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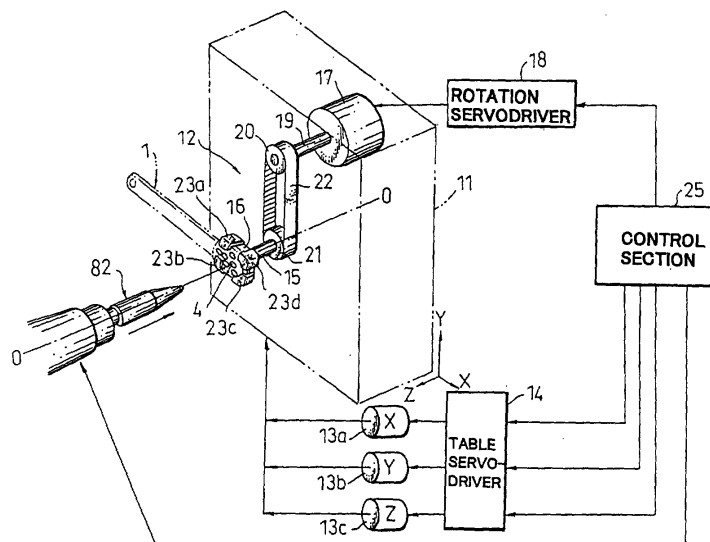
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(54) **BRUSH, AND DEVICE AND METHOD FOR TRANSPLANTING HAIR WITH THE BRUSH**

(57) A brush of the anchor type capable of varying an anchor driven angle as desired, to thereby realize bristle setting at an increased packing density and in any desired pattern. Anchor driven angles (θ) at which at least two anchors (95) are driven into bristle set holes (4) of a head (2) of the brush are set to be different from each other. A bristle setting apparatus for realizing such a brush includes a bristle setting mechanism (82) using the anchor, an X-Y-Z table mechanism (11) arranged opposite to the bristle setting mechanism, and a brush rotating mechanism (12) rotatably arranged on the table

mechanism. The brush rotating mechanism (12) is constituted of a brush holder (16) arranged so as to be rotatable in both normal and reverse directions and constructed so as to clampedly hold the head (2) of a toothbrush handle (1) at a predetermined position, a servomotor (17) for rotating the brush holder in both normal and reverse directions, gears (20, 21), and a drive belt (22). Control of movement and rotation of the X-Y-Z table mechanism (11) and brush holder (16) permits a rotational inclination angle of the toothbrush handle (1) held on the brush holder (16) to be varied as desired.

FIG. 1



Description

Technical Field

[0001] This invention relates to a brush, a bristle setting apparatus therefor and a bristle setting method therefor, and more particularly to a brush having bristle tufts set thereon by means of small metal pieces called anchors, and a bristle setting apparatus therefor and a bristle setting apparatus therefor.

Background Art

[0002] Now, a bristle setting apparatus of the anchor type for a toothbrush which is one of brushes conventionally known in the art will be described with reference to Figs. 13 and 14 by way of example. The bristle setting apparatus generally includes a bristle tuft feed mechanism 84, an auxiliary guide 88, a bristle setting needle 83, a bristle setting guide 92, a bristle cutting mechanism 94 and an anchor feed mechanism 96. The bristle tuft feed mechanism 84 is constructed so as to intermittently feed bristle tufts 81 each formed by bundling a predetermined number of continuous bristles such as continuous nylon monofilaments together by a predetermined length for every intermittent feeding during upward movement of a bristle setting needle 83 of a bristle setting mechanism 82. The auxiliary guide 88 is arranged above a front side of the bristle tuft feed mechanism 84 and includes a presser section 85 provided on a lower surface thereof so as to press the bristle tufts. The auxiliary guide 88 is formed therein with a needle insertion hole 86 vertically extending therethrough perpendicularly to the presser section 85 and an anchor insertion hole 87 extending therethrough to the needle insertion hole 86. The bristle setting needle 83 is arranged so as to vertically slide in the needle insertion hole 86. The bristle setting guide 92 is positioned below the auxiliary guide 88 so as to be vertically movable and formed with a needle guide hole 90 so as to vertically extend therethrough and be aligned with an extension line of the needle insertion hole 86. The bristle setting guide 92 is formed on an upper surface thereof with a bristle tuft receiving recess 91, which functions to interposedly hold the bristle tuft 81 in cooperation with the presser section 85 when the bristle setting guide is raised. The bristle tuft cutting mechanism 94 is positioned between the bristle tuft feed mechanism 84 and the bristle setting guide 92 and in proximity to the bristle tuft 81 and includes a rotary cutter 93 for cutting the bristle tuft 81 into a predetermined length when the bristle setting guide 92 is raised. The anchor feed mechanism 96 is arranged so as to feed an anchor 95 into the anchor insertion hole 87 of the auxiliary guide 88. The conventional bristle setting apparatus thus constructed is disclosed in Japanese Patent Publication No. 27382/1974.

[0003] Now, the manner of setting the bristle tufts 81 on a bristle set surface of a head of a toothbrush handle

1 by means of the conventional bristle setting apparatus thus constructed will be described. First, as shown in Fig. 13, the bristle tuft feed mechanism 84 is driven to feed the bristle tuft of a continuous length toward the bristle tuft receiving recess 91, to thereby abut the bristle tuft 81 against a stopper 97. Concurrently, as shown in Fig. 14, the anchor feed mechanism 96 is driven to feed the anchor of a sheet-like shape into the anchor insertion hole 87 of the auxiliary guide 88.

[0004] Then, the bristle tuft 81 thus fed into the bristle tuft receiving recess 91 is interposedly held by the presser section 85 at a distal end of the auxiliary guide 88 and then the bristle tuft 81 thus held is cut into a predetermined size by means of the rotary cutter 93 of the bristle tuft cutting mechanism 94. Thereafter, the bristle setting mechanism 82 and auxiliary guide 88 are downwardly moved together toward the toothbrush handle 1.

[0005] Also, concurrently with downward movement of the bristle setting mechanism 82 and auxiliary guide 88, the bristle setting needle 83 is downwardly moved through the needle insertion hole 86 and needle guide hole 90. This permits a tip end of the bristle setting needle 83 to cut the anchor 95 into a predetermined length and force out the anchor 95 thus cut. The anchor 95 thus cut forces the bristle tuft 81 cut into the predetermined length into the needle guide hole 90 while folding it into two parts in the middle thereof or bending it into a U-shape.

[0006] Subsequently, the bristle setting needle 83 is permitted to outwardly project at a distal end thereof from the needle guide hole 90 at the time when the bristle setting mechanism 82 is approached at a distal end thereof to the bristle set surface 3 of the head 2 of the toothbrush handle 1 to the utmost, so that the bristle tuft 81 cut into the predetermined length is driven into each of bristle set holes 4 formed on the bristle set surface 3 while being kept folded in two by means of the anchor 95, resulting in bristle setting being accomplished as shown in Figs. 15A and 15B.

[0007] The above-described operation is repeated for each of the bristle set holes 4, so that the bristle tufts folded in two by the anchors 95 may be set in the bristle set holes 4 of the head 2 of the toothbrush handle 1 in order.

[0008] The conventional bristle setting apparatus described above, as shown in Fig. 16, is so constructed that an angle θ at which the anchor 95 is driven into the bristle setting hole 4 (hereinafter referred to as "anchor driven angle θ ") is kept constant at, for example, 12 degrees. Thus, the prior art fails to vary the anchor driven angle for every bristle setting hole 4 as desired. This possibly causes the anchors 95 set in the bristle set holes 4 adjacent to each other to be abutted against or contacted with each other when a distance or interval between the bristle set holes 4 is excessively decreased. Also, it often causes cracks to occur in the head of the toothbrush or causes whitening of a resin material for the toothbrush handle due to setting of the

anchors into the bristle set holes 4, resulting in the head of the toothbrush handle being brittle. Thus, the prior art fails to significantly reduce an interval between the bristle set holes 4, resulting in it failing to realize setting of bristles at an increased packing density. The term "anchor driven angle θ " used herein indicates an angle between a longitudinal direction of the anchor and a predetermined direction of the brush head such as, for example, a longitudinal direction of the brush head.

[0009] Also, in the prior art, the anchor driven angle θ is fixed, therefore, arrangement of setting of the bristle tufts is limited to a pattern which prevents interference between the anchors adjacent to each other, such as a linear arrangement pattern, a lattice arrangement pattern or the like, so that the prior art fails to realize any other arrangement pattern such as a circular pattern in which bristle tufts are arranged in a circular manner as a whole, a curved pattern in which bristle tufts are arranged in conformity to any desired curve or the like. Thus, the conventional bristle setting apparatus substantially fails to provide a toothbrush of the anchor type in which bristles are arranged in any desired directions so as to be commonly accommodated to a brushing site in the mouth cavity and a manner of brushing as in a toothbrush produced by in-mold techniques or thermal fusion bonding.

[0010] Further, the bristle setting guide 92 for driving the anchor 95 into the bristle set hole 4, as shown in Fig. 17, is generally provided on a side of a distal end thereof with a bristle tuft separating unit 99 for reciprocating a bristle tuft separating plate 98 while pivotally moving it in synchronism with bristle setting operation of the bristle setting guide 92, although such construction is not shown in Figs. 13 and 14. The bristle tuft separating unit 99 functions to hold down, during setting of a bristle tuft 81 in the bristle set hole 4, an already-set bristle tuft 81 adjacent thereto to keep it away from a path of movement of the bristle setting guide 92, resulting in the already-set bristle tuft being kept out of the setting. This prevents formation of such a connection bristle as indicated by reference numeral 81a in Fig. 18A or such a ring bristle as indicated by 81b in Fig. 18B.

[0011] However, in the conventional bristle setting apparatus, the bristle tuft separating unit 99 is kept fixed at a predetermined position with respect to the bristle setting mechanism 82, so that a toothbrush handle is merely subject to parallel displacement. Thus, in order to prevent formation of the connection bristle 81a or ring bristle 81b due to entangling between the bristle tufts adjacent to each other, it is required that setting of the bristle tufts is successively carried out on a side which permits an already-set bristle tuft to be separated from an adjacent one by the bristle tuft separating unit. However, in spite of such an approach, the conventional bristle setting apparatus still causes a pattern of arrangement of the bristle tufts to be subject to restriction. In an actual production line, a bristle tuft arrangement pattern obtained by the conventional bristle setting apparatus

necessarily causes setting of the bristle tufts to be carried out on a side away from the bristle tuft separating unit 99, leading to possible formation of the connection bristle 81a and/or ring bristle 81b, resulting in the product being often defective.

[0012] The present invention has been made in view of the foregoing disadvantages.

[0013] Accordingly, it is an object of the present invention to provide a brush of the anchor type which is capable of permitting an anchor driven angle to be varied depending on an anchor driven position, to thereby attain bristle setting at an increased packing density and/or in any desired arrangement pattern.

[0014] It is another object of the present invention to provide a bristle setting apparatus and a bristle setting method which are capable of varying an anchor driven angle as desired, realizing bristle setting at an increased packing density, attaining bristle setting in any desired arrangement pattern such as a circular pattern, a curved pattern or the like which is never obtained in a conventional brush of the anchor type, and preventing formation of a connection bristle and/or a ring bristle.

Disclosure of Invention

[0015] In order to attain the above-described objects of the present invention, in accordance with one aspect of the present invention, a brush is provided which has bristle tufts set in bristle set holes formed on a bristle set surface of a head of the brush, each of the bristle tufts being kept folded into two parts with an anchor being interposed between the two parts. The brush is characterized in that at least two of a plurality of the anchors are driven into the bristle set holes at anchor driven angles different from each other.

[0016] It is preferable that the head is formed with a plurality of the bristle set holes separated from each other and the bristle set holes each have one of the bristle tufts set therein by means of the anchor. In this instance, at least two of the bristle set holes adjacent to each other are preferably separated from each other by means of a partition wall formed to have a thickness of between 0.1 mm and 3.0 mm. Also, the anchor driven angles of the anchors are each preferably so set that an extension line of the anchor defined in a longitudinal direction thereof does not intersect the bristle set hole adjacent thereto. Further, the bristle set hole may have a plurality of the bristle tufts set therein by means of the anchors.

[0017] The above-described construction of the present invention permits the anchor driven angle to be varied as desired, to thereby prevent the anchors adjacent to each other from being abutted against each other, resulting in bristle setting at an increased packing density which is never attained in the conventional brush of the anchor type being realized. Also, such construction permits the bristle tufts to be arranged in any desired pattern such as a circular pattern wherein the bristle tufts are arranged in a circular array, a curved pattern where-

in the bristle tufts are arranged along any desired curve or the like which has been conventionally obtained only by in-mold techniques, thermal fusion bonding or the like.

[0018] In accordance with another aspect of the present invention, a bristle setting apparatus for a brush is provided. The bristle setting apparatus is characterized in that the apparatus includes a bristle setting means for setting bristle tufts on a bristle set surface of a head of the brush by means of anchors, a brush holder arranged opposite to the bristle setting means while being spaced therefrom at a predetermined interval and constructed so as to permit the head of the brush to be held at a predetermined position thereon, a position adjusting means for adjusting a position of the brush holder with respect to the bristle setting means, and a brush rotating mechanism for adjusting a rotational inclination angle of the brush holder with respect to the bristle setting means. The position adjusting means is moved while being controlled, to thereby vary the position of the brush holder with respect to the bristle setting means and the brush rotating mechanism is rotated while being controlled, to thereby vary the rotational inclination angle of the brush holder with respect to the bristle setting means.

[0019] In accordance with a further aspect of the present invention, a bristle setting method for a brush wherein bristle tufts are set on a bristle set surface of a head of the brush by means of anchors, each of the bristle tufts being folded into two, is provided. The bristle setting method is characterized in that the method includes the steps of arranging a brush holder so as to be opposite to a bristle setting means of the anchor type after holding the head of the brush to be subjected to bristle setting at a predetermined position on the brush holder and successively setting bristle tufts on the bristle set surface of the head of the brush while varying a position of the brush holder with respect to the bristle setting means and varying a rotational inclination angle of the brush holder with respect to the bristle setting means.

[0020] The above-described construction of each of the bristle setting apparatus and bristle setting method permits the anchor driven angle at which the anchor is driven into the bristle set hole to be varied as desired for every bristle set hole, resulting in bristle setting at a high packing density and arranging the bristle tufts in any desired pattern such as a circular pattern, a curved pattern or the like which is never obtained in the conventional brush of the anchor type being realized.

[0021] Also, such construction permits the head of the brush to be rotated over an angle of 360 degrees, resulting in positional relationship between the bristle tuft which has been just subjected to bristle setting and the bristle to be subjected to the next bristle setting operation being kept constant as shown in Fig. 17. This permits bristle setting to be started at any desired bristle set hole, to thereby prevent an order of bristle setting

from being limited by the bristle tuft arrangement pattern and eliminate formation of a connection bristle and/or a ring bristle due to entangling between the bristle tufts adjacent to each other. Further, the construction which permits rotation of the head over 360 degrees leads to bristle setting in a ring-like pattern as shown in each of Figs. 6A, 6B, 7 and 8.

Brief Description of Drawings

[0022]

Fig. 1 is a schematic diagram showing an electric circuit of a bristle setting apparatus for a toothbrush of the anchor type according to an embodiment of the present invention;

Fig. 2 is a schematic front elevation view of the bristle setting apparatus for a toothbrush of the anchor type shown in Fig. 1;

Fig. 3 is a schematic sectional view taken along line A-A of Fig. 2;

Fig. 4 is a schematic view showing a variation in rotational inclination angle of a toothbrush handle due to rotation of a brush holder by way of example; Figs. 5A to 5H each are a schematic view showing an anchor driven angle obtained by the bristle setting apparatus for a toothbrush of the anchor type shown in Fig. 1 by way of example;

Figs. 6A to 6D each are a schematic view showing a bristle tuft arrangement pattern in which the bristle setting apparatus for a toothbrush of the anchor type shown in Fig. 1 may carry out bristle setting by way of example, wherein Fig. 6A is a plan view showing bristle setting in a circular pattern, Fig. 6B is a plan view showing bristle setting in a U-shaped pattern, Fig. 6C is a plan view showing bristle setting in a Y-shaped pattern and Fig. 6D is a plan view showing bristle setting in a windmill-shaped pattern; Fig. 7 is a plan view showing a first example of a toothbrush having bristle tufts set thereon by the bristle setting apparatus for a toothbrush of the anchor type shown in Fig. 1;

Fig. 8 is a plan view showing a second example of a toothbrush having bristle tufts set thereon by the bristle setting apparatus for a toothbrush of the anchor type shown in Fig. 1;

Fig. 9 is a plan view showing a third example of a toothbrush having bristle tufts set thereon by the bristle setting apparatus for a toothbrush of the anchor type shown in Fig. 1;

Fig. 10 is a plan view showing a fourth example of a toothbrush having bristle tufts set thereon by the bristle setting apparatus for a toothbrush of the anchor type shown in Fig. 1;

Figs. 11A and 11B each are a schematic view showing an anchor driven angle obtained by the present invention, wherein Fig. 11A shows an anchor driven angle obtained when a bristle set hole is formed to

have a circular shape and Fig. 11B shows an anchor driven angle obtained when a bristle set hole is formed to have a square shape;

Figs. 12A and 12B each show continuous setting of a plurality of bristle tufts in a bristle set hole without arranging any partition wall, wherein Fig. 12A is a schematic vertical sectional view showing the bristle tufts in the bristle set hole and Fig. 12B is a schematic plane view showing the bristle tufts in the bristle set hole;

Fig. 13 is a schematic vertical sectional view showing a conventional bristle setting apparatus for a toothbrush of the anchor type;

Fig. 14 is a schematic vertical sectional view taken along line B-B of Fig. 13;

Fig. 15A is a plan view showing a bristle set hole having bristle tufts set therein;

Fig. 15B is a sectional view taken along line C-C of Fig. 15A;

Fig. 16 is a plan view showing a toothbrush having bristle tufts set thereon by the conventional bristle setting apparatus for a toothbrush of the anchor type shown in Fig. 13 by way of example;

Fig. 17 is a schematic view showing separation of bristle tufts from each other by a bristle tuft separating unit;

Fig. 18A is a schematic view showing formation of a connection bristle; and

Fig. 18B is a schematic view showing formation of a ring bristle.

Best Modes for Carrying Out the Invention

[0023] Now, embodiments of the present invention will be described with reference to the accompanying drawings.

[0024] Referring first to Figs. 1 to 3, an embodiment of a bristle setting apparatus according to the present invention is illustrated, which is applied to a bristle setting apparatus for a toothbrush of the anchor type. In connection with the illustrated embodiment, reference numerals like those in the conventional bristle setting apparatus for a toothbrush of the anchor type described above with reference to Figs. 13 and 14 designate like or corresponding parts. Also, a bristle tuft separating unit (not shown) incorporated in the illustrated embodiment may be constructed in substantially the same manner as that described above with reference to Fig. 17.

[0025] A bristle setting apparatus of the illustrated embodiment, as shown in Figs. 1 and 2, generally includes a bristle setting mechanism (bristle setting means) 82 which is so constructed that a bristle tuft bent or folded in two is knocked out by an anchor 95 (Figs. 5A to 12B) to carry out bristle setting in substantially the same manner as the conventional bristle setting apparatus for a toothbrush of the anchor type, an X-Y-Z table mechanism 11 arranged opposite to the bristle setting mechanism 82 so as to be movable in X-axis, Y-axis and Z-

axis directions, resulting in it being positionally adjustable in the directions, and a brush rotating mechanism 12 rotatably arranged on the X-Y-Z table mechanism 11.

[0026] The bristle setting mechanism 82 is constructed in substantially same manner as that incorporated in the conventional bristle setting apparatus described above with reference to Figs. 13 and 14. Thus, it is constructed so as to reciprocate along a central line O-O of a needle guide hole to knock out a bristle tuft 81 folded into two by the anchor by means of a brief setting needle and set it in each of bristle set holes 4 of a bristle set surface 3 of a head 2 of a toothbrush handle 1 clamped or gripped by a handle holder 16 described hereinafter.

[0027] The X-Y-Z table mechanism 11 is constituted by a combination of an X-axis table 11a arranged so as to be reciprocated in a lateral direction, a Y-axis table 11b arranged so as to be reciprocated in a vertical direction and a Z-axis table 11c arranged so as to be reciprocated in a longitudinal direction, which are positionally adjusted by driving and controlling an X-axis servomotor 13a, a Y-axis servomotor 13b and a Z-axis servomotor 13c through a table servodriver 14, respectively.

[0028] The brush rotating mechanism 12 includes a brush holder 16 arranged so as to be rotatable in both normal and reverse directions through a rotation shaft 15 fixed on a rear surface of the brush holder 16, a rotation servomotor 17, a rotation servodriver 18 for driving and controlling the rotation servomotor 17, and a combination of gears 20 and 21 and a drive belt 22 arranged so as to operatively connecting the rotation shaft 15 of the brush holder 16 and a revolving shaft 19 of the servomotor 17 to each other therethrough.

[0029] The brush holder 16 acts as a clamp or grip mechanism for holding the toothbrush handle 1 at a predetermined position while clamping the head 2 of the toothbrush which is inserted therinto. For this purpose, the brush holder 16 may be provided at four corners thereof with pawls 23a to 23d, so that the head 2 of the toothbrush 1 is inserted into a space defined by the pawls 23a to 23d, resulting in the whole toothbrush handle 1 being held at the predetermined position while being clamped by the pawls 23a to 23d.

[0030] The brush rotating mechanism 12 equipped with the brush holder 16 thus constructed is securely mounted on the X-Y-Z table 11 by means of a mounting member 24, so that movement and control of the X-Y-Z table 11 may permit a position of the brush holder 16 in each of the X-axis, Y-axis and Z-axis directions to be varied as desired. Also, rotation of the brush holder 16 by means of the rotation servomotor 17 permits a direction of the toothbrush handle 1 clampedly held on the brush holder 16 or a rotational inclination angle θ of the handle 1 to be varied as desired as shown in Fig. 4. Fig. 4 shows a representative or typical example of setting of the rotational inclination angle. Thus, of course any desired intermediate angle may be suitably set or selected.

[0031] In Fig. 1, reference numeral 25 designates a

control section for controlling operation of the whole apparatus including the table servodriver 14, rotation servodriver 18 and bristle setting mechanism 82. The control section 25 may be constituted by, for example, a combination of a personal computer and a PC (sequencer).

[0032] Now, the manner of operation of the bristle setting apparatus of the illustrated embodiment thus constructed will be described. First of all, the toothbrush handle 1 to be subjected to bristle setting is inserted into the space defined by the pawls 23a to 23d of the brush holder 16 manually or by means of any suitable automatic loading machine while keeping the bristle set surface 3 of the toothbrush handle 1 facing outside, to thereby clampedly hold the whole toothbrush handle 1 on the handle holder 16.

[0033] After the toothbrush handle 1 is thus held on the handle holder 16, the control section 25 controls the table servo driver 14, to thereby drive the X-axis servomotor 13a, Y-axis servomotor 13b and Z-axis servomotor 13c, resulting in a position of the brush holder 16 in each of the X-axis direction, Y-axis direction and Z-axis direction being adjusted so that a position of a first bristle set hole 4 to be subjected to bristle setting may be aligned with the central axis O-O of the needle guide hole 90 (see Figs. 13 and 14) of the bristle setting mechanism 82.

[0034] Concurrently, the control section 25 controls the rotation servodriver 18 to drive the rotation servomotor 17, to thereby adjust a rotation angle of the toothbrush handle 1 clampedly held on the brush holder 16 so that the toothbrush handle 1 may have an indicated inclination angle.

[0035] After positional adjustment of the toothbrush handle 1 in the X-axis, Y-axis and Z-axis directions and adjustment of the inclination angle of the toothbrush handle 1 are completed, the control section 25 controls the bristle setting mechanism 82 so that the bristle setting mechanism 82 may knock out the bristle tuft 81 while folding it into two by means of the anchor 95 to set it in the bristle set hole 4 on the bristle setting surface 3.

[0036] The bristle setting operation described above is repeated for every bristle set hole 4. This permits bristle setting to be carried out while varying an anchor driven angle θ as desired with respect to each of the bristle set holes 4, as shown in Figs. 5A to 5H. This prevents the anchors 95 in the bristle set holes 4 adjacent to each other from interfering with each other due to contact therebetween, to thereby permit the bristle tufts 81 to be set on the bristle set surface 3 at an increased packing density. Figs. 5A to 5H each show a representative or typical example of setting of the rotational inclination angle. Thus, it is a matter of course that any desired intermediate angle may be suitably set or selected.

[0037] Rotation of the toothbrush handle 1 permits positional relationship between the bristle tuft 81 which has been just subjected to bristle setting and the next bristle set hole 4 to be subsequently subjected to bristle setting

to be kept constant as shown in Fig. 17. Thus, the illustrated embodiment permits bristle setting to be started at any desired bristle set hole 4, to thereby eliminate the disadvantage of the prior art that an order of bristle setting is restricted by a pattern of arrangement of the bristle tufts. Also, the illustrated embodiment fully prevents formation of the connection bristle 81a and/or ring bristle 81b shown in Figs. 18A and 18B, to thereby minimize defectives.

[0038] Figs. 6A to 6D each show a pattern of arrangement of the bristle tufts which may be obtained by the bristle setting apparatus of the illustrated embodiment by way of example. In each of the arrangement patterns, the bristle set holes 4 of a rectangular shape adjacent to each other are positioned in proximity to each other, to thereby be densely arranged while being spaced from each other through a thin partition wall. More specifically, Fig. 6A shows a circular arrangement pattern obtained by arranging the bristle set holes 4 of a rectangular shape in a ring-like array. Fig. 6B shows a U-shaped arrangement pattern obtained by arranging the rectangular bristle set holes 4 in a U-shaped array. Fig. 6C shows a Y-shaped arrangement pattern obtained by arranging the rectangular bristle set holes 4 in a Y-shaped array. Fig. 6D shows a windmill-like arrangement pattern obtained by arranging the rectangular bristle set holes 4 in a windmill-like array.

[0039] As will be noted from Figs. 6A to 6D, the arrangement patterns each permit an anchor driven angle at which the anchor 95 is driven into the bristle set hole 4 to be varied, to thereby prevent the anchors 95 adjacent to each other from being contacted with or abutted against each other, resulting in that bristle setting can be attained in any desired arrangement pattern. The bristle set holes 4 are arranged in proximity to each other through the partition wall decreased in thickness, to thereby prevent formation of a gap between the bristle tufts in the bristle set holes 4, so that bristle setting may be attained at a highly increased packing density.

[0040] A toothbrush having bristle tufts set thereon by the bristle setting apparatus of the illustrated embodiment will be described with reference to Figs. 7 to 10.

[0041] An arrangement pattern of bristle tufts set on each of the toothbrushes shown in Figs. 7 to 10 has never been realized by the conventional bristle setting apparatus for a toothbrush of the anchor type. Thus, in the prior art, it is exclusively realized by in-mold techniques, thermal fusion bonding or the like. On the contrary, the above-described construction of the illustrated embodiment permits bristle setting in such a highly complicated arrangement pattern as shown in each of Figs. 7 to 10 to be attained without causing any trouble. Also, it permits bristle setting with respect to the bristle set holes 4 of any suitable configuration other than a circle, such as a square, a fan-like shape, a triangle, a polygon, a star-like shape, a shape like a composite curve or the like. Thus, the illustrated embodiment provides a toothbrush of the anchor type having bristles arranged in a variety

of desired directions thereon so as to be commonly accommodated to a brushing site in the mouth cavity and a manner of the brushing.

[0042] In manufacturing of the toothbrushes having the bristle tufts set thereon in various arrangement patterns as shown in Figs. 7 to 10, driving of the anchor 95 into the bristle set hole 4 concerned is desirably carried out within an angle range which prevents an extension P-P of the anchor 95 defined in a longitudinal direction thereof from intersecting the bristle set holes 4 adjacent to the concerned bristle set hole 4, as shown in Figs. 11A and 11B. Driving of the anchor 95 within such an angle range prevents any crack from occurring between the concerned bristle set hole 4 and any bristle set hole 4 adjacent thereto. Also, it prevents whitening of resin of which the head of the toothbrush handle is made. The partition wall through which the bristle set holes 4 adjacent to each other are isolated from each other is desirably formed to have a thickness d between 0.1 mm to 3.0 mm.

[0043] In each of Figs. 7 to 10, the bristle set holes 4 adjacent to each other are isolated from each other through the partition wall, resulting in the bristle set holes being arranged independently from each other. The bristle set holes 4 thus arranged each have the single bristle tuft 81 set therein by means of the single anchor 95. However, bristle setting is not limited to such a way. For example, the bristle set holes 4, as shown in Figs. 12A and 12B, each may be formed to have an elongated configuration of which a length corresponds to a sum of lengths of a plurality of the bristle set holes 4 each shown in Fig. 11A or 11B. In each of the elongated bristle set holes 4 thus formed, a plurality of the bristle tufts 81 are set one by one in a manner to adjoin each other by means of a plurality of the anchors 95. Bristle setting in such a manner possibly causes the bristle tuft 81 now set in the elongated bristle set hole 4 to tilt into a space defined on a side on which the next bristle setting is to be carried out, to thereby interfere with the next bristle setting operation. However, such a problem may be effectively solved by carrying out the next bristle setting while holding down the just set bristle tuft in an opposite direction by means of such a bristle tuft separating unit as indicated by reference numeral 99 in Fig. 17.

[0044] Bristle setting in such a manner as shown in Figs. 12A and 12B keeps the bristle tufts adjacent to each other from being separated from each other through such a partition wall as described above, to thereby permit formation of a long bristle tuft chain which is rendered fully continuous as seen in a toothbrush made by in-mold techniques or thermal fusion bonding. This results in the toothbrush exhibiting enhanced design and aesthetic characteristics and being provided with a novel bristle arrangement pattern which compares favorably with that of a toothbrush made by in-mold techniques or thermal fusion bonding.

[0045] In the illustrated embodiment, the brush holder 16 is rotated through a combination of the rotation ser-

vomotor 17, gears 20 and 21, and drive belt 22. However, it is merely required to construct the brush holder 16 in a rotatable manner, therefore, the brush holder 16 may be connected directly to the servomotor 17 or rotated by any other suitable rotation means.

[0046] Also, in the illustrated embodiment, the head 2 of the toothbrush handle 1 is clampedly held by the pawls 23a to 23d formed on the four corners of the brush holder 16. However, any other suitable clamp mechanism may be used for this purpose, so long as it effectively clamps the head 2 of the toothbrush handle 1.

[0047] Further, the illustrated embodiment is so constructed that the X-Y-Z table mechanism 11 is driven by means of the three servomotors 13a to 13c. Alternatively, any other suitable drive mechanism such as, for example, a linear slider or the like may be substituted for the servomotor to this end.

[0048] Moreover, in the illustrated embodiment, the handle rotating mechanism 12 on which the brush holder 16 is mounted is rotatably mounted on the X-Y-Z table mechanism 11.

Alternatively, the illustrated embodiment may be constructed in a contrary manner. More specifically, the brush holder 16 may be fixedly mounted on the X-Y-Z table mechanism 11, which may be then mounted on the revolving shaft of the brush rotating mechanism so as to be movable in the X-axis, Y-axis and Z-axis directions.

[0049] Furthermore, the illustrated embodiment includes the X-Y-Z table mechanism 11 which permits positional control in the X-axis, Y-axis and Z-axis directions. However, when the bristle set surface 3 of the toothbrush handle 1 is formed to be even or flat, positional control in the Z-axis direction may be eliminated. Thus, in this instance, an X-Y table mechanism may be substituted for the X-Y-Z table mechanism 11.

[0050] The brush according to the present invention is so constructed that at least two of the anchors are driven into the respective bristle set holes at anchor driven angles different from each other. Such construction permits bristle setting to be carried out at a high packing density which is never obtained in the conventional brush of the anchor type made by keeping the anchor driven angle fixed. Also, such construction realizes bristle setting in any desired arrangement pattern such as, for example, a circular pattern in which the bristle tufts are arranged in a circular array, a curved pattern in which the bristle tufts are arranged along any desired curve or the like. Such an arrangement pattern is conventionally obtained by only in-mold techniques, thermal fusion bonding or the like. Thus, the brush of the present invention can be commonly accommodated to an object of brushing and a manner of the brushing.

[0051] Also, the bristle setting apparatus and bristle setting method of the present invention are each so constructed that the position adjusting means is moved while being controlled, to thereby vary a position of the brush holder relative to the bristle setting means as de-

sired and the brush rotating mechanism is rotated while being controlled, to thereby set the bristle tuft in the intended bristle set hole of the head of the toothbrush while varying a rotational inclination angle of the brush holder relative to the bristle setting means. Such construction permits the anchor driven angle with respect to the bristle set hole to be varied as desired for every bristle set hole, to thereby realize bristle setting at a high packing density and attain bristle setting in any desired bristle tuft arrangement pattern such as a circular arrangement pattern, a curved arrangement pattern or the like which is never attained by the conventional brush of the anchor type and in any order. Also, such construction permits bristle setting to be started at any desired bristle set hole irrespective of the bristle tuft arrangement pattern, to thereby eliminate the disadvantage of the prior art that an order of bristle setting is limited by the bristle tuft arrangement pattern and prevent formation of a connection bristle and/or a ring bristle due to entangling between bristle tufts adjacent to each other.

Industrial Applicability

[0052] The present invention may be applied to not only such a toothbrush as described above but other brushes such as a hair brush, a dressing brush, a cleaning brush and the like so long as they have bristles set thereon by means of anchors. Also, the present invention is applicable to a brush free from a handle or grip.

Claims

1. A brush having bristle tufts set in bristle set holes formed on a bristle set surface of a head of the brush, each of the bristle tufts being kept folded into two parts with an anchor being interposed between the two parts, **characterized in that:**
 - at least two of a plurality of the anchors are driven into the bristle set holes at anchor driven angles different from each other.
2. A brush as defined in claim 1, wherein said head is formed with a plurality of the bristle set holes separated from each other; and
 - said bristle set holes each have one of the bristle tufts set therein by means of the anchor.
3. A brush as defined in claim 2, wherein at least two of the bristle set holes adjacent to each other are separated from each other by means of a partition wall formed to have a thickness of between 0.1 mm and 3.0 mm.
4. A brush as defined in claim 2 or 3, wherein said anchor driven angles of said anchors are each so set that an extension line of the anchor defined in a lon-

gitudinal direction thereof does not intersect the bristle set hole adjacent thereto.

5. A brush as defined in any one of claims 1 to 4, wherein said bristle set hole has a plurality of the bristle tufts set therein by means of the anchors.
6. A bristle setting apparatus for a brush, **characterized in that** the apparatus comprises:

- a bristle setting means for setting bristle tufts on a bristle set surface of a head of the brush by means of anchors;
- a brush holder arranged opposite to said bristle setting means while being spaced therefrom at a predetermined interval and constructed so as to permit the head of the brush to be held at a predetermined position thereon;
- a position adjusting means for adjusting a position of said brush holder with respect to said bristle setting means; and
- a brush rotating mechanism for adjusting a rotational inclination angle of said brush holder with respect to said bristle setting means;
- said position adjusting means being moved while being controlled, to thereby vary the position of said brush holder with respect to said bristle setting means and said brush rotating mechanism being rotated while being controlled, to thereby vary the rotational inclination angle of said brush holder with respect to said bristle setting means.

7. A bristle setting method for a brush wherein bristle tufts are set on a bristle set surface of a head of the brush by means of anchors, each of bristle tufts being folded into two, **characterized in that** the method comprises the steps of:

- arranging a brush holder so as to be opposite to a bristle setting means of the anchor type after holding the head of the brush to be subjected to bristle setting at a predetermined position on the brush holder; and
- successively setting bristle tufts on the bristle set surface of the head of the brush while varying a position of the brush holder with respect to the bristle setting means and varying a rotational inclination angle of the brush holder with respect to the bristle setting means.

FIG. 1

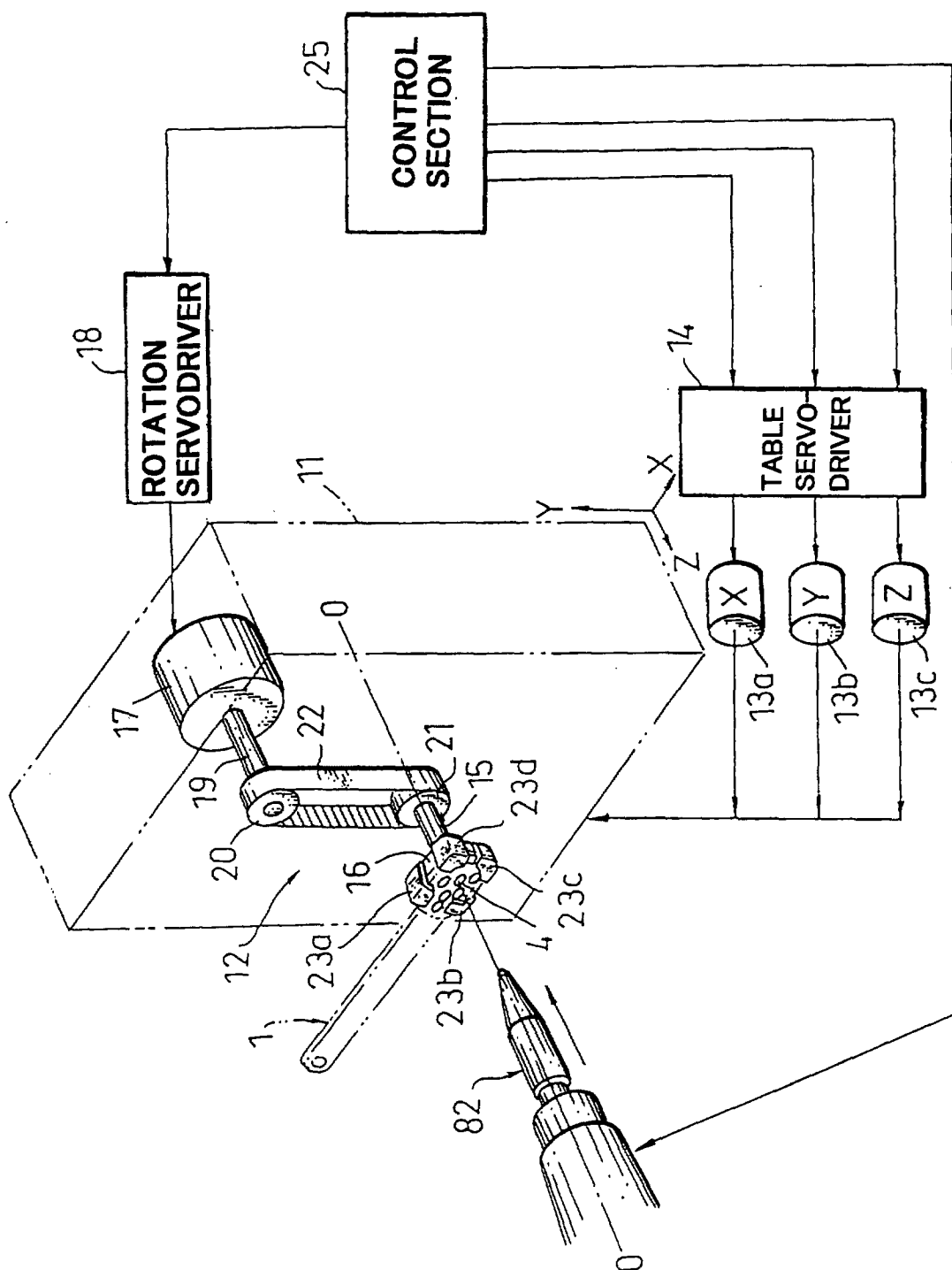


FIG. 2

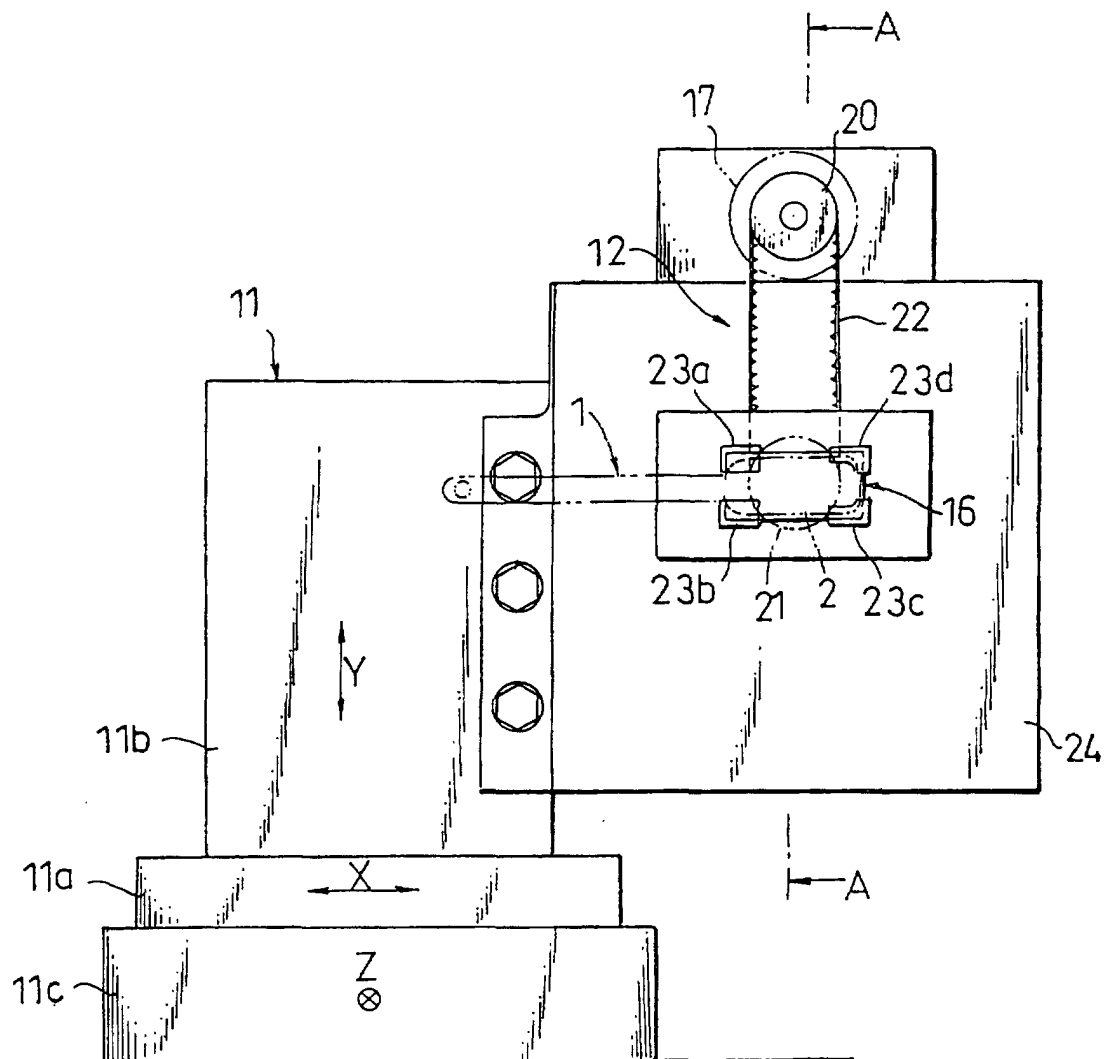


FIG. 3

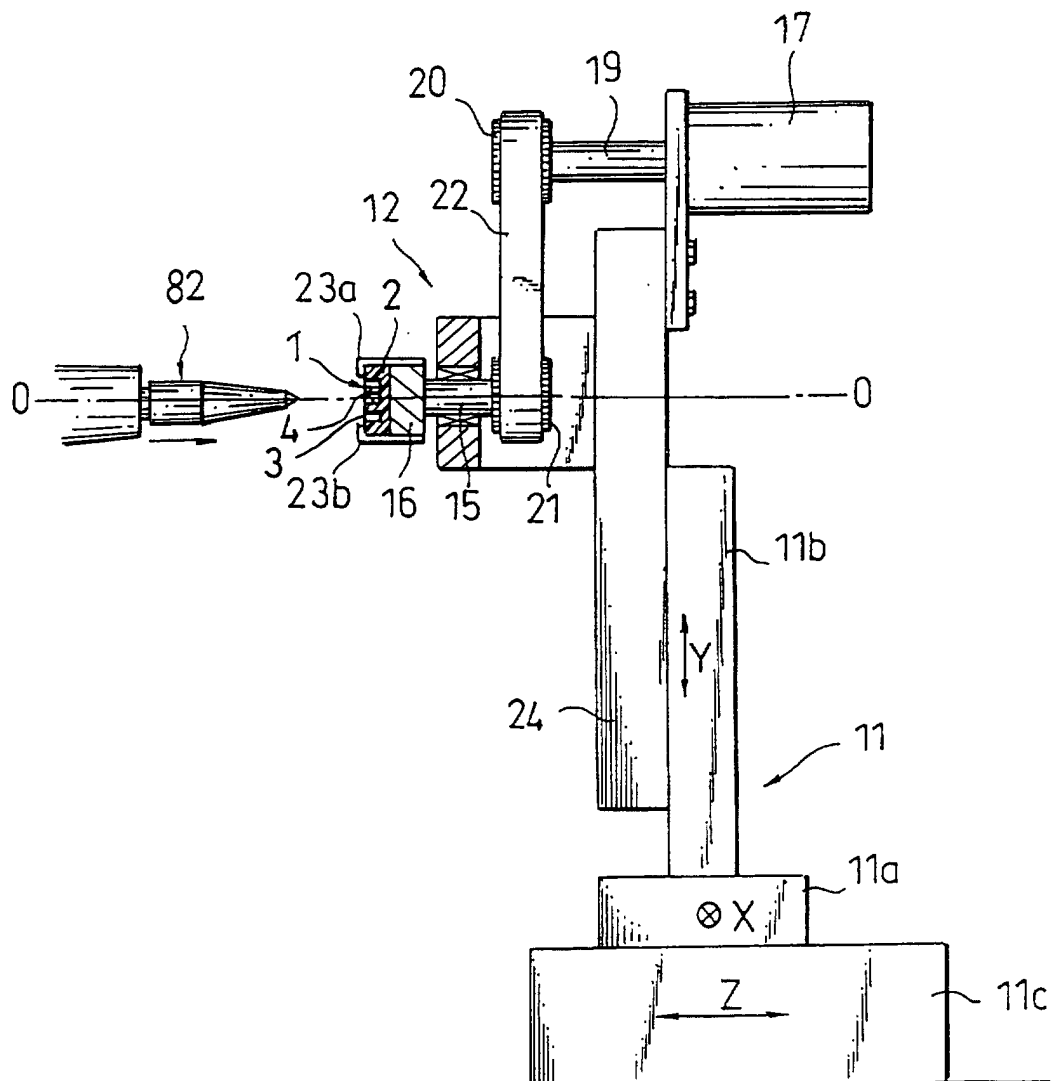


FIG. 4

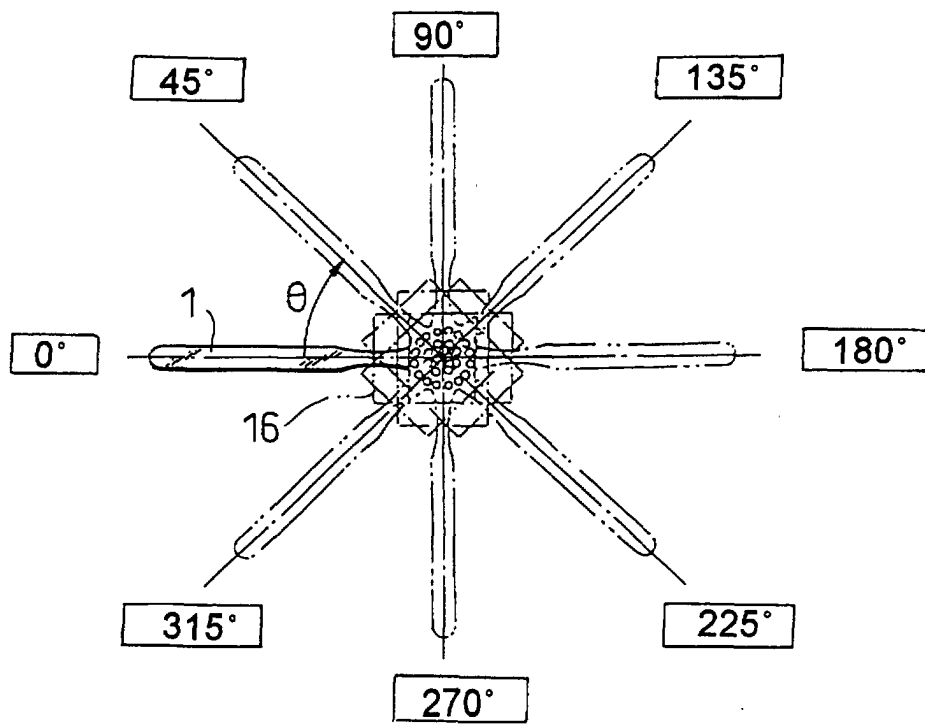


FIG. 5A

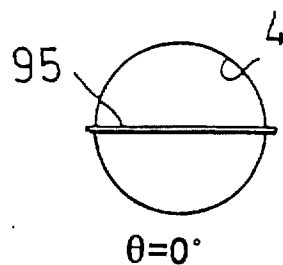


FIG. 5B

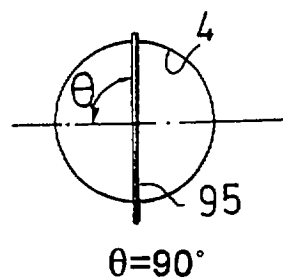


FIG. 5C

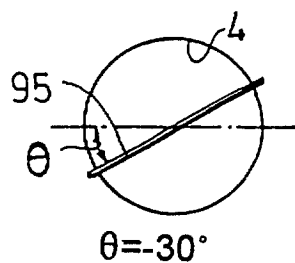


FIG. 5D

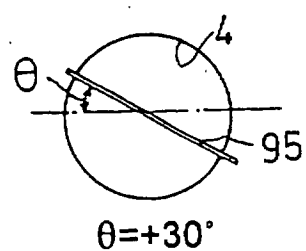


FIG. 5E

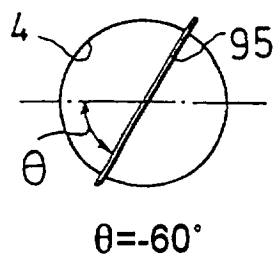


FIG. 5F

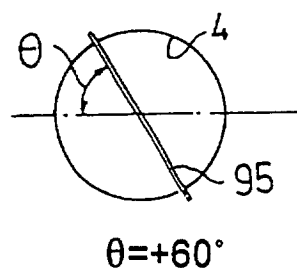


FIG. 5G

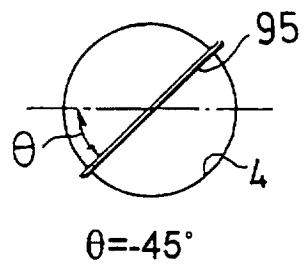


FIG. 5H

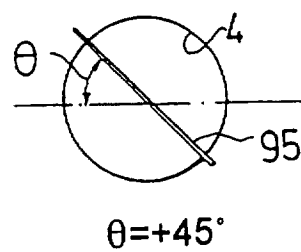


FIG. 6A

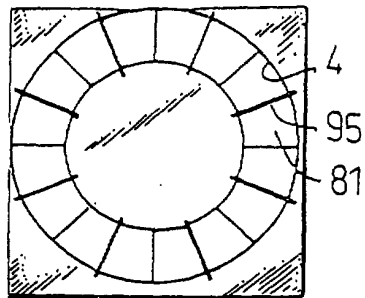


FIG. 6B

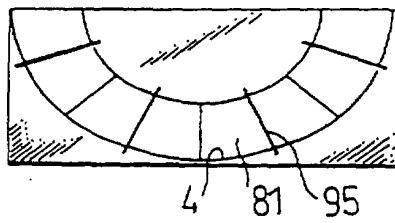


FIG. 6C

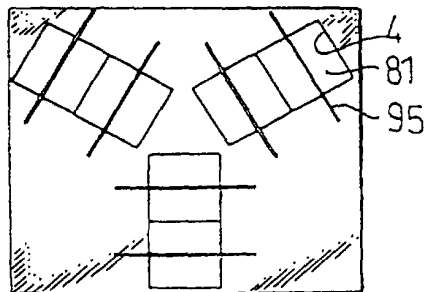


FIG. 6D

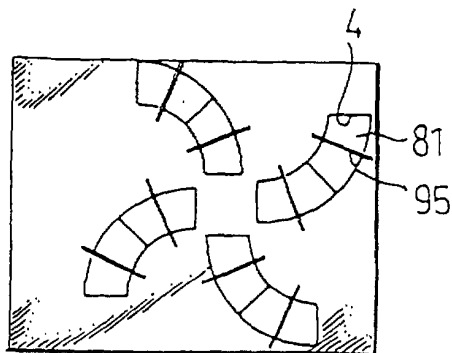


FIG. 7

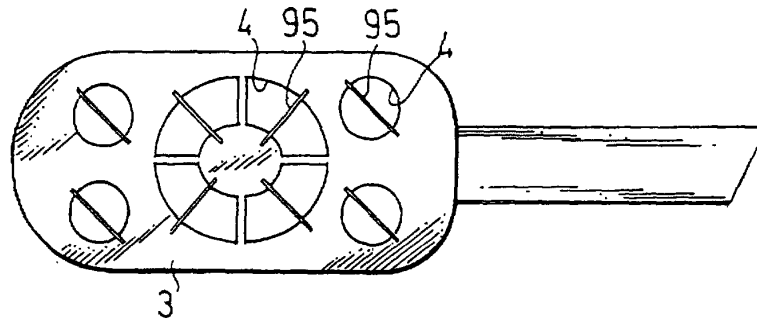


FIG. 8

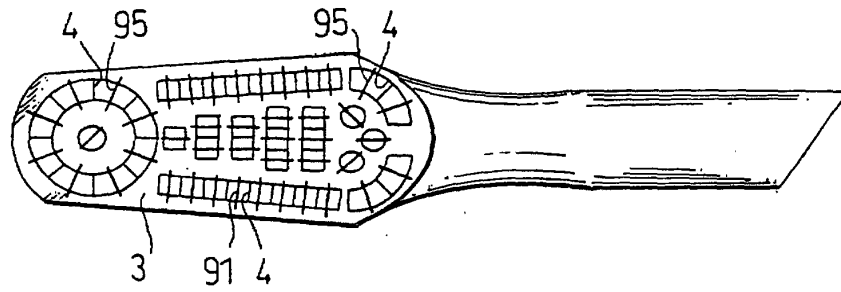


FIG. 9

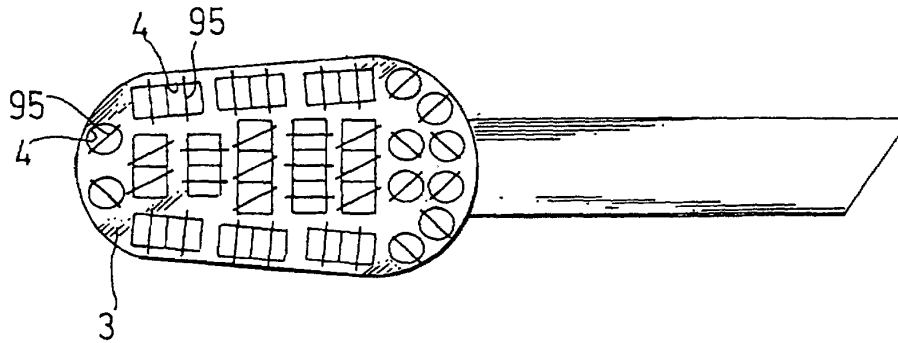


FIG. 10

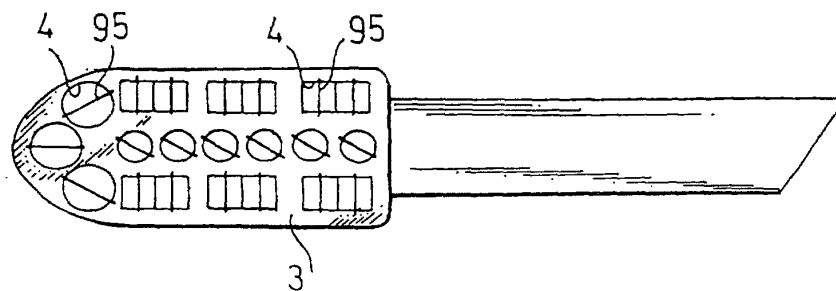


FIG. 11A

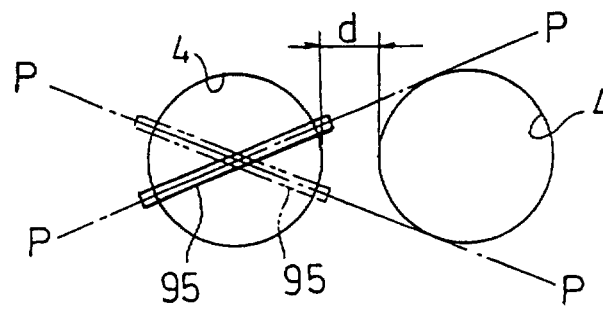


FIG. 11B

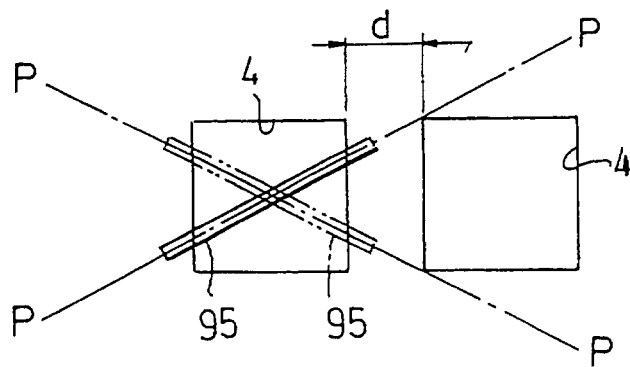


FIG. 12A

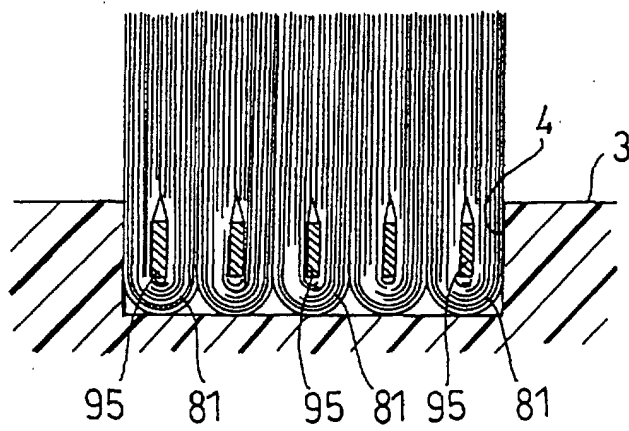


FIG. 12B

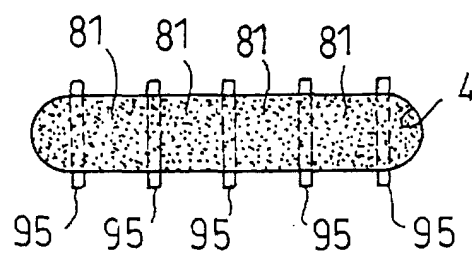


FIG. 13

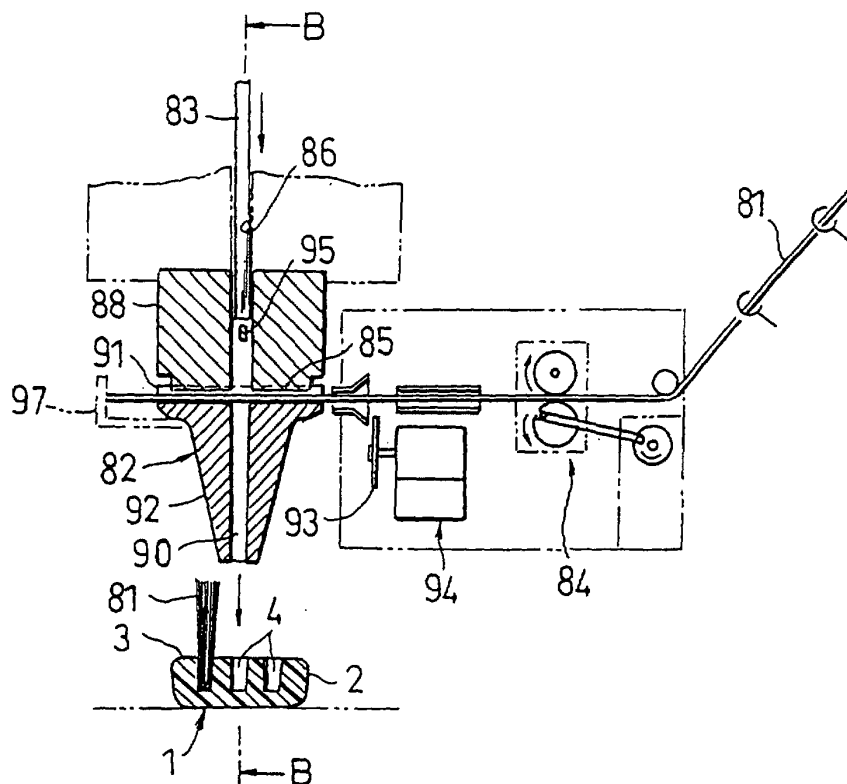


FIG. 14

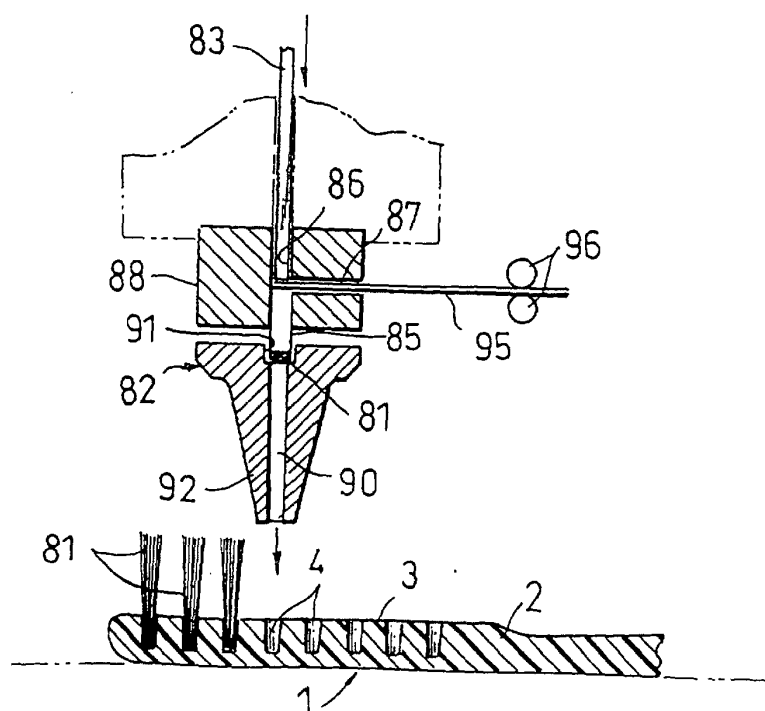


FIG. 15A

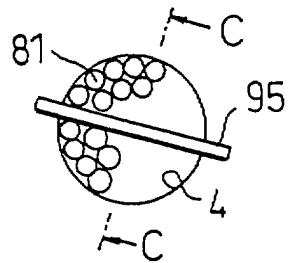


FIG. 15B

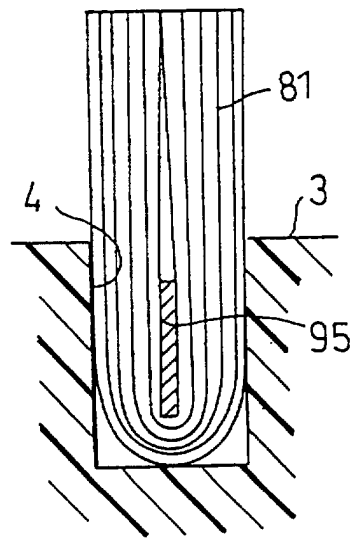


FIG. 16

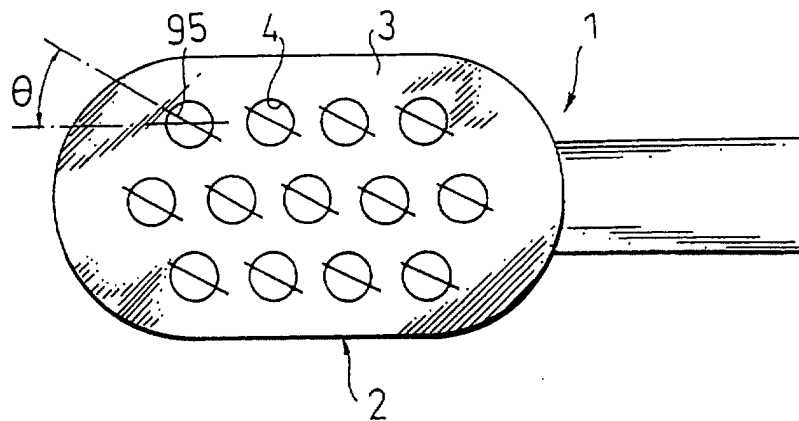


FIG. 17

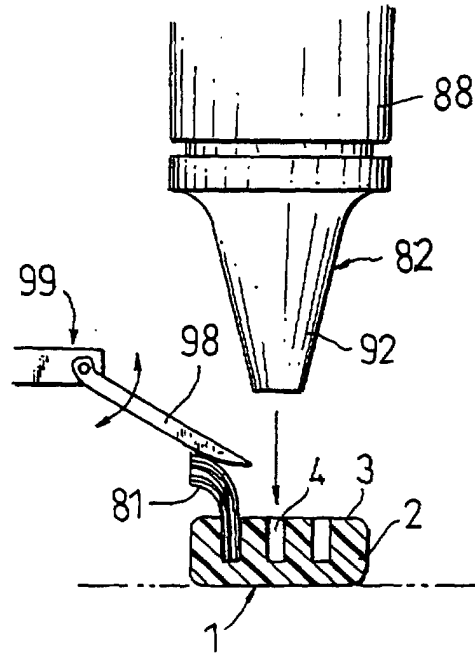


FIG. 18A

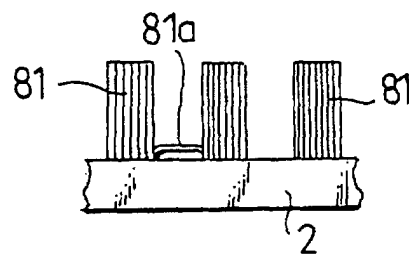
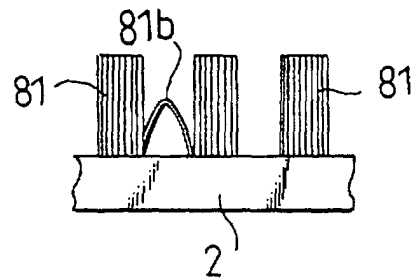


FIG. 18B



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP00/03073

A. CLASSIFICATION OF SUBJECT MATTER Int. Cl. ⁷ A46D3/06		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) Int. Cl. ⁷ A46B1/00-17/08, A46D1/00-9/06		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1996 Jitsuyo Shinan Toroku Koho 1996-2000 Kokai Jitsuyo Shinan Koho 1971-2000 Toroku Jitsuyo Shinan Koho 1994-2000		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) esp@cent A46B3/16, A46B9/04, A46D3/04, toothbrush PATENT FULL TEXT AND IMAGE DATABASE A46B3/16, A46B9/04, A46D3/04, toothbrush		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP, 11-113634, A (LION CORPORATION), 27 April, 1999 (27.04.99) (Family: none)	1-7
A	JP, 10-42957, A (LION CORPORATION), 17 February, 1998 (17.02.98) (Family: none)	1-7
A	JP, 5-38305, A (Yamato Esuron K.K.), 19 February, 1993 (19.02.93) (Family: none)	1-7
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 14 June, 2000 (14.06.00)		Date of mailing of the international search report 4 July 2000 (04.07.00)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)