Nov. 17, 1964 H. L. HARTMAN ETAL 3,156,936

ELECTRIC TOOTHBRUSHES

Filed Nov. 21, 1962 3 Sheets-Sheet 1

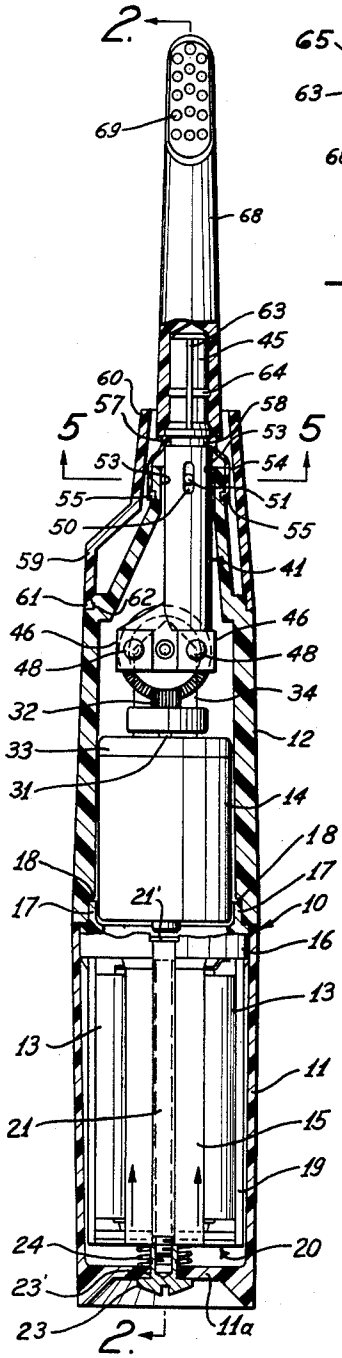


Fig. 1.

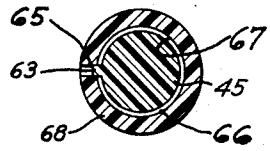


Fig. 10.

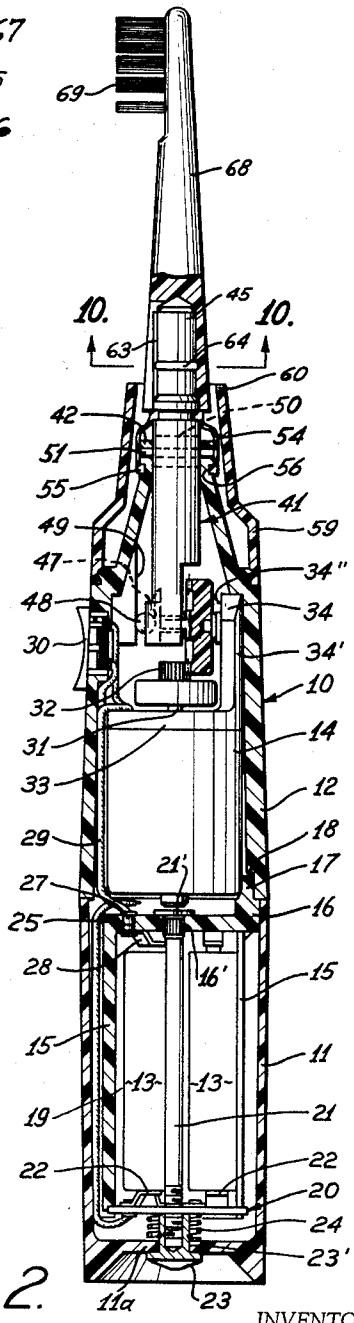


Fig. 2.

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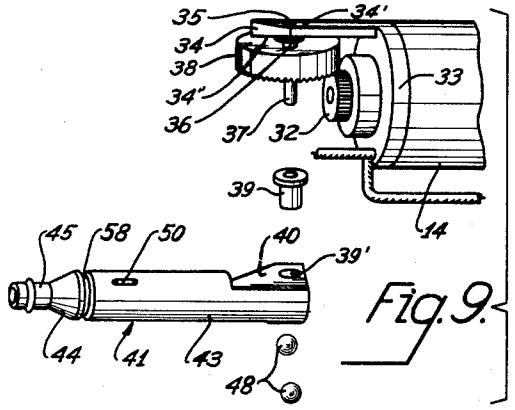


Fig. 9.

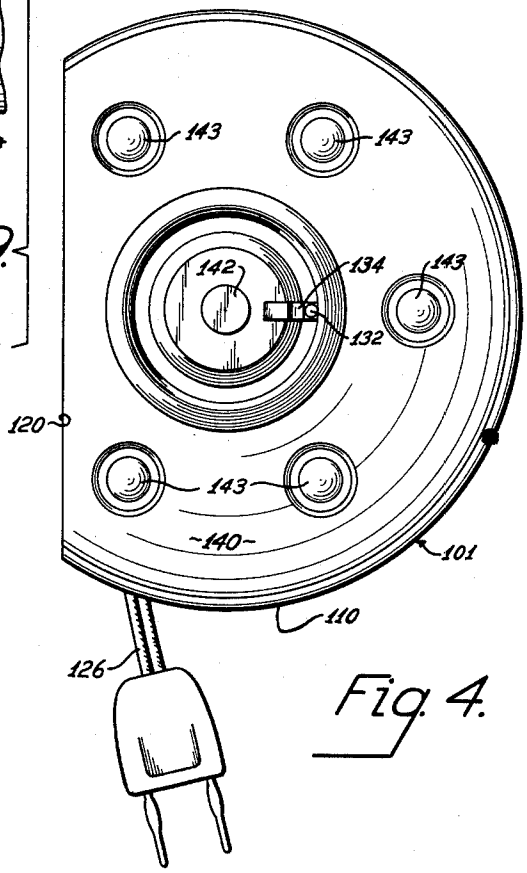


Fig. 4.

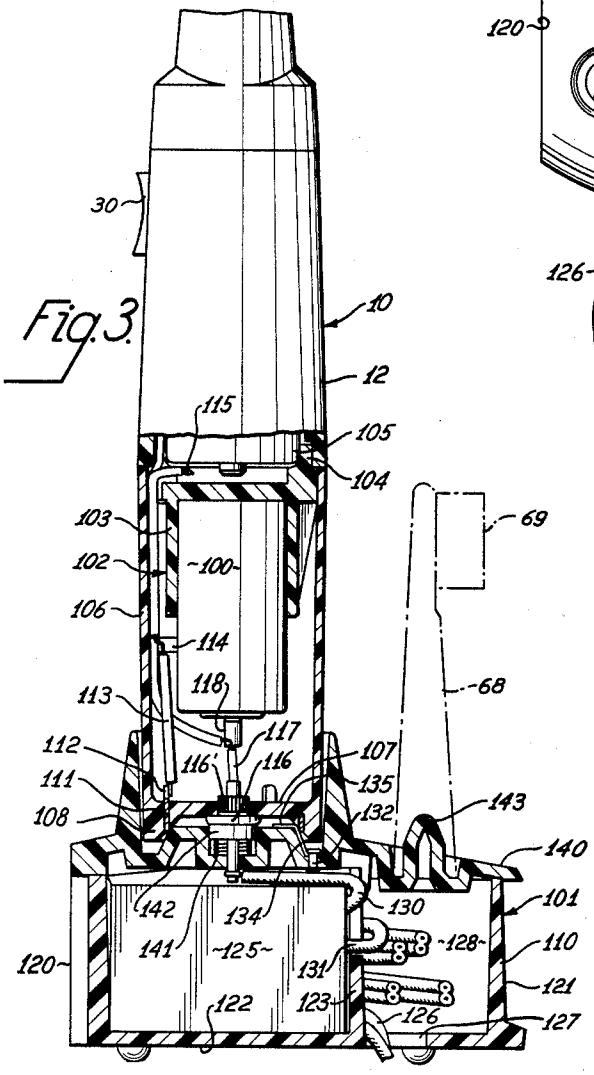


Fig. 3.

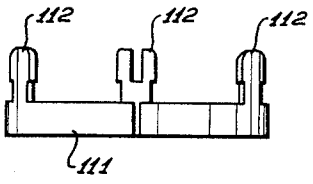


Fig. 11.

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ELECTRIC TOOTHBRUSHES

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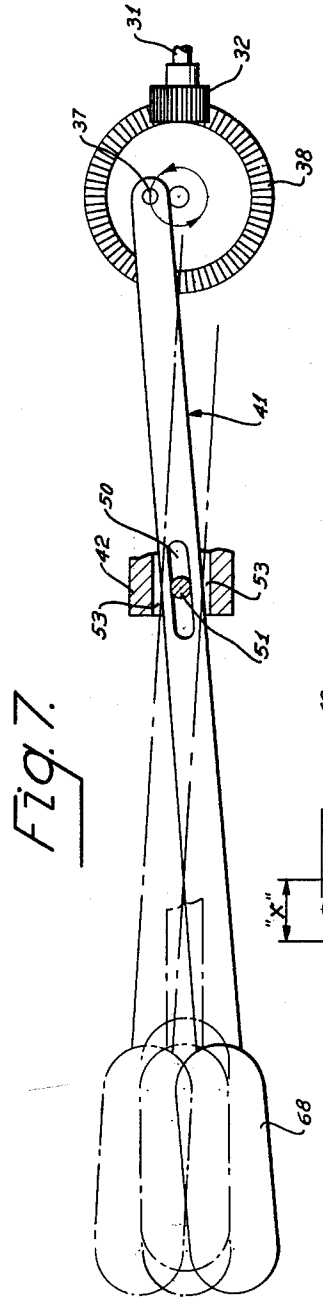


Fig. 7.

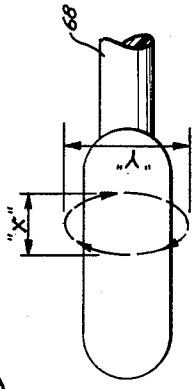


Fig. 8.

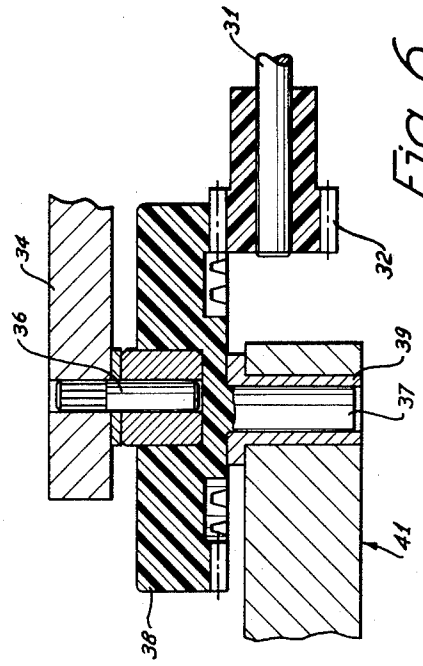


Fig. 6.

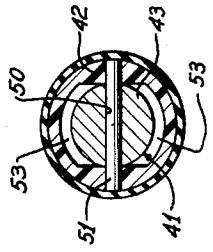


Fig. 5.

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United States Patent Office 3,156,936 Patented Nov. 17, 1964

3,156,936

ELECTRIC TOOTHBRUSHES

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Filed Nov. 21, 1962, Ser. No. 239,283
4 Claims. (Cl. 15—22)

My invention relates to an electric toothbrush and relates more particularly to a cordless toothbrush adapted to be electrically driven by a replaceable or rechargeable battery housed in the brush holder, and adapted to be held in the hand while in use.

Toothbrushes heretofore constructed for electrical operation have commonly been operated for either upward and downward reciprocating movement, or longitudinally reciprocating movement of the brush, or the bristles are caused to move in a rotary direction or in a semicircular path. These are not effective to thoroughly clean the teeth and are usually highly complex mechanisms.

In the present invention, the toothbrush is given an orbital motion, the orbital path being oval or elliptical, the major component being an upward and downward movement and the teeth are thus thoroughly cleaned and the bristles caused to enter the crevices between the teeth and the gum line, and to contact entire surfaces of the teeth during cleaning.

My invention is particularly adapted to use with removable toothbrushes so that any of a plurality of brushes may be operated by the same motor means. Further the invention contemplates the optional manual use of such separate brushes.

An object of my invention is to provide improved apparatus for electrically driving toothbrushes of the type referred to in the path related and in which the driving mechanism is linked to the brush in an improved manner.

Another object of the invention is to provide an improved electrical toothbrush having a minimum of parts, simplicity of assembly, being inexpensive to manufacture and highly efficient in use.

A still further object of my invention is to provide a highly compact motor drive unit, sealed against the ingress of saliva and moisture.

Another object of my invention is to provide an improved cordless electrically driven toothbrush having self-contained battery power means for driving the same ensuring safe shock-resistant operation thereof and providing ease in handling.

Other objects of my invention and the invention itself will become readily apparent from the following description and appended drawings, in which:

FIG. 1 is a longitudinal sectional view of the electric toothbrush of my invention housing a replaceable battery unit;

FIG. 2 is a sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is a view pattern in section, of a modification of the toothbrush of my invention, in which form a rechargeable battery is contained within the housing, said battery adapted to be charged by charger means mounted in the standard shown therein, certain parts similar to parts employed in the form of FIGS. 1 and 2 being shown in elevation;

FIG. 4 is an enlarged plan view of the charged stand of FIG. 3;

FIG. 5 is a sectional view taken on the line 5—5 of FIG. 1;

FIG. 6 is an enlarged view four times the size of the drive gears shown in FIGS. 1 and 2;

FIG. 7 is a simplified diagrammatic view of the improved gear drive and linkage means for driving the

toothbrush showing in dot and dash lines the path of movement of the toothbrush and linkage;

FIG. 8 is an enlarged view of the orbital path of the brush of my invention, the letter "y" designating the major vertical axis and the letter "x" the minor horizontal axis of the orbital movement;

FIG. 9 is an exploded view of the gear and link drive means of my invention;

FIG. 10 is a view taken on the line 10—10 of FIG. 2;

FIG. 11 is a side elevational view of the ring contact shown at 111 in FIG. 3.

Referring now to the drawings in all of which like parts are designated by like reference characters, and referring more particularly to the embodiment of FIGS. 1 and 2, the numeral 10 generally indicates the body which consists in a pair of tubular housing elements 11 and 12, the body being formed of any suitable material, as for example, from a plastic material. As shown in the figures, the housing element 11 houses replaceable battery means 13 in the form shown in FIGS. 1 and 2 and the casing element 12 houses an electric motor, as for example a 3 to 4½ volt direct current motor 14 or the like.

The battery means shown in FIGS. 1 and 2 preferably consists in a plurality, preferably three in number, of 1½ volt penlite battery units 13 connected in series and retained in a battery holder 15; said battery holder having a plastic centrally apertured disc 16 having a plurality of upwardly extending lugs 17 adapted to lockingly engage in a plurality of end recesses 18 provided about the lower periphery of the interior of the motor housing 12; the battery holder 15 also comprises a plurality, preferably 3 in number, of generally exteriorly arcuate tapered battery enclosing fingers 19 of plastic material depending from the disc 16, said fingers adapted to securedly mount the battery holder 15 within the battery housing 11. The tubular battery housing 11 is provided with an aperture 23' centrally disposed within an end or bottom wall 11*a* thereof. A generally circular centrally apertured battery contact plate 20 is telescoped over a screw threaded bolt 21 having an enlarged head 21', which bolt is securely seated in the circular opening 16' in the battery holder disc 16 and bottomed in screw threaded engagement with the cap nut 23 projecting through the opening 23' in the end wall of the battery housing. The fingers 19 of the battery holder 15 are disposed in generally U-shaped recesses positioned about the outer periphery of the contact assembly plate 20. The plate 20 is provided with terminal contact 22 adapted to contact battery terminals. A lead line connected to the terminal 22 connects one end of the series connected batteries to the motor 14. Coil spring means 24 telescoped about the cap nut 23 and interposed between the contact plate 20 and the end wall 11*a* of the battery housing yieldingly exert pressure upon the contact plate to maintain the terminals mounted thereon in engagement with the batteries mounted within the battery holder 15.

The disc 16 is provided with a pair of concentrically disposed openings 25, 25, through one of which is projected a tubular conductor 27 carrying a spring contact 28, and through the other a separate spring contact (not shown) is mounted. By these means the batteries 13 are connected in series, and by lead line 29 projected through the conductor 27, connected to the motor 14 through the switch means 30. The switch 30 is a button type switch mounted within an exterior side wall of the motor housing.

The motor 14 is disposed within the motor housing 12 which housing is secured by means of the upwardly projecting lugs 17 of the battery holder 15 to the said holder

to form an integral housing. The motor is provided with a drive shaft 31 on which is carried a gear pinion 32. At the drive shaft end of the motor, a bell end cover 33 is provided, said cover having a bracket 34 disposed at one end and generally at right angles thereto, and formed integrally therewith; the said bracket is provided with an outer semi-arcuate surface 34' conforming to the inner cylindrical walls of the motor housing 12 and with flat inner surfaces 34'' underlying the same. An opening 35 is disposed within the outer end of the bracket 34 into which an upwardly knurled pin 36 is pressed, the lowermost end of the said pin acting as a drive shaft for the rotary face gear 38 which is in meshed driving engagement with the gear pinion 32. The reduction between the gears is in the preferable ratio of approximately 3:1. The rotary face gear 38 is provided with an integrally formed output shaft 37 projecting outwardly from the face portion of the gear eccentrically of the axis of the pin or shaft 36, and said shaft 37 is journalled within a bushing 39 located within a circular recess 39' carried on a land 40 of a brush holder 41. A brush holder 41 is adapted to longitudinally reciprocate within the motor housing 12 which is preferably, as shown, provided with an offset nose portion 42 disposed laterally of the longitudinal axis of the housing 12, through which said brush holder 41 projects.

The brush holder 41, as best illustrated in FIGS. 1, 2 and 9, has a generally cylindrical body portion 43, a conical nose portion 44 and a male member 45 disposed at one end thereof and has a recessed end portion 40 disposed at the opposite end thereof. The upper surface of the said portion 40 is provided, as hereinbefore recited, with a circular opening 39' adapted to receive the bushing 39, and the lower surface has a pair of depending reentrant arms 46, each having a circular race 47 therein, in which a ball bearing 48 is adapted to rotate during rotation of the brush holder 41 effected through the gearing described. The bearings 48 are adapted to ride on oppositely positioned raised longitudinally disposed flat surfaces 49 projecting inwardly of the housing 12 adjacent the offset end thereof. The brush holder 41, it will be noted, is secured to the rotary gear 38 eccentrically of the axis of rotation of said gear as illustrated in FIGS. 1 and 6 and diagrammatically in FIG. 7. Adjacent the forward end of the body portion of the brush holder, the holder is provided with an elongated guide slot 50, through which a guide pin 51 projects, which guide pin is journalled in aligned openings in the apertured end of the nose 42 of the motor housing. As best shown in FIG. 5 clearance 53 is provided between the nose 42 of the housing and the body portion of the brush holder 41. An apertured generally cup shaped flexible sealing member 54 is secured to the motor housing 12 by means of the penetration of the peripheral inturned flange 55 of the seal 54 into circular groove 56 encircling the nose 42 of said motor housing 12 and on its opposite end, the seal 54 is provided with a peripheral inturned flange 57 which is received within an annular groove 58 encircling the brush holder, whereby the motor housing is effectively sealed against the ingress of moisture or saliva. A further cover seal 59 of preferably plastic material is disposed in spaced relation to the nose 42 being telescoped thereover and is provided with an offset conical nose portion 60, the same having an inturned flange 61 at one end seated within a groove 62 in the motor housing 12 adjacent the nose portion 42 thereof.

The toothbrush holder 41 is provided with a longitudinally extending rib 63 and with a circular rib 64 adapted to be seated in a longitudinally and traversely extending groove respectively, which grooves 65, 66 are disposed in a socket 67 in a toothbrush handle 68 which handle is formed of plastic material and carries at its forward end bristles 69 as in conventional toothbrushes.

When the motor is energized by the switch and battery means associated therewith, the rotary gear 38 imparts reciprocating movement of the crank shaft type through the eccentric pin 37 to the brush holder 41 and, due to the pivotal lost-motion movement of said holder about the pin 51, effects orbital movement of the brush as indicated in FIGS. 7 and 8. As will be noted, due to the illustrated relation of the guide slot to the eccentric path of movement of the pin about the axis of rotation of the face gear 38 the resultant orbital movement has a major component "y" and, as illustrated, the axis of said movement "y" is approximately twice that of the minor component "x" which results in an oval or elliptical brushing action.

In the form of my invention shown in FIG. 3, I have shown a cordless electrically actuated toothbrush powered by a rechargeable battery 100, and have shown in FIG. 4 the charger and standard 101 for such brushes. The motor and reciprocating rotary toothbrush holder, toothbrush, etc. of the invention of FIGS. 1 and 2 is the same in the form of FIG. 3. However, in FIG. 3 the battery holder 102 is a tubular member preferably of plastic material and having a plurality, preferably three in number, equally spaced ribs 103 disposed externally thereof. The holder is provided with a circular upstanding flange 104 adapted to be projected within, and cemented to an end portion of the motor housing 12 and to encircle the motor casing 105. The battery housing 106 is a tubular member having a centrally apertured end wall 107, said end having a depending skirt 108 adapted to be seated within a charging stand 101 for the rechargeable battery. A ring contact 111 is mounted upon the end wall 107 of the housing 106 and said ring is provided with a plurality of upstanding lugs 112, equally spaced about its circumference, one of said lugs having a lead line 113 soldered thereto, said lead being connected to the negative terminal 114 of the battery, and to the motor, as at 115. A button conductor 116 is projected through the central aperture 116' of the battery housing 106 and a lead 117 is soldered thereto, the lead being threaded through the positive terminal 118 of the battery to the switch 30 and thence back to the motor 14.

The battery charger and toothbrush standard is a truncated circular housing 110 consisting of a generally cup shaped base having a flat end wall 120, arcuate side walls 121, bottom wall 122, an upstanding generally semi-arcuate partition 123 being integral therewith and circumferentially spaced inwardly of the arcuate side walls of the base and of relatively less heighth than said walls. The charger unit 125 is enclosed within the partitioned portion of the base and cemented thereto and the power cord 126 therefrom extends through an opening 127 in the bottom wall of its base, the cord being coiled within the space 128 provided between the outer periphery 121 of the standard and the partition 123. A cover 140 for the standard centrally apertured at 141 is adapted to have a spring pressed contact 142 seated therein and a positive lead 130 from the charger is soldered thereto, said contact adapted to contact the button conductor 116. A negative lead 131 from the charger is soldered to an eyelet 132 projected through the cover 140 upon which is mounted a generally Z-shaped contact plate 134, the upper land 135 of which contacts the ring 111. Concentrically spaced from the central aperture 116' of the cover 140 are a plurality of upstanding lugs 143, equally spaced and adapted to be projected within end sockets 67 of various toothbrushes 68 adapted to be optionally used with the electrically actuating means of my invention.

What I claim is:

1. In a cordless electric toothbrush comprising battery means, an electric motor, a housing, adapted to be held in the hand, enclosing said battery means and said motor, said housing having an open end, drive means including a motor drive shaft, gear transmission means comprising

a gear pinion on said drive shaft, bracket means disposed at one end of said motor, said bracket means carrying a gear-supporting shaft, a rotary face gear supported thereby, said face gear driven by said gear pinion, an elongated brush holder journalled eccentrically on said rotary face gear, said holder provided with an elongated guide slot, pin means extending transversely through said guide slot and journalled in said housing, said holder adapted to be projected through said open end of said housing with clearance, rotary movement of said rotary gear imparting reciprocating movement to said holder, said holder pivoting about said pin and effecting orbital movement of the brush secured thereto.

2. In a cordless electric toothbrush comprising battery means, an electric motor, a housing, adapted to be held in the hand, enclosing said battery means and said motor, said housing having an open end, drive means including a motor drive shaft, gear transmission means comprising a gear pinion on said drive shaft, a rotary face gear in driving engagement with said gear pinion, an elongated brush holder journalled eccentrically on said rotary face gear, said holder provided with an elongated guide slot, pin means extending transversely through said guide slot and journalled in said housing, said holder adapted to be projected through said open end of said housing with clearance, rotary movement of said rotary gear imparting reciprocating movement to said holder, said holder pivoting about said pin and effecting orbital movement of the brush secured thereto, a cup-shaped flexible sealing element secured at one end to the end of said brush holder projecting beyond the housing and secured at its opposite end to the said housing.

3. In a cordless electric toothbrush comprising battery means, an electric motor, a housing, adapted to be held in the hand, enclosing said battery means and said motor, said housing having an open end, drive means including a motor drive shaft, gear transmission means comprising a gear pinion on said drive shaft, a rotary face gear in driving engagement with said gear pinion, an elongated brush holder journalled eccentrically on said rotary face gear, said holder provided with an elongated guide slot, pin means extending transversely through said guide slot and journalled in said housing, said holder adapted to be projected through said open end of said housing with clearance, rotary movement of said rotary gear imparting

reciprocating movement to said holder, said holder pivoting about said pin and effecting orbital movement of the brush secured thereto, a handle secured to said toothbrush, said handle provided with a socket, an end of said brush holder securely seated within said socket.

4. In a cordless electric toothbrush comprising battery means, an electric motor, a housing, adapted to be held in the hand, enclosing said battery means and said motor, said housing having an open end, drive means including a motor drive shaft, gear transmission means comprising a gear pinion on said drive shaft, a rotary face gear in driving engagement with said gear pinion, an elongated brush holder journalled eccentrically on said rotary face gear, said holder provided with an elongated guide slot, pin means extending transversely through said guide slot and journalled in said housing, said holder adapted to be projected through said open end of said housing with clearance, rotary movement of said rotary gear imparting reciprocating movement to said holder, said holder pivoting about said pin and effecting orbital movement of the brush secured thereto, said brush holder comprising a recessed flat surface, said surface provided with an opening, a shaft carried by the rotary face gear and disposed eccentrically of the axis of rotation of said rotary face gear adapted to be disposed within said opening, said recessed end of the holder being provided with a pair of dependent reentrant arms, ball bearing means adapted to be captured between said arms and raised elongated seating surfaces on the interior of the housing and adapted to have rotative and reciprocating movement therewith.

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