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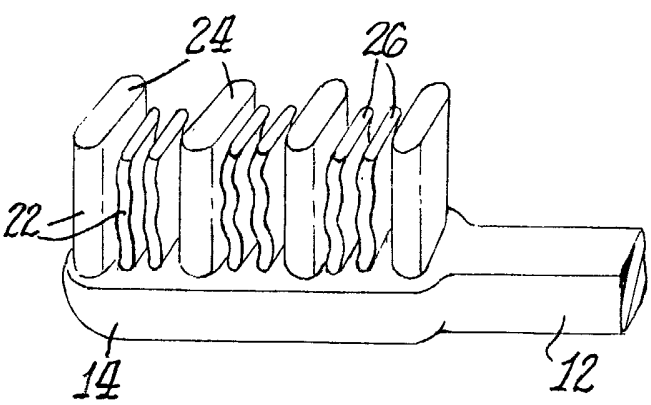
(54) Title: TOOTHBRUSH



(57) Abstract: A toothbrush includes a head having multiple cleaning elements. One set of the cleaning elements is longer than the other and relatively rigid. That set alternates with a shorter, springier set of cleaning elements. The flexibility of the shorter springier cleaning elements facilitates penetration of the longer cleaning elements into the interproximal area of the user's teeth.

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TOOTHBRUSH

Background of the Invention

The present invention is directed to a toothbrush, either manual or powered, which includes a handle and a head. Cleaning elements are mounted to the head such as tufts of bristles. When toothpaste is applied to the cleaning elements the user inserts the head into the mouth and brushes the teeth in a known manner.

The head of a conventional toothbrush usually has a flat or slightly altered surface to which cleaning elements are attached. Usually the cleaning elements are strands of plastic material(s) formed into tufts, bundles or other groupings. The strands are attached to the head either before or after forming the toothbrush. Cleaning elements should be arranged in the head so that all areas of the teeth are cleansed, particularly the interproximal spaces.

One approach to cleaning of tooth surfaces is disclosed in United States Patent No. 4,519,111 issued to Paolo Cavazza on May 28, 1985. This patent discloses a toothbrush where dual sets of cleaning elements are used. One set increases in height the further they get from the distal end of the toothbrush and the second set is the same height across the length of the toothbrush head (column 1, lines 27-33).

Another approach to tooth cleansing using cleaning elements of varying height is described in United States Patent No. 5,896,614 issued April 27, 1999 to Flewitt. This patent discloses rows of strips or alternating rows of strips and bristles running perpendicular to the longitudinal axis of the toothbrush. The longitudinal profile of the alternating rows may be flat or undulating. The transverse profile may be concave, "V" or "U" shaped (Column 1, lines 53-66). In one embodiment, the greater dimension of the strips is aligned parallel to the longitudinal axis of the toothbrush (column 2, lines 32-40, Figs 5-7); in another embodiment perpendicular to the longitudinal axis (Figs. 1-4). According to this patent, the use of the flatter (thin bristle) strip material wipes the tooth surfaces (column 3, lines 63-65).

United States Patent No. 5,341,537 issued August 30, 1994 and assigned to the assignee of the instant application, discloses an arrangement of bristles designed to improve removal of plaque from teeth. Three groups of cleaning elements are disclosed. The first is a relatively wide set of elements arranged in rows perpendicular to the longitudinal axis of the toothbrush. This group is generally shorter than the other groups of cleaning elements. The second group is also aligned with the first group in rows but with the outboard tufts of cleaning elements slanted toward the outside periphery of the toothbrush head. The third

group of cleaning elements is tilted laterally (about 30E) towards the outside of the toothbrush head and tilted to a lesser degree to the distal and/or proximal end of the toothbrush head (column 3, lines 25-56). This angulation of some bristles assists in sweeping plaque from the teeth at the gumline and from in-between teeth (column 5, lines 10-16).

Summary of the Invention

This invention addresses the problem of getting the cleansing action of toothbrush bristles into the interproximal areas of the teeth. A problem common to many prior art toothbrushes is that the stiffness of some bristles keeps other bristles away from the teeth. Thus, in a typical brush, the bristles readily cleanse the outer surfaces of the teeth but few bristles reach the areas between teeth, i.e., the interproximal areas.

This invention solves this problem by using alternating sets of cleaning elements or bristles. One set is longer than the other and has relatively rigid bristles that can reach into the interproximal areas. The other set comprises shorter, springier bristles that easily compress under load.

Preferably, the first set of more rigid bristles are spaced from each other a distance that approximates the average width of a tooth so that they are better positioned to fit into the areas between the teeth. The sets of shorter springier bristles are located in

the areas between the sets of longer rigid bristles. The shorter bristles are preferably crimped or otherwise constructed to permit ready compression when the user applies pressure on the toothbrush. As the shorter, springier bristles compress under that pressure, the longer rigid bristles will extend further into the interproximal areas. This combination of bristle types facilitates cleansing of all portions of the teeth.

The Drawings:

Figure 1 is a fragmental perspective view of the manual toothbrush head of this invention having a set of long, relatively rigid bristles alternating with shorter, springer bristles;

Figure 2 is a side elevational view of Figure 1.

Figure 3 is a top plan view of Figure 1.

Figures 4-6 are side elevational views showing alternative configurations of long bristles.

Figure 7 is a top plan view of a power toothbrush which includes the bristle arrangements of Figures 1-4.

Figure 8 illustrates the bristles of the toothbrush of this invention and their contact with teeth of a user of the toothbrush.

Detailed Description

Figures 1-4 illustrate a manual toothbrush 10 in accordance with this invention. As shown therein toothbrush 10 includes a handle 12 and a head 14. Handle 12 may include a suitable grip pad made of an elastomeric material. The invention, however, is primarily directed to the arrangement of cleaning elements relative to head 14. As shown in Figures 1-4 head 14 has a base portion 18 with an upper surface 20 which forms the base for inserting cleaning elements 22. As illustrated in these Figures, one set of cleaning elements 24 is longitudinally aligned in rows and is relatively rigid relative to a second set of cleaning elements 26 which is shorter and springier.

The invention is particularly suitable for cleaning elements in the form of strands or bristles attached via anchor free tufting (AFT). In anchor free tufting a plate or membrane is mounted in the head generally by using ultrasonic welding of the plate or membrane to portions of the head. Bristles extend through the plate or membrane. The free or outer ends of the bristles perform the cleaning function. The inner ends of the bristles on the opposite side of the plate or membrane are melted together by the application of heat to create the anchor free tufting.

In the embodiment of the invention illustrated in Figures 1-3 a first row of relatively rigid bristles or elastomeric walls or fingers 24 is arrayed across the

distal end of the manual toothbrush head 14 in a direction generally perpendicular to the longitudinal axis of the toothbrush. Moving toward the handle 12 the next row of cleaning elements 26 is shorter and springier (less rigid) than the adjacent row of cleaning elements 24. The flexibility of bristles 26 can be achieved by imparting an "S" shape to the bristles before or during assembly into the toothbrush head 14. Other ways of imparting relative stiffness to bristles 24 and flexibility to bristles 26 are known to those skilled in the toothbrush art.

The balance of head 14 contains alternating rows of relatively rigid and springy cleaning elements 22. The spacing between adjacent rows of relatively rigid cleaning elements preferably approximates typical spacing of teeth in the human mouth. As illustrated in Figure 8 the spacing facilitates the placement of the longer, relatively rigid bristles in the interproximal areas of the teeth when pressure (represented by the arrow in Figure 8) is applied to the toothbrush. This combination of cleaning elements enhances cleaning of all parts of the teeth, particularly the interproximal areas which are prone to decay because of trapped food and plaque buildup.

As illustrated in Figures 1-4 each row of springy cleaning elements 26 comprises a plurality (preferably two) of longitudinally adjacent elements.

Figure 4 illustrates an alternate configuration 24a of the relatively rigid cleaning elements. In this embodiment, each row of the relatively rigid cleaning elements comprises longitudinally adjacent elements which have tapered tops and, in combination creates a "V" shape that further facilitate penetration of these elements into the inverted "V" shape of the interproximal areas between teeth. If desired, the "V" shape could be achieved by having a single cleaning element with the tapered top to form the "V".

Figures 5-6 illustrate a further configuration 26a for the springy cleaning elements. In this embodiment of the invention the springy cleaning elements 26a are in the form of fiber bristles 28 mounted to floating cleansing pads 30. The pads 30 are made from a soft elastomer material to support the cleaning elements 28. Pads 30 are compressible. The compressibility could be achieved by having the pads hollow as illustrated in Figures 5-6. In use the support pads 30 collapse under pressure as shown in Figure 6 wherein the arrow shows the pressure applied to one of the pads 30. This allows for deeper interproximal penetration of the adjacent rigid bristles or cleaning elements 24.

The embodiment of Figures 5-6 thus provides a variation to the easily compressed "S" shaped cleaning elements 26 of Figures 1-4. In this alternative a pad of fine cleaning elements 28 which could be either elastomer or bristle form are supported by the thin, flexi-

ble elastomer supports 30. As illustrated in Figure 6 these thin supports collapse, in a similar manner to the "S" elements, allowing deeper penetration of the more rigid bristles 24.

As with the embodiment of Figures 1-3 the row of springy cleaning elements 26a of Figures 5-6 may comprise a plurality of longitudinally adjacent cleaning elements. Similarly, as in Figure 4 each row of rigid cleaning elements in Figures 5-6 may comprise a plurality of longitudinally adjacent cleaning elements.

The various embodiments of the invention may have each row of rigid cleaning elements 24 to be of longer length across the brush head than the springy cleaning elements 26, as in Figures 1 and 3. The invention could be practiced where the springy elements are of longer length across the brush head.

The various embodiments could be practiced where each of the cleaning elements extends laterally across generally the entire width of the cleaning head 14 with the other elements extending a lesser distance, as in Figures 1 and 3. The invention may be practiced where one or more rows of either the rigid cleaning elements and/or the springy cleaning elements comprise a plurality of individual cleaning elements extending laterally across the brush head. This would be particularly used where the cleaning elements are, for example, natural or fiber bristles rather than the illustrated elastomeric walls. The use of a plurality of laterally

aligned cleaning elements in a single row could also be achieved by elastomeric fingers. Various combinations may also be used in the practices of this invention such as having one or more rows of rigid and/or springy cleaning elements with a plurality of longitudinally adjacent cleaning elements in that row (such as in Figure 4), while other rows of the same type of cleaning elements have only a single set of cleaning elements in that row.

As also illustrated, in the preferred practice of this invention the combination of the sets of alternating rows of cleaning elements has the rigid cleaning elements as the outermost row of the combination.

Any suitable form of cleaning elements may be used as the cleaning elements 22 in the broad practice of this invention. The term "cleaning elements" is intended to be used in a generic sense which could include conventional fiber bristles or massage elements or other forms of cleaning elements such as elastomeric fingers or walls arranged in a circular cross-sectional shape or any type of desired shape including straight portions or sinusoidal portions. Where bristles are used, the bristles could be mounted to tuft blocks or sections by extending through suitable openings in the tuft blocks so that the base of the bristles is mounted within or below the tuft block.

It is to be understood that the specific illustration of the cleaning elements is merely for exem-

plary purposes. The invention can be practiced with various combinations (such as AFT bristles, etc.) and/or with the same bristle or cleaning element materials (such as nylon bristles, spiral bristles, rubber bristles, etc.) Similarly, while the Figures illustrate the cleaning elements to be generally perpendicular to head 14, some or all of the cleaning elements may be angled at various angles with respect to the upper surface 20 of head 14. It is thereby possible to select the combination of cleaning element configurations, materials and orientations to achieve specific intended results to deliver additional oral health benefits, like enhanced cleaning, tooth polishing, tooth whitening and/or massaging of the gums.

Handle 12, including head 14, is preferably made of hard plastic material which is used for manual toothbrushes.

This invention may also be practiced where the head 14 includes one or more power or electrically operated movable sections carrying cleaning elements. Figure 7 illustrates a toothbrush 10A which includes a power driven movable disc or section 40 having cleaning elements. The movable section 40 could be oscillated rotationally such as by using the type of drive mechanism shown in U.S. Patent No. 5,625,916, or could move in and out using the type of drive mechanism shown in U.S. Patent No. RE 35,941; all of the details of both patents are incorporated herein by reference thereto.

Alternatively, the other types of drives referred to above could move section 40 in other manners and directions. Although Figure 7 shows movable section 40 to be at the distal end of the head, the movable section(s) could be located at any desired location on the head.

What is claimed is:

1. A toothbrush comprising a handle, a head secured to the handle, a first set of cleaning elements mounted on the head which are relatively rigid and are longer than other sets of cleaning elements mounted on the head a second set of cleaning elements which are springy and more easily compressed than said first set of cleaning elements, and said first and second sets of cleaning elements arranged in alternating rows on the head.

2. The toothbrush of claim 1 wherein said rows of said first set of cleaning elements are spaced from each other a distance approximately equal to the average width of a human tooth.

3. The toothbrush of claim 1 wherein said second set of cleaning elements have an "S" shape over at least a portion of their length.

4. The toothbrush of claim 1 wherein the upper surface of the first set of cleaning elements has a V-shaped profile.

5. The toothbrush of claim 4 wherein each row of said first set of cleaning elements comprises a pair of longitudinally adjacent cleaning elements having tapered tops to form in combination said V-shaped profile.

6. The toothbrush of claim 1 wherein each of said second set of cleaning elements is in the form

of a compressible pad which supports its cleaning elements.

7. The toothbrush of claim 6 wherein said compressible pad is made of a compressible soft hollow elastomer, and its said cleaning elements are fiber bristles mounted on the outer surface of said tab.

8. The toothbrush of claim 1 wherein said rows of first cleaning elements extend a further distance across said head than said rows of second cleaning elements.

9. The toothbrush of claim 1 wherein said first sets of cleaning elements are located at the outermost ends of the combination of said first and second sets of cleaning elements.

10. The toothbrush of claim 1 wherein at least one row of said first set of cleaning elements comprises longitudinally adjacent cleaning elements.

11. The toothbrush of claim 1 wherein at least one row of said second set of cleaning elements comprises two longitudinally adjacent cleaning elements.

12. The toothbrush of claim 1 wherein said toothbrush is a manual toothbrush.

13. The toothbrush of claim 1 wherein a portion of the toothbrush includes a powered cleaning element.

Fig.1.

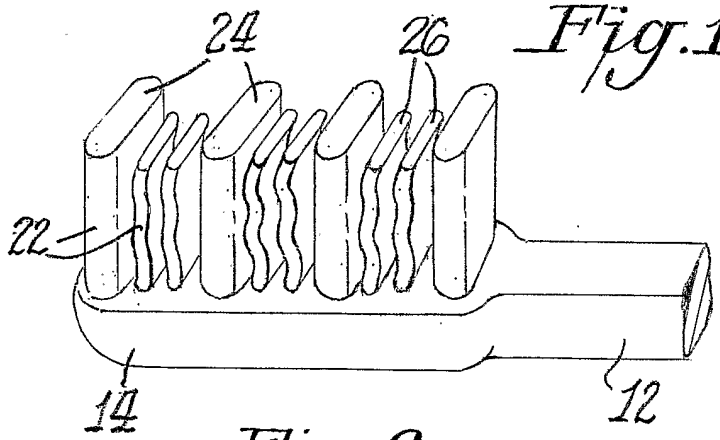

Fig.3.

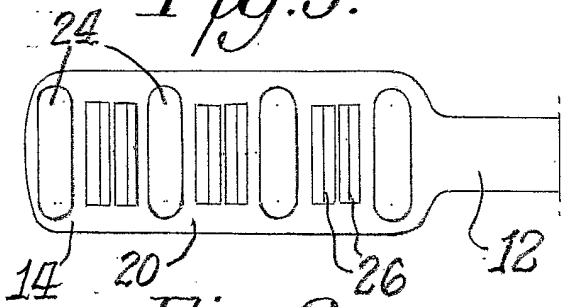

Fig.2.

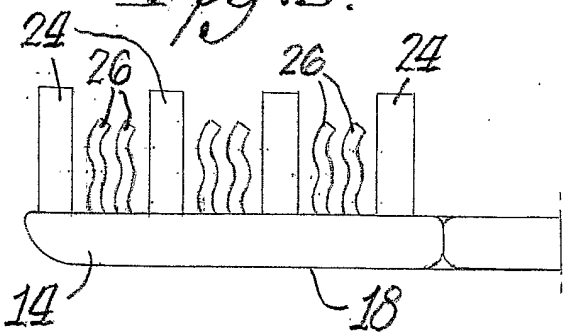

Fig.4.

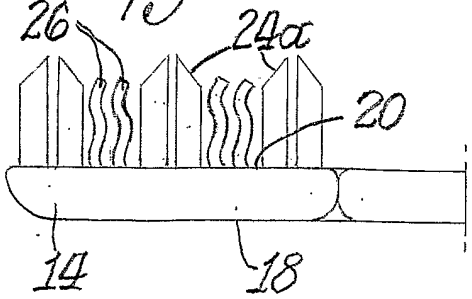

Fig.8.

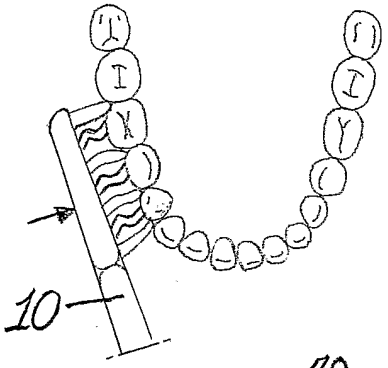

Fig.7.

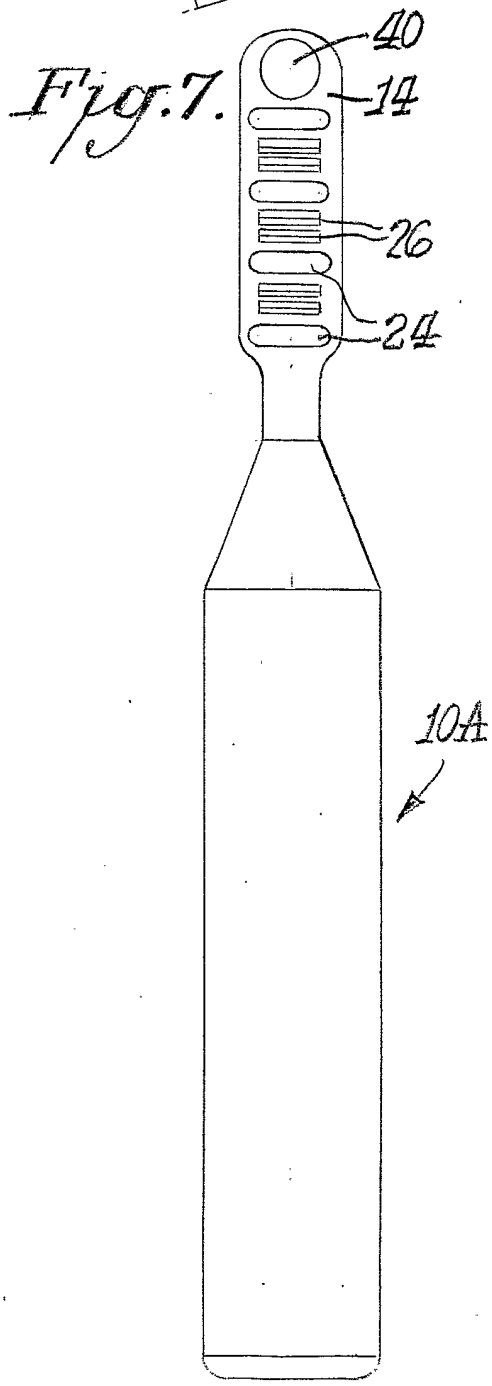

Fig. 5.

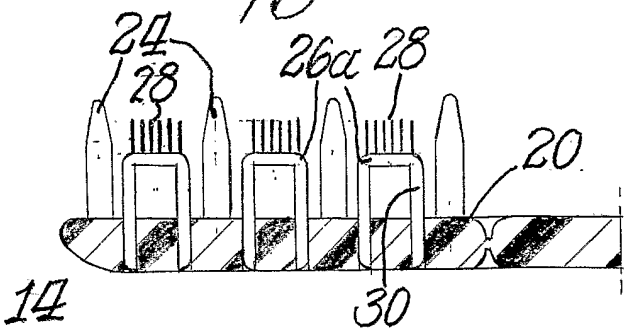

Fig. 6.