

Nov. 18, 1969

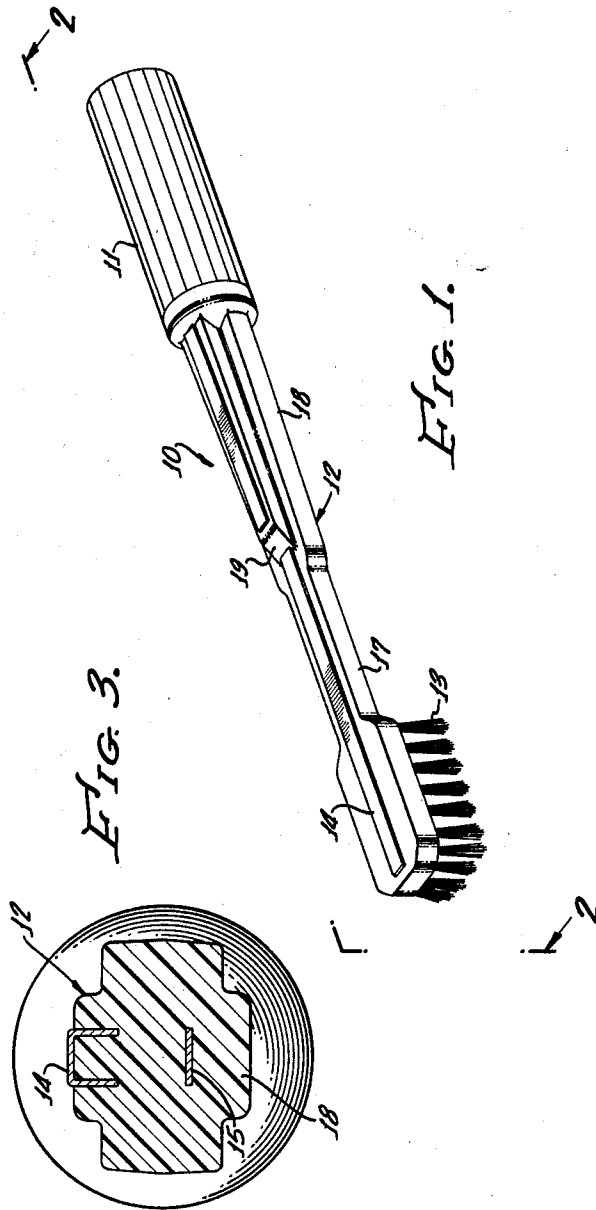
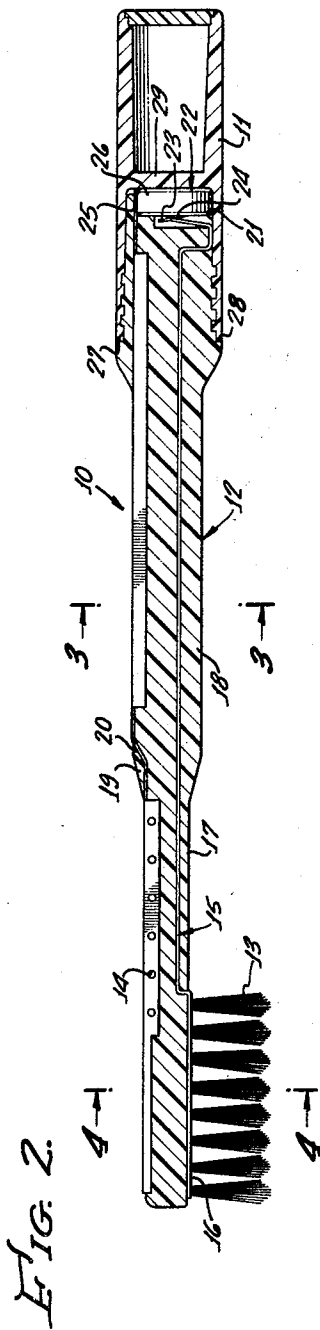
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3,478,741

TOOTHBRUSH FOR PRODUCING ELECTRICAL POTENTIALS

Filed March 30, 1967

3 Sheets-Sheet 1



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TOOTHBRUSH FOR PRODUCING ELECTRICAL POTENTIALS

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3 Sheets-Sheet 2

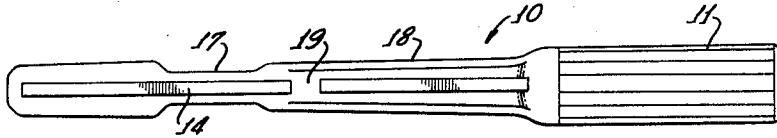


FIG. 5.

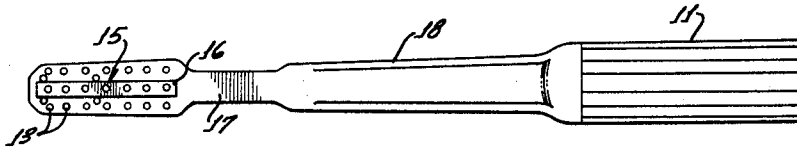


FIG. 6.

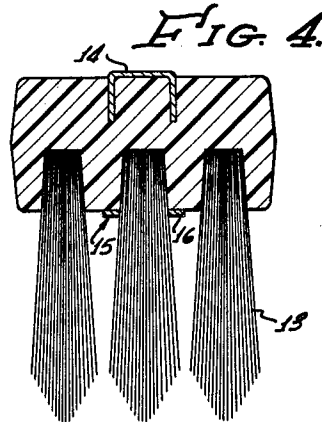


FIG. 4.

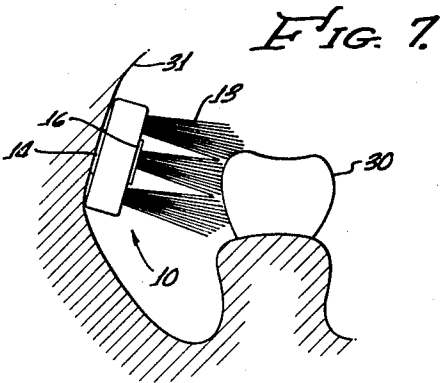


FIG. 7.

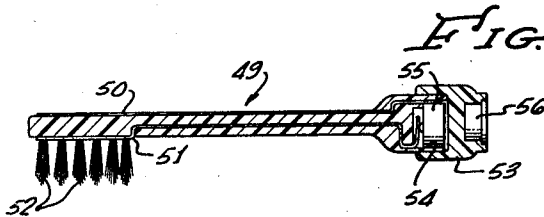


FIG. 12.

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3 Sheets-Sheet 3

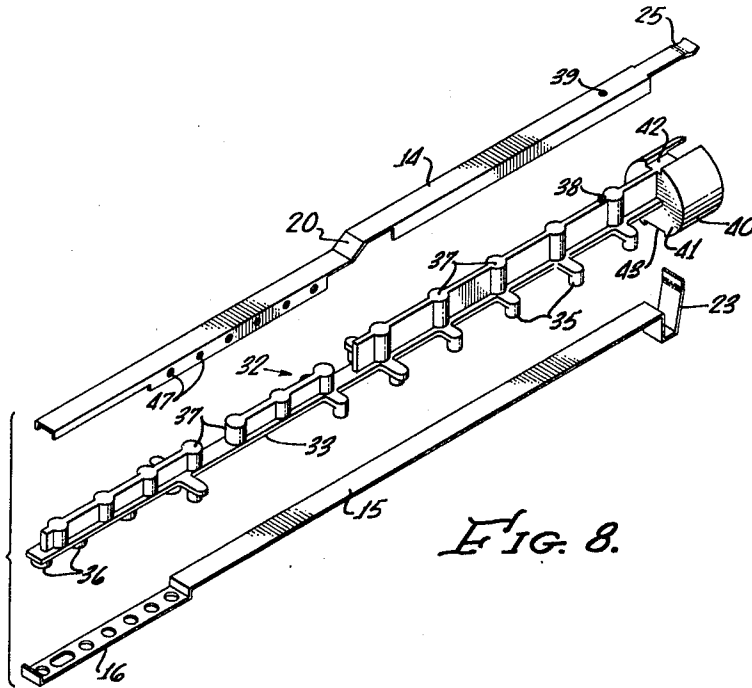


FIG. 8.

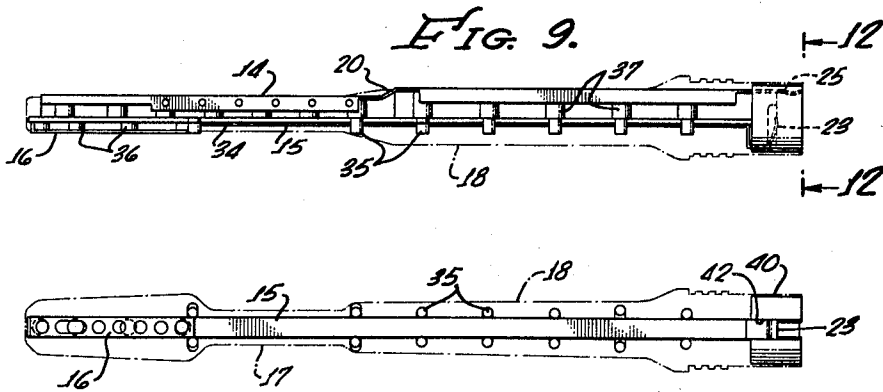


FIG. 9.

FIG. 10.

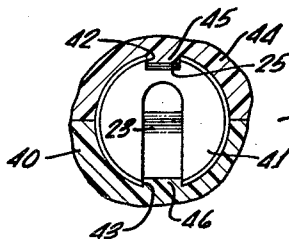


FIG. 11.

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TOOTHBRUSH FOR PRODUCING ELECTRICAL POTENTIALS

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U.S. Cl. 128—172.1

9 Claims

ABSTRACT OF THE DISCLOSURE

A toothbrush for topical application of ions of medications or other substances to the surface of a tooth through iontophoresis through a means to provide an electrical potential to attract the ions to the tooth, with an electrode being provided on the brush for engagement with the mouth to provide a low-resistance current path to establish the potential.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to toothbrushes having means for providing an electrical potential.

Description of the prior art

It has become well established that topical application of fluorine and certain other substances to teeth has certain important beneficial consequences. For some time, it was recognized that fluorine would reduce painful tooth sensitivity experienced by some persons. In recent years, it has been shown also that fluorine accomplishes a substantial reduction in the incidence of tooth decay, and that the application of fluorine to the surface of a tooth is a convenient way of obtaining these results.

Topical application of fluorine loses much of its effectiveness, however, because of an inherent difficulty in depositing the fluoride ions on the surface of the tooth. This is because teeth have a small negative electrical charge, while fluoride ions also are negative, being the most negative of any on the periodic chart. Consequently, the like charges repel so that the fluoride ions are held away from the teeth and become washed from the mouth without adequately being applied to the surface of the teeth.

This situation may be alleviated by providing the teeth with a positive charge so that they will attract rather than repel the fluoride ions. One approach to this is outlined in U.S. Patent No. 2,834,344 in which a toothbrush is provided with a negative electrode at the bristles and a positive electrode in the handle. A battery is carried by the brush to supply a potential to the electrodes. When the handle is gripped by the user of the brush, the current flows through the arm to the body and thence to the neck and head to the teeth to produce the positive electrical charge. However, with that arrangement the current must flow a long distance through the arm and body to the teeth of the user, resulting in considerable resistance to the flow of electricity. There is a variation in the resistance from the hand to the teeth among individuals, and in any one person the resistance is not always the same. The amount of resistance also depends upon whether the handle is wet or dry, or the grip is tight or loose. Moreover, only a small battery is used, so that any losses seriously detract from the available potential at the teeth. Therefore, with that design it cannot always be assured that the teeth will receive an adequate positive electrical charge. The situation is aggravated if the battery is not new or has deteriorated in any manner.

SUMMARY OF THE INVENTION

The present invention provides an improved fluoridating toothbrush in which the positive electrode is exposed along the backside of the shank of the brush opposite from the bristles. This causes it to be engaged by the inner surface of the cheek and also by the lips of the person when using the toothbrush. Consequently, the current need flow only a very short distance from the mouth to the tooth, so that a low-resistance path is provided. Good contact is made between the electrode and soft tissue of the cheek and lips in a wet environment. The performance of the brush in providing an adequate electrical potential in the tooth is enhanced considerably in this manner.

The brush is of molded plastic construction, with the electrodes being secured to the brush as the molding takes place. The electrodes first are mounted in a plastic insert, a portion of which forms a barrier within the mold cavity, allowing the electrode ends to project outwardly away from the plastic for later association with a battery in the completed toothbrush.

An object of this invention is to provide an improved arrangement for providing the teeth with an electrical charge.

Another object of this invention is to provide a toothbrush for providing the teeth with an electrical potential in which a short low-resistance path for the flow of current is provided from the source of electrical energy to the surface of the tooth.

A further object of this invention is to provide a toothbrush to create an electrical potential in which the positive electrode is engaged by the mouth of the user rather than only by the hand.

These and other objects will become apparent from the following detailed description taken in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIGURE 1 is a perspective view of a toothbrush constructed in accordance with this invention;

FIGURE 2 is an enlarged longitudinal sectional view of the toothbrush of FIGURE 1;

FIGURE 3 is an enlarged transverse sectional view taken along line 3—3 of FIGURE 2;

FIGURE 4 is an enlarged transverse sectional view taken along line 4—4 of FIGURE 2;

FIGURE 5 is a top plan view of the toothbrush of FIGURE 1;

FIGURE 6 is a bottom plan view of the toothbrush;

FIGURE 7 is an enlarged sectional view, partially in elevation, showing the toothbrush in use, with the positive electrode engaging the inner surface of the cheek;

FIGURE 8 is an exploded perspective view of the insert and electrodes prior to the molding of the complete shank of the brush;

FIGURE 9 is a side elevational view of the insert with the electrodes associated with it;

FIGURE 10 is a bottom plan view of the arrangement of FIGURE 9;

FIGURE 11 is a transverse sectional view taken along line 11—11 of FIGURE 9, with the surrounding portions of mold added, illustrating how the insert and electrodes form the barrier at one end of the mold; and

FIGURE 12 is a longitudinal sectional view of the brush modified for use as an electrically operated toothbrush.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The toothbrush 10 of this invention has a generally conventional overall configuration, including a handle 11

from which projects a shank 12 that at its outer end carries bristles 13. Additionally, however, the brush 10 includes a positive electrode 14 extending forwardly from the handle along the backside of the shank 12 to a position opposite the bristles 13. On the other side of the shank at the base of the bristles is a negative electrode 15. Normally, the two electrodes are made of stainless steel. The body of the brush 10 is made of plastic, with the electrodes 14 and 15 being secured to it at the time the brush is molded. The negative electrode 15 includes a portion 16 that is exposed at the base of the bristles 13, but otherwise is buried within the plastic, extending longitudinally of the shank 12 to the handle 11. The positive electrode 14, on the other hand, is exposed along the length of the brush between the handle 11 and the end of the shank 12.

The shank 12 of the brush increases in cross-sectional dimension between a narrower section 17 adjacent the bristles 13 and a larger portion 18 next to the handle 11. At the tapered portion where the change in dimension occurs, there is a short inclined section 19 of the plastic material of the brush, extending over a similarly sloping portion 20 of the positive electrode 14 and confining it. The purpose of this is to allow the brush handle to flex while the brush is in use. The offset portion 20 of the electrode 14 provides sufficient length to permit adequate bending of the shank.

Within the handle section 11 of the brush is a cavity 21 that receives a battery 22, which is confined in place by the wall 29 of the handle 11 when the handle is threaded onto the end of the shank of the brush. The ends of the positive electrode 14 and the negative electrode 15 enter the cavity 21 to engage the battery 22. The end 23 of the negative electrode 15 is bent so that it extends transversely of the brush and engages the negative pole 24 of the battery. The end 25 of the positive electrode 14 is curved and bears against the circumference 26 of the battery 22, which forms the positive terminal of the battery. Consequently, the electrodes are shaped to provide leaf springs at their ends which bear against the battery 22 to receive opposite electrical charges.

The handle 11 includes a radial shoulder 27 that engages a similar shoulder 28 on the shank at the end of the threaded portion when the unit is assembled. This seals the battery 22 within the handle 11 of the brush so that moisture will never enter the cavity 21 to cause damage.

In use of the brush 10 of this invention, a fluoride dentifrice is applied to the bristles 13. In the presence of moisture, the dentifrice forms a solution containing negative fluoride ions. This solution is in contact with the exposed portion 16 of the negative electrode 15 at the base of the bristles. As the brush is inserted into the mouth to engage the teeth 30, the backside of the shank of the brush naturally is brought into contact with the inner surface 31 of the cheek (see FIGURE 7). This distends the cheek outwardly slightly so that the inner surface 31 is brought firmly to bear against the outer surface of the positive electrode 14. As a result, an electrical circuit is completed to the surface 31 of the cheek. With only a short low-resistance path, the current flows to the teeth 30, imparting a positive charge to the teeth. There is very little loss through the distance from the cheek to the teeth, so that a full potential is realized at the teeth. As a result, therefore, the negative fluoride ions are repelled by the negative electrode 15 and attracted by the positive charge on the teeth. Hence, the fluoride ions readily are deposited on the surface of the teeth 30 to accomplish their beneficial effect.

In addition to engaging the surface 31 of the cheek, the long exposed surface of the positive electrode 14 means that it also will engage the lips to provide an additional path for current flow to the teeth. Moreover, if the user engages the positive electrode 14 by his fingers adjacent the handle 11 in use of the brush, still another

path for the current is provided. While this is of greater resistance than that of the cheek to the teeth, it serves to augment the flow of current.

When the toothbrush is in use, it is possible for some of the current to flow directly from the negative electrode 15 to the positive electrode 14 through the path provided by the saliva within the mouth. Of course, such current is dissipated and does not serve the desired function of providing the teeth with a positive charge to attract the fluoride ions. However, according to Ohm's law, this current flow does not detract from that which is conducted through the tissue. Regardless of any such loss, the rate of current flow to the teeth remains unchanged, so that the performance of the brush is unaffected.

The toothbrush 10 of this invention preferably is manufactured by injection molding for economical production on a volume basis. The molding process is complicated, however, by the necessity for having the ends 23 and 25 of the electrodes 15 and 14 extend into the cavity 21 for engagement with the battery, while they are fully or partially embedded within the plastic for the remaining portions of their lengths. In order to produce the brush by a molding operation, the electrodes 14 and 15 first are associated with an insert 32, as seen in FIGURES 8-11.

The insert 32 is made of plastic of the same type as used for the other parts of the brush later molded around it. It includes an elongated portion 33 having a flat lower surface 34 provided with a plurality of opposed pairs of short projections 35. The flat strip 15 forming the negative electrode of the brush is snapped between the projections 35, which hold it temporarily in place adjacent the undersurface 34. At one end of the elongated part 33 of the insert 32, to the left as illustrated in FIGURES 8, 9 and 10, are central protuberances 36. These space the portion 16 of the electrode 15 outwardly at that location, and subsequently hold it against the surface of the mold so that its exterior is exposed when the brush is completed. The portion 16 is perforated to allow the bristles 13 to extend through it.

The positive electrode 14 is in the form of a U-shaped channel which fits down over upwardly projecting enlargements 37 on the top of the insert section 33. The electrode 14 is dimensioned to wedge tightly onto the insert, while the small protuberance 38 fits into the opening 39 in the electrode 14 to position it longitudinally.

At the end of the insert 32 is a short cylindrical element 40 having a radial wall 41 adjacent the longitudinal section 33 of the insert. The cylindrical end portion is provided with a pair of opposed longitudinally extending recesses 42 and 43 which extend into an open end portion that defines the cavity 21 when the brush is assembled. When the electrodes 14 and 15 are applied to the insert 31, their ends 25 and 23, respectively, extend through the slots 42 and 43 to communicate with the cavity 21.

When the insert 32 and assembled electrodes are placed in the mold, the radial wall 41 and the electrodes 14 and 15, passing through the slots 42 and 43, provide the closure for one end of the mold cavity. This effect is best observed in FIGURE 11, where the mold 44 may be seen fitting closely around the periphery of the cylindrical section 40 of the insert 32. The mold 44 has projections 45 and 46 that fit into the outer portions of the slots 42 and 43 and bear against the electrodes 14 and 15 at those locations. By this arrangement, therefore, the barrier at one end of the mold is defined by the radial wall 41 and the small portions of the electrodes 14 and 15 at the slots 42 and 43.

The plastic then is injected into the mold to form the remaining portions of the shank 12 of the brush. The insert 32 becomes a part of the brush as the additional plastic is formed around it. At the same time, the electrodes are secured in place. The openings 47 in the side flanges of the U-shaped positive electrode 14 allow the plastic to

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flow through, so that a mechanical attachment of the electrode to the shank is formed.

In this way, through utilizing the insert and part of the metal strips of the electrodes themselves as one end of the mold, the electrodes have ends 23 and 25 projecting into the cavity 21 for proper engagement with the battery.

The brush of this invention is readily adapted for use with an electric toothbrush as well as one which is hand-held. A brush of the former type is shown in FIGURE 12. Here, the brush 49 is essentially the same as that described above, insofar as the shank arrangement is concerned. There is a positive electrode 50 along the backside of the shank, while the negative electrode 51 extends through the shank and is exposed at the base of the bristles 52. An adapter 53 connects to the cavity portion 54 where the ends of the electrodes and the battery 55 are located. A receptacle 56 in the adapter 53 receives the end of the electric toothbrush which provides the oscillatory movement.

By not being required to rely upon a flow of current from the hand of the user to the teeth, the device can be used with an electric toothbrush where the handle (not shown) is of a dielectric material. The oscillating brush 49 is not held or restricted by the hand. As before the engagement of the positive electrode with the surface of the cheek and the lips of the mouth provides the conductor for the flow of current to the teeth. This type of toothbrush is not flexed as greatly as a hand-held brush, and, hence, the short section of the positive electrode at an angle and confined by the plastic of the shank, as at the offset section of the electrode 14, normally is not provided.

The foregoing detailed description is to be clearly understood as given by way of illustration and example only, the spirit and scope of this invention being limited solely by the appended claims.

I claim:

1. A brush for imparting an electrical potential to the teeth comprising
 - a handle means,
 - a shank projecting from said handle means,
 - bristle means projecting from the distal end portion of said shank,
 - a first electrode adjacent said bristle means,
 - a second electrode on said distal end portion remote from said bristle means and from said first electrode,
 - a source of electrical energy, and
 - means connecting said electrodes to said source of electrical energy for providing said electrodes with electrical charges of opposite polarity.
2. A brush for imparting an electrical potential to the teeth comprising
 - a member one end portion of which is adapted to receive an actuating force,
 - bristle means projecting from one side of the opposite end of said member,
 - a first electrode carried by said member along the exterior of said one side thereof adjacent said bristle means,
 - a second electrode carried by said member along the exterior of the opposite side of said opposite end of said member,
 - a source of electrical energy on said member, and
 - means connecting said electrodes to said source of electrical energy for providing said electrodes with opposite electrical polarities.
3. A device as recited in claim 2 in which said first electrode is positioned at the base of said

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bristle means and is substantially coextensive with said bristle means, and

said second electrode extends a substantial portion of the length of said member and for a greater distance than the extent of said first electrode.

4. A device as recited in claim 3 in which said second electrode intermediate the ends thereof includes a relatively short laterally offset portion,

said offset portion extending beneath the outer surface of said member, and permitting flexure of said member during use of said brush.

5. A device as recited in claim 2 in which said second electrode includes a central portion and a flange portion along either side of said central portion,

said flange portions extending outwardly from said central portion in the same general direction, whereby said second electrode is substantially U-shaped in cross section,

said central portion facing the exterior of said member and said flange portions extending within said member beneath the surface thereof.

6. A device as recited in claim 5 in which said flange portions include aperture means therethrough,

said member having portions extending through said aperture means for holding said second electrode to said member.

7. A toothbrush for imparting an electrical potential to the teeth comprising

means defining a cavity therein,

a battery in said cavity,

a shank extending from said means and terminating in a distal end remote from said means,

a plurality of bristles projecting from one side of said shank at said distal end,

a first electrode means carried by said shank and communicating with the exterior of said shank on the surface thereof adjacent said bristles,

a second electrode means carried by said shank and communicating with the exterior of said shank at said distal end on the side thereof remote from said bristles,

a first conductor extending from said first electrode means through said shank to said cavity and engaging the negative terminal of said battery, and

a second conductor extending from said second electrode means to said cavity and engaging the positive terminal of said battery.

8. A device as recited in claim 7 in which said second electrode means is elongated and extends a substantial distance along said shank in communication with the exterior thereof from said distal end toward said means defining a cavity,

said distance being greater than the extent of said first electrode means.

9. A device as recited in claim 8 in which said second electrode means includes a relatively short transversely offset portion interiorly of said shank intermediate the ends of said second electrode means for permitting flexure of said shank during use of said brush.

References Cited

UNITED STATES PATENTS

1,374,414	4/1921	Weiss	128—393
2,834,344	5/1958	Kanai	128—172.1

WILLIAM E. KAMM, Primary Examiner