

Dec. 15, 1964

J. R. AYMAR
MECHANICAL TOOTHBRUSH

3,160,902

Filed Feb. 8, 1963

3 Sheets-Sheet 1

Fig. 1

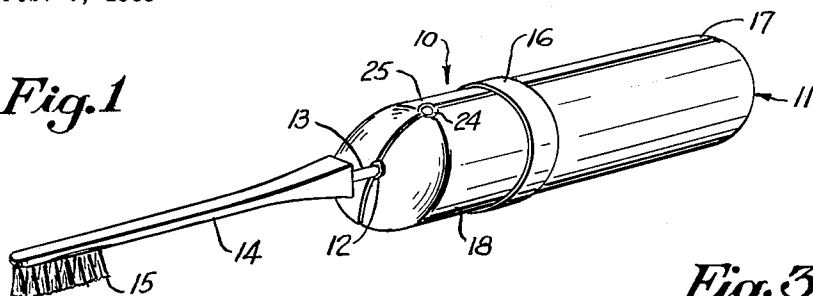


Fig. 3

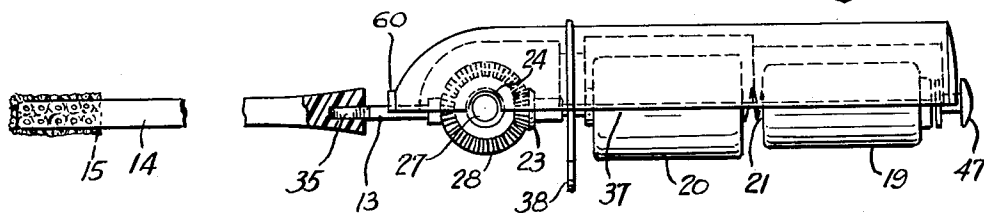


Fig. 2

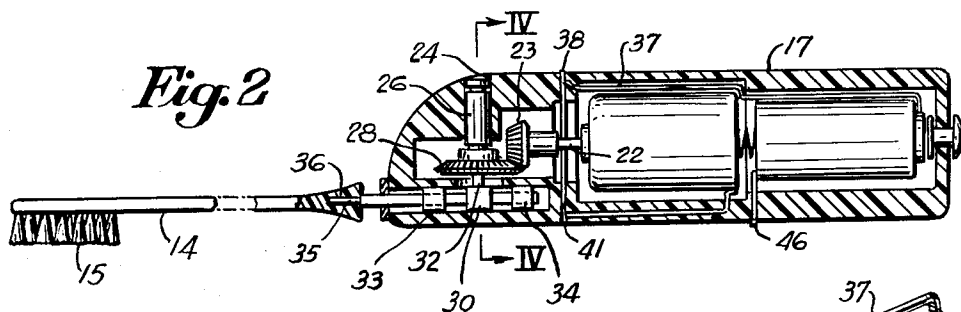


Fig. 4

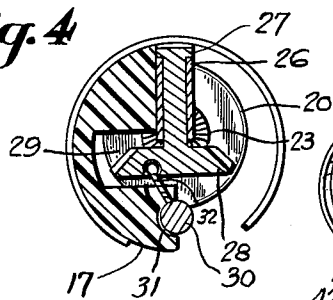


Fig. 5

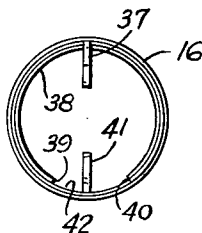
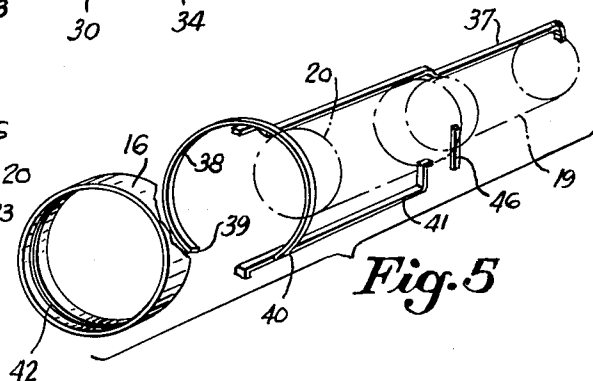


Fig. 6

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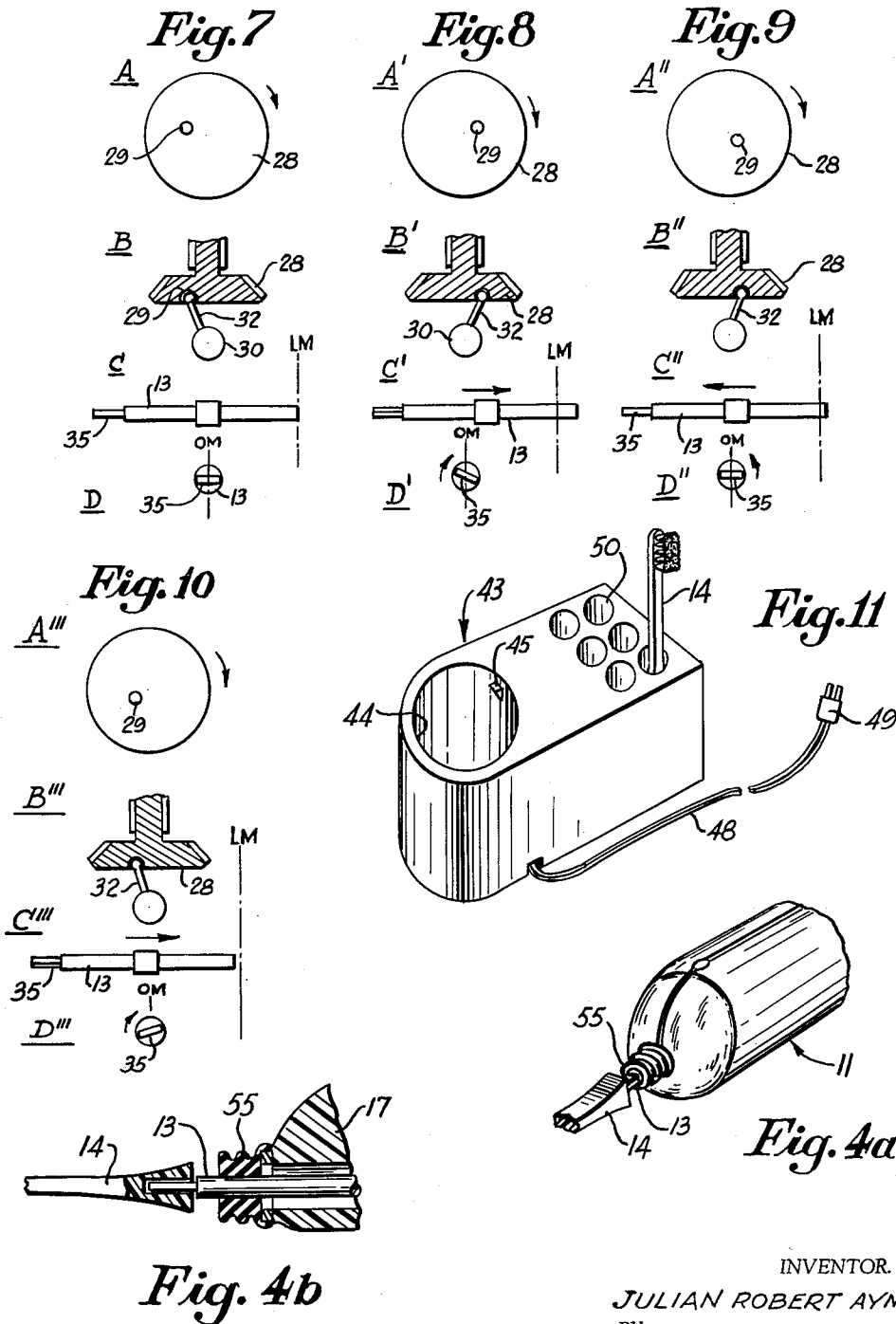
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3 Sheets-Sheet 2



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Fig. 12

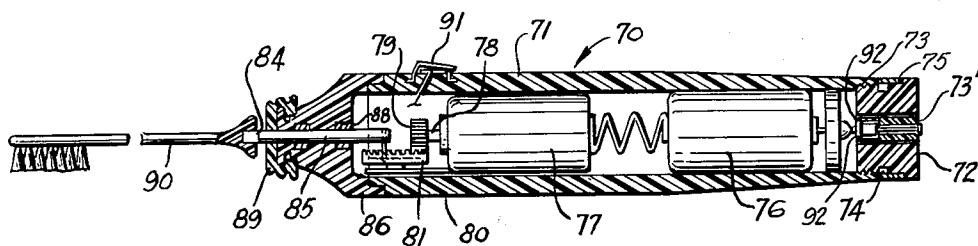


Fig.13

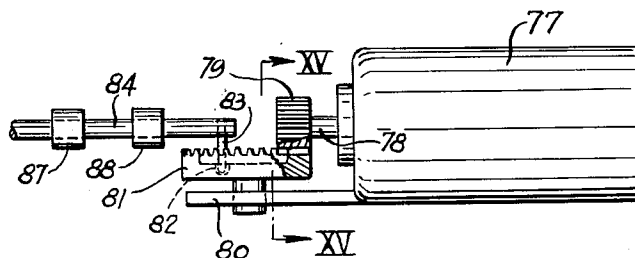


Fig.14

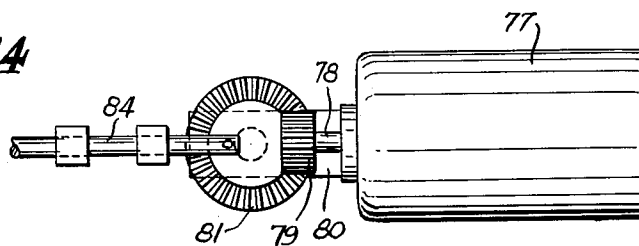
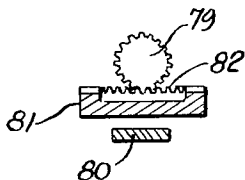


Fig. 15



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MECHANICAL TOOTHBRUSH

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8 Claims. (Cl. 15-22)

This invention relates to a toothbrush and refers more particularly to a battery operated toothbrush for brushing the teeth in that manner considered by dentists to be the most effective movement to employ during brushing.

It is well known that dentists advise patients to brush their teeth with an up and down stroke of the brush to accomplish cleaning in the most effective way. This brush movement is not a truly up and down motion. It is rather an upward and downward oscillation of the brush head along its axis and relatively to the teeth. Many people, however, do not follow this advice and instead brush their teeth by moving the brush bristles back and forth across the teeth. The latter while it may be a faster and less cumbersome means of manipulating the toothbrush, is not totally effective for cleaning the teeth as it does not succeed in removing particles from between the teeth or from within surface indentations in the teeth.

It is, therefore, a primary object of the present invention to provide a mechanical toothbrush for brushing teeth.

Another object is to provide a mechanical toothbrush which in operation moves the brush element against the teeth with both a reciprocating and an oscillating movement, thereby providing maximum cleaning action.

Still another object is to provide a mechanical toothbrush which in use enables any person to brush his teeth in a correct and prescribed manner.

A further object is to provide a mechanical toothbrush which is compact in size, light in weight and easily held in the user's hand.

A still further object is to provide a mechanical toothbrush which has a removable brush element thereby facilitating periodic replacement of worn bristles.

Other objects of the present invention will become apparent in the course of the following specification.

The aforementioned objectives of the present invention may be achieved by providing a mechanical toothbrush which has an elongated hollow casing wherein may be supported a battery and a small electric motor. The electric motor drives a bevel gear pinion which drives a larger bevel gear, the latter being connected with a shaft supported rotatably in the hollow casing. A brush rod is supported slidably in the casing at one end and extends outwardly therefrom. Connected to the extension of the brush rod is a brush element having a number of bristles carried thereon. A crank pin is firmly connected at one end to the brush rod and extends perpendicularly to the axis of the brush rod, the other end of the crank pin extending into an eccentrically located opening in one face of the larger bevel gear. When the larger bevel gear is rotated, the crank pin is moved in such manner that the brush rod reciprocates axially within the casing. Furthermore, the brush rod is caused to oscillate so that the combined movement gives a proper brushing motion to the brush element.

The invention will appear more clearly from the following detailed description when taken in conjunction with the accompanying drawings showing, by way of example, preferred embodiments of the inventive concept.

In the drawings:

FIGURE 1 is a perspective view of a mechanical toothbrush constructed in accordance with the principles of the present invention.

FIGURE 2 is a side elevational view on enlarged scale of the mechanical toothbrush shown in FIGURE 1, one side of the casing having been removed.

FIGURE 3 is a top plan view of FIGURE 2.

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FIGURE 4 is a sectional view as taken along line IV-IV of FIGURE 2.

FIGURE 4a is a fragmentary perspective view showing a rubber seal enclosing the brush rod to prevent water from entering the casing.

FIGURE 4b is a fragmentary section showing the construction of the rubber seal shown in FIGURE 4a.

FIGURE 5 is a view in perspective of the conductor members and switch ring used for establishing continuity between the battery and electric motor for starting and stopping the toothbrush.

FIGURE 6 is an end elevational view of the conductor members and switch ring shown in FIGURE 5, the switch ring being shown in an "on" position.

FIGURES 7 to 10 illustrate diagrammatically the relative positions of the brush rod during its reciprocating and oscillating movement caused by one complete revolution of the larger bevel gear.

FIGURE 11 is a perspective view of the battery charger and stand wherein the mechanical toothbrush and spare brush elements may be stored when not in use.

FIGURE 12 is a longitudinal sectional view of a different embodiment of the toothbrush, as taken along a cutting plane passing vertically through the axis of the toothbrush casing.

FIGURE 13 is a side elevational view of the drive train of the toothbrush shown in FIGURE 12.

FIGURE 14 is a top plan view of FIGURE 13.

FIGURE 15 is a sectional view as taken along line XV-XV of FIGURE 13.

Throughout the specification, like reference numerals are used to indicate like parts.

The mechanical toothbrush 10 illustrated in FIGURE 1 comprises an elongated, generally cylindrically-shaped casing 11 having an opening 12 at one end through which extends a brush rod 13 and on the end of which is carried a brush element 14, the latter having a number of bristles 15. A ring switch 16 encloses the casing 11 and is used for turning the toothbrush on and off. As seen in FIGURE 1, the casing 11 is made in two semi-cylindrical sections 17 and 18 which facilitates assembly of the toothbrush and provides for easy breakdown when making repairs, etc.

Referring now in greater detail to FIGURES 2 to 4, the toothbrush includes a battery 19 which is supported within casing 11 at one end. In this connection, the battery 19 may be a dry cell type, but is preferably one of a rechargeable type as, for example, a nickel cadmium battery. A small electric motor 20 is supported in the casing 11 in front of the battery 19. A spring 21 is connected with the motor 20 and engages the battery 19. The electric motor 20 has a drive shaft 22 to which is firmly connected a bevel type pinion gear 23. Casing sections 17 and 18 have semi-cylindrical slots 24 and 25, respectively, which extend in the sections substantially normal to the axis of the casing. A bushing 26 is supported in the slots 24 and 25 and a shaft 27 is rotatably supported within the bushing. A large bevel type gear 28 is firmly connected with shaft 27 and meshes with pinion gear 23. As seen in FIGURES 4 and 7 to 10, the lower face of gear 28 contains an eccentrically positioned opening 29.

Brush rod 13 which has an enlarged intermediate portion 30, is supported slidably in the casing 11 in an elongated cylindrically-shaped cavity 31 which extends parallel to the axis of the casing. A crank pin 32 is firmly connected with enlarged portion 30 of the brush rod and extends perpendicular thereto. The crank pin 32 extends away from the brush rod and into the eccentric opening 29 in gear 28. Sleeves 33 and 34 enclose brush rod 13 for supporting it within cavity 31.

The outer end 35 of brush rod 13 is substantially flat and fits in slot 36 of brush element 14, this being the

means by which the brush element is removably supported on the brush rod. As seen in FIGURES 4a and 4b, the brush rod 13 is provided with a rubber accordion type seal 55 which encloses the rod and prevents water from entering the casing. The seal 55 is supported on a boss like projection 60 surrounding the opening 12 in the casing.

FIGURE 5 illustrates the means employed for turning the toothbrush "on" and "off." A thin elongated conductor 37 is connected at one end with one terminal of battery 19. The other end of conductor 37 is connected with a hoop-shaped conductor 38, the terminal ends 39 and 40 of which are symmetrically arranged on each side of the casing near the bottom. Another thin conductor member 41 extends from a position between ends 39 and 40 of hoop-shaped conductor 38 along the underside of electric motor 20 and is connected to the motor housing. Ring switch 16 is an annular member made from a non-conductive material. The inner face of the ring switch carries an annular conductor segment 42. The ring switch 16 is rotatable on casing 11 and is positioned thereon around the hoop-shaped conductor which also extends through and around the casing as shown in FIGURES 2 and 3. To establish continuity in the circuit, or to turn the toothbrush "on," ring switch 16 is merely squeezed on the casing 11 until conductor segment 42 is brought into contact with and bridges the gap between conductor 41 and either the end 39 or the end 40 of hoop-shaped conductor 38. This position is shown in FIGURE 6. To turn the toothbrush "off," the finger pressure on the ring switch is merely relaxed until conductor segment 42 is out of contact with conductor 41. Spring 21 is, obviously, also one of the conductors used in establishing the circuit.

In operation:

Let it be assumed that the toothbrush 10 has been assembled, a brush element 14 inserted on brush rod 13 and ring switch 16 properly positioned on casing 11. Ring switch 16 is then squeezed so that conductor segment 42 contacts and bridges the gap between either end 39 or end 40 of conductor 38 and conductor 41. This completes the circuit and current flows from battery 19 to motor 20. Motor drive shaft 22 will thus rotate driving pinion gear 23 which in turn drives bevel gear 28. As bevel gear 28 rotates, it imparts eccentric motion to crank pin 32. This motion of the crank pin is transmitted to brush rod 13 as a combined reciprocating and oscillating motion therein. This motion thus moves the bristle carrying end of the brush element 14 in the preferred manner for effectively brushing the teeth. In use, the user holds the casing in one hand while the brush element is inserted in the mouth with the bristles resting against the teeth. There is no need for the user to manipulate the toothbrush except to move it from one tooth to next, etc. until all the teeth have been cleaned.

The brush element movement may be better understood by referring to FIGURES 7 to 10 which show the cyclic movement of the brush rod and which is the same as that occurring in the brush element. FIGURE 7 shows the position A of bevel gear 28 at the start of one revolution, the corresponding position B of the opening 29 and crank pin, the corresponding longitudinal position C of brush rod 13 with respect to a selected longitudinal mark LM, and position D the end elevation of the brush rod with respect to a vertical plane OM passing through the axis of the brush rod. After one-quarter revolution of bevel gear 28, the opening 29 is in position A', crank pin 32 in position B' and brush rod 13 has moved axially to the right beyond longitudinal mark LM. At the same time brush rod 13 has also rotated clockwise to position D' (FIG. 8). In FIGURE 9, or the effect after one-half revolution, it is seen that brush rod 13 has started to move in an opposite direction to position C'', while it also starts to rotate in a counterclockwise direction. The positions A'', B'', C'', D'' show this combined reciprocation-oscillation movement as the bevel gear nears the three-quarters revolution mark. Thus for each revolution of the bevel gear 28, brush rod makes one reciprocating stroke while at the same time it undergoes one full period of oscillation.

FIGURE 11 illustrates a recharging stand 43 wherein the toothbrush 10 may be inserted when not in use. The stand has an opening 44 for inserting the toothbrush, a contact 45 for recharging which engages a recharging conductor 46 connected with one terminal of battery 19 (FIG. 2). Another contact (not shown) at the bottom of opening 44 contacts button conductor 47 connected to the other terminal of the battery 19. An electric cord 48 with plug 49 is used to connect the stand to a source of electricity for recharging the battery. The construction and operation of the recharging stand is well known among those skilled in the art. The stand 43 also includes a bank of vertical slots 50 for supporting spare brush elements 14.

FIGURES 12 to 15 illustrate a somewhat different embodiment 70 of the toothbrush. In this embodiment, the casing 71 is a hollow cylindrical member with openings at both ends. A plug 72 is removably connected to one end of the casing 71 by means of screw threads 73. The plug 72 contains a conductor 73' and has an annular shoulder 74 which is enclosed by an annular sealer ring 75. When the plug is screwed into the end of the casing, the sealer ring is urged into firm contact with the end of the casing and the annular shoulder 74 and thus acts as a seal to prevent water from entering into the casing.

A battery 76 is disposed concentrically within casing 71 and is used to power drive motor 77. The drive motor has an output shaft 78 to which is firmly connected a spur type pinion gear 79. A support bracket 80 is firmly connected with the motor 77 and extends outwardly therefrom and substantially parallel to the axis of casing 71. The support bracket 80 serves to support rotatably a driven gear 81. The driven gear 81 has pointed teeth 82 as shown in FIGURE 15 which due to their lesser length than the length of the teeth of pinion gear 79, mesh adequately with the pinion gear to provide a continuous non-slip drive between the two gears. It is preferable for sake of quiet running of the gears that the driven gear 81 be of a synthetic material such as a soy bean composition while the pinion gear 28 be of metal. The upper face of driven gear 81 is provided with an eccentric opening 82 wherein fits the crank pin 83 on brush rod 84. The same combined reciprocation-oscillation motor as was described for the toothbrush 10 is thus imparted to the brush rod 84. An important feature of toothbrush 70 is that brush rod 84 is located to move along the axis of the casing 71. Furthermore, the crank pin 83 is located at the end of the brush rod in contrast with toothbrush 10 wherein the crank pin 32 is located intermediate the ends of brush rod 13.

The brush rod 84 extends through a central opening 85 in cap member 86 which is firmly connected with casing 71. A number of metal sleeves 87 and 88 are imbedded in the cap member 86 for supporting the brush rod. A rubber accordion type seal 89 is used to prevent water from entering into the casing 71. Brush rod 13 also carries a brush element 90. A push button switch 91 of a type similar to those used on flashlights is used for turning toothbrush 70 on and off. The wiring for toothbrush 70 is not illustrated inasmuch as the same conductor arrangement illustrated in FIGURE 5 may be utilized for this embodiment.

Referring again to FIGURE 12 it was found advantageous to mount a rectifier 92 within plug 73. The rectifier is utilized in recharging battery 76 and is normally mounted in recharging stand 43 in a manner well known in the prior art. By mounting the rectifier in the toothbrush body rather than in the recharging stand a considerable cost saving is obtained in making the recharging stand.

While there is above disclosed but some embodiments

of the toothbrush, it is possible to produce still other embodiments without departing from the scope of the inventive concept herein disclosed.

What is claimed is:

1. A mechanical toothbrush comprising an elongated hollow casing having an opening at one end, said opening being offset with respect to the longitudinal axis of said casing, a brush rod slidably supported in said casing and extending through and beyond said opening, a crank pin firmly connected with said brush rod and extending perpendicular thereto, a gear having a plain lower face and an opening in said lower face located eccentrically with respect to the center of said gear, means for supporting said gear in said casing for rotation in a plane parallel to the axis of said casing, said crank pin extending into the eccentric opening in said gear, means for rotating said gear whereby said crank pin transmits reciprocating and oscillating movement to said brush rod, and a brush element carried by said brush rod.

2. A mechanical toothbrush comprising an elongated hollow casing having an opening at one end, said opening being offset with respect to the longitudinal axis of said casing, a brush rod slidably supported in said casing and extending through and beyond said opening, a crank pin firmly connected with said brush rod and extending perpendicular thereto, a bevel gear having a plain lower face and an opening in said lower face located eccentrically with respect to the center of said bevel gear, means for supporting said bevel gear in said casing for rotation in a plane parallel to the axis of said casing, said crank pin extending into the eccentric opening in said bevel gear, another bevel gear meshing with the first-mentioned bevel gear for driving said first-mentioned gear, means for rotating said other bevel gear whereby the rotation of the first-mentioned bevel gear causes said crank pin to transmit reciprocating and oscillating movement to said brush rod, and a brush element carried by said brush rod.

3. A mechanical toothbrush in accordance with claim 1 wherein the means for rotating said other bevel gear comprises an electric motor supported in said casing and having a drive shaft firmly connected with said other bevel gear, and a battery for supplying electricity to said electric motor.

4. A mechanical toothbrush in accordance with claim 3 further comprising means for controlling flow of electricity from said battery to said electric motor.

5. A mechanical toothbrush comprising a cylindrical shaped casing having a cavity extending from one end of said casing a distance in the direction of the other end, said cavity being radially offset from, and parallel with the axis of said casing, a brush rod slidably supported in said cavity and extending beyond the end of said casing, a crank pin firmly connected with said brush rod and extending perpendicular thereto, a bevel gear having a plain lower face and an opening in said lower face located eccentrically with respect to the center of said bevel gear, means for supporting said bevel gear in said casing for rotation in a plane parallel to the axis of said casing, said crank pin extending into the eccentric opening in said bevel gear, another bevel gear meshing with the first-

mentioned bevel gear for driving said first-mentioned gear, an electric motor supported within said casing and having a drive shaft firmly connected with said other bevel gear, a battery supported within said casing in alignment with said electric motor for supplying electricity to said electric motor, said other bevel gear being adapted to rotate the first-mentioned bevel gear whereby said crank pin transmits reciprocating and oscillating motion to said brush rod, and a brush element carried by said brush rod.

6. A mechanical toothbrush comprising an elongated hollow casing having openings at both ends, a plug removably connected to one end of said casing, an electric motor supported concentrically within said casing and having a drive shaft extending coaxially with the longitudinal axis of said casing, a battery supported in said casing for supplying electricity to said electric motor, a pinion gear firmly connected with said drive shaft, another gear meshing with said pinion gear, means supporting said other gear for rotation about an axis extending perpendicular to the axis of said casing, said other gear having an upper face and an opening located concentrically in said face with respect to the axis of rotation of said gear, a cap member firmly connected to the other end of said casing and having an opening therein concentric with respect to the axis of said casing, a brush rod supported in said cap member and extending through and beyond the opening in said cap, a crank pin firmly connected at one end to said brush rod, and extending at the other end into the opening in said other gear whereby rotation of said other gear causes said crank pin to transmit a combined reciprocating and oscillating motion to said brush rod, and a brush element carried by said brush rod.

7. A toothbrush in accordance with claim 6 wherein said plug has a central opening, and a rectifier supported in said central opening.

8. A mechanical toothbrush comprising an elongated hollow casing having an opening at one end, a brush rod slidably supported in said casing, a crank pin connected with one end of said brush rod, the other end of said brush rod extending through and beyond said opening, drive means including a rotary driving member supported in said casing, said rotary driving member having an eccentric opening therein for receiving said crank pin whereby said brush rod is reciprocated in the direction of its longitudinal axis and oscillated about said longitudinal axis when said rotary driving member rotates, and a brush element carried by said brush rod.

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