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## EUROPEAN PATENT APPLICATION

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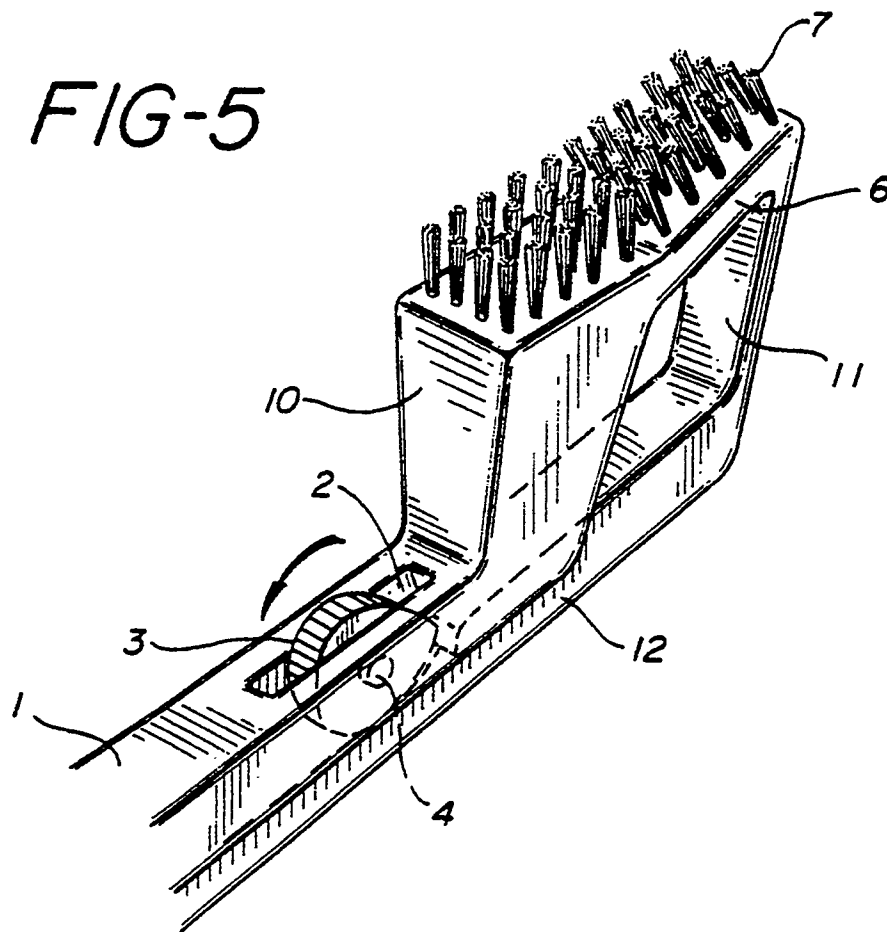
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(54) **Adjustable curvature toothbrush.**

(57) The present invention pertains to an adjustable curvature toothbrush which comprises (a) an elongated handle (1) having an aperture (2), (b) a cam (3) attached to the handle (1) within the aperture by means of a cam shaft (4), (c) a cam follower (12) which is engaged with, and follows, the cam (3), (d) a flexible brush head (6), (e) bristles (7) supported by the brush head (6), (f) a rigid neck (10) attached to a first end of the brush head (6) and to an end of the handle (1), and (g) a flexible neck (11) attached to a second end of the brush head (6) and to the cam follower (12), whereby the curvature of the brush head (6) can be adjusted by rotation of the cam (3). In another embodiment, the invention pertains to an adjustable curvature toothbrush wherein the cam (3) and cam follower (4) are replaced by a slidable button (17). In yet another embodiment, the invention pertains to an adjustable curvature toothbrush in the form of a compressible closed loop (26).

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FIG-5



This invention pertains to toothbrushes. More particularly, this invention pertains to adjustable curvature toothbrushes which comprise a flexible brush head which is adjustable to convex, concave, and straight configurations in order to conform the toothbrush to the curvature of human teeth.

The configuration of human teeth requires that the ideal bristle contour for toothbrushes for brushing the labial or outside surfaces of teeth be concave and that the ideal bristle contour for brushing the lingual or inside surfaces of teeth be convex. Conventional toothbrushes are generally of a fixed curvature or configuration or are adjustable into different configurations. Fixed configuration toothbrushes have limited effectiveness and cannot properly clean teeth and convertible toothbrushes are generally difficult to manipulate and are unreliable.

United States patent no.4,712,267, issued to Cheng, discloses a convertible toothbrush comprising an S-shaped elongated handle of shape-retaining material having curved end regions of opposite curvature, a flexible brush block containing bristles, and a means for mounting the flexible brush block on the handle for longitudinal movement along the length of the handle. The curved portions of the handle bend the flexible block and bristles into a concave or convex configuration which corresponds to the curved configuration of the handle.

United States patent no.4,694,844, issued to Berl et al., discloses a toothbrush comprising a handle and a hollow head supporting a plurality of tufts. The hollow head further comprises an elastically deformable element which urges the tufts toward a generally straight position. When pressure is applied to a tuft during the use of the toothbrush, the pressure causes the tips of the tufts to conform to the contours of a given group of teeth because the tufts are pushed into the hollow head to varying degrees against the restoring force of the elastically deformable element.

United States patent no.4,691,405, issued to Reed, discloses a toothbrush comprising a handle and a base at the end of the handle consisting of two tabs containing bristles. The tabs pivot relative to the base so that the bristles mounted on the tabs deflect in order to conform to the varying tooth surfaces.

United States patent no.4,524,478, issued to Ross, discloses a toothbrush consisting of two brush heads extending outwardly from a common elongated handle. The brush heads are connected to the handle by means of curved necks extending in parallel but opposing directions and at opposite and equal angles of forty-five degrees. Each brush head is designed to clean one-half of the teeth.

European Patent Application no. 86107868.1, to Sullit, discloses a toothbrush with two brush heads, one concave and one convex. The brush heads are either integral or slidable and are perpendicular at the opposite ends of their common handle. The brush

head with a concave-shaped bristle surface is longer while the brush head with a convex-shaped bristle surface is shorter.

United Kingdom patent application no. 8609437, to Ming, discloses a toothbrush having a brushing surface which is set at an angle to the plane of the handle and is inclined or curved in a convex shape, as viewed in transverse cross-section. The angle of the brushing surface conforms to the tooth-gum junction.

While the above toothbrushes provide brush heads with some degree of curvature, none of the above toothbrushes is entirely satisfactory. Fixed configuration toothbrushes have limited effectiveness and adjustable curvature toothbrushes are generally difficult to manipulate and are unreliable. Accordingly, it would be advantageous to provide an adjustable curvature toothbrush which can efficiently clean teeth and which is not awkward to use. The present invention provides such an improved adjustable curvature toothbrush.

The present invention pertains to an adjustable curvature toothbrush which comprises (a) an elongated handle having an aperture, (b) a cam attached to the handle within the aperture by means of a cam shaft, (c) a cam follower which is engaged with, and follows, the cam, (d) a flexible brush head, (e) bristles supported by the brush head, (f) a rigid neck attached to a first end of the brush head and to an end of the handle, and (g) a flexible neck attached to a second end of the brush head and to the cam follower, whereby the curvature of the brush head can be adjusted by rotation of the cam. In another embodiment, the invention pertains to an adjustable curvature toothbrush wherein the cam and cam follower are replaced by a slidable button. In yet another embodiment, the invention pertains to an adjustable curvature toothbrush in the form of a compressible closed loop.

FIGURES 1 through 4 show a first embodiment of an adjustable curvature toothbrush which has a flexible brush head, and bristles supported by the brush head, which is adjusted by means of a cam wheel and cam follower.

FIGURE 1 shows a profile of the toothbrush with the bristle surface in a concave configuration for brushing the labial surfaces of teeth.

FIGURE 2 shows a profile of the toothbrush with the bristle surface in a convex configuration for brushing the lingual surfaces of teeth.

FIGURE 3 shows a partial front view of the toothbrush with the bristle surface in a concave configuration.

FIGURE 4 shows a partial front view of the toothbrush with the bristle surface in a convex configuration.

FIGURES 5 and 6 show a second embodiment of an adjustable curvature toothbrush which has a flexible brush head, and bristles supported by the brush

head, which is adjusted by means of a cam wheel and cam follower.

FIGURE 5 shows a partial front view of the toothbrush with the bristle surface in a concave configuration. FIGURE 6 shows a partial front view of the toothbrush with the bristle surface in a convex configuration.

FIGURES 7 and 8 show a variation of the first embodiment of an adjustable curvature toothbrush which has a hinged brush head, and bristles supported by the brush head, which is adjusted by means of a cam wheel and cam follower.

FIGURE 7 shows a partial front view of the toothbrush with the bristle surface in a concave configuration.

FIGURE 8 shows a partial front view of the toothbrush with the bristle surface in a convex configuration.

FIGURES 9 and 10 show a variation of the second embodiment of an adjustable curvature toothbrush which has a hinged brush head, and bristles supported by the brush head, which is adjusted by means of a cam wheel and cam follower.

FIGURE 9 shows a partial front view of the toothbrush with the bristle surface in a concave configuration.

FIGURE 10 shows a partial front view of the toothbrush with the bristle surface in a convex configuration.

FIGURES 11 and 12 show a third embodiment of an adjustable curvature toothbrush which has a hinged brush head, and bristles supported by the brush head, which is adjusted by means of a slidable button.

FIGURE 11 shows a partial front view of the toothbrush with the bristle surface in a concave configuration.

FIGURE 12 shows a partial front view of the toothbrush with the bristle surface in a convex configuration.

FIGURES 13 and 14 show a fourth embodiment of an adjustable curvature toothbrush which has a hinged brush head, and bristles supported by the brush head, which is adjusted by means of a slidable button.

FIGURE 13 shows a partial front view of the toothbrush with the bristle surface in a concave configuration.

FIGURE 14 shows a partial front view of the toothbrush with the bristle surface in a convex configuration.

FIGURES 15 and 16 show a fifth embodiment of an adjustable curvature toothbrush in the form of a compressible closed loop. FIGURE 15 shows a partial front view of the toothbrush with the bristle surface in a concave configuration.

FIGURE 16 shows a partial front view of the toothbrush with the bristle surface in a convex configuration.

ration.

To provide a better understanding of the preferred embodiments, applicant will describe the invention by reference to the above described figures in which like numerals refer to like parts of the invention throughout the several figures. The details shown are for the purpose of illustrating the preferred embodiments of the present invention and no attempt is made to show every structural detail of the invention. The description taken with the drawings will make apparent to those skilled in the art how the several forms of the invention may be embodied in practice.

FIGURES 1 through 4 show a first embodiment of an adjustable curvature toothbrush which comprises an elongated handle 1 having an aperture 2; a cam 3 attached to the handle within the aperture by means of a cam shaft 4; a cam follower which is engaged with, and follows, the cam; a flexible brush head 6; bristles 7 supported by the brush head; a rigid neck attached to a first end of the brush head and to an end of the handle; and a flexible neck 9 attached to a second end of the brush head and to the cam follower 5. The curvature of the brush head can be adjusted by rotation of the cam.

In this first embodiment, the first end of the brush head attached to rigid neck 8 is an end remote to cam 3 and the second end of the brush head attached to flexible neck 9, which is attached to cam follower 5, is an end adjacent to the cam. When the cam follower is urged toward the cam by rotation of the cam, the cam follower drives the flexible neck to adjust the brush head 6 into a concave configuration. When the cam follower is urged away from the cam, the cam follower drives the flexible neck to adjust the brush head into a convex configuration.

FIGURES 5 and 6 show a second embodiment of an adjustable curvature toothbrush. In this second embodiment, the first end of the brush head attached to rigid neck 10 is an end adjacent to cam 3 and the second end of the brush head attached to flexible neck 11, which is attached to cam follower 12, is an end remote to the cam. When the cam follower is urged toward the cam by rotation of the cam, the cam follower drives the flexible neck to adjust the brush head into a convex configuration. When the cam follower is urged away from the cam, the cam follower drives the flexible neck to adjust the brush head into a concave configuration.

In the first and second embodiments, the flexible brush head 6 is made of a flexible material. In variations of the first and second embodiments set out below, the flexible brush head 13 comprises a centrally located hinge 14, perpendicular to a longitudinal axis of the brush head, which supplies flexibility to the brush head. The brush head with a centrally located hinge may be made of a flexible or inflexible material.

FIGURES 7 and 8 show a variation of the first embodiment of an adjustable curvature toothbrush. In

this embodiment, brush head 13 has a centrally located hinge 14, perpendicular to the longitudinal axis of the brush head. Rigid neck 8 is remote to the cam and the flexible neck 9, which is attached to cam follower 5, is adjacent to the cam. When the cam follower is urged toward the cam by rotation of the cam, the cam follower drives the flexible neck to adjust the brush head into a concave configuration. When the cam follower is urged away from the cam, the cam follower drives the flexible neck to adjust the brush head into a convex configuration.

FIGURES 9 and 10 show a variation of the second embodiment of an adjustable curvature toothbrush. In this embodiment, brush head 13 has a centrally located hinge 14, perpendicular to the longitudinal axis of the brush head. Rigid neck 10 is adjacent to the cam and flexible neck 11, which is attached to cam follower 12, is remote to the cam. When the cam follower is urged toward the cam by rotation of the cam, the cam follower drives the flexible neck to adjust the brush head into a convex configuration. When the cam follower is urged away from the cam, the cam follower drives the flexible neck to adjust the brush head into a concave configuration.

In the variations of the first and second embodiments, the centrally located hinge in the brush head may be any conventional hinge made of a material such as metal or plastic. In a preferred embodiment, the hinge is made of a plastic material thinner than the material used in the remainder of the brush head.

In the first and second embodiments, cam followers 5 and 12 may optionally contain one or more detents, whereby the cam can be engaged with the detent in the cam follower to lock the brush head into a desired position.

FIGURES 11 and 12 show a third embodiment of an adjustable curvature toothbrush which comprises an elongated handle 15 having an elongated aperture 16; a button 17 slideably engaged within the elongated aperture of the handle; a brush head 18 having a centrally located hinge 19 perpendicular to the longitudinal axis of the brush head; bristles 20 supported by the brush head; a rigid neck 21 attached to a first end of the brush head and to an end of the handle; and a flexible neck 22 attached to a second end of the brush head and to the slidable button. The curvature of the brush head can be adjusted by sliding movement of the button.

In this third embodiment, rigid neck 21 is adjacent to slidable button 17 and flexible neck 22 is remote to the slidable button. Flexible neck 22 is attached to the slidable button, which is inserted through, and is slideably engaged within, the aperture of the handle. When the button is slideably moved within the aperture of the handle toward brush head 18, the button drives the flexible neck to adjust the brush head into a concave configuration. When the button is slideably moved away from the brush head, the button drives

the flexible neck to adjust the brush head into a convex configuration.

FIGURES 13 and 14 show a fourth embodiment of an adjustable curvature toothbrush. In this fourth embodiment, rigid neck 23 is remote to slidable button 25 and flexible neck 24 is adjacent to the slidable button. Flexible neck 24 is attached to the slidable button, which is inserted through, and is slideably engaged within, the aperture of the handle. When the button is slideably moved within the aperture of the handle toward the brush head, the button drives the flexible neck to adjust the brush head into a concave configuration. When the button is slideably moved away from the brush head, the button drives the flexible neck to adjust the brush head into a convex configuration.

In a variation of the third and fourth embodiments of an adjustable curvature toothbrush (not shown), the flexible brush head does not contain a hinge but rather is made of a flexible material.

FIGURES 15 and 16 show a fifth embodiment of an adjustable curvature toothbrush in the form of a compressible closed loop which comprises a compressible handle 26 in the form of a closed loop; a flexible brush head 27 integral with the closed loop; bristles 28 supported by the brush head; a rigid neck 29 attached to a first end of the brush head and to a first end of the handle; and a flexible neck 30 attached to a second end of the brush head and to a second end of the handle.

The curvature of the brush head can be adjusted by compression of the closed loop handle. When handle 26 is in a rest or normal position (the handle is not compressed), brush head 27 is in a concave configuration.

When the handle is compressed, the handle drives flexible neck 30 to adjust the brush head into a convex configuration.

In a variation of the fifth embodiment of an adjustable curvature toothbrush (not shown), the flexible brush head comprises a centrally located hinge, perpendicular to a longitudinal axis of the brush head.

The handle, brush heads, and necks of the adjustable curvature toothbrushes of the present invention can be made of any flexible or soft shape retaining material known to be useful in the art or conceived to be useful by one skilled in the art, such as plastic. The material comprising the handles, brush heads, and necks preferably should be the same material and when possible, the material should be integrally molded to form one piece, such as with conventional toothbrush handles, brush heads, and necks. All edges and corners should be round and smooth.

The flexible brush head in the present invention maybe made of a flexible material such as plastic or may comprise a centrally located hinge, perpendicular to a longitudinal axis of the brush head. The hinged brush head may be made of a flexible or inflexible ma-

terial such as a metal or a plastic. In a preferred embodiment, the hinge is made of a plastic material thinner than the material used in the remainder of the brush head.

The bristles can be mounted on the brush head in a plurality of tufts set in rows on the brush head or in any other manner known in the art or conceived by one skilled in the art. The bristles should preferably be nylon and have rounded ends.

The apparatus and materials useful in accordance with the manufacture of the present invention comprises apparatus well known in the toothbrush manufacturing arts, and therefore the selection of the specific apparatus will be apparent to the artisan.

The present invention is summarised by the following clauses, numbered 1-14 and is defined by the claims appended thereafter.

1. An adjustable curvature toothbrush which comprises:

- (a) an elongated handle having an aperture;
- (b) a cam attached to the handle within the aperture by means of a cam shaft;
- (c) a cam follower which is engaged with, and follows, the cam;
- (d) a flexible brush head;
- (e) bristles supported by the brush head;
- (f) a rigid neck attached to a first end of the brush head and to an end of the handle; and
- (g) a flexible neck attached to a second end of the brush head and to the cam follower;

whereby the curvature of the brush head can be adjusted by rotation of the cam.

2. The adjustable curvature toothbrush according to 1, wherein the first end of the brush head attached to the rigid neck is an end remote to the cam and the second end of the brush head attached to the flexible neck is an end adjacent to the cam, whereby the curvature of the brush head is concave when the cam follower is urged toward the cam and the curvature of the brush head is convex when the cam follower is urged away from the cam.

3. The adjustable curvature toothbrush according to 1, wherein the first end of the brush head attached to the rigid neck is an end adjacent to the cam and the second end of the brush head attached to the flexible neck is an end remote to the cam, whereby the curvature of the brush head is concave when the cam follower is urged away from the cam and the curvature of the brush head is convex when the cam follower is urged toward the cam.

4. The adjustable curvature toothbrush according to 1, wherein the cam follower further comprises a detent, whereby the cam can be engaged with the detent in the cam follower to lock the brush head in a desired position.

5. The adjustable curvature toothbrush according

to 1, wherein the flexible brush head is made of a flexible material.

6. The adjustable curvature toothbrush according to 1, wherein the flexible brush head comprises a centrally located hinge perpendicular to a longitudinal axis of the brush head.

7. An adjustable curvature toothbrush which comprises:

- (a) an elongated handle having an elongated aperture;
- (b) a button slideably engaged within the elongated aperture of the handle;
- (c) a flexible brush head;
- (d) bristles supported by the brush head;
- (e) a rigid neck attached to a first end of the brush head and to an end of the handle; and
- (f) a flexible neck attached to a second end of the brush head and to the slidable button;

whereby the curvature of the brush head can be adjusted by sliding movement of the button.

8. The adjustable curvature toothbrush according to 7, wherein the first end of the brush head attached to the rigid neck is an end adjacent to the slidable button and the second end of the brush head attached to the flexible neck is an end remote to the slidable button, whereby the curvature of the brush head is concave when the button is slideably moved toward the brush head and the curvature of the brush head is convex when the button is slideably moved away from the brush head.

9. The adjustable curvature toothbrush according to 7, wherein the first end of the brush head attached to the rigid neck is an end remote to the button and the second end of the brush head attached to the flexible neck is an end adjacent to the button, whereby the curvature of the brush head is concave when the button is slideably moved toward the brush head and the curvature of the brush head is convex when the button is slideably moved away from the brush head.

10. The adjustable curvature toothbrush according to 7, wherein the flexible brush head is made of a flexible material.

11. The adjustable curvature toothbrush according to 7, wherein the flexible brush head comprises a centrally located hinge perpendicular to a longitudinal axis of the brush head.

12. An adjustable curvature toothbrush in the form of a compressible closed loop which comprises:

- (a) a compressible handle in the form of a closed loop;
- (b) a flexible brush head integral with the closed loop;
- (c) bristles supported by the brush head;
- (d) a rigid neck attached to a first end of the

brush head and to a first end of the handle;  
and

(e) a flexible neck attached to a second end of the brush head and to a second end of the handle;

whereby the curvature of the brush head can be adjusted by compression of the closed loop handle.

13. The adjustable curvature toothbrush according to 12, wherein the flexible brush head is made of a flexible material.

14. The adjustable curvature toothbrush according to 12, wherein the flexible brush head comprises a centrally located hinge perpendicular to a longitudinal axis of the brush head.

### Claims

1. An adjustable curvature toothbrush which comprises:

(a) an elongated handle having an aperture;

(b) a cam attached to the handle within the aperture by means of a cam shaft;

(c) a cam follower which is engaged with, and follows, the cam;

(d) a flexible brush head;

(e) bristles supported by the brush head;

(f) a rigid neck attached to a first end of the brush head and to an end of the handle; and

(g) a flexible neck attached to a second end of the brush head and to the cam follower;

whereby the curvature of the brush head can be adjusted by rotation of the cam.

2. The adjustable curvature toothbrush according to claim 1, wherein the first end of the brush head attached to the rigid neck is an end remote to the cam and the second end of the brush head attached to the flexible neck is an end adjacent to the cam, whereby the curvature of the brush head is concave when the cam follower is urged toward the cam and the curvature of the brush head is convex when the cam follower is urged away from the cam.

3. The adjustable curvature toothbrush according to claim 1, wherein the first end of the brush head attached to the rigid neck is an end adjacent to the cam and the second end of the brush head attached to the flexible neck is an end remote to the cam, whereby the curvature of the brush head is concave when the cam follower is urged away from the cam and the curvature of the brush head is convex when the cam follower is urged toward the cam.

4. The adjustable curvature toothbrush according to

claim 1, wherein the cam follower further comprises a detent, whereby the cam can be engaged with the detent in the cam follower to lock the brush head in a desired position.

5. An adjustable curvature toothbrush which comprises:

(a) an elongated handle having an elongated aperture;

(b) a button slideably engaged within the elongated aperture of the handle;

(c) a flexible brush head;

(d) bristles supported by the brush head;

(e) a rigid neck attached to a first end of the brush head and to an end of the handle; and

(f) a flexible neck attached to a second end of the brush head and to the slidable button;

whereby the curvature of the brush head can be adjusted by sliding movement of the button.

6. The adjustable curvature toothbrush according to claim 5, wherein the first end of the brush head attached to the rigid neck is an end adjacent to the slidable button and the second end of the brush head attached to the flexible neck is an end remote to the slidable button, whereby the curvature of the brush head is concave when the button is slideably moved toward the brush head and the curvature of the brush head is convex when the button is slideably moved away from the brush head.

7. The adjustable curvature toothbrush according to claim 5, wherein the first end of the brush head attached to the rigid neck is an end remote to the button and the second end of the brush head attached to the flexible neck is an end adjacent to the button, whereby the curvature of the brush head is concave when the button is slideably moved toward the brush head and the curvature of the brush head is convex when the button is slideably moved away from the brush head.

8. An adjustable curvature toothbrush in the form of a compressible closed loop which comprises:

(a) a compressible handle in the form of a closed loop;

(b) a flexible brush head integral with the closed loop;

(c) bristles supported by the brush head;

(d) a rigid neck attached to a first end of the brush head and to a first end of the handle; and

(e) a flexible neck attached to a second end of the brush head and to a second end of the handle;

whereby the curvature of the brush

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head can be adjusted by compression of the closed loop handle.

- 9.** The adjustable curvature toothbrush according to any preceding claim, wherein the flexible brush head is made of a flexible material. 5
- 10.** The adjustable curvature toothbrush according to any preceding claim, wherein the flexible brush head comprises a centrally located hinge perpendicular to a longitudinal axis of the brush head. 10

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FIG-1

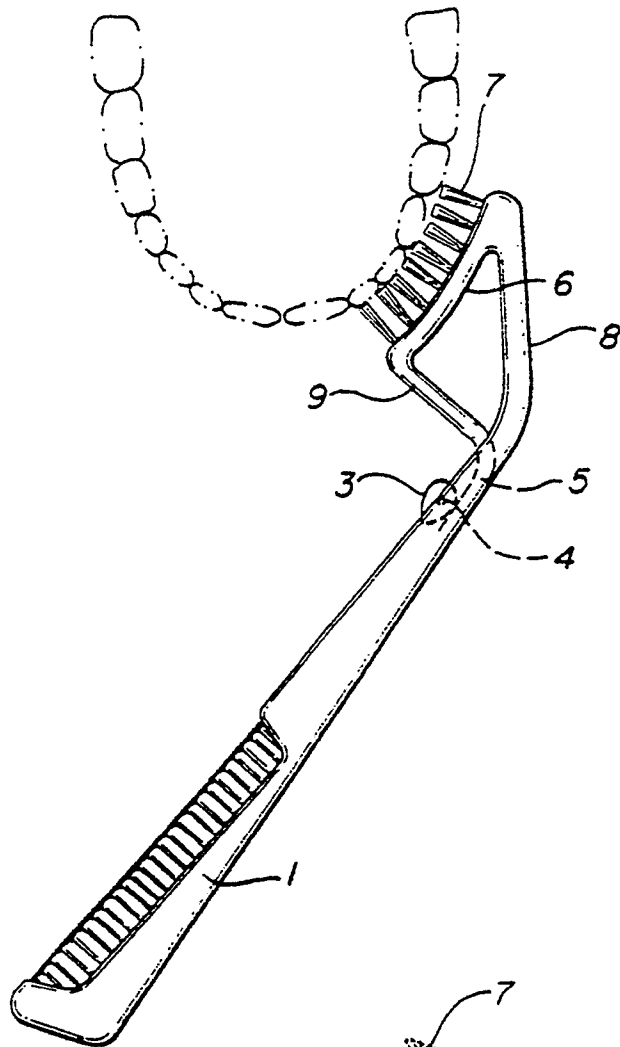


FIG-2

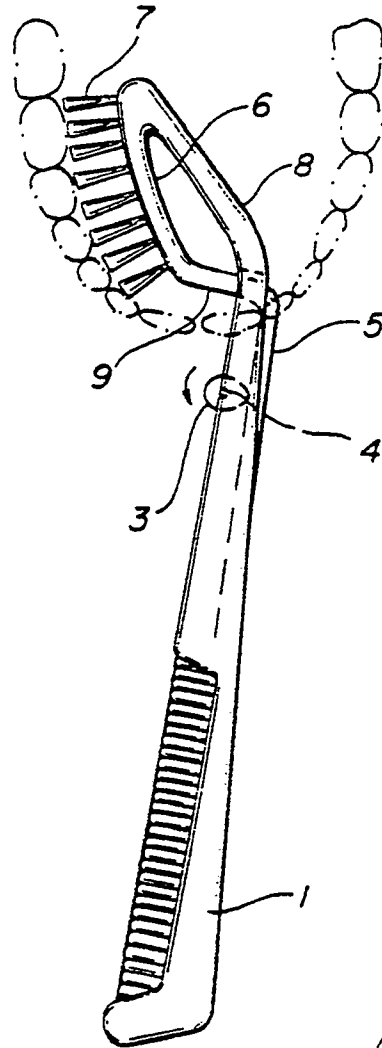


FIG-3

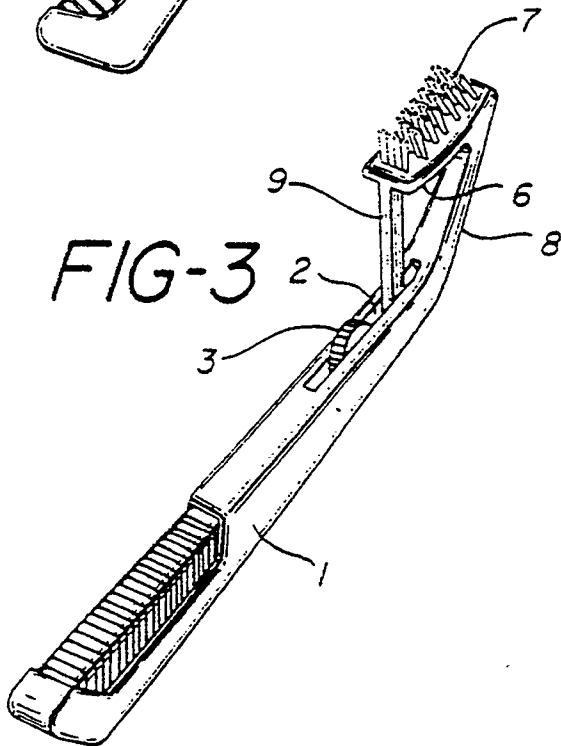


FIG-4

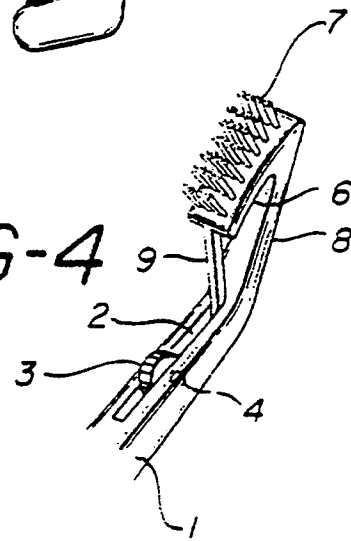


FIG-5

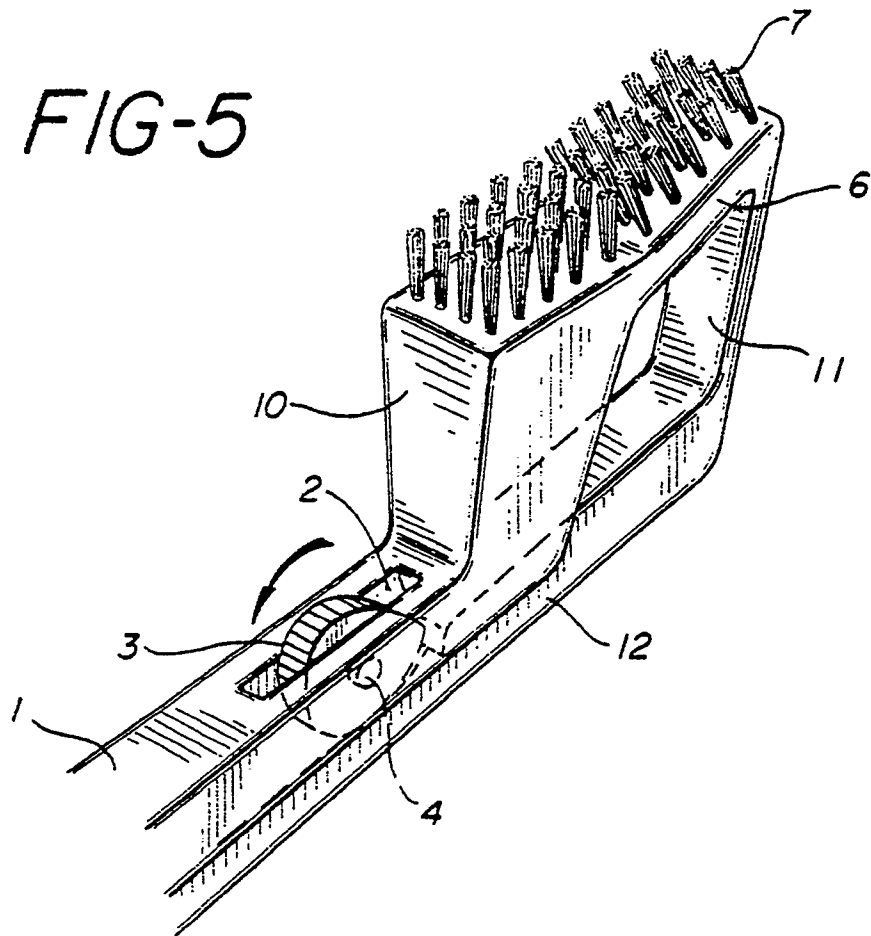


FIG-6

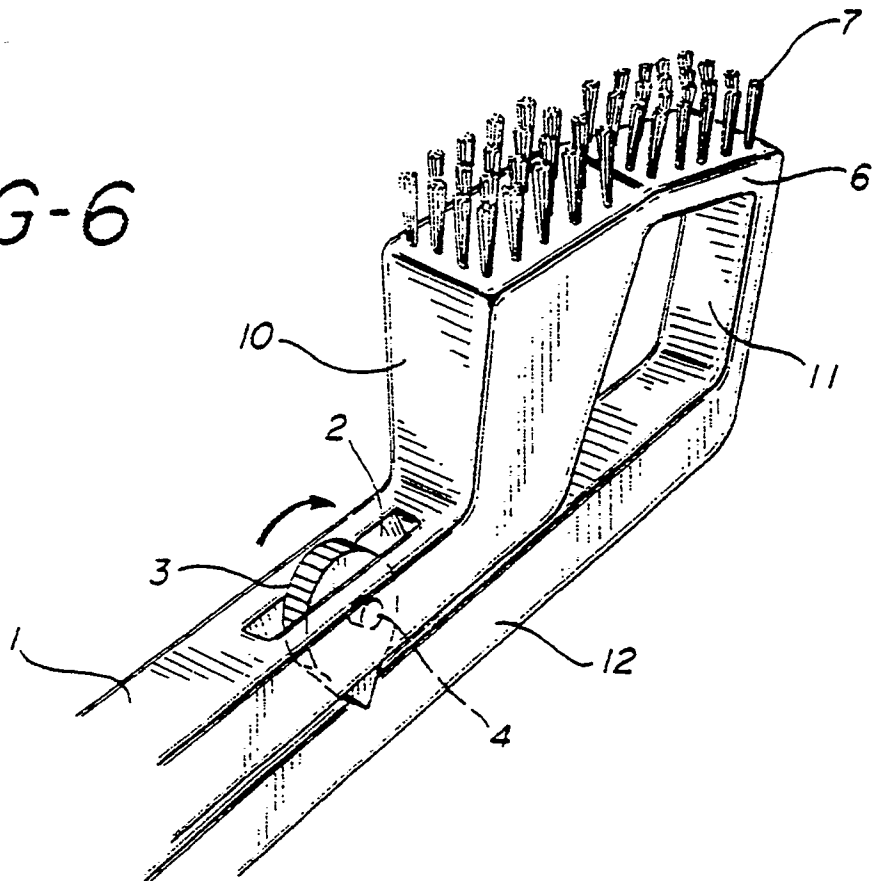


FIG-7

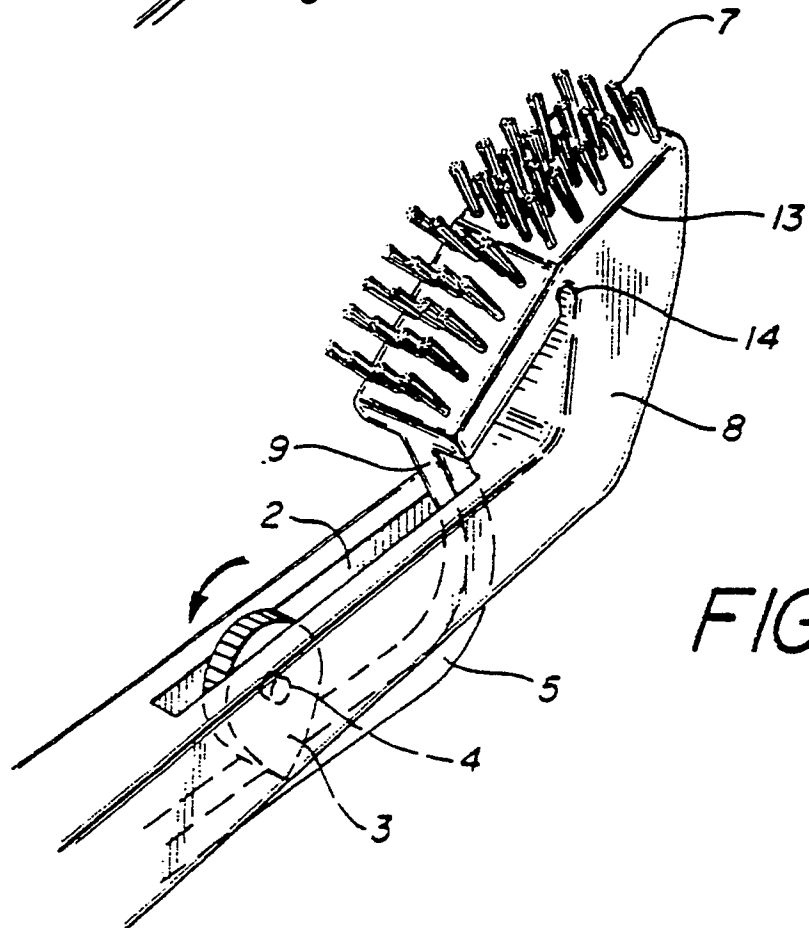
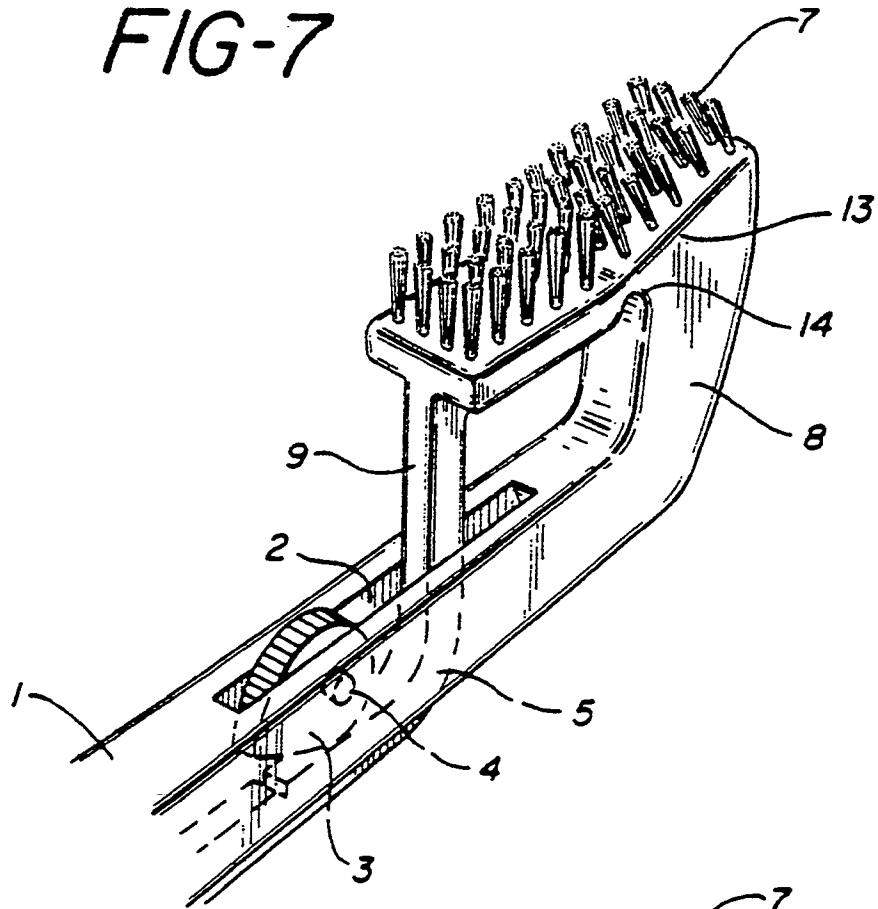


FIG-8

FIG-9

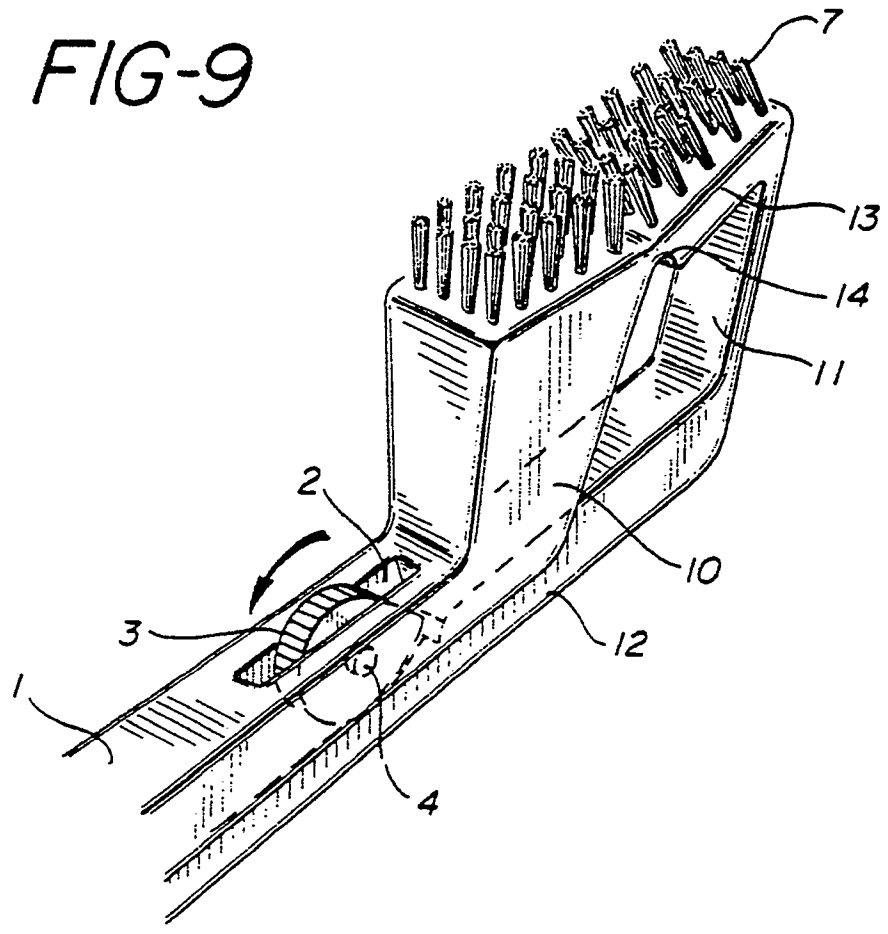


FIG-10

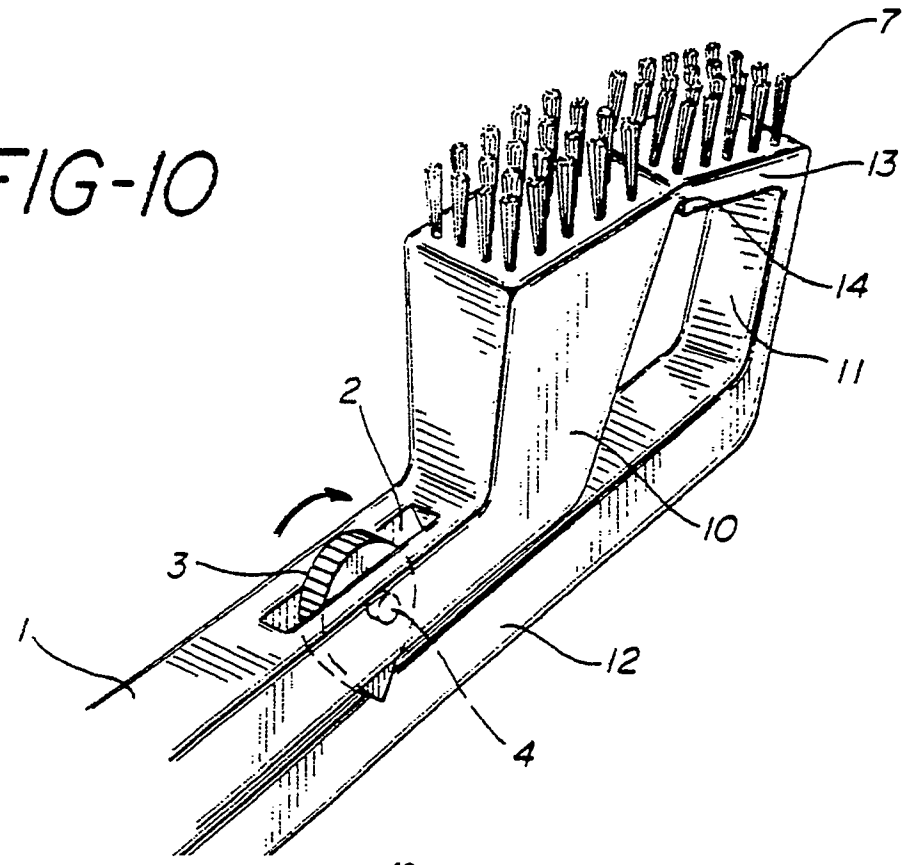


FIG-11

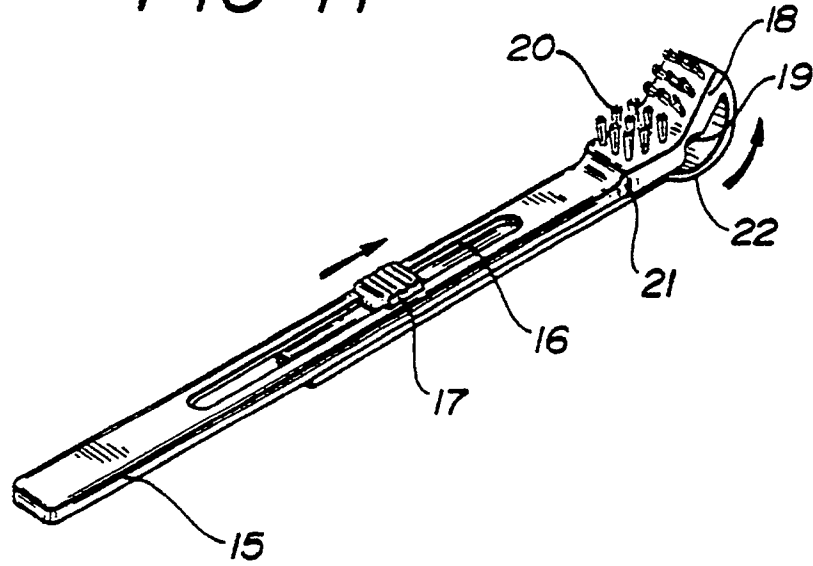


FIG-12

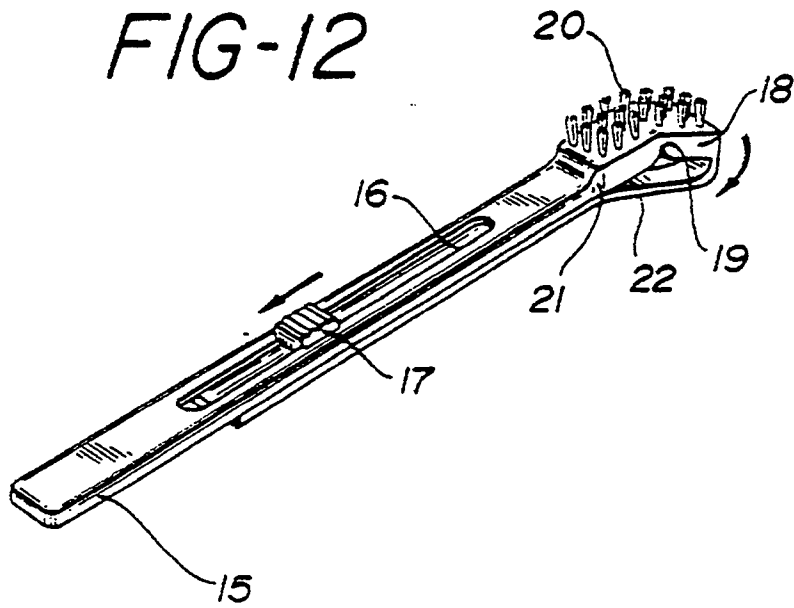


FIG-13

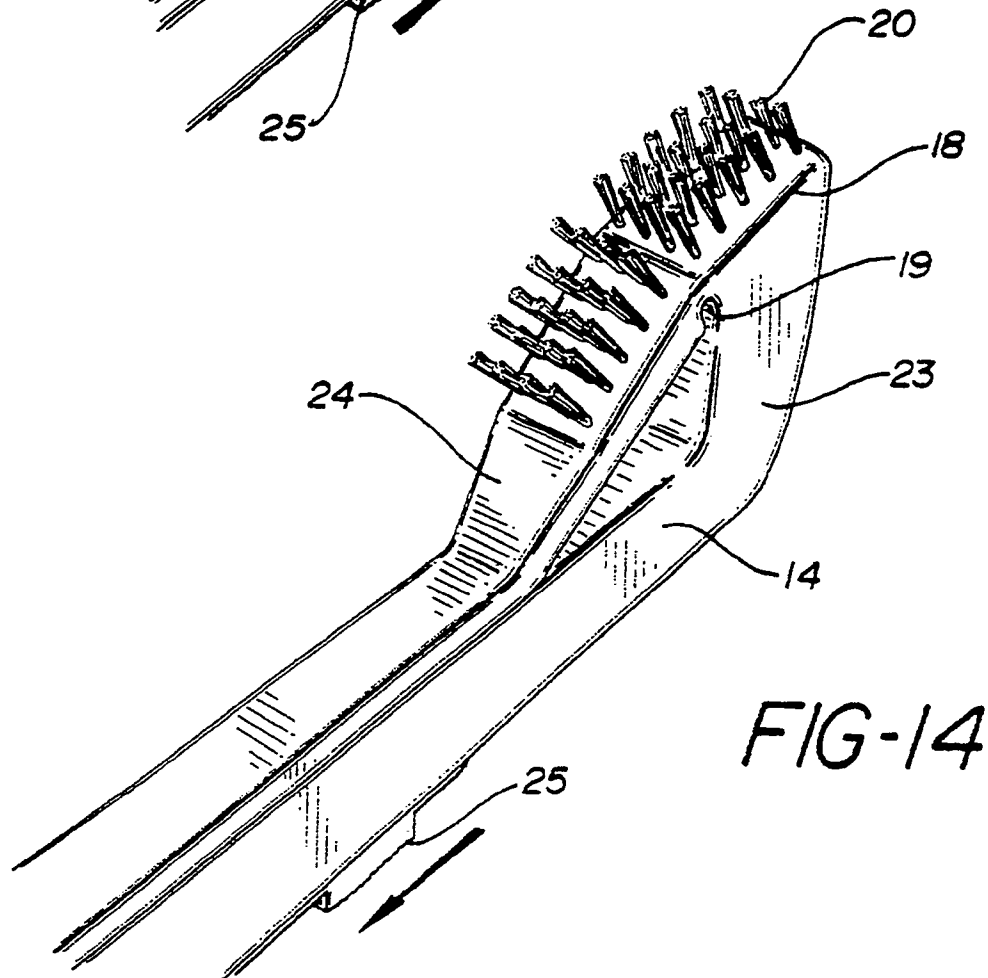
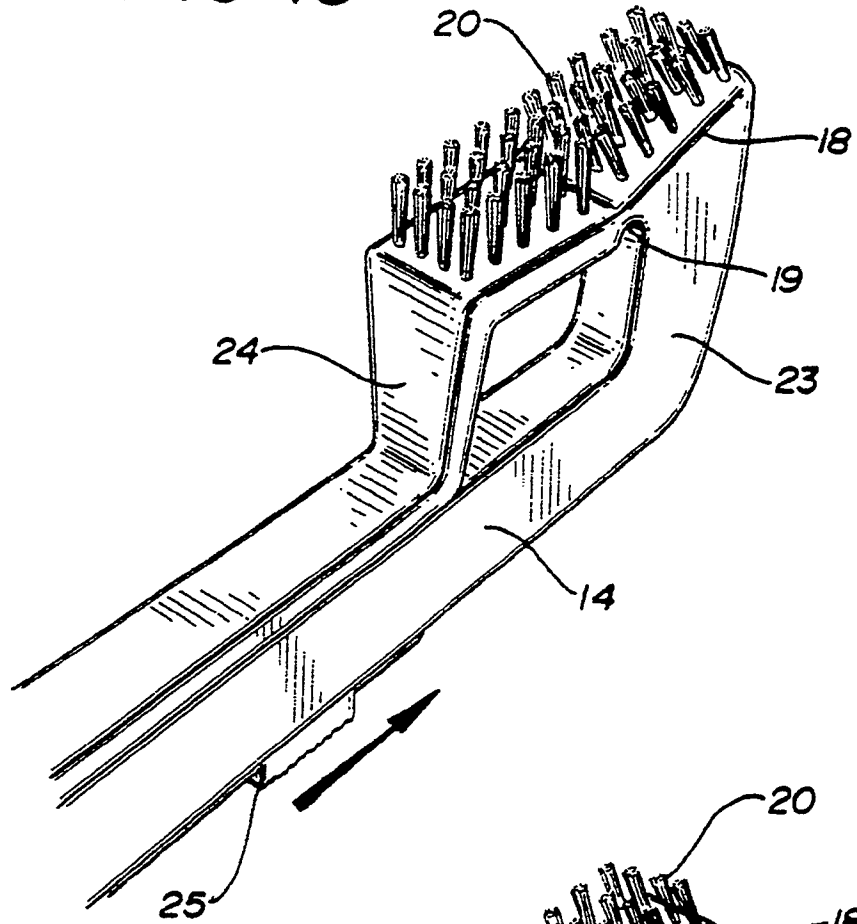


FIG-14

FIG-15

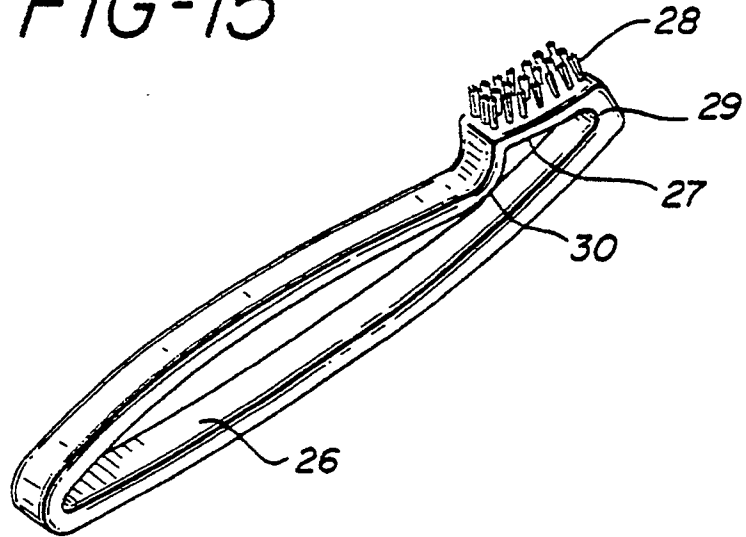
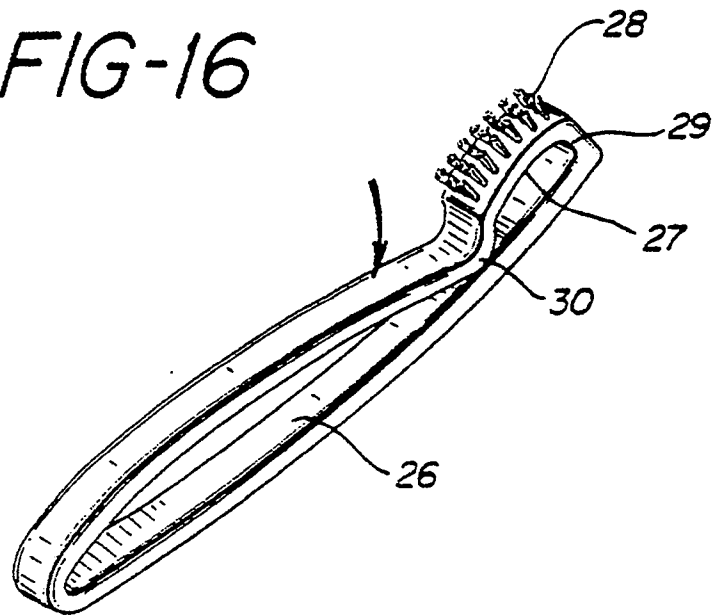


FIG-16





European Patent  
Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 81 0293

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-2111880 (WATERS) * page 1, column 1, line 54 - page 1, column 2, line 60; figures 1-11 * ---	1, 5, 8	A46B7/02
A	DE-C-283892 (VOIGT) * claim 1; figures 1-3 * ---	1, 5, 8	
A	DE-U-8705474 (HARNISCHMACHER) * page 4, paragraph 3; figures 1-3 * ---	1, 5, 8	
A	EP-A-0339350 (BLENDAX) * claims 1-5; figures 1-6 * -----	8	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			A46B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 01 AUGUST 1991	Examiner ERNST R.T.
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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