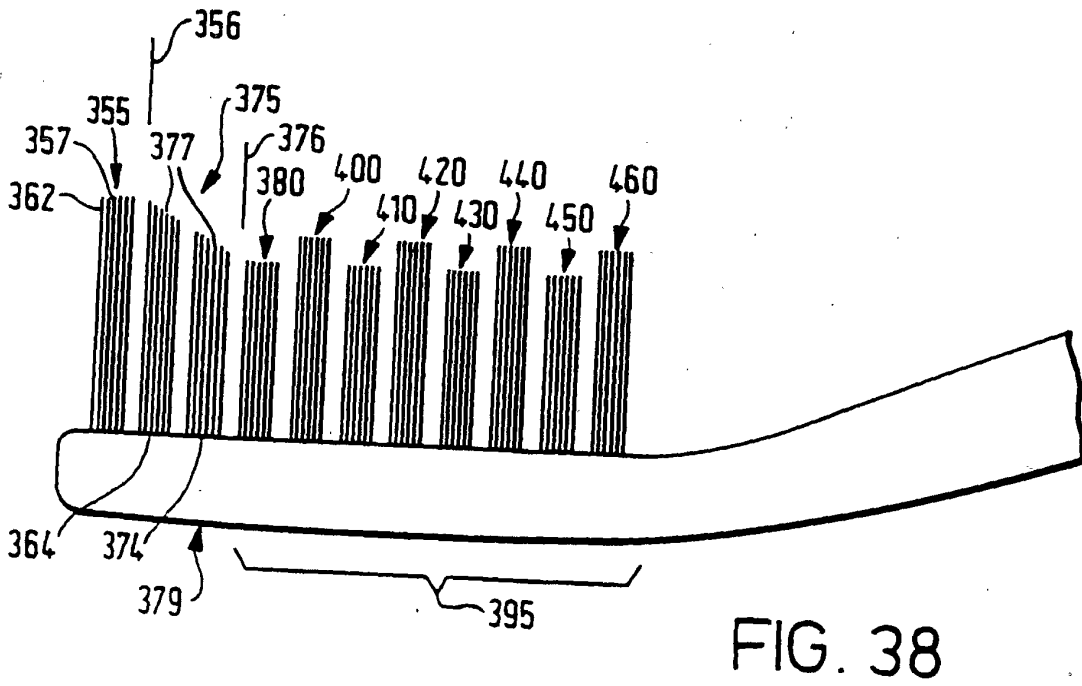
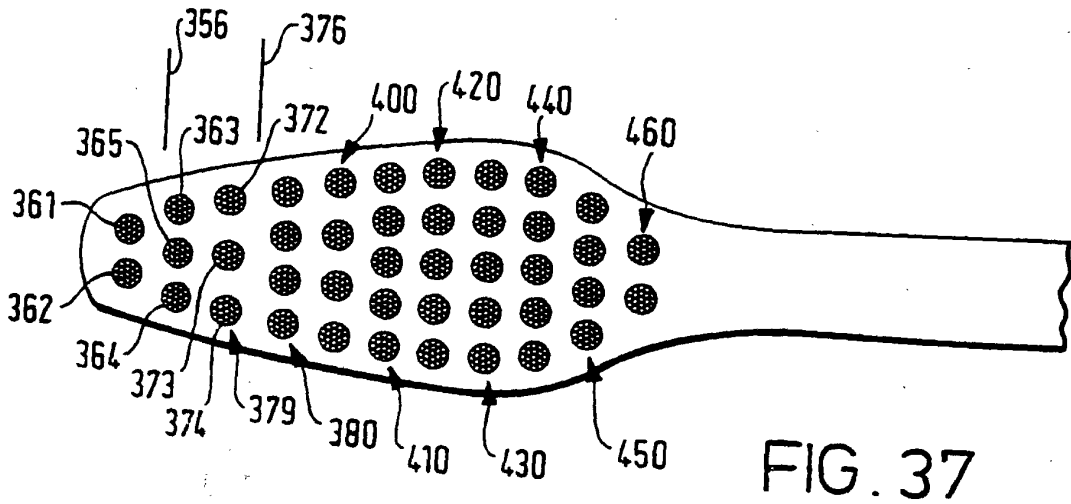


FIG. 32







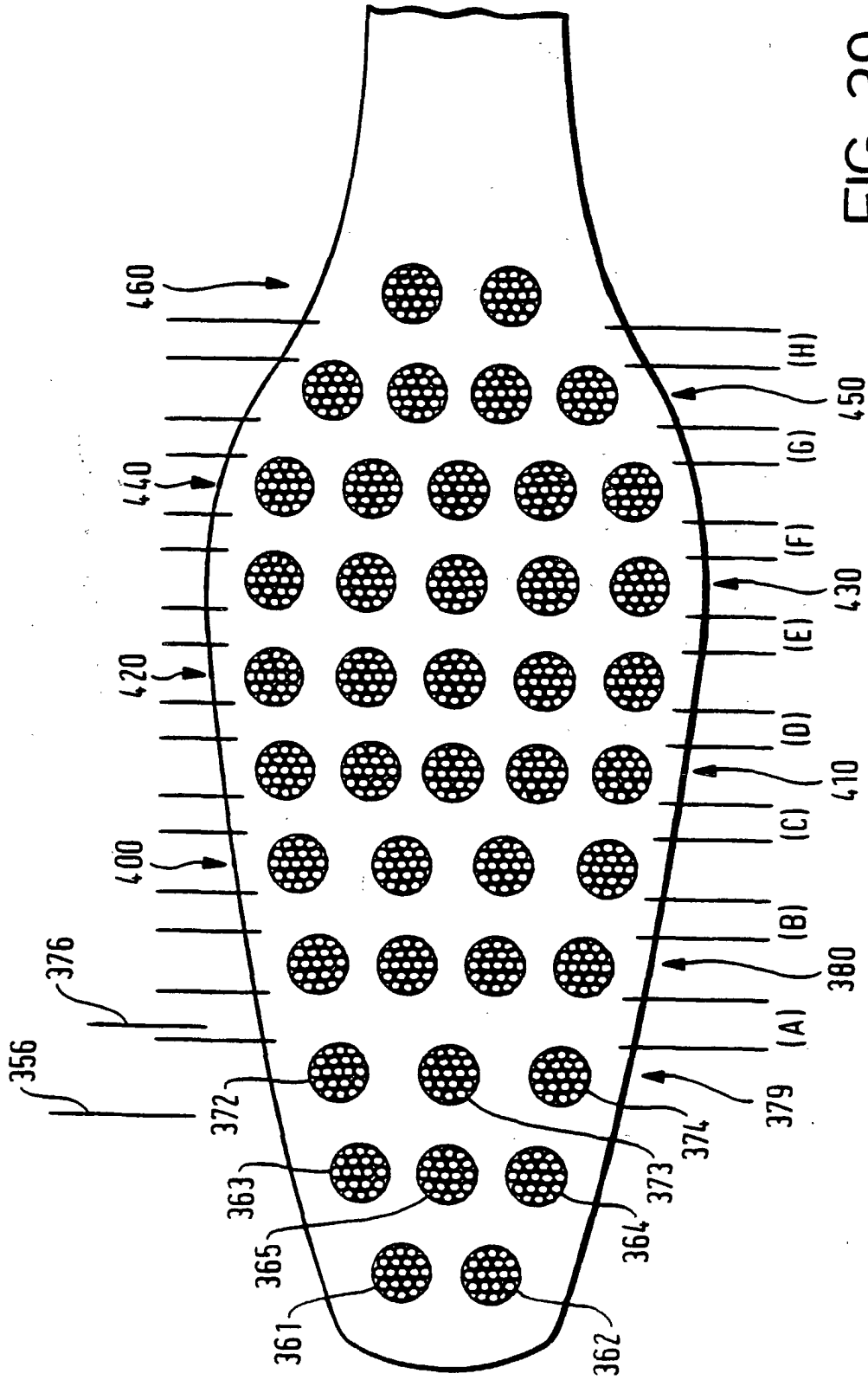


FIG. 39