DRIVING UNIT FOR ELECTRIC TOOTHBRUSH

Filed Oct. 24, 1965 3 Sheets-Sheet 1

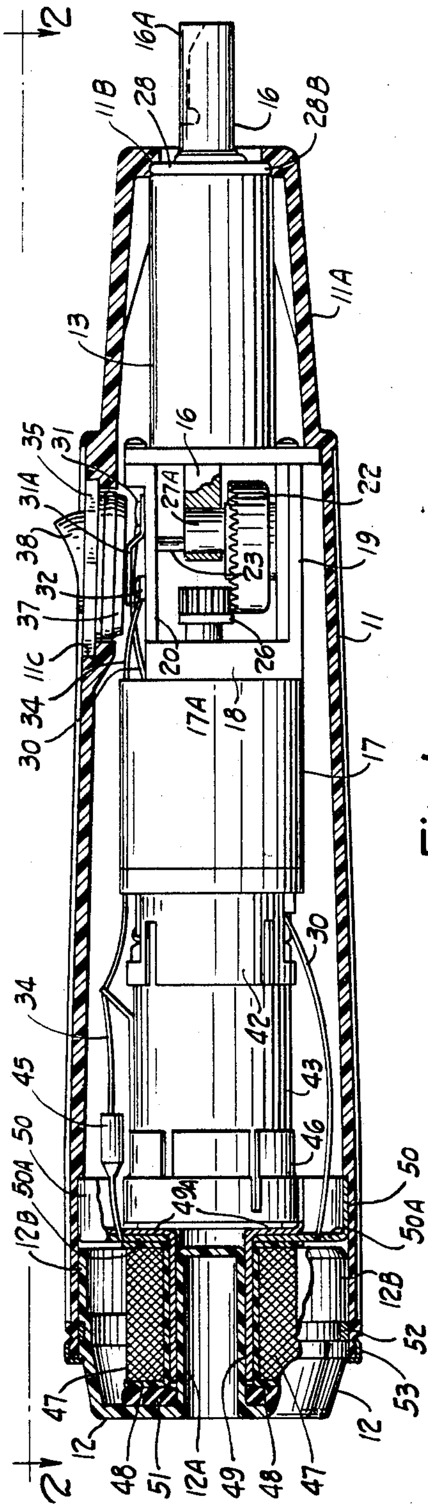

Fig. 1

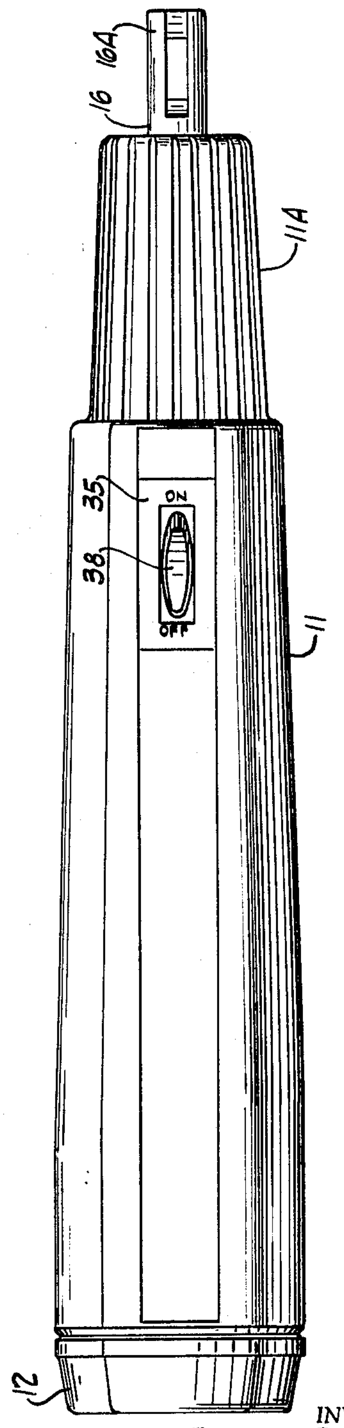

Fig. 2

INVENTORS.
BRUNO SATKUNAS
MERLE E. LYONS
BY Woodling, Krost, Granger and Rust.
ATTORNEYS

July 23, 1968 B. SATKUNAS ET AL 3,394,277

DRIVING UNIT FOR ELECTRIC TOOTHBRUSH

Filed Oct. 24, 1965 3 Sheets-Sheet 2

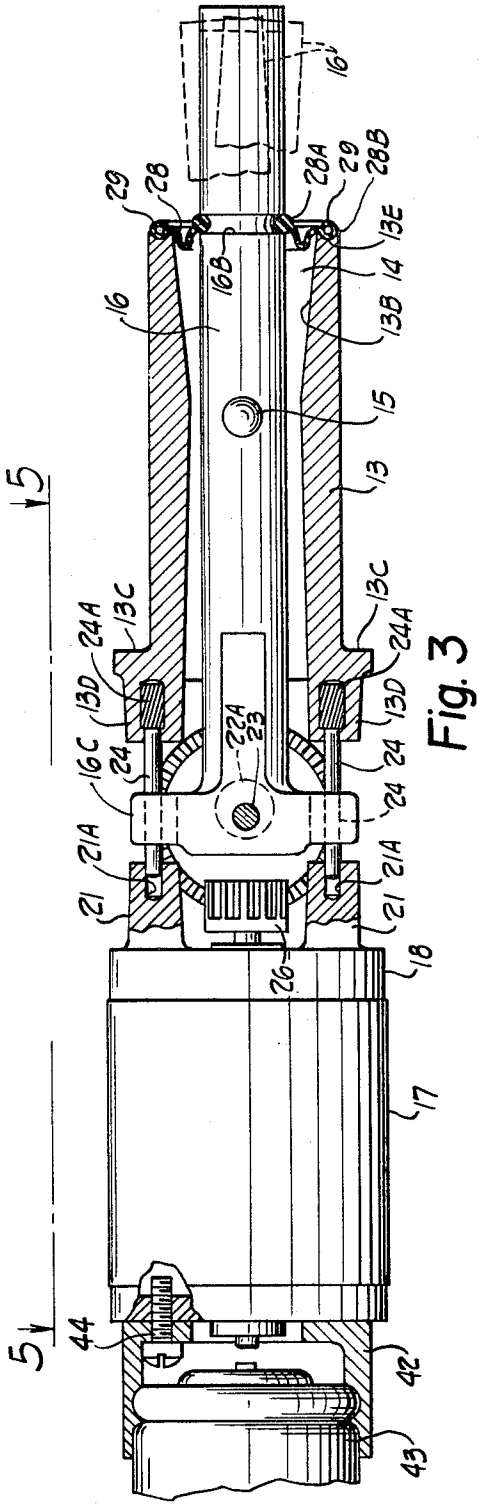

Fig. 3

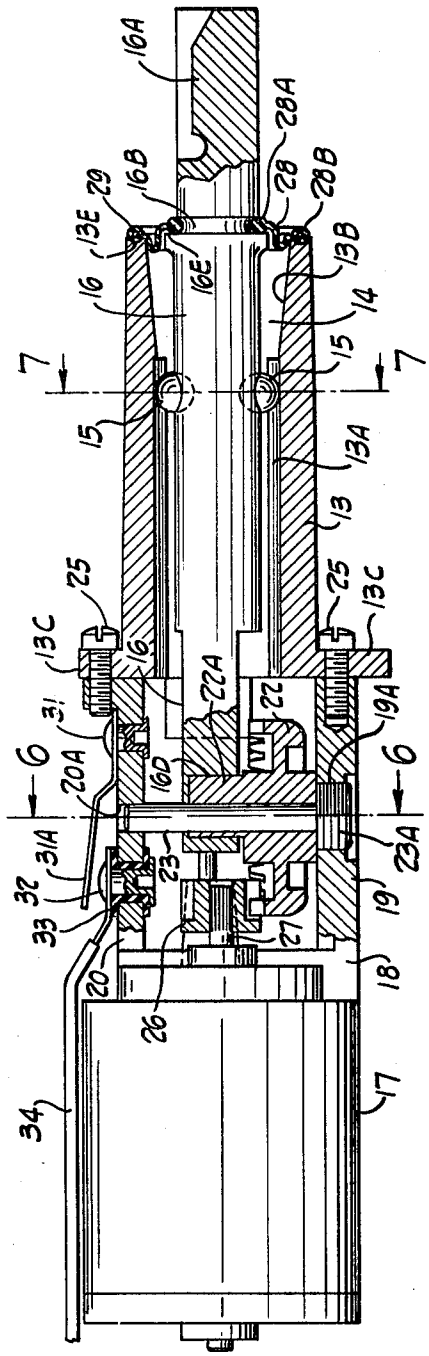

Fig. 4

INVENTORS.
BRUNO SATKUNAS
MERLE E. LYONS
BY
ATTORNEYS.

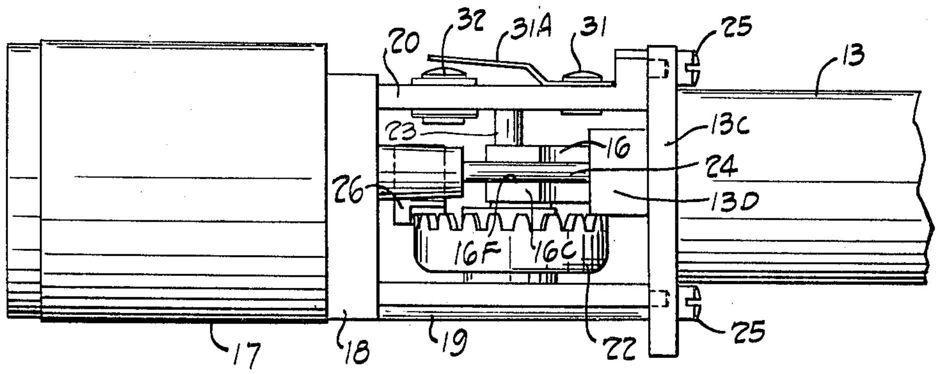

Fig. 5

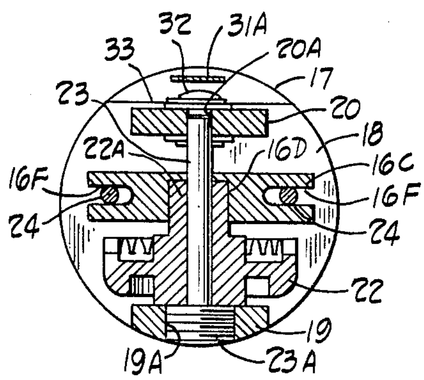

Fig. 6

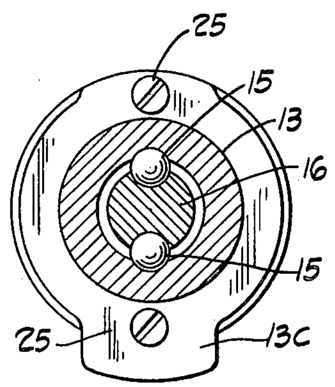

Fig.7

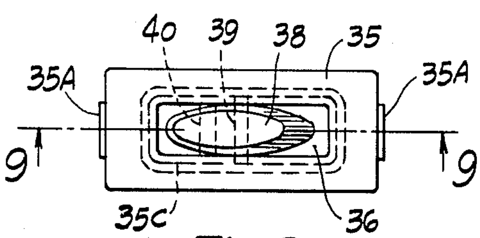

Fig.8

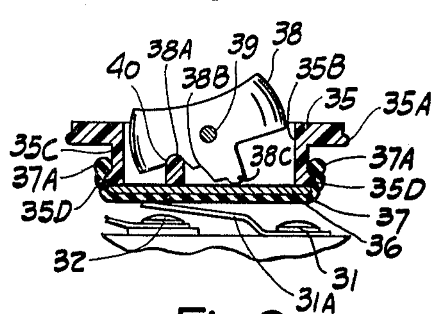

Fig.9

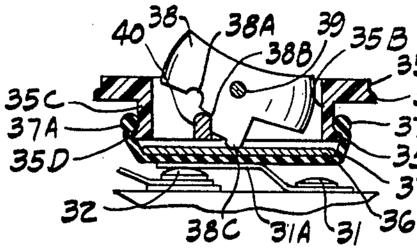

Fig.10

INVENTORS
BRUNO SATKUNAS
MERLE E. LYONS

BY [illegible signature]

ATTORNEYS.

United States Patent Office 3,394,277 Patented July 23, 1968

3,394,277

DRIVING UNIT FOR ELECTRIC TOOTHBRUSH

Bruno Satkunas, Lexington, Ohio, and Merle E. Lyons, Gallatin, Tenn., assignors to Dominion Electric Corporation, a corporation of Ohio

Filed Oct. 24, 1965, Ser. No. 504,500
6 Claims. (Cl. 310—80)

ABSTRACT OF THE DISCLOSURE

A driving unit for a toothbrush in which an electric motor by a gearing arrangement reciprocates a plunger in the casing, the rearward portion of the plunger being guided by two parallel pin members carried by the casing which are accommodated in longitudinally extending grooves along on opposite sides of the rearward portion of the plunger, the grooves having open opposite ends through which the pin members protrude, the free ends of the pin members fitting into sockets carried by the electric motor and thereby being retained in parallel relationship, the fit of the pin members in the grooves being such that the plunger axis may tilt as the plunger reciprocates in a plane determined by the guidance of the pin members.

Our invention relates to driving units for electric toothbrushes.

An object of our invention is to provide an improved mechanical structure for the driving or power unit of an electric tootbrush.

Another object is the provision of an improved mechanical arrangement in the portion of such a toothbrush in which rotary movement is translated into the required movement of the toothbrush actuated thereby.

Another object is the provision of improved guide means for controlling the movement and disposition of the parts in a motion-translating mechanism, as in an electric toothbrush.

Another object is the provision of an improved switch structure providing a waterproof seal to the switch mechanism and actuatable from outside of the casing of the mechanism.

Another object is the provision of improved means for mounting and sealing the switch to the casing of an electric toothbrush driving unit.

Another object is the provision of an improved sealing member at the forward end of an electric toothbrush driving unit which permits required actuation of the arm carrying the toothbrush and seals the interior of the casing around the arm.

Another object is the provision of such a sealing element constructed and arranged to provide a superior sealing function and also well-adapted for the actuation of the toothbrush-carrying arm.

Another object is the provision in a battery-containing driving unit for a toothbrush or the like of an improved arrangement for mounting an induction coil therein and the disposition of an induction ring within the casing for better reception of a charging flux from a charging unit.

Another object is the provision of a unique and useful arrangement for the disposition of a charging coil and charging ring in a driving unit containing a battery to be charged by induction.

Another object is the provision of a unique arrangement and combination of structural parts in such a driving unit for a toothbrush or the like, giving improved results and in a novel and useful manner.

Other objects and a fuller understanding of the invention may be had by referring to the following description

and claims, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a longitudinal sectonal view taken through a driving unit embodying the preferred form of our invention;

FIGURE 2 is a plan view of the driving unit and looking in the direction of the arrow 2—2 of FIGURE 1;

FIGURE 3 is an enlarged sectional view of the forward portion of the driving mechanism in our unit shown removed from the casing;

FIGURE 4 is a longitudinal sectional view of the same at a right angle to the view shown in FIGURE 3;

FIGURE 5 is a sectional view taken through the line 5—5 of FIGURE 3;

FIGURE 6 is a cross-sectional view taken through the line 6—6 of FIGURE 4;

FIGURE 7 is a cross-sectional view taken through the line 7—7 of FIGURE 4;

FIGURE 8 is a plan view of the switch mechanism embodied in our driving unit;

FIGURE 9 is a cross-sectional view of the switch mechanism taken through the line 9—9 of FIGURE 8 and showing the switch button in an "Off" position; and

FIGURE 10 is a view similar to that of FIGURE 9 but showing the switch button in an "On" position.

Our driving unit has a casing 11 of molded plastic material of the usual nature and is of electrical insulating material as usually utilized for such appliances. The casing 11 is of general cylindrical shape and contour as illustrated. It has a nose portion 11A of reduced diameter at its forward end. There is a grooved inner shoulder 11B at its forwardmost end, the groove of the shoulder 11B facing radially inward and axially rearwardly of the casing. On one side of the casing 11 there is an opening 11C in which is mounted a switch box 35.

The rearward end of the casing 11 is closed by a base cover 12 also of similar molded plastic material. This base cover 12 has a central recessed portion 12A extending inwardly and axially of the casing as illustrated. The cover 12 has an outer cylindrical wall 12B which tightly fits within the rearward end of the casing 11. Between the cover 12 and the rearward portion of casing 11 there are sealing rings 52 and 53, as shown, which seal off moisture from the interior of the casing.

Positioned within the nose portion 11A and axially thereof is a guide portion 13 which accommodates an arm member 16 which is adapted to carry a toothbrush or the like on its outer free end, the toothbrush not being shown. The toothbrush is connected by a coupling portion 16A at the free end of the arm member 16.

Formed in the arm member 16 in proximity to the forward end of the guide portion 13 there is an annular groove 16B. Adjacent one side of the groove 16B is an annular shoulder 16E directed forwardly of the arm member. On the front end face of the guide portion 13 there is an annular groove 13E directed forwardly. As shown in the drawings, there is a rubber sealing member 28 which sealingly connects the guide portion 13 and the arm member 16 at the forward end of the guide portion 13. This rubber sealing member has a beaded inner edge 28A which snugly engages in the groove 16B. The sealing member 28 also has a beaded outer edge 28B which sealingly engages in the groove 13E. Within the annular outer beaded edge 28B there is imbedded a wire ring 29 which gives strength and rigidity to the sealing member 28 and aids in preventing it from collapsing. The sealing member 28 between the inner beaded edge 28A and outer beaded edge 28B is folded back upon itself as illustrated. The sealing member is resiliently yieldable so that it assumes the shape illustrated in its normal position when the

arm member 15 is axial of the guide portion 13. However, the resiliency of the sealing member 28 is such that the arm member may reciprocate between limits and may also rock or tilt about the axis of the guide portion 13, sealing thus being maintained for the space 14 between the guide portion 13 and the arm member 16 so as to prevent liquid or other matter from entering the bore of the guide portion 13.

Disposed on diametrically opposite sides of the inner bore of the guide portion 13 are two longitudinally extending grooves 13A which accommodate in each a steel ball 15. These balls 15 are carried in two diametrically opposed sockets formed in the wall of the arm member 16. The balls 15 provide a pivot for the rocking of the arm member and also the balls in riding or moving along the respective grooves 13A guide forward and rearward movement of the arm member. Thus, the arm member may move both forwardly and rearwardly in the guide portion 13 and also may rock or tilt relative to the axis of the guide portion 13. To provide for the rocking or tilting of the arm member 16, the forward portion of the bore of the guide portion 13 has a frusto-conical wall 13B.

Positioned within the casing 11 at a location rearwardly of the guide portion 13 and in axial alignment therewith is an electric motor 17. This motor has a bell cap portion 18 integrally formed on the forward end thereof. This bell cap portion 18 has two forwardly directed parallel brackets 19 and 20 extending forwardly therefrom. The bracket 19 has an opening 19A therethrough and the bracket 20 has an opening 20A therethrough, the openings 19A and 20A being in axial alignment. Extending through the aligned openings 19A and 20A is a shaft 23. This shaft 23 has threaded head 23A threadably engaged in the opening 19A so as to hold the shaft 23 in a position which is normal to and intersecting the axis of the driving unit. Journaled upon the shaft 23 so as to rotate thereon is a ring gear 22 having its teeth directed inwardly toward the axis of the unit. The ring gear 22 is enmeshed with a pinion gear 26 which is non-rotatably mounted on the motor shaft 27 driven by the motor 17. Thus the motor rotates the ring gear 22.

The rearward end portion of the arm member 16 is widened to form the broad rear portion 16C. Formed within the broad rear portion 16C at the axis of the arm member 16 there is a recess 16D. Positioned within this recess 16D there is an eccentric stud portion 22A. The outer cylindrical surface of portion 22A is eccentric relative to the axis of the shaft 23. Therefore as portion 22A rotates with the ring gear 22, the rearward broad portion 16C of the arm member 16 is moved in a circular path about the axis of shaft 23.

Also carried by and extending outwardly from the bell cap portion 18 are two lugs 21 on diametrically opposite sides. These lugs 21 are disposed 90° out of phase with the brackets 19 and 20. Extending rearwardly from the forward face of each lug 21 is a recess 21A. At the rearward end of the guide portion 13 there is a rear flange portion 13C and this flange portion 13C has two lugs 13D directed rearwardly therefrom. These lugs 13D are in alignment with the lugs 21 of the bell cap portion 18.

Embedded in each lug 13D is a knurled head 24A of a guide pin 24. These guide pins 24 are disposed parallel to each other and on opposite sides of the axis of the guide portion 13. The rearward end of each guide pin 24 is positioned within a recess 21A. of a lug 21. Thus the pins 24 extend between the guide portion 13 and the lugs 21 and are held in parallel fixed position.

Formed in the opposite sides of the broad rear portion 16C are parallel grooves or slots 16F. These grooves or slots 16F face away from each other and have a depth greater than the diameter of a guide pin 24. The width of each groove or slot 16F is slightly greater than the diameter of a guide pin 24. These guide pins 24 are positioned within the respective slots 16F and permit the broad rear portion 16C to move forwardly and rearwardly and simultaneously to move in a circular path. Thus the guide pins 24 allow the arm member to move in a recurrent path in a single plane but maintain the position of the arm member in that single plane of its movement. By this arrangement, it is not necessary for the arm member to be pressed downwardly toward the ring gear 22. The usual sliding or ball bearing on the side of the arm member opposite the ring gear 22 is obviated by the use of the guide pins 24 as described.

The guide portion 13 is held firmly to the brackets 19 and 20 by means of screws 25 which extend through flange portion 13C and the end of the brackets 19 and 20. Thus the motor and guide portion with parts carried thereby are held in the position illustrated.

The bracket 20 also carries the elements of the switch mechanism utilized for controlling the energization of the motor 17. An electric terminal 31 is riveted to the bracket 20. The bracket 20, being of metal (as are the outer casing of motor 17, the bell cap portion 18, the bracket 19 and the lugs 21), may be grounded by a wire 30 whereby the terminal 31 carries the current on one side of the electrical circuit connected to the motor. Also riveted to the bracket 20 at a spaced location in alignment with the terminal 31 is another electrical terminal 32. This terminal 32 is insulated from the bracket 20 by an insulating sleeve 33. This terminal 32 connected to a wire 34 also is in electrical circuit with the motor 17. The terminal 32 has an outwardly directed face providing the contact of a switch arrangement. Connected to the terminal 31 there is a spring electrical contact element 31A which when pressed downwardly upon the terminal 32 completes a circuit between the terminals 31 and 32 so as to energize the motor. The spring bias of the electrical contact element 31A is such that it is biased away from the terminal 32 as illustrated in FIGURE 4.

Positioned within the opening 11C formed in the wall of casing 11 is the switch box 35, which is of general rectangular shape as shown in FIGURE 8. This switch box 35, also of molded plastic insulating material, has on opposite ends projection portions 35A which are sufficiently yieldably flexible as to engage in oppositely disposed niches in the wall of the opening 11C. Upon pressing the switch box downwardly, the projections 35A flex sufficiently to enter the opening 11C and then to engage in these opposite niches and thus secure the switch box firmly in position. Extending through the switch box 35 is an opening 35B defined by walls 35C protruding inwardly of the casing 11. The lower end of the wall 35C has a beaded end 35D formed therearound. The beaded end 35D is directed outwardly and extends around the periphery of the wall 35C. Extending across the lower ends of the walls 35C so as to close the opening 35B is a plate 36. This plate 36 when in the position shown in FIGURE 9 is up against the bottom edge of the wall 35C.

Carried by the lower end of the wall 35C and particularly by the beaded end 35D is a rubber sealing diaphragm 37 having a shape complementary to the lower end of the wall 35C and the plate 36. This rubber sealing diaphragm 37 has upturned walls terminating in a bead 37A extending around its upper edge. This beaded portion 37A snugly engages over the beaded end 35D. The snug fit of the diaphragm 37 about the wall 35C is such as to firmly hold the diaphragm 37 upon the beaded end 35D. This, in turn, firmly holds the plate 36 upwardly against the lower end of the wall 35C. The diaphragm 37 is sufficiently resiliently yieldable that it may be distorted and pressed downwardly while its beaded edge 37A is still firmly held in engagement with the wall 35C and about the beaded end 35D.

Pivotally mounted on a pivot pin 39 extending across between, and carried by, opposite sides of the switch box 35 is a switch button 38. This axis of the pivot pin

39 is such that the button 38 may be swung thereon in a plane parallel to the axis of the casing 11. Extending across the opening 35B of the switch box 35, and carried by wall 35C, is a stop bar 40 which is positioned to provide a limit to rearward swinging of the button 38. The button 38 has a dwell or recess 38A adapted to engage the stop bar 40 when the button 38 is swung rearwardly to its "Off" position, which is the position shown in FIGURE 9. The button 38 has an alternate dwell or recess 38B forwardly and adjacent the dwell 38A which receives the stop bar 40 when the button is swung to the "On" position illustrated in FIGURE 10.

Extending downwardly from the button 38 is a rounded nose portion 38C which is adapted to engage the top of the plate 36 and to cammingly force it downwardly upon swinging of the button 38 from its "Off" position shown in FIGURE 9 to its "On" position shown in FIGURE 10. Upon swinging of the button 38 again to its "Off" position, then the nose portion 38C releases the plate 36 to permit it to assume its position shown in FIGURE 9. It is to be noted that the rubber diaphragm 37 provides a resilient bias urging the plate 36 upwardly to the position shown in FIGURE 9. However, the resilient bias of the diaphragm 37 is such that the plate 36 may be moved downwardly to the position shown in FIGURE 10 but at the same time a good sealing engagement is retained with the beaded end 35D of the wall 35C. Thus, a waterproof seal is maintained through the switch mechanism at all times and the switch may be freely operated without water or other matter entering the casing through the opening 35B of the switch box 35.

As the electrical spring contact element 31A is positioned below the diaphragm 37, it is moved downwardly from its position shown in FIGURE 9 and into electrical contact with the terminal 32 in the position shown in FIGURE 10 when the button 38 is moved to the "On" position. Thus, the switch elements are engaged and disengaged by the operation of the button 38 between its alternate positions.

The motor 17 is also in electrical circuit with a battery 43 whereby the battery 43 energizes the motor 17. This battery 43 is secured by a top cap 42 clamped thereon to the motor 17, the cap 42 being secured to the motor 17 by a screw 44. It is noted that the battery 43 is thus firmly held to and in axial alignment with the motor 17. The wire 34 in electrical circuit with the motor 17 is also electrically connected with the battery 43 and a rectifier 45 is connected in circuit by means of the wire 34.

Connected in circuit with the battery 43 is an induction coil 47, which induction coil is mounted upon a spool 48 of ferrous metal. Clamped on the rearward end of the battery 43 is a cup-shaped bottom cap 46. This cap 46 is secured to and firmly held in a cupped flange 49A of a bracket holder 49. The bracket holder 49 has a cylindrical portion extending from the cupped portion 49A to within the spool 48 and around the central recessed portion 12A of the base cover 12. Thus, the induction coil 47 is firmly held on the spool 48 which in turn is snugly engaged on the bracket 49 which in turn snugly fits over the central recessed portion 12A. The induction coil 47 is therefore firmly held to and in axial alignment with the battery 43.

Snugly interposed between and in engagement with the end of the spool 48 and the cupped flange 49A is a flat portion 50A of an induction ring 50 of ferrous material. This induction ring 50 has the flat portion 50A thereof disposed normal to the axis of the ring and the outer cylindrical portion of the ring 50 disposed parallel to the axis of the ring. It is to be noted that the outer cylindrical portion of the ring 50 is in close proximity to the wall of the casing 11 and extends radially outward as far as possible and yet within the confines of the casing. The cylindrical portion of the ring 50 is spaced substantially radially outward from the battery 43 and cap 46 mounted on the bottom thereof. This induction ring 50 of ferrous material is thus in a good and efficient position for receiving charging flux provided by a charging unit having a coil within which the lower end of the casing 11, holding the induction coil 47, is positioned for the purpose of charging the battery 43 by the process of induction charging. An improved charging operation is obtained by the arrangement and disposition of the parts shown and illustrated.

To firmly hold the internal parts snugly within the casing and to absorb any shock, there is a rubber spring-like spacing washer 51 interposed between the rearward end of the spool 48 and the base cover 12.

The present disclosure includes that contained in the appended claims, as well as that of the foregoing description.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. In an electric toothbrush driving unit having an electric motor mounted in a longitudinal casing, and having an arm member extending from the casing actuated by the motor to move in a recurrent path in a plane, and adapted to carry a toothbrush on the extended end of the arm member, said driving unit including a forward guide portion concentrically mounted in said housing and accommodating said arm member for guiding the movement of the arm member in said recurrent path, said arm member having a rearward portion operatively connected through gearing with said motor to be actuated thereby to move in said path, said rearward portion of the arm member in its movement having variable spacing relative to the forward guide portion, the improvement of two spaced pin members carried by the said guide portion and extending rearwardly therefrom, said pin members being disposed parallel to each other and on opposite sides of the axis of said guide portion, said arm member having two spaced slots extending therealong on opposite axial sides of the axis of said arm member and accommodating said pin members, respectively, said slots being open at their opposite ends to permit said pin members to extend through said slots, respectively, and the arm members to move along the pin members, said slots being formed in respect to said pin members for permitting the arm member to move generally forwardly and rearwardly relative to said guide portion in its said recurrent path, said pin members being embraced by opposite walls of said slots and restraining said arm member against rotation on its axis to maintain the arm member in said plane.

2. The improvement claimed in claim 1 and in which said pin members have rearwardly extending end portions, said motor has forwardly extending lugs in alignment with said pin members, said lugs each having a recess for accommodating said rearwardly extending end portion of a said pin member, respectively, said lugs holding said pin members parallel to the axis of the motor for resisting displacement of said pin members relative to said axis.

3. In an electric toothbrush driving unit having an electric motor, gearing driven by the motor, an arm member operatively connected adjacent its rearward end to said gearing to be actuated in a recurrent path disposed in a plane, a guide portion in axial alignment with said motor for guiding the movement of said arm member, said arm member being adapted to be connected adjacent its forward end to a toothbrush for actuation thereof, the improvement of first socket means carried by and extending forwardly of said motor toward said guide portion, second socket means carried by said guide portion and extending rearwardly toward said motor, a pair

of pin members disposed parallel to each other and spaced apart on opposite sides of an axially disposed plane through the said guide portion and motor, said pin members being disposed in axially aligned socket means, respectively, of said first and second socket means to be maintained in said parallel spaced relationship, said arm member adjacent said rearward end thereof and on opposite sides of the axis thereof having a pair of outwardly facing slots formed therein, the opposite sides of each of said slots being disposed parallel to each other and parallel to said plane, the width of said slots corresponding to the axes of said pin members, respectively, said pin members being received in said slots and inter-fitting therewith to permit movement of said arm member in said recurrent path and simultaneously to maintain said arm member in said plane during its movement in said recurrent path, said slots being open at their opposite longitudinally spaced ends to permit said pin members, respectively, to extend out through said opposite ends of the slots.

4. The improvement claimed in claim 3 and in which said arm member moves in a recurrent path and in which the arm member adjacent said rearward end thereof is revolved by said gearing whereby the axis of said arm member is recurrently tilted relative to the axis of said motor and guide portion, said slots having sufficient depth to accommodate for said tilting.

5. In an electric toothbrush driving unit having an electric motor, multi-gear gearing driven by the motor, an arm member operatively connected adjacent its rearward end to said gearing to be actuated in a recurrent path disposed in a first plane, a guide portion in axial alignment with said motor for accommodating said arm member and guiding the movement of said arm member, the improvement of spaced parallel bracket members interconnecting said motor and guide portion, a shaft carried by said bracket members, said shaft carrying a ring gear of said gearing and the rearward end portion of said arm member connected to said ring gear, a pair of guide pins extending intermediate said motor and guide portion and carried thereby, said guide pins being disposed parallel to each other and to the axis of said motor and guide portion, said pins being disposed in a second plane parallel to the said first plane, the said arm member having a pair of open-ended slots disposed parallel to each other adjacent said rearward end portion of the arm member, said slots accommodating said pin members to extend through the open ends of the respective slots and to permit movement of the arm member in a sliding fit with the pin members and maintaining said arm member in said first plane during said recurrent movement, and electrical contact members carried by one of said bracket members in circuit arrangement with said motor and disposed to be interengaged for controlling energization of said motor.

6. The improvement claimed in claim 5 and in which said ring gear is disposed on said shaft between said arm member and the other said bracket members, and eccentric means operatively connecting said ring gear and said rearward end portion of the arm member to revolve the said rearward end portion in said recurrent path.

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J. D. MILLER, *Primary Examiner.*