

Aug. 4, 1964

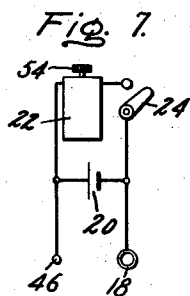
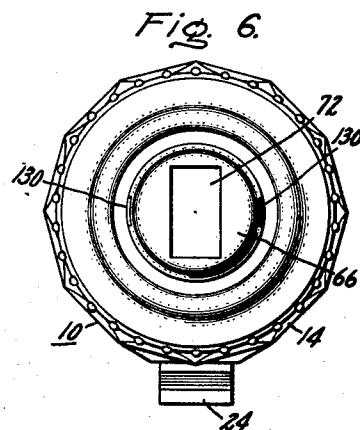
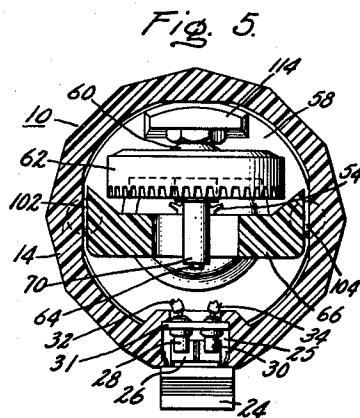
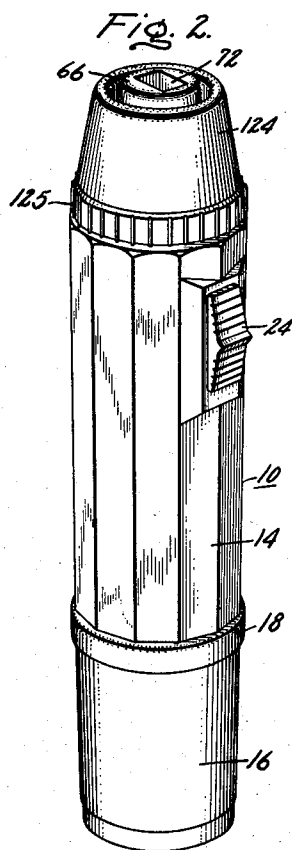
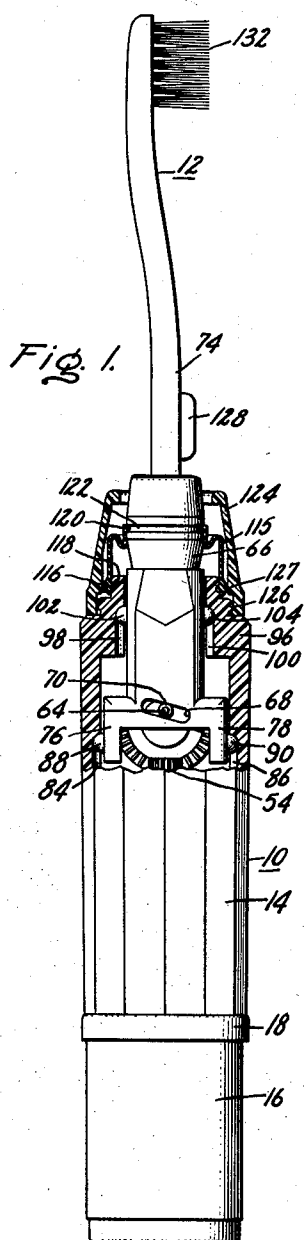
E. A. PHANEUF ETAL

3,142,852

AUTOMATIC TOOTHBRUSH

Filed May 31, 1962

3 Sheets-Sheet 1



Inventors:  
Edgar A. Phaneuf,  
Flans Springer,  
by Leonard Blatt  
Their Attorney.

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AUTOMATIC TOOTHRUSH

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3 Sheets-Sheet 2

Fig. 3.

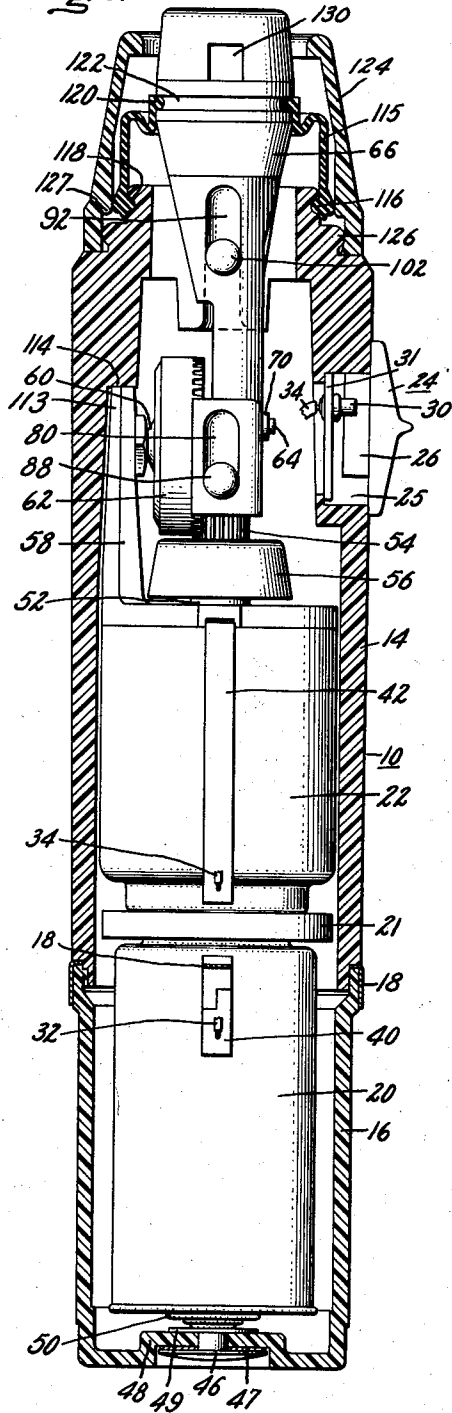
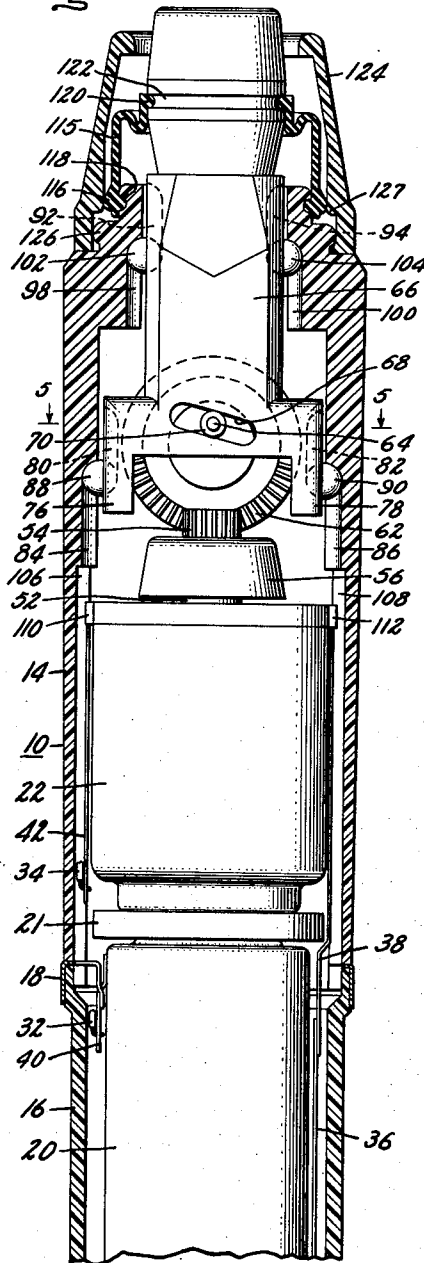


Fig. 4.

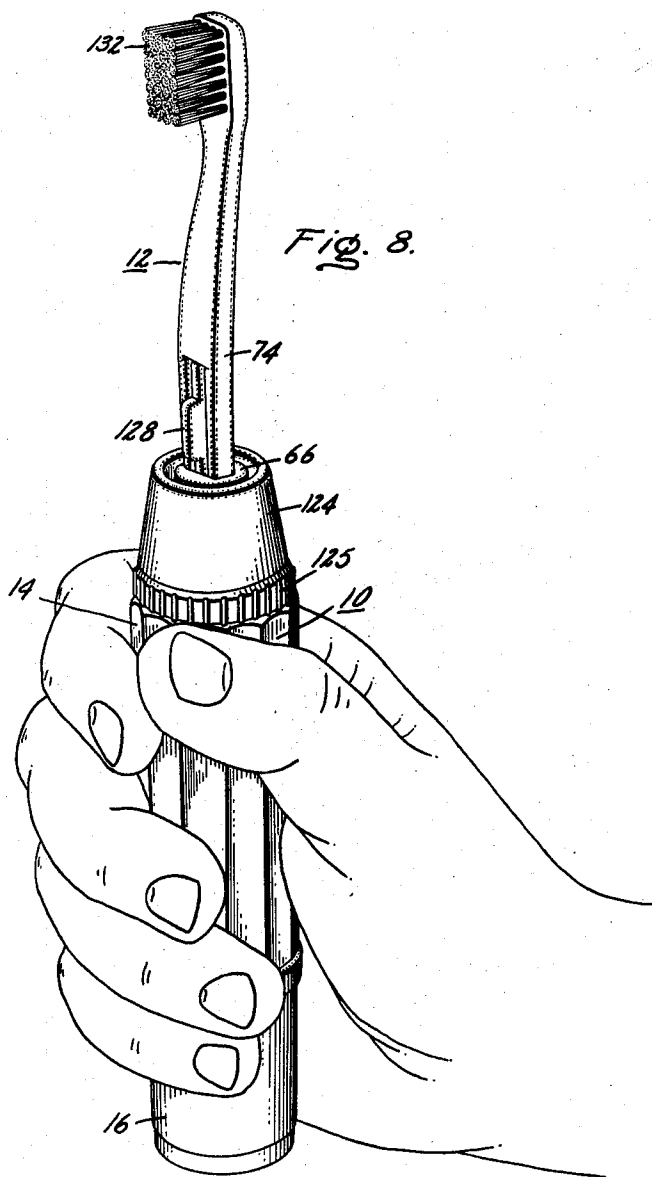


Inventors:  
 Edgar A. Phaneuf,  
 Hans Springer,  
 by Leonard Platt  
 Their Attorney.

**E. A. PHANEUF ETAL**  
**AUTOMATIC TOOTHBRUSH**

3 Sheets-Sheet 3

Filed May 31, 1962



Inventors:  
Edgar A. Phaneuf,  
Flans Springer,  
by Zennard J. Platt  
Their Attorney.

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3,142,852

## AUTOMATIC TOOTHBRUSH

Edgar A. Phaneuf, Southborough, and Hans Springer, Ashland, Mass., assignors to General Electric Company, a corporation of New York

Filed May 31, 1962, Ser. No. 198,883

18 Claims. (Cl. 15—22)

This invention relates to a mechanized toothbrush, and more particularly to an electrically driven motorized handle and brush for cleaning teeth and massaging gums in a greatly improved and beneficial manner.

Although electrically powered and other forms of mechanized toothbrushes have been known for many years, such toothbrushes have never become widely accepted for use in the home. The majority of the early devices known require a power transmission cord connecting the mechanized brush handle to a source of mechanical power or electrical power. Thus, such connecting cords make the devices cumbersome, difficult to operate and generally inconvenient; and they also tend to give many users concern as to the safety of the device. A small, easily handled and manipulated, motor driven toothbrush which has no connecting power cords and which remains completely sealed at all times is particularly desirable to obtain safe, reliable and convenient operation.

Accordingly, it is a primary object of this invention to provide a practical electrically driven toothbrush which will clean teeth and massage gums in a manner superior to conventional hand brushing.

Another object of this invention is to provide a motorized toothbrush which will remove food particles from between teeth more effectively than by hand brushing and which will effectively clean the interproximal and the gingival margin surfaces of the teeth.

A further object of this invention is to provide a gentle automatic toothbrush for cleaning teeth and beneficially massaging gingivae without trauma even though the gingival tissues may be sore or infected from gingivitis or other gingival diseases.

Another object of the invention is to provide a rechargeable battery operated toothbrush handle which is compact, easily manipulated, and can be conveniently grasped and used by children.

Briefly stated, in accordance with one aspect of this invention a tubular power handle containing a battery and an electric motor is provided for driving a toothbrush holding member. A guiding arrangement also within the handle permits only axially directed straight line reciprocation of the holding member so that a toothbrush carried by the member is reciprocated in only a straight line substantially perpendicular to the brush bristles. The bristles are of such length and flexibility that, during operation, substantially all of the bristle tips placed with a moderate amount of pressure into contact with gingival tissue tend to remain where placed while the non tip portions of the bristles rapidly move to and fro causing the tips to produce a massaging action. Simultaneously, all of the bristle tips placed into contact with tooth surfaces tend to slide on the surfaces producing a rubbing action.

As another aspect of the invention, the electrically operated toothbrush is provided with a compact power handle containing a battery for powering an electric motor. The battery positioned in the toothbrush handle is rechargeable, and externally accessible contacts are fixed to an outside surface of the toothbrush handle for conveniently and safely connecting the battery to be recharged while the battery and other components remain sealed within the handle.

Further features, objects and advantages will become apparent with reference to the following drawings in which:

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FIG. 1 is a side elevation of the motorized toothbrush of the invention shown partially in cross-section;

FIG. 2 is a perspective view of the power handle of the invention;

FIG. 3 is a cross-sectional view of the motorized handle of the invention;

FIG. 4 is a cross-sectional view of the handle when rotated 90° from that of FIG. 3;

FIG. 5 is a cross-sectional view taken along the lines 5—5 of FIG. 4;

FIG. 6 is a plan view of one end of the handle of FIG. 2;

FIG. 7 is a schematic diagram of the electrical circuit of the invention; and

FIG. 8 is a perspective view of the toothbrush held in the hand of a user.

Referring first to FIGS. 1 and 2, the automatic toothbrush of the invention includes a power handle 10 adapted to receive a toothbrush or brush member 12. The handle 10 has a tubular casing which may be given a generally cylindrical shape and may be formed of an upper half portion 14 and a lower half portion 16 connected together by any suitable means in the area of metal ring 18, which has a function to be hereinafter described. The portions 14 and 16 of the handle casing 10 are preferably made of plastic or similar electrically insulating material which is relatively strong and lightweight. In the embodiment shown, the handle is approximately 1½" in diameter and approximately 6" in length; thus it will be appreciated that the unit may be easily held in one hand as may be seen in FIG. 8. Upper half 14 is formed with a plurality of exterior planar surfaces to further facilitate hand holding and to resist rolling when the handle 10 is placed on a flat surface. The switch 24, to be later described, can be easily operated with the thumb of the hand holding the handle 10.

Turning now to FIGS. 3 and 4, there is shown positioned in the lower casing half 16 a battery 20 for driving a small direct current motor 22 in upper casing half 14 and spaced from the battery 20 by an insulating disc 21. The motor is controlled by a suitable on-off switch mechanism which includes for example, an external control button 24 which is slidably mounted within a recess 25 in the casing half 14. The button 24 is attached to a bifurcated contact member 26 that is slidably moved into or out of engagement with a pair of fixed terminals 28 and 30 extending through a plate 31 positioned in recess 25 and the terminals 28 and 30 are in turn connected to wires 32 and 34, respectively, as best seen in FIG. 5. The switch mechanism does not form a part of this invention and is more particularly claimed and described in a copending application of Hans Springer and Edgar A. Phaneuf, Serial No. 198,886, filed May 31, 1962, and assigned to the General Electric Company, assignee of the present invention. Conducting wire 32 is connected to one terminal 40 of battery 20 and wire 34 is connected to one terminal 42 of motor 22. Connecting the other battery terminal 36 to the other motor terminal 38 completes the motor operating circuit. The motor-battery electrical circuit is shown schematically in FIG. 7, where to the extent possible, the numerals identifying the physical elements have been used to designate the corresponding elements in the diagram.

The battery 16 is of the rechargeable type and means are provided for charging the battery while it is positioned within the casing. For this purpose, the contact ring 18 serves as a charging terminal and is formed with a contact tab 44 which extends inwardly through the casing wall and engages battery terminal 40. The other battery terminal 36 is connected to one end of the battery 20 adjacent the end wall of casing half 16. The other charging terminal is a contact button 46 which extends through a recessed portion 48 of the casing end

wall, a sealing washer 47 is positioned between the head of button 46 and the exterior end wall surface, and the button is secured in this position by retaining member 49 or similar means. A spring member 50 engages contact button 46 and the end of battery 20 connected to a battery terminal 36. By connecting contact ring 18 and contact button 46 to the proper contacts of a charging device, the rechargeable battery 20 may be easily charged while positioned within the handle. This feature is, of course, very convenient in that it eliminates the necessity to disassemble the toothbrush handle whenever charging is necessary. The arrangement of contact ring 18, contact button 46 and the contacts of a suitable battery recharger do not form a part of this invention and are more particularly claimed and described in a copending application of Mr. Hans Springer, application Serial Number 198,884, filed May 31, 1962, and assigned to General Electric Company, assignee of the present invention.

For safety purposes, the motor has been designed to operate on a voltage of approximately 1.2 volts. Consequently, even if one accidentally, simultaneously touched both contact ring 18 and contact button 46 no electrical shock perceptible to the touch would be received. To minimize the possibility of accidental discharging of the battery, for example by placing the handle end on a metal surface while the side of the handle engages a metal side wall of the surface, the recessed portion 48 has been provided so that the contact button 46 is slightly recessed from the plane of the exterior surface of the handle end wall. While the type of rechargeable battery employed is not critical, it has been found that a completely sealed battery of the nickel-cadmium variety is particularly satisfactory.

In operation, the motor 22 produces a rotational output through its shaft 52 carrying a pinion and a ballast wheel 56. It has been found that it is desirable to move the brush member 12 in a reciprocal stroke parallel with the longitudinal axis of the handle 10. Accordingly, it is necessary that the handle be provided with motion translating means to translate the motor rotational output into reciprocal movement and it is further necessary to transmit the reciprocal movement to the brush 12. For this purpose, the motor 22 is provided, in accordance with the invention, with a mounting bracket 58 attached to one end of the motor as seen in FIGS. 3 and 4. The mounting bracket includes a portion which extends axially within the handle adjacent the inner cylindrical surface of the handle. The bracket 58 supports a stub shaft 60 carrying a gear 62 adapted to be driven by the pinion 54. A pin or shaft 64 eccentrically mounted on the gear 62 extends in a direction parallel to the stub shaft 60 and perpendicular to the longitudinal axis of the handle. Thus, the rotational output of pinion 54 is translated into circular movement of pin 64 in a plane perpendicular to the rotational plane of pinion 54.

To translate the circular motion of the pin 64 into axial movement there is provided a uniquely formed plunger or toothbrush holder 66 having a slot 68 which extends in a direction generally transverse to the longitudinal axis of the handle, as clearly seen in FIGS. 1 and 4. The slot 68 is adapted to receive a roller 70 which is positioned on pin 64 to function as a bearing for the pin. Thus as the motor pinion 54 rotates, the resulting circular movement of pin 64 is translated into reciprocal movement of the plunger 66 by means of slot 68. It should be noted that the slot 68 is positioned at an angle from a line which is transverse to the handle axis. The angled plunger slot arrangement does not form a part of this invention and is more particularly claimed and described in a copending application of Garabed Hovhanesian and Daniels B. Fisk, Serial No. 198,885, filed May 31, 1962, and assigned to the General Electric Company, assignee of the present invention.

The plunger 66 is an elongated somewhat cylindrical

member having a socket 72, as easily seen in FIGS. 2 and 6, which is adapted to receive the shank portion 74 of toothbrush 12. A ball bearing support arrangement has been designed to guide the holder 66 for longitudinal straight line movement. To accomplish this function, the lower end of plunger 66 is provided with a yoke including a pair of diametrical arms 76 and 78 which straddle pin 64 and pinion 54, as shown in FIGS. 1 and 4. Each of the arms 76 and 78 are provided with an axially extending groove, 80 and 82 respectively, in the surface facing the inner wall of casing half 14. Casing half 14 is provided with a pair of grooves 84 and 86 which mate respectively with grooves 80 and 82. A ball bearing 88 is positioned within the passage formed by grooves 80 and 84 and ball 90 is similarly positioned in the grooves 82 and 86.

To complement the guiding action and stability provided by the bearings and grooves in the lower end of the plunger or toothbrush holder 66 there is provided an additional pair of grooves 92 and 94 diametrically positioned intermediate the ends of the plunger. As can be seen from FIGS. 1 and 4, this portion of plunger 66 has a diameter smaller than that between arms 76 and 78 to fit within the neck 96 of upper casing half 14. A pair of grooves 98 and 100 formed within the neck portion 96 mate respectively with plunger grooves 92 and 94, and ball-bearings 102 and 104 are respectively positioned within the passage formed by the mating grooves. Thus, it should be appreciated that with the two sets of grooves and ball bearings, the plunger 66 is smoothly guided for straight line reciprocation within the handle 10.

In connection with the mounting of the various handle components, it should be noted that the casing grooves 84 and 86 have extensions 106 and 108 respectively, which extend to the lower end of upper casing half 14, as viewed in FIG. 4. These grooves serve as retaining slots for ears 110 and 112 radially extending from the mounting bracket 58 to prevent the motor 22 from rotating within the handle 10 in response to the torque produced by the motor. Additionally, the grooves 84 and 86 provide space for electrical wires. The upper end 113 of mounting bracket 58, as viewed in FIG. 3, abuts casing projection 114 in response to the urging of spring member 50. This provides further stability to the handle by preventing axial movement of the motor and battery, and in addition, the spring 50 acts as a cushion in the event of a shock blow on the end of the toothbrush.

To insure proper operation of the toothbrush, it is necessary to prevent moisture and solid particles from entering the toothbrush handle. Also, to maintain the toothbrush in a proper sanitary condition it is desirable that the toothbrush be adequately sealed to permit submersion of the handle in water for cleaning. For this purpose, there is provided a flexible grommet 115 made of rubber or similar material. The lower edge of the grommet 115 is formed with a circumferential bead 116 adapted to fit within a groove 118 in the exterior surface of plunger neck 96, and the opposite edge of the grommet is formed with a bead 120 adapted to fit within a circumferential groove 122 in the exterior surface of plunger 66. As the plunger 66 reciprocates within the handle the end of the grommet attached to the plunger, of course, moves with the plunger; and since the opposite end of the grommet is attached to the stationary casing, the intermediate portions of the grommet flex during the reciprocal movement. However, the snug fitting beads 116 and 120 effectively prevent any moisture, toothpaste or other material from entering the handle. To make the unit completely submersible, the joint between the casing halves 14 and 16 and the contact ring may be made water tight with suitable sealing material during assembly. Similarly, the switch mechanism joints and the joints between the casing half 16 and contact button 46 may be sealed during assembly. Note that the rechargeable battery

brush, guide means positioned within the casing for permitting only straight line reciprocation of said holder member with respect to said casing, said motor and said guide means causing said holder member to reciprocate said toothbrush in only a straight line direction substantially perpendicular to said bristles through a predetermined short stroke length, said bristles being of such flexibility and length that when said toothbrush is reciprocated in a straight line by said holder member through said predetermined short stroke length substantially all of the bristle tips placed into contact with gingival tissue tend to remain where placed while the non-tip portions of the bristles move to and fro causing the tips to produce a massaging action and substantially all of the bristle tips that are simultaneously placed into contact with tooth surfaces slide on said surfaces producing a scrubbing action.

2. In an electrically operated toothbrush comprising a casing, a battery positioned within said casing, an electric motor positioned within the casing and powered by said battery, a toothbrush holder movably connected to said motor, a toothbrush fixed to said holder and having a plurality of bristles extending generally perpendicularly from said toothbrush, guide means positioned within said casing for permitting only straight line reciprocation of said holder with respect to the casing, said motor and said guide means causing said holder to reciprocate said toothbrush in only straight line direction substantially perpendicular to said bristles through a stroke of approximately  $\frac{3}{16}$  of an inch, said bristles being of such flexibility and length that when said toothbrush is reciprocated in a straight line by said holder member substantially all of the bristle tips placed into contact with gingival tissue tend to remain where placed while the non-tip portions of the bristles move to and fro causing the tips to produce a massaging action and substantially all of the bristle tips that are simultaneously placed into contact with tooth surfaces tend to slide on said surfaces producing a scrubbing action.

3. An electrically operated toothbrush including a tubular casing, a toothbrush extending from one end of said casing and having a plurality of bristles extending generally perpendicularly from said toothbrush positioned in substantially parallel relationship, an electric motor positioned within said casing and connected to said toothbrush for reciprocating said toothbrush through a stroke of approximately  $\frac{3}{16}$  of an inch, guide means for permitting only straight line reciprocation of said toothbrush in a direction substantially parallel to the longitudinal axis of said casing and substantially perpendicular to said bristles, said brush being reciprocated at a speed of approximately 2,000 strokes per minute, said bristles being of such flexibility and length that when said toothbrush is reciprocated in a straight line by said holder member through said stroke substantially all of the bristle tips placed into contact with gingival tissue tend to remain where placed while the non-tip portions of the bristles move to and fro causing the tips to produce a massaging action and substantially all of the bristle tips that are simultaneously placed into contact with tooth surfaces slide on said surfaces producing a scrubbing action.

4. In an electrically operated toothbrush, an elongated tubular casing, an electric motor positioned within said casing, a toothbrush extending from one end of said casing and connected to be axially reciprocated by said motor, said toothbrush having a plurality of bristles positioned in substantially parallel relationship and extending generally perpendicularly from said toothbrush approximately  $\frac{1}{16}$  of an inch, and guide means for permitting only straight line reciprocation of said toothbrush in a direction substantially perpendicular to said bristles, said motor being adapted to reciprocate said brush through a stroke of approximately  $\frac{3}{16}$  of an inch at a speed of approximately 2,000 strokes per minute, said bristles being of such flexibility and length that

when said toothbrush is reciprocated in a straight line by said holder member through said stroke substantially all of the bristle tips placed into contact with gingival tissue tend to remain where placed while the non-tip portions of the bristles move to and fro causing the tips to produce a massaging action and substantially all of the bristle tips that are simultaneously placed into contact with tooth surfaces slide on said surfaces producing a scrubbing action.

5. An electrically operated toothbrush comprising a tubular casing, an electric motor positioned within said casing, a toothbrush connected to be rapidly reciprocated through a short stroke by said motor, guide means for permitting only a straight line reciprocation of said toothbrush, and said brush having a plurality of bristles extending in a direction substantially perpendicular to the direction of reciprocation, said bristles extending from said brush approximately  $\frac{1}{16}$  of an inch and having a diameter between the ranges of .007 and .012 inch, said bristles being of such flexibility and length that when said toothbrush is reciprocated in a straight line by said holder member through said stroke substantially all of the bristle tips placed into contact with gingival tissue tend to remain where placed while the non-tip portions of the bristles move to and fro causing the tips to produce a massaging action and substantially all of the bristle tips that are simultaneously placed into contact with tooth surfaces slide on said surfaces producing a scrubbing action.

6. An electrically operated toothbrush comprising a brush member having a shank portion and a bristle portion including a plurality of nylon bristles extending generally perpendicularly from said toothbrush and positioned in substantially parallel relationship, said bristle portion having a cross-sectional area approximately  $\frac{3}{8}$  of an inch in length by  $\frac{3}{8}$  of an inch in width, said bristles being approximately  $\frac{1}{16}$  of an inch in length, said bristles having equal diameters between the ranges of .007 and .012 inch, said electric motive means connected to the shank portion of said brush member to rapidly reciprocate said brush member through a stroke no greater than  $\frac{3}{16}$  of an inch in a straight line direction substantially perpendicular to said bristles, said bristles being of such flexibility and length that when said toothbrush is reciprocated in a straight line by said holder member through said stroke substantially all of the bristle tips placed into contact with gingival tissue tend to remain where placed while the non-tip portions of the bristles move to and fro causing the tips to produce a massaging action and substantially all of the bristle tips that are simultaneously placed into contact with tooth surfaces slide on said surfaces producing a scrubbing action.

7. In an electrically operated toothbrush, a tubular casing forming a handle, a cylindrically shaped rechargeable battery positioned within one end of said casing, said battery having a first terminal on one end and a second terminal at its opposite end which is positioned intermediate the ends of said casing, electric motor means powered by said battery, a toothbrush holder positioned within the other end of said casing, motion translating means centrally located in said casing connecting the toothbrush holder and said motor means for reciprocating said toothbrush holder in a predetermined manner, and means for connecting said battery to be recharged while the battery is positioned within said casing comprising a contact button connected to said first battery terminal and positioned in an opening in the end of said casing and a contact ring positioned on the periphery of said casing adjacent said second battery terminal and including a tab extending through the wall of said casing and engaging said second battery terminal.

8. In an electric toothbrush, the combination comprising a generally tubular casing, a rechargeable battery located in one end of said casing, an electric motor positioned in an intermediate portion of said casing, a mem-

complements the effectiveness of the handle sealing means in that the various joints can be sealed permanently during assembly due to the fact that the battery can be re-charged while remaining within the handle.

To protect the fingers of the operator and to prevent interference with the flexible grommet 115, there is provided a rigid annular cap member 124 which fits over the grommet and surrounds the socket end of plunger 66. The cap is made of plastic or similar material and is formed to snap over a ridge 126 on the neck 96 of the casing half 14, as viewed in FIGS. 3 and 4. The cap is provided with a circumferential ribbed portion 125, seen in FIG. 2, to permit easy removal of the cap for cleaning purposes. It should be noted that the cap 124 is also formed with an annular ridge 127 which extends inwardly engaging grommet bead 116 to prevent the bead from being dislodged from groove 118.

As previously mentioned, the shank portion 74 of toothbrush 12 is adapted to fit within the socket 72. The shank 74 is secured in this position by an easily releasable fastening means so that brushes may be readily removed for cleaning purposes or for replacement. Consequently, the uniquely designed automatic toothbrush handle may be used by an entire family since each member can easily insert and withdraw his or her own toothbrush. The brush 12 is provided with a plurality of bristles positioned in parallel relation with respect to each other and extending in a direction substantially perpendicular to the shank 74 and the longitudinal axis of handle 10.

From the foregoing description it will be appreciated that as the plunger 66 and toothbrush 12 are reciprocated in a line parallel with the longitudinal axis of the handle 10, the bristles 132 are moved in a direction substantially perpendicular to their longitudinal axes. It has been found that for best results the bristle portion of the brush 12 should be approximately  $\frac{3}{8}$ " in width and  $\frac{5}{8}$ " in length. Further, it has been found that it is preferable that the bristles be made of nylon, be of equal length, namely, about  $\frac{7}{16}$ " and have bristle diameters between the ranges of .007 to .012".

It is believed that the best way to brush teeth is to move the brush bristles in a direction generally perpendicular to the side surfaces of the teeth. In this manner, the bristles will slide along that portion of the gingiva in contact with the teeth and the debris will be moved toward the interproximal areas between adjacent teeth. This method is considered to be far superior than brushing the teeth from the gums towards the tips of the teeth. When the last mentioned method is used the bristles tend to jump across the very small depression formed between the gingiva and the tooth. It is this area between the teeth and the gingiva which is very critical in controlling gingivitis. The area must be maintained cleaned and polished at all times to prevent the gingiva from moving on top of the debris or to prevent the debris from moving under the gingiva. Accordingly, it is now recommended that this area be cleaned by having the bristles move along the gingival tissue and the teeth between the teeth and the gingiva. In accordance with our invention, the toothbrush bristles are reciprocated in a relatively straight line in a direction generally perpendicular to the longitudinal axis of the tooth being brushed. It is preferred that the plunger 66 and brush 12 be reciprocated through a stroke of approximately  $\frac{3}{16}$ " and at a rate of approximately 2,000 strokes per minute.

Utilizing an automatic toothbrush with the foregoing parameters produces very satisfactory results. When the bristles 132 are placed against the gingivae or gum tissue with a light amount of force or pressure, it has been found that substantially all of the bristle tips placed into engagement with the gums tend to remain in this position while the body or non-tip portions of such bristles are moved back and forth so that the bristles effectively describe a triangular pattern. In this manner, the bristle tips effectively massage the gingivae. The limited relative movement between the bristles and the gingivae

tissue tend to prevent any trauma or injury to the tissue as could be caused by scraping or tearing if bristles were dragged across the gingivae. Those bristle tips placed with a light amount of pressure into contact with tooth surfaces tend to slide along the surfaces in a short path to produce a rubbing cleaning action. When the bristles 132 are placed against the gingivae and teeth with a moderate amount of pressure, the bristle tips will be moved further into the interproximal regions between adjacent teeth to remove food particles. Further, with a moderate amount of pressure, the bristle tips placed into engagement with the gums tend to remain in this position while the body or non-tip portions of the bristles buckle to thereby create a perpendicular pulsating massage. When the bristles 132 are placed against the gingivae with a very light amount of pressure some of the bristle tips slide gently on the gingivae to provide a desirable rubbing cleaning action. If the brush is pressed too hard against the tooth or gum surfaces, the motor will slow down or stop; thus the possibility of damage is obviated.

As previously mentioned, it is believed that one of the causes of gingivitis is the failure to adequately clean the gingival margin surfaces and adjacent surfaces of the teeth. It has been found that the rapid reciprocatory stroke of the powered toothbrush of the invention causes the brush bristles to gently move under the gingival tissue to thoroughly clean tooth surfaces without injury or other trauma to the surrounding gingival tissue. The short rapid reciprocal stroke is also very effective in cleaning the interproximal spaces or crevices. Since the stroke is short and since the flexibility of the bristles results in a certain amount of bristle lag causing the bristle tips in contact with the tooth surfaces to normally move less than  $\frac{3}{16}$ " while the brush body moves  $\frac{3}{16}$ ", the bristle tips do not simply slide from one tooth to the next tooth, but instead have a tendency to gently work into the interproximal spaces to remove any particles which may be lodged therein and to remove plaque and stains from tooth surfaces which they contact. In effect, in being wedged into the interproximal spaces, the bristles appear to act as miniature flexible pry bars which pry particles from such areas.

Finally, it should be appreciated that the foregoing beneficial results attributed to the automatic toothbrush of the invention are obtained by operating the toothbrush for a period of time considered to be average or less than average time for hand brushing operations. The automatic toothbrush not only obtains some results not obtainable by hand brushing but does a better job in the same length of time. As an additional benefit, use of the toothbrush results in a pleasant stimulating sensation; and consequently, there is a definite tendency to brush longer. This, of course, is also desirable. Along these lines, it should be reiterated that the automatic toothbrush of the invention is very easy to handle, as may be seen from FIG. 8, and simple to operate. As a result, children learn to operate the brush without difficulty and also appear to enjoy the task.

From the foregoing description it will be appreciated that the automatic toothbrush of the invention constitutes a valuable contribution to the art as an oral hygienic tool particularly suited for home use. While a specific embodiment of the invention has been shown and described, it should be understood that the invention is not limited to the particular construction described. Accordingly, it is intended in the appended claims to cover all modifications within the true spirit and scope of the invention.

What we claim is:

1. An electrically operated toothbrush comprising a casing, a battery positioned within said casing, an electric motor positioned within the casing and powered by said battery, a toothbrush holder member connected to be reciprocated by said motor, a toothbrush supported by said holder member and having a plurality of bristles extending generally perpendicularly from said tooth-



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ber mounted for reciprocation positioned in said casing, motion translating means position between said motor and said member for causing reciprocation of said member when said motor is driven by said battery, opposed grooves formed on an inside surface of said casing, opposed ears formed on the outside surface of said motor for reception by said opposed grooves to prevent the motor from rotating within the casing in response to the torque produced by the motor.

9. In an electric toothbrush, the combination comprising a generally tubular casing having an upper portion, a lower portion, an intermediate portion, and a longitudinal axis; a rechargeable cylindrical battery positioned in the lower portion of said casing; a generally cylindrical electric motor positioned in the intermediate portion of said casing; a bracket connected to an end of said motor; a shelf integrally formed with said casing extending inwardly at the upper portion of said casing arranged for contact with said bracket to prevent upward movement of said generally cylindrical motor within said casing; an insulating disk positioned between said motor and said battery for cooperating with the battery, the motor, the inwardly extending shelf and the lower portion of the casing to securely hold the motor and the battery within the casing; said motor having a rotatable shaft extending in the direction of the longitudinal axis of said casing; a toothbrush holder positioned within the upper portion of said casing for receiving a toothbrush; means connecting said motor shaft with said holder for translating the rotation of said motor shaft into reciprocation of said holder in a direction generally parallel to said casing longitudinal axis; and guide means positioned in the upper portion of said casing for permitting only straight line reciprocation of said holder with respect to said casing; said casing surrounding and housing said guide means, said motor and other parts of the toothbrush for preventing debris from entering and fouling these parts of the toothbrush, and said cylindrical casing being of such size to permit the hand of a user to grip the casing including the upper portion of the casing which houses the guide means in order to provide a toothbrush holder which may be conveniently gripped and operated even by a child.

10. In an electric toothbrush, the combination comprising a generally tubular casing having an upper portion, a lower portion, an intermediate portion, and a longitudinal axis; a rechargeable cylindrical battery positioned in the lower portion of said casing; said battery having first and second terminals sealed within said toothbrush casing; first and second contact means fixed to an outer surface of said toothbrush casing and connected to said first and second battery terminals for permitting said battery to be recharged while said battery is positioned within said casing; a generally cylindrical electric motor positioned in the intermediate portion of said casing powered by said battery; a shelf integrally formed with said casing extending inwardly in the upper portion of said casing and arranged for preventing upward movement of said generally cylindrical motor within said casing; an insulating disk positioned between said motor and said battery for cooperating with said battery, the motor, the inwardly extending shelf and the lower portion of the casing to securely hold the motor and the battery within the casing; said motor having a rotatable shaft extending in the direction of the longitudinal axis of said casing; a toothbrush holder positioned within the upper portion of said casing for receiving a toothbrush; means connecting said motor shaft with said holder for translating the rotation of said motor shaft into reciprocation of said holder; said casing surrounding and housing said motor and other parts of the toothbrush for preventing debris from entering and fouling these parts of the toothbrush; and said tubular casing being of such size to permit the hand of a user to grip the casing including the upper portion thereof in order to provide a toothbrush holder which may be conveniently gripped and operated even by a child.

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11. In an electric toothbrush combination comprising a generally tubular casing having an upper portion, a lower portion, an intermediate portion, and a longitudinal axis; a rechargeable cylindrical battery positioned in the lower portion of said casing; a generally cylindrical electric motor powered by said battery positioned in the intermediate portion of said casing; a shelf integrally formed with said casing extending inwardly at the upper portion of said casing for preventing upward movement of said generally cylindrical motor within said casing; an insulating disk positioned between said motor and said battery for cooperating with the battery, the motor, the inwardly extending shelf and the lower portion of the casing to securely hold the motor and the battery within the casing; said motor having a rotatable shaft extending in the direction of the casing axis; a toothbrush holder positioned within the upper portion of said casing for receiving a toothbrush; means connecting said motor shaft with said holder for translating the rotation of said motor shaft into reciprocation of said holder in a direction generally parallel to said casing longitudinal axis; and guide means positioned in the upper portion of said casing for permitting only straight line reciprocation of said holder with respect to said casing; said casing surrounding and housing said guide means, the motor and the other parts of the toothbrush for preventing debris from entering and fouling the moving parts of the toothbrush; and said tubular casing being of such size that the thumb and forefinger of an average hand will surround the outer periphery of the casing and the hand will be in contact with approximately half of the outer surface area of the casing, the thumb and forefinger of the hand being positioned at the upper portion of the casing which houses the guide means so that the toothbrush may be readily manipulated by the hand of a user.

12. In an electric toothbrush, the combination comprising a generally tubular casing having an upper portion, a lower portion, an intermediate portion, and a longitudinal axis; a rechargeable cylindrical battery positioned in the lower portion of said casing; a generally cylindrical electric motor powered by said battery positioned in the intermediate portion of said casing; said motor having a shaft extending in the direction of the longitudinal axis of said tubular casing, a pinion mounted on said shaft; a toothbrush holder positioned in the upper portion of said casing for receiving a toothbrush; means connecting said motor shaft with said holder for translating the rotation of said pinion into reciprocation of said holder comprising a mounting bracket attached to said motor, a stub shaft supported by said bracket and extending in a direction perpendicular to said motor shaft, a gear mounted on said stub shaft to be driven by said pinion, an eccentrically mounted shaft on said gear and extending in a direction parallel to said stub shaft, said toothbrush holder having a slot extending in a direction transverse to said motor shaft and being adapted to receive said eccentric shaft, and guide means positioned with respect to said toothbrush holder so that circular movement of said eccentric shaft caused by said motor and gear arrangement is translated into axial straight line reciprocation of said toothbrush holder; said casing surrounding and housing said means for translating the rotation of said pinion into reciprocation of said holder for preventing debris from entering and fouling the parts of the toothbrush.

13. In an electric toothbrush, the combination comprising a generally tubular casing having an upper portion, a lower portion, an intermediate portion, and a longitudinal axis; a rechargeable cylindrical battery positioned in the lower portion of said casing; said battery having first and second terminals sealed within said toothbrush casing; first and second contact means fixed to an outer surface of said toothbrush casing and connected to said first and second battery terminals for permitting said battery to be recharged while said battery is positioned within said casing; a generally cylindrical electric motor posi-



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tioned in the intermediate portion of said casing, the longitudinal axis of said cylindrical motor being generally in line with the longitudinal axis of said battery whereby the motor and the battery may be readily secured within said casing, said motor having a rotatable shaft extending in the direction of the longitudinal axis of said tubular casing; a toothbrush holder positioned within the upper portion of said tubular casing for receiving a toothbrush, means for controlling the motion of said toothbrush holder, crank means connecting said motor shaft with said toothbrush holder for translating the rotation of said motor shaft into actuation of said holder, said casing surrounding and housing said motion control means and the other parts of the toothbrush for preventing debris from entering and fouling these moving parts of the toothbrush; and said generally tubular casing being of such size as to permit the hand of a user to grip the casing including the upper portion thereof which houses the crank means in order to provide a toothbrush holder which may be conveniently gripped and operated even by a child.

14. In an electric toothbrush, the combination comprising a generally tubular casing having an upper portion, a lower portion, an intermediate portion, and a longitudinal axis; a rechargeable cylindrical battery positioned in the lower portion of said casing; said battery having first and second terminals sealed within said toothbrush casing; first and second contact means fixed to an outer surface of said toothbrush casing and connected to said first and second battery terminals for permitting said battery to be recharged while said battery is positioned within said casing; a generally cylindrical electric motor positioned in the intermediate portion of said casing, the longitudinal axis of said cylindrical motor being generally in line with the longitudinal axis of said battery whereby the motor and the battery may be readily secured within said casing, a switch located on the outside of said casing; electrical means extending from said battery to said switch and to said motor for permitting said battery to provide power for said electric motor, said motor having a rotatable shaft extending in the direction of the longitudinal axis of said tubular casing; a toothbrush holder positioned within the upper portion of said tubular casing for receiving a toothbrush, means for controlling the motion of said toothbrush holder, crank means connecting said motor shaft with said toothbrush holder for translating the rotation of said motor shaft into actuation of said holder, said casing surrounding and housing said motion control means and the other parts of the toothbrush for preventing debris from entering and fouling these moving parts of the toothbrush; and said generally tubular casing being of such size as to permit the hand of a user to grip the casing including the upper portion thereof which houses the crank means in order to provide a toothbrush holder which may be conveniently gripped and operated even by a child.

15. In an electric toothbrush, the combination comprising a generally tubular casing having an upper portion, a lower portion, an intermediate portion, and a longitudinal axis; a rechargeable cylindrical battery positioned in the lower portion of said casing; said battery having first and second terminals sealed within said toothbrush casing; first and second contact means fixed to an outer surface of said toothbrush casing and connected to said first and second battery terminals for permitting said battery to be recharged while said battery is positioned within said casing; a generally cylindrical electric motor positioned in the intermediate portion of said casing powered by said battery; a toothbrush holder positioned within the upper portion of said tubular casing for receiving a toothbrush; means for controlling the motion of said toothbrush holder; crank means connecting said motor shaft with said toothbrush holder for translating the rotation of said motor shaft into actuation of said holder; a flexible grommet positioned between said toothbrush holder and the

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upper portion of said tubular casing and said casing surrounding and housing said motion control means, said crank means and the other parts of the toothbrush for preventing moisture and other debris from entering and fouling the parts of the toothbrush; and a rigid annular cap covering said grommet removably attached to the upper portion of said casing.

16. In an electric toothbrush, the combination comprising a generally tubular casing having an upper portion, a lower portion, an intermediate portion, and a longitudinal axis; a cylindrical battery positioned in the lower portion of said casing; a generally cylindrical electric motor positioned in the intermediate portion of said casing powered by said battery; said motor having a shaft extending in the direction of the longitudinal axis of said tubular casing, a pinion mounted on said shaft, a toothbrush holder positioned within one end of said casing for receiving a toothbrush, means for translating the rotation of said pinion into reciprocation of said holder comprising a mounting bracket attached to said motor; a stub shaft supported by said mounting bracket and extending in a direction perpendicular to said motor shaft; a gear mounted on said stub shaft to be driven by said pinion; an eccentrically mounted shaft on said gear extending in a direction parallel to said stub shaft; said toothbrush holder having a slot extending in a direction transverse to said motor shaft and being adapted to receive said eccentric shaft, and guide means positioned with respect to said toothbrush holder so that circular movement of said eccentric shaft caused by said motor and gear arrangement is translated into axial straight line reciprocation of said toothbrush holder; a shelf integrally formed with said casing extending inwardly in the upper portion of said casing arranged for contact with said mounting bracket to prevent upward movement of said generally cylindrical motor within said casing.

17. In an electric toothbrush, the combination comprising a generally tubular casing having an upper portion, a lower portion, an intermediate portion, and a longitudinal axis; a rechargeable cylindrical battery positioned in the lower portion of said casing; means for connecting said battery to be recharged while the battery is positioned within said casing comprising a first contact positioned in a recess at the end of said casing adjacent to the bottom of said battery and a second contact on said casing, a generally cylindrical electric motor positioned in the intermediate portion of said casing, the longitudinal axis of said cylindrical motor being generally in line with the longitudinal axis of said battery whereby the motor and the battery may be readily secured within said casing, said motor having a rotatable shaft extending in the direction of the longitudinal axis of said tubular casing; a toothbrush holder positioned within the upper portion of said tubular casing for receiving a toothbrush, means for controlling the motion of said toothbrush holder, crank means connecting said motor shaft with said toothbrush holder for translating the rotation of said motor shaft into actuation of said holder, said casing surrounding and housing said motion control means and the other parts of the toothbrush for preventing debris from entering and fouling these moving parts of the toothbrush; and said generally tubular casing being of such size as to permit the hand of a user to grip the casing including the upper portion thereof which houses the crank means in order to provide a toothbrush holder which may be conveniently gripped and operated even by a child.

18. In an electric toothbrush, the combination comprising a generally tubular casing having an upper portion, a lower portion, an intermediate portion, and a longitudinal axis; a rechargeable cylindrical battery positioned in the lower portion of said casing; means for connecting said battery to be recharged while the battery is positioned within said casing comprising a first contact positioned in a recess at the end of said casing adjacent to the bottom of said battery and a second contact on said casing, a

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generally cylindrical electric motor positioned in the intermediate portion of said casing, the longitudinal axis of said cylindrical motor being generally in line with the longitudinal axis of said battery whereby the motor and the battery may be readily secured within said casing, a switch located on the outside of said casing; electrical means extending from said battery to said switch and to said motor for permitting said battery to provide power for said electric motor, said motor having a rotatable shaft extending in the direction of the longitudinal axis of said tubular casing; a toothbrush holder positioned within the upper portion of said tubular casing for receiving a toothbrush, means for controlling the motion of said toothbrush holder, crank means connecting said motor shaft with said toothbrush holder for translating the rotation of said motor shaft into actuation of said holder, said casing surrounding and housing said motion control means and the other parts of the toothbrush for preventing debris from entering and fouling these moving parts of the toothbrush; and said generally tubular casing being of such size as to permit the hand of a user to grip the casing including the upper portion thereof which houses the crank means in order to provide a toothbrush holder which may be conveniently gripped and operated even by a child.

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