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(54) TOOTHBRUSH HAVING IMPROVED TUFT RETENTION AND ANCHOR WIRE

ZAHNBÜRSTE MIT VERBESSERTER BÜSCHELFIXIERUNG UND VERANKERUNGSDRAHT

BROSSE À DENTS AYANT UNE MEILLEURE RETENUE DES TOUFFES ET DES FILS D'ANCRAGE

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Description

Field of the Invention

[0001] The present invention relates generally to brushes, especially toothbrushes, and specifically to an improved anchor or staple design for securing tufts of bristles within the head of the brush.

Background of the Invention

[0002] In the conventional manufacturing process for brushes, particularly toothbrushes, the brushes are injection molded with empty tuft holes in the toothbrush head. The tuft holes may also be drilled after the injection molding as well as initially formed in the head concurrently with the injection molding. In a secondary operation, U shaped tufts of bristles are inserted into the holes in the head. Each tuft of bristles is held in place by a plate-like staple that is wider than the tuft hole so that when the staple is used to drive the U-shaped bristle tufts into the tuft hole, the edges of the staple slightly cut and deform the sides of the hole. The pressure and resulting static friction of the surrounding plastic on the staple contributes to forces maintaining the staple in place. However, there are certain problems associated with brushes made in this manner. Specifically, individual bristles, or even entire tufts of bristles, may occasionally come out of the tuft holes during brushing by a consumer. The staple or anchor art has dealt with these problems in a variety of ways. However, adequately securing tufts of bristles within the tuft holes must be balanced against other considerations, such as costs of materials and the ability to mass manufacture product.

[0003] Over the years, toothbrush staples of the rectangular type have become available in which at least one of the major surfaces thereof is provided with parallel horizontal grooves (i.e., grooves that extend parallel with a longitudinal axis of the staple), thereby yielding a staple that has been found to be more resistant to becoming separated from its tuft hole than staples with smooth surfaces.

[0004] Staples have also been developed having a rounded edges that eliminate and/or minimize the problem of tuft weakening and possible rupture of filaments or bristles at the bight of the U. With such a rounded construction, the zone or area of contact between the lower staple edge and the bristle filament closely matches the U shape at the bight portion of each tuft. In turn, this permits the staples to be driven deeper into the head and thus a larger and more consistent force can be applied to each U shaped tuft without cutting or damaging the filaments.

[0005] More recently, staples having specialized groove patterns on the major surfaces of the staples for improved retention, including a slanted configuration of parallel grooves, have been introduced to the art.

[0006] Staples constructed of materials having oligodynamic action have also been disclosed in the art. These oligodynamic staples have smooth major surfaces and are constructed of a material having oligodynamic action, such as cadmium, silver, brass, copper, stainless steel, titanium and mercury.

[0007] Typically, toothbrush staples are constructed of a nickel-silver alloy. Due to the costs associated with the nickel-silver alloy, it has long been desired to create staples from cheaper metals, such as brass. While the general concept of using a brass staple has been disclosed, testing and experimentation have proven that merely creating and using a flat-faced brass staple cannot be used in the manufacture of toothbrushes to provide effective tuft retention. Moreover, merely applying known groove patterns has also proven to be ineffective.

[0008] JP2004-081286 discloses a toothbrush comprising flat wires used to hold respective tufts of bristles within holes in a head of the toothbrush. Each flat wire has a plurality of slots formed in a surface thereof, each slot following a linear axis that is aligned at an angle of between 30 and 150 degrees to a surface of the head.

Summary of the Invention

[0009] The present invention provides a staple having an optimized pattern of grooves in at least one of its major surfaces. The optimized groove pattern makes it possible to create the staples out of a material that is more cost effective than a nickel-silver alloy, such as brass, while still providing the necessary tuft retention so as to be utilized in a viable toothbrush product.

[0010] A first aspect of the invention provides a staple for securing cleaning elements within an ansate implement, the staple being as defined in claim 1.

[0011] The acute angle is between 40 and 70 degrees, more preferably between 55 and 65 degrees, and most preferably approximately 60 degrees.

[0012] Optional features of the present invention are recited in the claims depending from claim 1.

[0013] A second aspect of the present invention provides an ansate implement comprising the staple of the first aspect of the present invention, the ansate implement being as defined in claim 14.

[0014] The ansate implement may be a toothbrush wherein the at least one cleaning element comprises at least one tuft of bristles.

Brief Description of the Drawings

[0015]

Figure 1 is a front perspective view of a staple according to a first embodiment of the present invention.

Figure 2 is a front view of the staple of Figure 1.

Figure 3 is a top view of the staple of Figure 1.

Figure 4 is a front view of a head of a toothbrush incorporating the staples of Figure 1 to anchor cleaning elements, which are in the form of tufts of bristles.

Figure 5 is a cross-sectional view of the toothbrush head along line V-V of Figure 4.

Figure 6 is a cross-section view of the toothbrush head along line VI-VI of Figure 4.

Figure 7 is a front perspective view of a staple according to a second embodiment of the present invention.

Figure 8 is a front view of the staple of Figure 7.

Figure 9 is a rear view of the staple of Figure 7.

Figure 10A is a table of experimental data for tuft retention for a first toothbrush type using Ag-Ni staples having longitudinal grooves.

Figure 10B is a graph of the experimental data of the table of FIG. 10A.

Figure 11A is a table of experimental data for tuft retention for the first toothbrush type using brass staples having angled grooves according to an embodiment of the present invention.

Figure 11B is a graph of the experimental data of the table of FIG. 11A.

Figure 12A is a table of experimental data for tuft retention for a second toothbrush type using Ag-Ni staples having longitudinal grooves.

Figure 12B is a graph of the experimental data of the table of FIG. 12A.

Figure 13A is a table of experimental data for tuft retention for the second toothbrush type using brass staples having angled grooves according to an embodiment of the present invention.

Figure 13B is a graph of the experimental data of the table of FIG. 13A.

Figure 14A is a table of experimental data for tuft retention for a third toothbrush type using Ag-Ni staples having longitudinal grooves.

Figure 14B is a graph of the experimental data of the table of FIG. 14A.

Figure 15A is a table of experimental data for tuft retention for the third toothbrush type using brass staples having angled grooves according to an embodiment of the present invention.

Figure 15B is a graph of the experimental data of the table of FIG. 15A.

Detailed Description of the Drawings

[0016] Referring now to FIGS. 1-3 concurrently, a staple **100** is illustrated according to one embodiment of the present invention. The staple **100** is a flattened piece of wire that is used as an anchor in a brush, particularly a toothbrush, to secure U shaped tufts of bristles within tuft holes created in the head of an ansate implement, such as a toothbrush. The staple **100** has a substantially rectangular cross-section (both longitudinal and transverse) and is elongated along the longitudinal axis **A-A.** Of course, other shapes can be utilized in creating the staple.

[0017] The staple **100** is delimited by a perimeter comprising a top edge **10**, a bottom edge **11**, a first lateral edge **12** and a second lateral edge **13**. The staple **100** has a length **L**, a height **H** and a thickness **t**. The length **L** of the staple **100** will depend on the size of the tuft hole in which it is to be inserted, but is in a preferred range of 2.09 to 2.13 millimeters, and most preferably about 2.11 millimeters for a 1.70 mm tuft hole. The height **H** of the staple **100** will also depend on the dimensions of its end use, but is in a preferred range of 1.49 to 1.51 millimeters, and most preferably about 1.50 millimeters for a 1.70 mm tuft hole. Similarly, the thickness **t** of the staple **100** will also depend on its end use, but is in a preferred range of 0.24 to 0.26 millimeters, and most preferably about 0.25 millimeters. The invention, however, is not so limited in all embodiments and other dimensions may be utilized. The exact dimensions in any final product will be dictated by the size of the tuft hole, the type and size of the bristle tufts, the type of brush in which the staples are used, etc. Furthermore, while the staple **100** is illustrated as having an overall uniform thickness **t**, height **H** and length **L**, one or more of these dimensions may be tapered and/or irregular.

[0018] In the illustrated embodiment, the edges **10-13** of the staple **100** are substantially flat. However, in other embodiments, one or more of the edges **10-13** may be shaped to provide additional tuft retention and/or decrease pressure at the bight of the bristle tuft. For example, the lateral edges **12-13** may be serrated, sharpened or barbed while the bottom edge **11** may be rounded.

[0019] The staple **100** further comprises a first major surface **20** and a second major surface **21**. The second major surface **21** is opposite the first major surface **20** so that the staple **100** is a flat rectangular plate-like structure. The first major surface **20** includes a first set of grooves **30** formed into and covering the substantial entirety of the first major surface **20**. All of the grooves **30** are arranged so as to be substantially parallel to one another and equidistantly spaced apart from one another. In certain embodiments, however, all of the grooves **30**

may not be substantially parallel to one another and the distance between adjacent grooves may vary either irregularly or as a function of distance from one or both of the lateral edges **12-13**.

[0020] As a result of the grooves **30** being spaced apart, an uninterrupted ridge **31** is formed between adjacent grooves **30**. Preferably, this ridge **31** is an elongated strip and is not segmented. In other words, it is preferred that the first major surface **20** contain no grooves that intersect with one another. Stated simply, the groove pattern on the first major surface **20** is preferably free of any intersecting grooves.

[0021] The grooves **30** are linear in shape for the illustrated preferred embodiment, each extending along a groove axis **B-B**.

[0022] The grooves **30** are preferably spaced apart from one another by a distance **D** of 0.29 to 0.31 millimeters, and most preferably about 0.30 millimeters. The grooves **30** preferably have a width **W** of 0.09 to 0.11 millimeters, and most preferably about 0.10 millimeters. In one embodiment, it is preferred that the ratio of the distance **D** to width **W** be in a range of 3.0 to 4.0, and most preferably be 3.0. The grooves **30** have a depth of 0.09 to 0.11 millimeters, and most preferably about 0.11 millimeters. The exact dimensions of the grooves and their pattern, however, can vary greatly and are not to be considered limiting of the present invention unless specifically recited in the claims. However, in one embodiment, the depth of the grooves **30** is preferably no greater than one-third of the thickness **t** of the staple **100**. It has been discovered that making the grooves **30** having a depth greater than one-third of the thickness **t** results in undesired distortion of the wire/staple **100**.

[0023] The grooves **30** extend the entire height **H** of the staple **100**, extending from the bottom edge **11** to the top edge **10**. The grooves **30** are oriented on the first major surface **20** of the staple **100** so as to be slanted with respect to the longitudinal axis **A-A**. Thought of another way, the groove axis **B-B** of each of the grooves **30** forms a non-normal angle with the longitudinal axis **A-A** of the staple **100**. More specifically, the groove axis **B-B** of the grooves **30** intersect the longitudinal axis **A-A** at an acute angle Θ that is specially selected to provide adequate tuft retention and retain structural integrity of the staple **100** when inserted in the toothbrush. It has been surprisingly and unexpectedly discovered that the acute angle Θ plays a determining role in achieving the desired goal of increased tuft retention, depending also on the metal of construction. The angle of the groove pattern has also been discovered to allow cheaper and/or softer metals to be used without resulting in unwanted deformation and/or curling of the wire. The metal selected, however, should not be so soft that the imprinting of the groove patters causes unwanted deformation and curling. For example, Aluminum has been discovered to be unsuitable in most cases. In one desired embodiment, a metal is selected for the staple **100** that has a Brinell hardness less than that of nickel-silver and greater than aluminum.

[0024] Through experimentation, it has been discovered that in order to create a staple **100** that performs adequately from brass, the acute angle Θ needs to be 40 to 70 degrees, more preferably 55 and 65 degrees, and most preferably about 60 degrees. When the acute angle Θ is less than 40 degrees for brass, the wire has a tendency to deform and coil. However, when the angle is greater than 70 degrees for brass, it is difficult to imprint the angled groove pattern. Furthermore, when the acute angle Θ of the grove is within the desired range, experiments using destructive testing of toothbrushes has shown that, when compared to other grooved or non-grooved anchors, tuft retention has surprisingly increased up to 25%.

[0025] The grooves **30** are oriented on the first major surface **20** as slanting upward from the bottom edge **11** to the top edge **10** going from the first lateral edge **12** to the second lateral edge **13**. Of course, the grooves **30** can be arranged to slant upward in the opposite direction if desired, i.e., from the bottom edge **11** to the top edge **10** going from the second lateral edge **13** to the first lateral edge **12**. The second major surface **21** of the staple **100** is preferably a smooth surface that is substantially free of grooves or other topography. In other embodiments (as will be discussed below with respect to FIGS. 7-9), the second major surface **21** may also be patterned with grooves.

[0026] The grooves **30** can be formed by roll pressing or stamping a sheet of brass with a die and then cutting the sheet into the desired strips, which are then cut to form the staples **100**.

[0027] Referring now to FIGS. 4-6 concurrently, a toothbrush **200** is illustrated wherein each of the bristle tufts **50** are anchored in the tuft holes **215** by one of the staples **100**. While bristle tufts **50** are illustrated, other cleaning elements could be used, including elastomeric fingers, fibers, etc. The toothbrush **200** comprises a head **210** and a neck portion **220** that extends into an elongated handle. A plurality of tuft holes **215** are formed into the front surface **211** of the head **210**. The head **210** is typically constructed of a hard plastic, such as polypropylene.

[0028] Each of the plurality of tuft holes **215** in the toothbrush head **210** extend downwardly from the front surface **211** of the head **210** along a central axis **C-C**. The tuft holes **215** are preferably circular bores formed into the head **210**. The tuft holes **215**, of course, can be formed to be in other shapes if desired.

[0029] During manufacture, the bristle tufts **50** are bent in a U shape and secured in the tuft holes **215** by the staples **100**. The staples **100** are driven into the tuft holes **215** so that each bristle tuft **50** bends in the U shape and comprises a bight portion **51** and two extending legs **52, 53**. The legs **52, 53** of the bristle tufts **50** extend upward and out of the holes **215** and above the front surface **211** of the head **210**. The bight or curved part **51** of the bristle tuft **50** is contacted by the bottom edge **11** of staple **100**

while the two legs **52, 53** extend upwardly and define the visible bristles of the toothbrush.

[0030] The two lateral edges **12-13** of each staple **10** are seen to extend slightly into opposite sidewalls of each hole **215**. The rotational orientation of the plane which contains each staple **100** is not critical, i.e., the staple **100** may be installed by rotating it, before installation, about its central vertical axis differently from the rotational orientation of about 45 degrees to assume any desired orientation. It is preferred, however, that the staples **100** be positioned in the tuft holes **215** so that the longitudinal axis **A-A** of the staples **100** are substantially normal to the central axis **C-C** of the tuft holes **215**.

[0031] Referring now to FIGS. 7-9 concurrently, a staple **100A** is illustrated according to a second embodiment of the invention. The basic structure of the staple **100A** is identical to that of staple **100**. Therefore, like numbers have been used to identify corresponding components and features with the addition of suffix "A." In order to avoid redundancy, only those features of staple **100A** that are different than the staple **100** will be discussed below with the understanding that the aforementioned discussion is applicable.

[0032] The major difference between staple **100A** and staple **100** is that the second major surface **21A** of the staple **100A** comprises a second set of grooves **40A** in addition to the first set of grooves **30A** formed into the first major surface **20A**. The discussion above with respect to the grooves **30** of staple **100** is generally applicable to both grooves **30A** and grooves **40A**, and is hereby incorporated by reference. It should be noted, however, that in this embodiment of the invention, the acute angle is from 40 to 70 degrees.

[0033] Of note, the grooves **30A** formed into the first surface **20A** of the staple **100A** are oriented so as to as slant upward from the bottom edge **10A** to the top edge **11A** going from the first lateral edge **12** to the second lateral edge **13**. The grooves **40A** formed into the second surface **21A** of the staple **100A**, however, are oriented on the second major surface **21A** so as to slant upward from the bottom edge **11A** to the top edge **10A** going from the second lateral edge **13** to the first lateral edge **12**. In other words, the grooves **30A** and the grooves **40A** extend in opposing slanted directions. Of course, the orientation of the slants of the grooves **30A** and the grooves **40A** could be alternated. Preferably, the grooves **30A** and grooves **40A** are arranged so that their openings along the top and bottom edges **10A, 11A** alternate along the length of the staple **100A**.

Experiment

[0034] An experiment was conducted on three different types of commercially available toothbrushes to determine and compare the tuft retention for typical Ag-Ni staples having longitudinal grooves (i.e., 0 degrees) and brass staples having grooves angled at 60 degrees according to the present invention. The three different toothbrushes tested are referred to herein as Toothbrush 1, Toothbrush 2, and Toothbrush 3.

[0035] Referring to FIGS. 10A-11B, test data for Toothbrush 1 will be discussed. The details of the test parameters and tuft retention data for Toothbrush 1 using Ag-Ni staples having longitudinal grooves as the anchors is set forth in the table of Figure 10A and the graph of Figure 10B. The details of the test parameters and tuft retention data for Toothbrush 1 using brass staples having grooves angled at 60 degrees as the anchors is set forth in the table of Figure 11A and the graph of Figure 11B. As can be seen, for Toothbrush 1, the longitudinally grooved Ag-Ni staples resulted in an Average Tuft Retention of 3.7 kgf and a CPK of 1.5. Comparatively, the brass staples having grooves angled at 60 degrees resulted in an Average Tuft Retention of 3.7 kgf and a greater CPK of 1.82.

[0036] Referring now to FIGS. 12A-13B, test data for Toothbrush 2 will be discussed. The details of the test parameters and tuft retention data for Toothbrush 2 using Ag-Ni staples having longitudinal grooves as the anchors is set forth in the table of Figure 12A and the graph of Figure 12B. The details of the test parameters and tuft retention data for Toothbrush 2 using brass staples having grooves angled at 60 degrees as the anchors is set forth in the table of Figure 13A and the graph of Figure 13B. As can be seen, for Toothbrush 2, the longitudinally grooved Ag-Ni staples resulted in an Average Tuft Retention of 3.8 kgf and a CPK of 2.24. Comparatively, the brass staples having grooves angled at 60 degrees resulted in an improved Average Tuft Retention of 4.0 kgf and a greater CPK of 2.48.

[0037] Referring now to FIGS. 14A-15B, test data for Toothbrush 3 will be discussed. The details of the test parameters and tuft retention data for Toothbrush 3 using Ag-Ni staples having longitudinal grooves as the anchors is set forth in the table of Figure 14A and the graph of Figure 14B. The details of the test parameters and tuft retention data for Toothbrush 3 using brass staples having grooves angled at 60 degrees as the anchors is set forth in the table of Figure 15A and the graph of Figure 15B. As can be seen, for Toothbrush 3, the longitudinally grooved Ag-Ni staples resulted in an Average Tuft Retention of 2.4 kgf and a CPK of 0.63. Comparatively, the brass staples having grooves angled at 60 degrees resulted in an improved Average Tuft Retention of 2.8 kgf and a greater CPK of 1.09.

[0038] While the invention has been described and illustrated in sufficient detail that those skilled in this art can readily make and use it, various alternatives, modifications, and improvements should become readily apparent without departing from the scope of the invention.

Claims

1. A staple (100, 100A) for securing a cleaning element (50) within an ansate implement (200), the staple (100, 100A) comprising a flat wire having a longitu-

dinal axis (A-A) and a first major surface (20, 20A), wherein a plurality of spaced-apart grooves (30, 30A) are formed into the first major surface (20, 20A), each of the grooves (30, 30A) extending along a linear axis (B-B) from a bottom edge (11, 11A) of the flat wire (100, 100A) toward a top edge (10, 10A) of the flat wire (100, 100A), the linear axis (B-B) intersecting the longitudinal axis (A-A) at an acute angle (Θ); **characterised by** the acute angle (Θ) being of 40 to 70 degrees.

2. The staple (100, 100A) of claim 1, wherein the staple (100, 100A) is constructed of brass.

3. The staple (100, 100A) of claim 1 or claim 2, wherein the staple (100, 100A) is a flat wire.

4. The staple (100, 100A) of any one of claims 1 to 3, wherein the acute angle (Θ) is of 55 to 65 degrees, optionally wherein the acute angle (Θ) is approximately 60 degrees.

5. The staple (100, 100A) of any one of claims 1 to 4, wherein the staple (100, 100A) has a thickness (t) and the grooves (30) have a depth no greater than one-third of the depth of the thickness (t) of the staple (100, 100A).

6. The staple (100, 100A) of any one of claims 1 to 5, wherein the plurality of grooves (30, 30A) extend substantially parallel to one another.

7. The staple (100, 100A) of any one of claims 1 to 6, wherein the grooves (30, 30A) are evenly spaced apart and cover the substantial entirety of the first major surface (20, 20A), optionally wherein adjacent grooves (30, 30A) are separated by a distance (D) of 0.29 to 0.31 millimeters, optionally wherein adjacent grooves (30, 30A) are separated by a distance (D) of 0.30 millimeters.

8. The staple (100, 100A) of any one of claims 1 to 7, wherein the grooves (30, 30A) have a width (W) of 0.09 to 0.11 millimeters, optionally wherein the grooves (30, 30A) have a width (W) of 0.10 millimeters.

9. The staple (100, 100A) of any one of claims 1 to 8, wherein the grooves (30, 30A) have a depth of 0.09 to 0.11 millimeters.

10. The staple (100, 100A) of any one of claims 1 to 9, wherein each of the grooves (30, 30A) has a width (W) and adjacent grooves (30, 30A) are separated by a distance (D), wherein the ratio of the distance (D) to the width (W) is of 3.0 to 4.0.

11. The staple (100) of any one of claims 1 to 10, wherein the staple (100) comprises a second major surface (21) opposite the first major surface (20), and wherein only the first major surface (20) comprises the grooves (30), the second major surface (21) being substantially flat and free of grooves.

12. The staple (100A) of any one of claims 1 to 10, wherein the staple (100A) comprises a second major surface (21A) opposite the first major surface (20A), and a second set of grooves (40A) formed into the second major surface (21 A) of the staple (100A), each of the grooves (40A) in the second set extending along a linear axis from the bottom edge (11A) of the staple (100A) to the top edge (10A) of the staple (100A) and slanting upward from the second lateral edge (13) of the staple (100A) to the first lateral edge (12) of the staple (100A), the linear axis of the second set of grooves (40A) intersecting the longitudinal axis at a second acute angle.

13. The staple (100A) of claim 12, wherein the second acute angle is of 40 to 70 degrees, optionally wherein both the acute angle (Θ) and second acute angle are approximately 60 degrees.

14. An ansate implement (200) comprising:

a handle;
a head (210) connected to said handle and having at least one hole (215) extending into the head (210) from a surface (211);
at least one cleaning element (50) positioned in the hole (215); and
a staple (100, 100A) located in the hole (215) anchoring the cleaning element (50) in the hole, the staple (100, 100A) being as defined in any one of claims 1 to 13.

15. The ansate implement (200) of claim 14, wherein the implement is a toothbrush (200); and
wherein the at least one cleaning element (50) comprises at least one tuft of bristles (50).

Patentansprüche

1. Klammer (100, 100A) zur Befestigung eines Reinigungselements (50) innerhalb eines Gebrauchsgegenstands (200) mit einem Griff, wo bei die Klammer (100, 100A) einen flachen Draht mit einer Längsachse (A-A) und einer ersten Hauptoberfläche (20, 20A) umfasst, wobei eine Vielzahl beabstandeter Nuten (30, 30A) in die erste Hauptoberfläche (20, 20A) gebildet sind, sich jede der Nuten (30, 30A) entlang einer linearen Achse (B-B) aus einer unteren Kante (11, 11A) des flachen Drahtes (100, 100A) in Richtung einer oberen Kante (10, 10A) des flachen Drahtes (100, 100A) erstreckt, wobei die lineare Achse

(B-B) die Längsachse (A-A) in einem spitzen Winkel(Θ) schneidet; **dadurch gekennzeichnet, dass** der spitze Winkel(Θ) 40 bis 70 Grad beträgt.

2. Klammer (100, 100A) nach Anspruch 1, wobei die Klammer (100, 100A) aus Messing konstruiert ist.

3. Klammer (100, 100A) nach Anspruch 1 oder Anspruch 2, wobei die Klammer (100, 100A) ein flacher Draht ist.

4. Klammer (100, 100A) nach irgendeinem der Ansprüche 1 bis 3, wobei die spitze Winkel (Θ) 55 bis 65 Grad beträgt, optional wobei der spitze Winkel (Θ) ca. 60 Grad beträgt.

5. Klammer nach irgendeinem der Ansprüche 1 bis 4, wobei die Klammer (100, 100A) eine Dicke (t) aufweist und die Nuten (30) eine Tiefe von nicht größer als ein Drittel der Tiefe der Dicke (t) der Klammer (100, 100A) aufweisen.

6. Klammer (100, 100A) nach irgendeinem der Ansprüche 1 bis 5, wobei sich die Vielzahl der Nuten (30, 30A) im Wesentlichen parallel zueinander erstrecken.

7. Klammer (100, 100A) nach irgendeinem der Ansprüche 1 bis 6, wobei die Nuten (30, 30A) gleichmäßig beabstandet sind und im Wesentlichen die Ganzheit der ersten Hauptoberfläche (20, 20A) bedecken, optional wobei benachbarte Nuten (30, 30A) durch einen Abstand (D) von 0,29 bis 0,31 Millimeter getrennt sind, optional wobei benachbarte Nuten (30, 30A) durch einen Abstand (D) von 0,30 Millimeter getrennt sind.

8. Klammer (100, 100A) nach irgendeinem der Ansprüche 1 bis 7, wobei die Nuten (30, 30A) eine Breite (W) von 0,09 bis 0,11 Millimeter haben, optional wobei die Nuten (30, 30A) eine Breite (W) von 0,10 Millimeter haben.

9. Klammer (100, 100A) nach irgendeinem der Ansprüche 1 bis 8, wobei die Nuten (30, 30A) eine Tiefe von 0,09 bis 0,11 Millimeter haben.

10. Klammer (100, 100A) nach der Ansprüche 1 bis 9, wobei jede der Nuten (30, 30A) eine Breite (W) hat und benachbarte Nuten (30, 30A) durch einen Abstand (D) getrennt sind, wobei das Verhältnis des Abstands (D) zur Breite (W) von 3,0 bis 4,0 ist.

11. Klammer (100) nach irgendeinem der Ansprüche 1 bis 10, wobei die Klammer (100) eine zweite Hauptoberfläche (21) gegenüber der ersten Hauptoberfläche (20) umfasst, und wobei nur die erste Hauptoberfläche (20) die Nuten (30) umfasst, wobei die zweite Hauptoberfläche (21) im Wesentlichen flach und frei von Nuten ist.

12. Klammer (100A) nach irgendeinem der Ansprüche 1 bis 10, wobei die Klammer (100A) eine zweite Hauptoberfläche (21A) gegenüber der ersten Hauptoberfläche (20A) aufweist und einen zweiten Satz von Nuten (40A) umfasst, die in die zweite Hauptoberfläche (21A) der Klammer (100A) geformt sind, wobei sich jede der Nuten (40A) im zweiten Satz entlang einer linearen Achse ab der unteren Kante (11A) der Klammer (100A) zur oberen Kante (10A) der Klammer (100A) erstreckt und sich schräg laufend nach oben ab der zweiten lateralen Kante (13) der Klammer (100A) zur ersten lateralen Kante (12) der Klammer (100A) erstreckt, wobei die lineare Achse des zweiten Satzes von Nuten (40A) die Längsachse in einem zweiten spitzen Winkel schneidet.

13. Klammer (100A) nach Anspruch 12, wobei der zweite spitze Winkel von 40 bis 70 Grad beträgt, optional wobei sowohl der spitze Winkel (Θ) als auch der zweite spitze Winkel ca. 60 Grad sind.

14. Gebrauchsgegenstand (200) mit einem Griff, umfassend:

Einen Griff;
einen Kopf (210), der mit dem genannten Griff verbunden ist und wenigstens ein Loch (215) aufweist, das sich in den Kopf (210) ab einer Oberfläche (211) erstreckt;
wenigstens ein Reinigungselement (50), das im Loch (215) positioniert ist; und
eine Klammer (100, 100A), die sich im Loch (215) befindet und das Reinigungselement (50) im Loch verankert, wobei die Klammer (100, 100A) ist, wie sie in irgendeinem der Ansprüche 1 bis 13 definiert ist.

15. Gebrauchsgegenstand (200) mit Griff nach Anspruch 14, wobei der Gebrauchsgegenstand eine Zahnbürste (200) ist ; und wobei wenigstens ein Reinigungselement (50) wenigstens ein Büschel aus Borsten (50) umfasst.

Revendications

1. Dispositif d'ancrage (100, 100A) pour fixer un élément de nettoyage (50) à l'intérieur d'un instrument ansé (200), ce dispositif d'ancrage (100, 100A) consistant en un fil plat ayant un axe longitudinal (A-A) et une première surface principale (20, 20A), dans lequel une pluralité de gorges espacées (30, 30A) sont formées dans la première surface principale (20, 20A), chacune de ces gorges (30, 30A) s'éten-

dant le long d'un axe linéaire (B-B) depuis un bord inférieur (11, 11A) du fil plat (100, 100A) vers un bord supérieur (10, 1 osa) du fil plat (100, 100A), cet axe linéaire (B-B) entrecoupant l'axe longitudinal (A-A) à un angle aigu (Θ) ; **caractérisé par** l'angle aigu (Θ) étant de 40 à 70 degrés.

2. Dispositif d'ancrage (100, 100A) selon la revendication 1, ce dispositif d'ancrage (100, 100A) étant construit en laiton.

3. Dispositif d'ancrage (100, 100A) selon la revendication 1 ou la revendication 2, ce dispositif d'ancrage (100, 100A) étant un fil plat.

4. Dispositif d'ancrage (100, 100A) selon l'une quelconque des revendications 1 à 3, dans lequel l'angle aigu (Θ) est de 55 à 65 degrés, facultativement dans lequel l'angle aigu (Θ) est environ de 60 degrés.

5. Dispositif d'ancrage (100, 100A) selon l'une quelconque des revendications 1 à 4, ce dispositif d'ancrage (100, 100A) ayant une épaisseur (t) et les gorges (30) ayant une profondeur pas plus grande qu'un tiers de la profondeur de l'épaisseur (t) du dispositif d'ancrage (100, 100A).

6. Dispositif d'ancrage (100, 100A) selon l'une quelconque des revendications 1 à 5, dans lequel la pluralité de gorges (30, 30A) s'étendent essentiellement parallèlement l'une à l'autre.

7. Dispositif d'ancrage (100, 100A) selon l'une quelconque des revendications 1 à 6, dans lequel les gorges (30, 30A) sont espacées de façon égale et couvrent essentiellement la totalité de la première surface principale (20, 20A), facultativement dans lequel des gorges adjacentes (30, 30A) sont séparées par une distance (D) de 0,29 à 0,31 millimètres, facultativement dans lequel des gorges adjacentes (30, 30A) sont séparées par une distance (D) de 0,30 millimètres.

8. Dispositif d'ancrage (100, 100A) selon l'une quelconque des revendications 1 à 7, dans lequel les gorges (30, 30A) ont une largeur (W) de 0,09 à 0,11 millimètres, facultativement dans lequel les gorges (30, 30A) ont une largeur (W) de 0,10 millimètres.

9. Dispositif d'ancrage (100, 100A) selon l'une quelconque des revendications 1 à 8, dans lequel les gorges (30, 30A) ont une profondeur de 0,09 à 0,11 millimètres.

10. Dispositif d'ancrage (100, 100A) selon l'une quelconque des revendications 1 à 9, dans lequel chacune des gorges (30, 30A) a une largeur (W) et des gorges adjacentes (30, 30A) sont séparées par une distance (D), dans lequel le rapport de la distance (D) relativement à la largeur (W) est de 3,0 à 4,0.

11. Dispositif d'ancrage (100) selon l'une quelconque des revendications 1 à 10, ce dispositif d'ancrage (100) comportant une deuxième surface principale (21) opposée à la première surface principale (20), et dans lequel la première surface principale (20) comporte les gorges (30), la deuxième surface principale (21) étant essentiellement plate et exempte de gorges.

12. Dispositif d'ancrage (100A) selon l'une quelconque des revendications 1 à 10, ce dispositif d'ancrage (110A) comportant une deuxième surface principale (21A) opposée à la première surface principale (20A), et un deuxième ensemble de gorges (40A) formées dans la deuxième surface principale (21A) du dispositif d'ancrage (100A), chacune de ces gorges (40A) dans le deuxième ensemble s'étendant le long d'un axe linéaire depuis le bord inférieur (11A) du dispositif d'ancrage (100A) jusqu'au bord supérieur (10A) du dispositif d'ancrage (100A) et s'inclinant vers le haut depuis le deuxième bord latéral (13) du dispositif d'ancrage (100A) jusqu'au premier bord latéral (12) du dispositif d'ancrage (100A), l'axe linéaire du deuxième ensemble de gorges (40A) entrecoupant l'axe longitudinal à un deuxième angle aigu.

13. Dispositif d'ancrage (100A) selon la revendication 12, dans lequel le deuxième angle aigu est de 40 à 70 degrés, facultativement dans lequel à la fois l'angle aigu (Θ) et le deuxième angle aigu sont d'environ 60 degrés.

14. Instrument ansé (200) comprenant :

une poignée,
une tête (210) rattachée à ladite poignée et ayant au moins un trou (215) s'étendant dans la tête (210) depuis une surface (211),
au moins un élément de nettoyage (50) positionné dans le trou (215) ; et
un dispositif d'ancrage (100, 100A) situé dans le trou (215) ancrant l'élément de nettoyage (50) dans le trou, ce dispositif d'ancrage (100, 100A) étant tel que défini dans l'une quelconque des revendications 1 à 13.

15. Instrument (200) selon la revendication 14, cet instrument étant une brosse à dents (200) ; et
dans lequel au moins un élément de nettoyage (50) comporte au moins une touffe de poils (50).

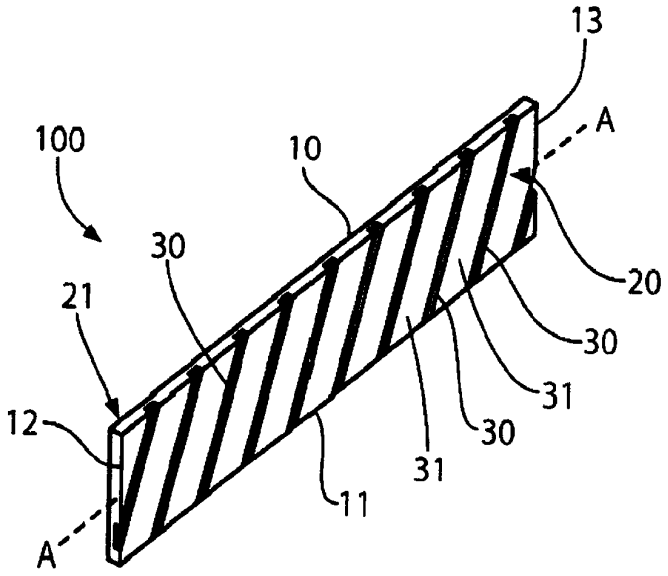


FIG. 1

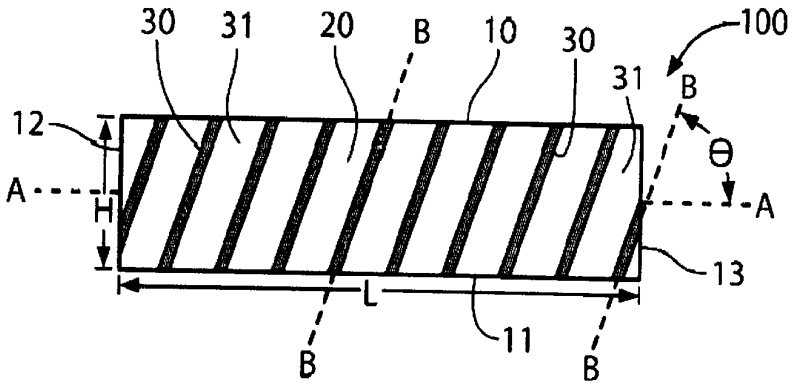


FIG. 2

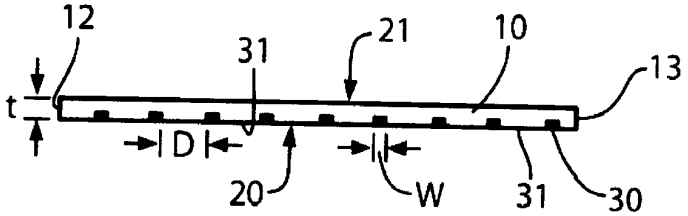


FIG. 3

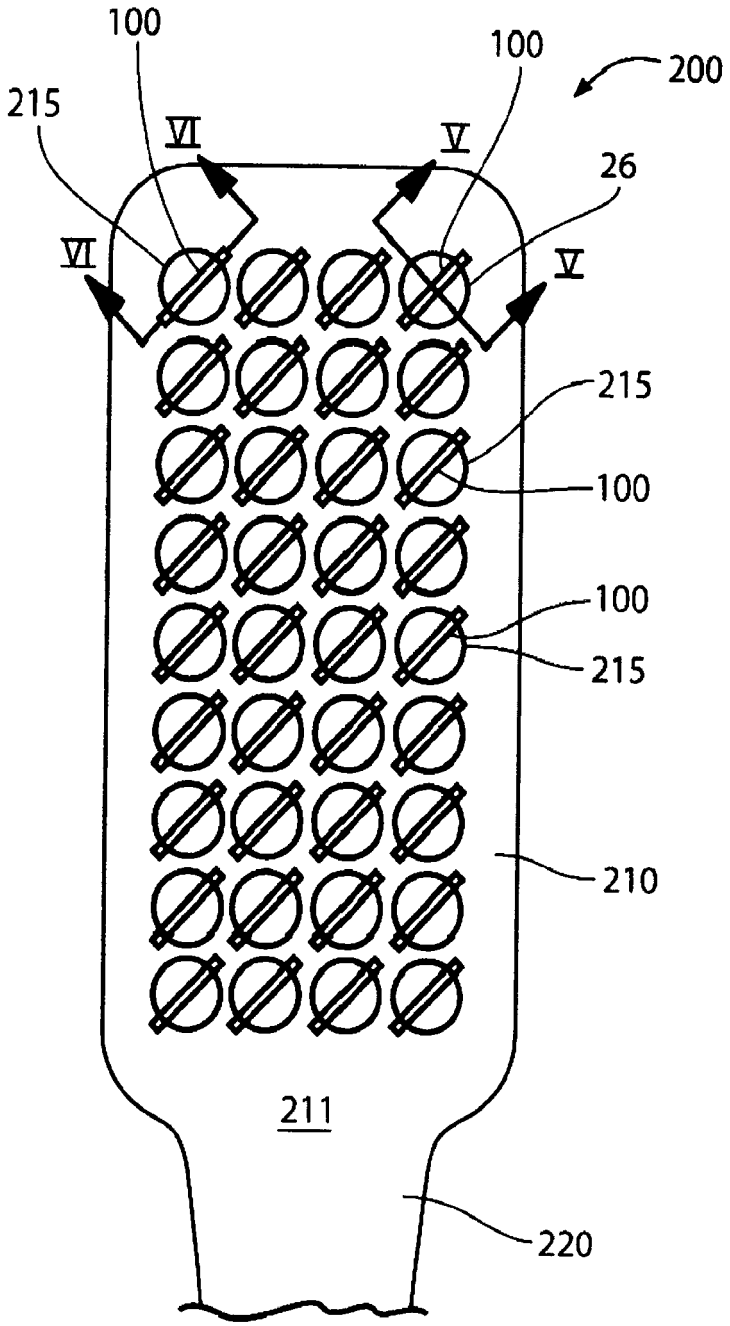


FIG. 4

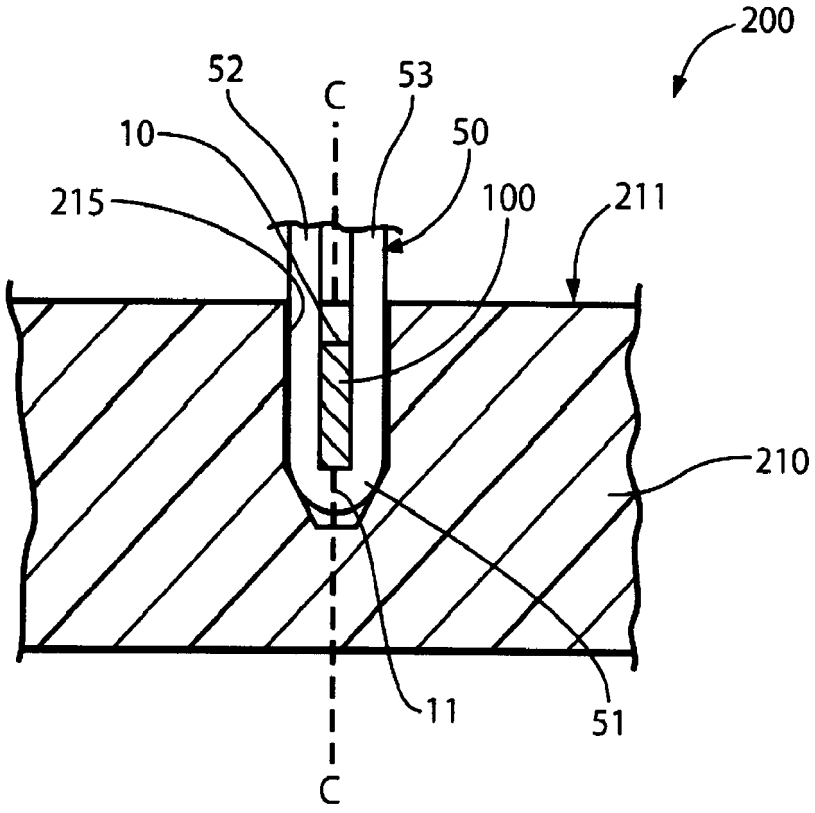


FIG. 5

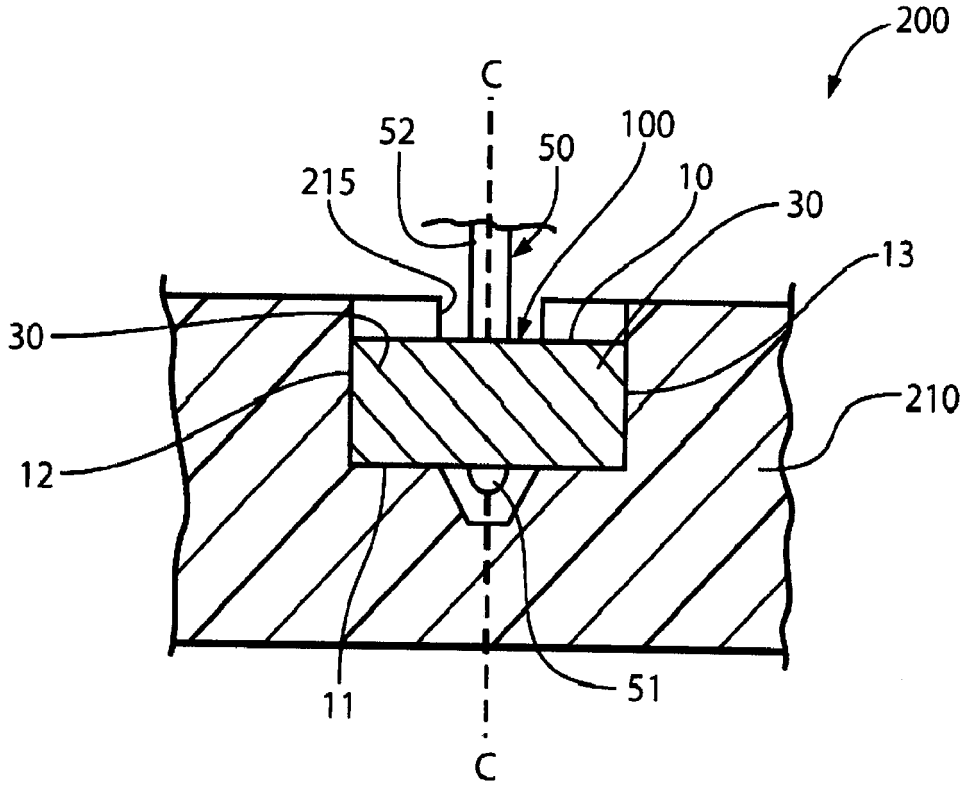


FIG. 6

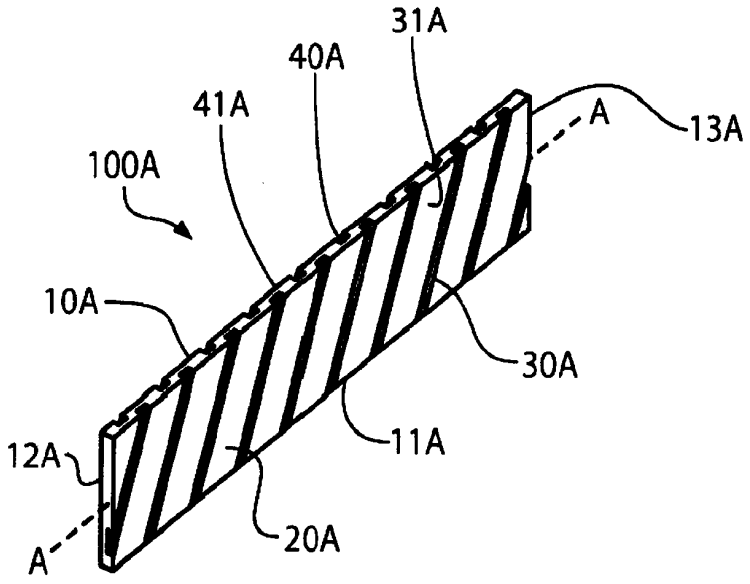


FIG. 7

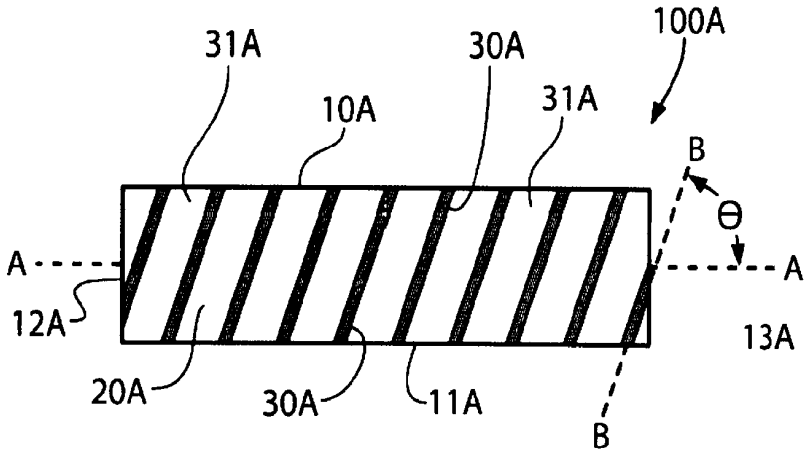


FIG. 8

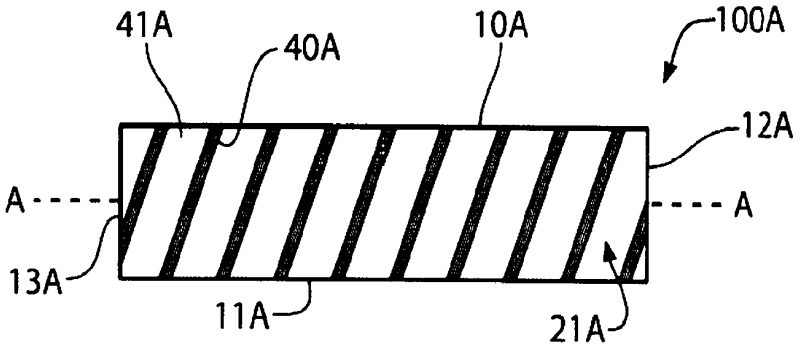


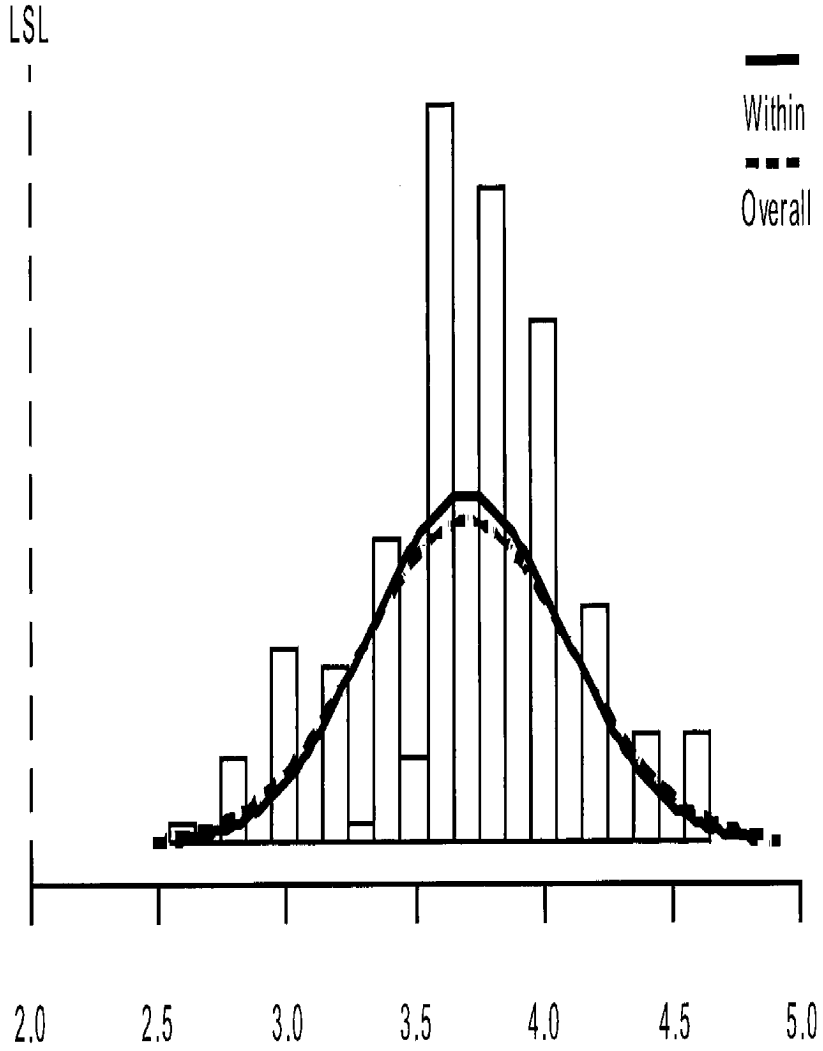
FIG. 9

(Toothbrush)	Toothbrush 1	(Material)		F401:J340=2:1
(Bristle)	Nylon 610	(Anchor Type) M#		M01380 Ag-Ni w/ Longitudinal Groove
(Instrument)	(Motorised Auto Tuft Retention Tester)--30.5cm/min			
(Criteria)	get>=1.33			

test point TR No.	T (kgf)	N	M1	M2	M3	Anchor Length	Count(T)
1	2.6	2.8	3.2	3.4	3.4	2.07	16
2	3.8	3.4	3.6	3.8	3.8	2.06	15
3	3.0	3.4	3.8	3.8	4.2	2.06	16
4	3.4	4.0	3.8	3.6	4.0	2.07	15
5	4.0	3.8	3.6	3.6	3.8	2.10	17
6	3.6	3.4	3.6	3.6	3.8	2.08	16
7	3.8	4.0	3.8	3.6	4.0	2.06	18
8	3.8	4.4	4.0	4.2	4.0	2.08	18
9	3.2	3.0	3.5	3.8	3.4	2.10	16
10	3.4	2.8	2.8	2.8	3.6	2.07	16
11	3.6	3.4	3.8	4.2	4.0	2.11	16
12	3.4	3.6	3.0	3.5	3.8	2.08	16
13	4.2	3.6	3.6	4.0	3.8	2.09	17
14	3.4	3.0	3.8	3.6	3.5	2.08	16
15	3.3	3.6	3.4	3.6	3.6	2.09	15
16	4.2	3.6	4.4	4.2	3.8	2.09	17
17	3.6	3.2	4.0	3.4	4.0	2.09	16
18	3.8	4.0	4.4	4.0	4.0	2.08	17
19	4.0	3.8	3.8	3.6	4.6	2.09	17
20	4.0	3.8	4.4	4.6	3.6	2.08	16
21	3.8	4.6	4.6	4.0	4.4	2.11	17
22	3.2	3.0	3.5	4.0	3.6	2.07	15
23	4.2	3.0	3.2	3.8	3.6	2.10	16
24	3.6	3.0	3.6	3.0	3.0	2.10	17
25	4.0	4.0	3.6	4.6	4.2	2.09	16
26	3.4	3.6	3.6	4.2	4.2	2.08	17
27	3.6	3.2	3.8	4.0	4.0	2.09	18
28	3.8	3.6	3.6	3.6	3.8	2.08	17
29	4.0	4.0	3.6	4.2	3.2	2.08	17
30	3.8	3.2	3.8	3.6	3.8	2.10	16
Maximum	4.2	3.8	4.6	4.6	4.6		
Minimum	2.6	3.2	2.8	2.8	3.0		
Average	3.7						
Cpk	1.50						

FIGURE 10A

Process Capability Analysis for Toothbrush 1



Process Data	
USL	*
Target	*
LSL	2.00000
Mean	3.69933
Sample N	150
StDev (Within)	0.377219
StDev (Overall)	0.406097

Potential (Within) Capability	
Cp	*
CPU	*
CPL	1.50
Cpk	1.50
Cpm	*

Overall Capability	
Pp	*
PPU	*
PPL	1.39
Ppk	1.39

Observed Performance		Exp."Within" Performance		Exp."Overall" Performance	
PPM < LSL	0.00	PPM < LSL	3.32	PPM < LSL	14.29
PPM > USL	*	PPM > USL	*	PPM > USL	*
PPM Total	0.00	PPM Total	3.32	PPM Total	14.29

FIGURE 10B

(Toothbrush)		Toothbrush 1		(Material)			F401:J340=2:1
(Bristle)		Nylon 610		(Anchor Type) M#			Brass Staple w/ 60 Degree Angled Grooves
(Instrument)		(Motorised Auto Tuft Retention Tester)--30.5cm/min					
(Criteria)		TR) =2.0kgf,Target>=3.4kgf;CPK>1.0,Target>=1.33					
test point TR No. (kgf)	T	N	M1	M2	M3	Anchor Length	Count(T)
1	3.2	3.7	3.2	3.8	4.2	2.12	18
2	3.5	3.6	4.4	3.6	3.4	2.12	18
3	3.0	3.6	3.8	3.6	4.6	2.12	18
4	3.4	4.4	4.0	4.2	4.2	2.11	18
5	3.6	3.2	4.0	3.2	3.8	2.12	18
6	4.2	3.4	3.6	4.4	3.8	2.11	18
7	3.6	3.8	3.8	4.0	4.6	2.11	18
8	3.6	3.8	3.5	4.4	4.0	2.12	18
9	3.2	4.2	3.8	3.6	4.0	2.12	18
10	3.0	3.2	4.0	3.4	4.0	2.12	16
11	3.6	3.5	3.8	4.0	3.7	2.11	17
12	3.7	4.2	3.8	4.0	4.0	2.12	17
13	3.8	3.8	3.2	3.4	3.8	2.11	19
14	3.2	3.2	3.8	4.0	3.8	2.11	18
15	3.4	3.7	3.8	3.6	3.6	2.12	18
16	3.4	4.0	3.8	3.6	3.4	2.12	18
17	3.0	4.0	3.6	3.6	4.4	2.11	17
18	4.0	3.8	3.6	4.0	3.7	2.11	18
19	3.4	3.4	4.0	4.0	3.6	2.10	18
20	3.0	3.8	3.6	3.8	4.0	2.11	17
21	3.6	3.8	3.4	3.5	4.1	2.12	18
22	3.4	4.2	3.4	4.2	3.8	2.12	17
23	4.2	3.6	4.2	3.8	3.8	2.10	18
24	3.6	4.2	4.0	3.4	3.6	2.11	18
25	3.6	3.6	4.0	3.6	3.8	2.12	17
26	3.0	3.6	3.5	4.0	3.8	2.11	18
27	3.5	3.8	3.6	3.8	4.0	2.12	18
28	3.0	3.8	3.8	4.2	4.0	2.11	17
29	3.2	3.6	3.8	3.2	4.0	2.12	16
30	3.7	4.2	3.6	3.8	4.0	2.12	17
Maximum	4.2	3.8	4.4	4.4	4.6		
Minimum	3.0	3.2	3.2	3.2	3.4		
Average	3.7						
Cpk	1.82						

FIGURE 11A

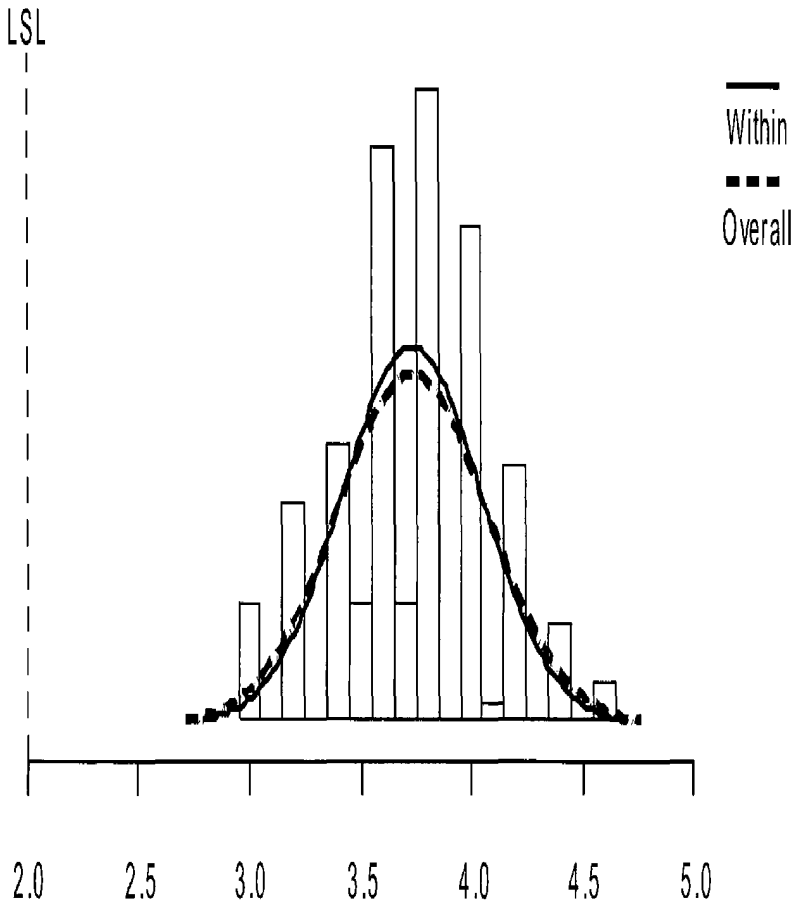
Process Capability Analysis for Toothbrush 1

Process Data

USL	*
Target	*
LSL	2.00000
Mean	3.73267
Sample N	150
StDev (Within)	0.316531
StDev (Overall)	0.342007

Potential (Within) Capability

Cp	*
CPU	*
CPL	1.82
Cpk	1.82
Cpm	*



Overall Capability		Observed Performance		Exp. "Within" Performance		Exp. "Overall" Performance	
Pp	*						
PPU	*	PPM < LSL	0.00	PPM < LSL	0.02	PPM < LSL	0.20
PPL	1.69	PPM > USL	*	PPM > USL	*	PPM > USL	*
Ppk	1.69	PPM Total	0.00	PPM Total	0.02	PPM Total	0.20

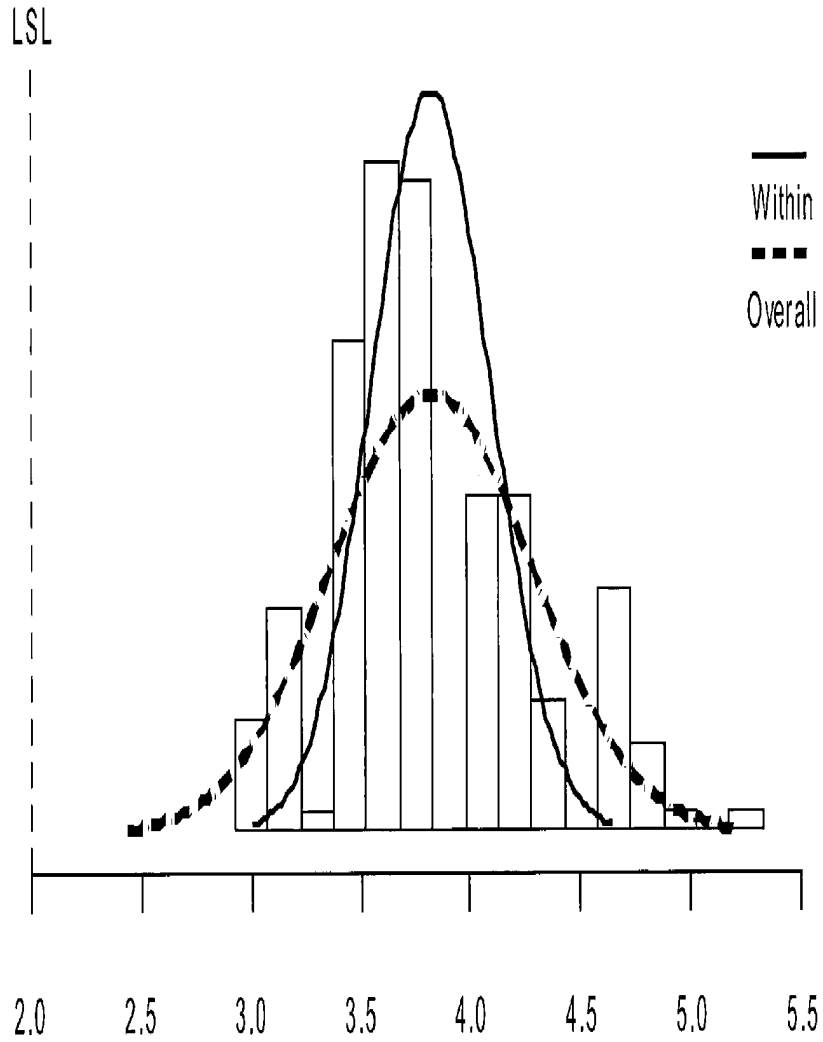
FIGURE 11B

(Toothbrush)	Toothbrush 2	(Material)		F401:J340=1:1
(Bristle)	Nylon 610	(Anchor Type) M#		M01380 Ag-Ni Staple w/ Longitudial Groove
(Instrument)	(Motorised Auto Tuft Retention Tester)--30.5cm/min			
(Criteria)	TR) =2.0kgf,Target>=3.4kgf;CPK>1.0,Target>=1.33			

test point TR No. (kgf)	T	N	M1	M2	M3	Anchor Length	Count(T)
1	3.4	4.6	3.8	3.6	3.8	2.25	35
2	3.4	5.2	4.0	3.8	4.0	2.26	36
3	3.5	4.4	3.6	3.8	4.0	2.27	33
4	3.4	4.8	3.6	3.2	3.5	2.26	34
5	3.2	4.2	3.8	4.0	4.2	2.26	36
6	3.0	4.6	4.2	3.6	4.2	2.25	36
7	3.4	4.6	3.6	3.6	3.6	2.24	36
8	3.6	4.8	4.0	4.2	3.8	2.26	36
9	3.2	4.4	4.2	3.8	4.0	2.25	36
10	3.6	5.0	3.6	3.4	3.8	2.25	37
11	3.4	4.6	4.2	3.6	3.8	2.25	37
12	3.8	4.4	3.6	3.5	4.0	2.26	36
13	3.2	4.6	3.8	3.6	3.7	2.26	33
14	3.6	4.2	3.8	4.2	3.6	2.26	35
15	3.4	4.4	3.8	3.6	4.0	2.27	35
16	3.2	4.2	4.0	4.2	3.8	2.26	36
17	3.6	4.6	4.2	3.8	3.6	2.26	36
18	3.6	4.8	3.8	3.8	3.6	2.26	36
19	3.2	4.7	3.4	4.0	3.6	2.27	34
20	3.4	4.6	4.0	3.6	3.4	2.27	36
21	3.4	4.0	3.6	3.2	3.8	2.26	36
22	3.0	4.8	3.4	3.4	3.8	2.24	35
23	3.2	4.2	3.8	3.8	3.8	2.26	36
24	3.0	4.2	3.6	3.5	3.6	2.26	36
25	3.4	4.2	3.6	3.2	3.4	2.27	36
26	3.0	4.6	3.8	3.8	4.0	2.26	35
27	3.3	4.4	4.6	3.4	3.6	2.26	36
28	3.0	4.4	3.8	3.6	3.2	2.26	36
29	3.4	4.6	3.7	3.6	4.0	2.25	36
30	3.4	4.0	3.8	3.8	3.6	2.25	35
Maximum	3.8	3.8	4.6	4.2	4.2		
Minimum	3.0	3.2	3.4	3.2	3.2		
Average	3.8						
Cpk	2.24						

FIGURE 12A

Process Capability Analysis for Toothbrush 2



Process Data	
USL	*
Target	*
LSL	2.00
Mean	3.82
Sample N	150
StDev (Within)	0.271312
StDev (Overall)	0.458513

Potential (Within) Capability	
Cp	*
CPU	*
CPL	2.24
Cpk	2.24
Cpm	*

Overall Capability	
Pp	*
PPU	*
PPL	1.32
Ppk	1.32

Observed Performance		Exp. "Within" Performance		Exp. "Overall" Performance	
PPM < LSL	0.00	PPM < LSL	0.00	PPM < LSL	36.03
PPM > USL	*	PPM > USL	*	PPM > USL	*
PPM Total	0.00	PPM Total	0.00	PPM Total	36.03

FIGURE 12B

(Toothbrush)		Toothbrush 2		(Material)			F401:J340=1:1
(Bristle)		Nylon 610		(Anchor Type) M#			Brass Staple With 60 Degree Angled Grooves
(Instrument)		(Motorised Auto Tuft Retention Tester)--30.5cm/min					
(Criteria)		TR〉 =2.0kgf,Target>=3.4kgf;CPK>1.0,Target>=1.33					
test point TR No.	(kgf) T	N	M1	M2	M3	Anchor Length	Count(T)
1	4.0	5.0	4.2	4.4	4.4	2.26	35
2	3.8	4.6	3.6	3.8	4.2	2.27	36
3	3.2	5.0	3.6	4.2	4.5	2.27	36
4	4.4	4.6	4.0	4.0	4.2	2.26	37
5	4.0	4.6	4.0	4.2	4.8	2.27	36
6	3.8	5.0	3.8	4.2	4.2	2.27	35
7	3.8	4.0	3.8	3.6	4.2	2.28	36
8	3.8	4.8	4.0	4.4	4.3	2.27	37
9	3.8	4.2	4.0	3.6	4.4	2.28	37
10	4.0	4.4	4.0	3.6	4.2	2.26	37
11	3.6	4.8	4.2	4.0	4.2	2.28	36
12	4.0	4.4	4.0	4.4	4.2	2.26	36
13	3.4	4.6	3.8	4.2	4.0	2.28	36
14	4.0	4.6	4.2	4.0	4.2	2.26	37
15	4.0	4.0	3.8	3.6	3.6	2.26	36
16	3.6	4.6	3.8	3.6	4.0	2.26	36
17	4.2	4.6	4.2	3.8	4.0	2.27	36
18	3.4	4.2	3.8	3.8	4.2	2.26	35
19	4.4	4.4	3.8	4.0	4.0	2.26	36
20	3.4	4.6	3.8	4.1	4.0	2.26	36
21	3.4	4.6	4.0	4.2	4.0	2.26	37
22	3.6	4.3	3.6	3.6	3.6	2.26	36
23	3.8	4.4	4.2	3.8	4.2	2.27	36
24	4.0	4.6	4.0	4.4	4.0	2.28	36
25	3.6	4.0	3.6	3.8	4.0	2.26	36
26	3.4	4.6	3.8	3.6	3.8	2.27	36
27	3.8	4.3	4.2	3.8	4.0	2.28	37
28	4.0	4.6	3.8	3.4	4.0	2.28	36
29	3.6	4.0	3.8	3.6	4.2	2.26	36
30	3.8	4.4	4.0	4.0	3.6	2.27	37
Maximum	4.4	3.8	4.2	4.4	4.8		
Minimum	3.2	3.2	3.6	3.4	3.6		
Average	4.0						
Cpk	2.48						

FIGURE 13A

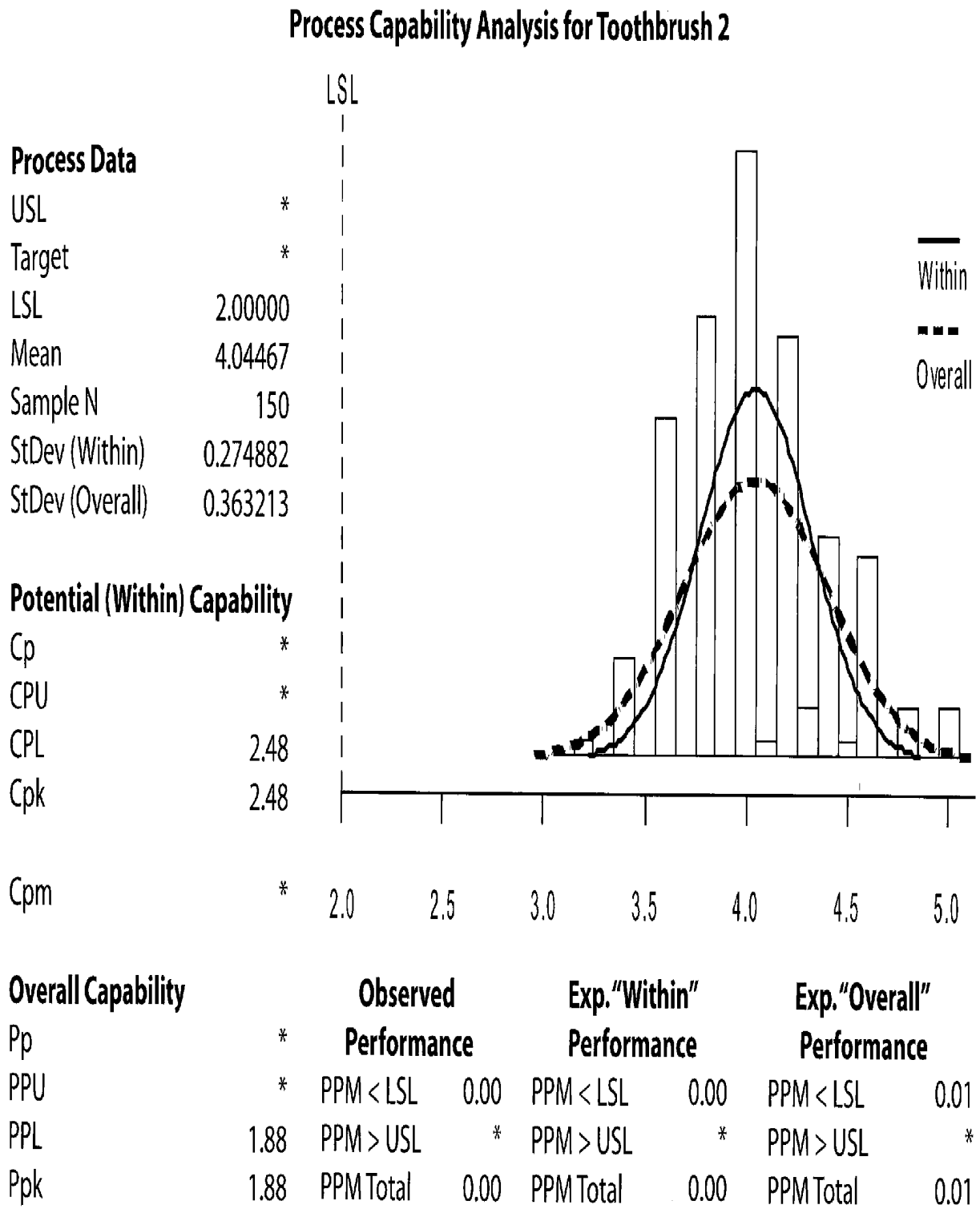
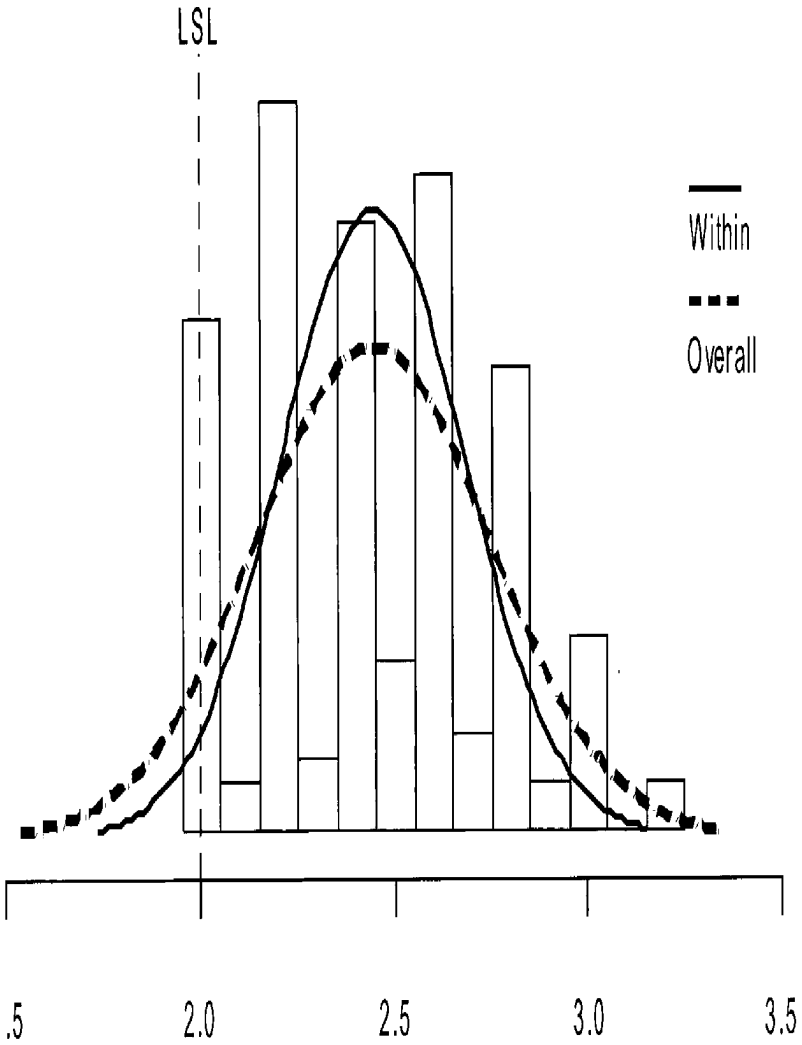

Process Capability Analysis for Toothbrush 2
LSL
Process Data
USL *
Target *
LSL 2.00000
Mean 4.04467
Sample N 150
StDev (Within) 0.274882
StDev (Overall) 0.363213
Potential (Within) Capability
Cp *
CPU *
CPL 2.48
Cpk 2.48
Cpm *
Within
Overall
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Overall Capability
Pp *
PPU *
PPL 1.88
Ppk 1.88
Observed Performance
PPM < LSL 0.00
PPM > USL *
PPM Total 0.00
Exp. "Within" Performance
PPM < LSL 0.00
PPM > USL *
PPM Total 0.00
Exp. "Overall" Performance
PPM < LSL 0.01
PPM > USL *
PPM Total 0.01

FIGURE 13B

(Toothbrush)		Toothbrush 3		(Material)			M700R
(Bristle)		Nylon		(Anchor Type) M#			M01380 Ag-Ni Staple w/ Longitudial Groove
(Instrument)		(Motorised Auto Tuft Retention Tester)--30.5cm/min					
(Criteria)		TR) =2.0kgf,Target>=3.4kgf;CPK>1.0,Target>=1.33					
test point TR No. (kgf)	T	N	M1	M2	M3	Anchor Length	Count(T)
1	2.8	2.6	2.8	3.2	2.2	1.98	33
2	2.8	2.6	2.8	2.8	2.6	1.97	32
3	2.8	2.6	2.2	2.8	2.2	1.98	33
4	2.4	2.4	2.2	2.7	2.4	1.98	32
5	2.4	2.5	2.0	2.6	2.2	1.98	32
6	3.0	2.4	2.0	2.4	2.2	1.97	31
7	2.6	2.2	2.4	2.8	2.0	1.97	32
8	3.0	2.6	2.4	2.8	2.4	1.98	32
9	2.6	2.4	2.2	2.6	2.2	1.98	33
10	2.8	2.4	2.0	2.2	2.8	1.98	33
11	2.4	2.5	2.1	2.8	2.2	1.97	33
12	2.6	2.2	2.6	2.8	2.0	1.97	32
13	2.6	2.0	2.0	2.4	2.2	1.98	33
14	2.6	2.2	2.4	2.5	2.2	1.98	32
15	2.5	2.0	2.0	2.4	2.0	1.97	33
16	2.6	2.0	2.2	2.6	2.2	1.98	33
17	2.2	2.4	2.0	2.6	2.2	1.99	31
18	3.0	2.6	2.6	2.6	2.0	1.98	32
19	2.8	2.2	2.4	2.4	2.0	1.98	32
20	2.8	2.5	2.6	2.6	2.7	1.97	33
21	2.6	2.2	2.1	2.2	2.8	1.98	32
22	2.8	3.0	2.8	3.0	2.3	1.97	33
23	2.9	2.4	2.9	2.6	2.6	1.98	33
24	3.0	2.0	2.2	2.4	2.2	1.98	32
25	2.5	2.2	2.2	2.7	2.3	1.98	32
26	3.2	2.2	2.6	3.0	2.4	1.98	33
27	2.6	2.4	2.5	2.8	2.4	1.97	31
28	2.4	2.0	2.0	2.0	2.3	1.97	32
29	2.7	2.4	2.0	2.2	2.2	1.98	32
30	3.0	2.2	2.0	2.6	2.0	1.98	32
Maximum	3.2	3.8	2.9	3.2	2.8		
Minimum	2.2	3.2	2.0	2.0	2.0		
Average	2.4						
Cpk	0.63						

FIGURE 14A

Process Capability Analysis for Toothbrush 3



Process Data	
USL	*
Target	*
LSL	2.00000
Mean	2.44667
Sample N	150
StDev (Within)	0.236803
StDev (Overall)	0.303218

Potential (Within) Capability	
Cp	*
CPU	*
CPL	0.63
Cpk	0.63
Cpm	*

Overall Capability	
Pp	*
PPU	*
PPL	0.49
Ppk	0.49

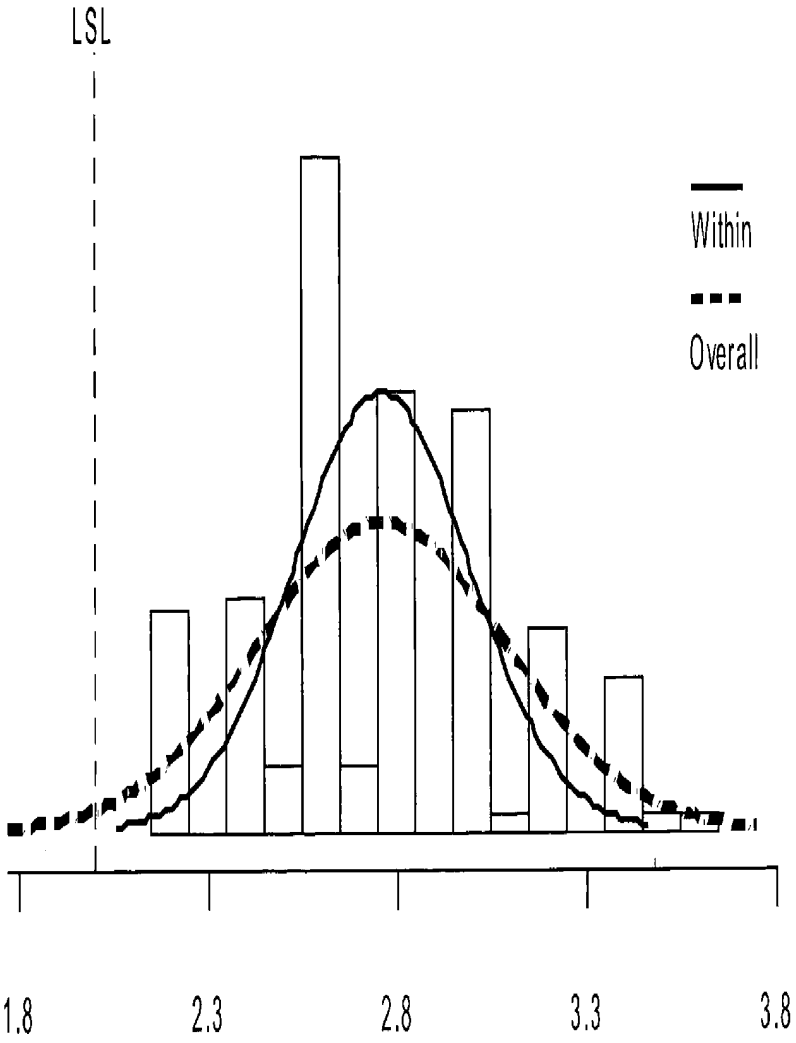
Observed Performance		Exp."Within" Performance		Exp."Overall" Performance	
PPM < LSL	0.00	PPM < LSL	29631.64	PPM < LSL	70363.67
PPM > USL	*	PPM > USL	*	PPM > USL	*
PPM Total	0.00	PPM Total	29631.64	PPM Total	70363.67

FIGURE 14B

(Toothbrush)		Toothbrush 3		(Material)			M700R
(Bristle)		Nylon		(Anchor Type) M#			Brass Staple With 60 Degree Angled Grooves
(Instrument)		(Motorised Auto Tuft Retention Tester)--30.5cm/min					
(Criteria)		TR〉 =2.0kgf,Target>=3.4kgf;CPK>1.0,Target>=1.33					
test point TR No. (kgf)	T	N	M1	M2	M3	Anchor Length	Count(T)
1	2.8	2.6	2.6	2.7	2.4	1.98	33
2	2.8	2.8	2.6	2.7	2.2	1.98	33
3	2.8	2.8	2.4	2.6	2.2	1.97	33
4	3.4	3.2	2.8	3.0	2.8	1.97	32
5	3.4	3.0	3.0	3.0	2.4	1.98	32
6	3.2	2.7	2.6	2.6	2.6	1.97	33
7	3.0	2.6	2.4	3.0	2.6	1.97	33
8	3.0	2.6	2.6	2.8	2.2	1.98	32
9	3.2	2.6	2.8	3.0	2.6	1.96	33
10	3.0	2.4	2.6	2.6	2.4	1.98	31
11	3.4	2.4	2.4	2.6	2.8	1.98	32
12	2.8	2.4	2.2	2.8	2.2	1.98	33
13	3.4	3.0	2.6	3.0	2.8	1.97	33
14	3.2	2.6	2.8	3.0	2.6	1.98	33
15	3.2	2.6	3.0	3.0	2.6	1.98	33
16	3.4	2.2	2.4	2.6	2.2	1.97	31
17	3.0	2.4	2.6	2.8	2.6	1.97	33
18	3.2	2.8	3.0	3.0	2.6	1.98	33
19	3.6	3.4	2.4	2.8	2.8	1.98	32
20	3.4	2.8	2.8	3.2	2.6	1.97	30
21	3.2	2.4	2.2	2.6	2.2	1.97	32
22	3.0	2.4	2.6	2.6	2.6	1.98	32
23	3.4	2.6	2.8	3.0	2.2	1.99	33
24	3.2	2.6	2.6	3.1	2.6	1.98	33
25	3.2	2.5	3.0	2.8	3.0	1.97	33
26	3.4	2.8	2.6	2.6	2.2	1.98	32
27	3.0	2.6	2.6	2.8	2.5	1.98	33
28	3.5	2.5	2.7	3.0	2.2	1.98	32
29	3.0	2.8	2.6	3.2	2.5	1.97	31
30	3.2	2.6	3.0	2.8	2.2	1.97	33
Maximum	3.6	3.4	3.0	3.2	3.0		
Minimum	2.8	2.2	2.2	2.6	2.2		
Average	2.8						
Cpk	1.09						

FIGURE 15A

Process Capability Analysis for Toothbrush 2



Process Data	
USL	*
Target	*
LSL	2.00
Mean	2.76
Sample N	150
StDev (Within)	0.233233
StDev (Overall)	0.328858

Potential (Within) Capability	
Cp	*
CPU	*
CPL	1.09
Cpk	1.09
Cpm	*

Overall Capability	
Pp	*
PPU	*
PPL	0.77
Ppk	0.77

Observed Performance		Exp."Within" Performance		Exp."Overall" Performance	
PPM < LSL	0.00	PPM < LSL	559.94	PPM < LSL	10415.64
PPM > USL	*	PPM > USL	*	PPM > USL	*
PPM Total	0.00	PPM Total	559.94	PPM Total	10415.64

FIGURE 15B

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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