Jan. 13, 1970 R. L. BOYLES 3,489,936

TOOTHBRUSH WITH MOTION SELECTOR BUTTON

Filed June 14, 1967 2 Sheets-Sheet 1

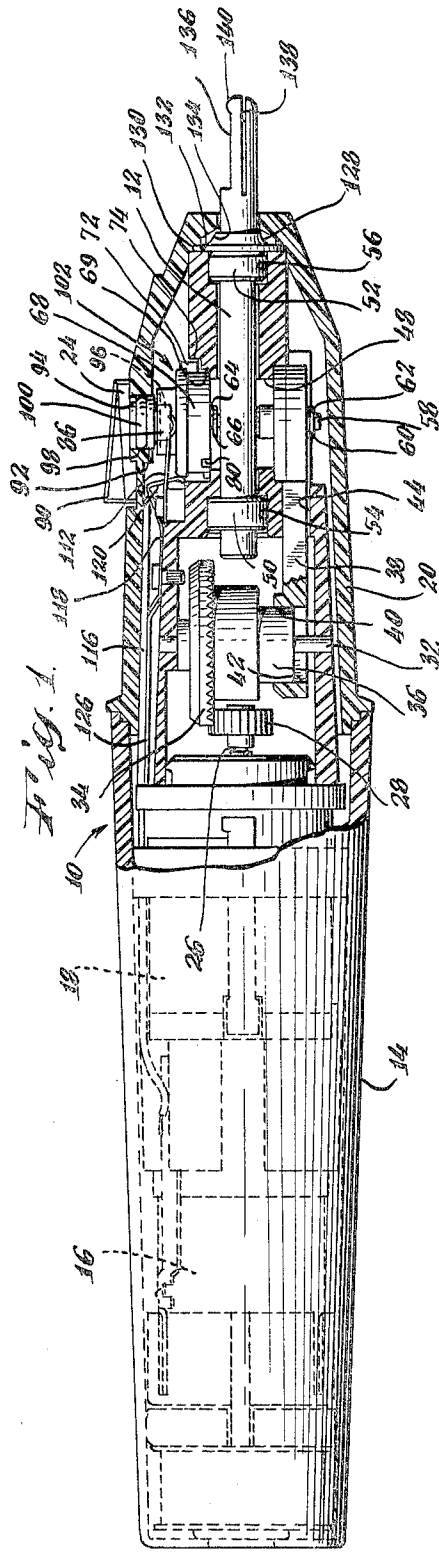


Fig. 1.

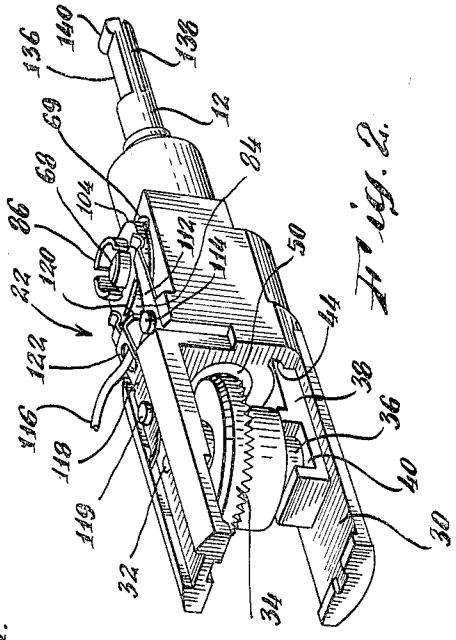


Fig. 2.

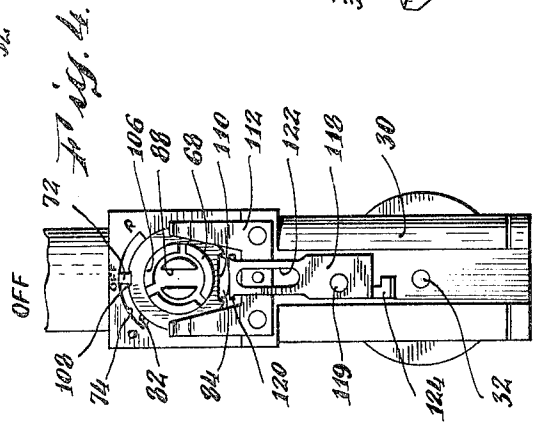


Fig. 4.

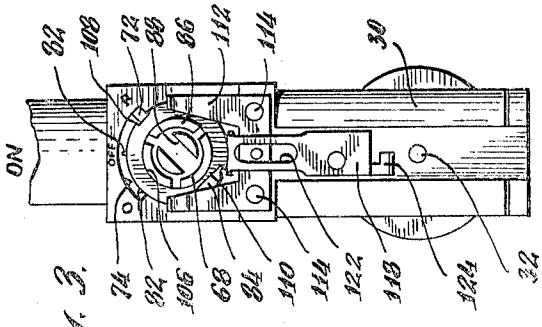


Fig. 3.

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Jan. 13, 1970 R. L. BOYLES 3,489,936

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Filed June 14, 1967 2 Sheets-Sheet 2

Fig. 5.

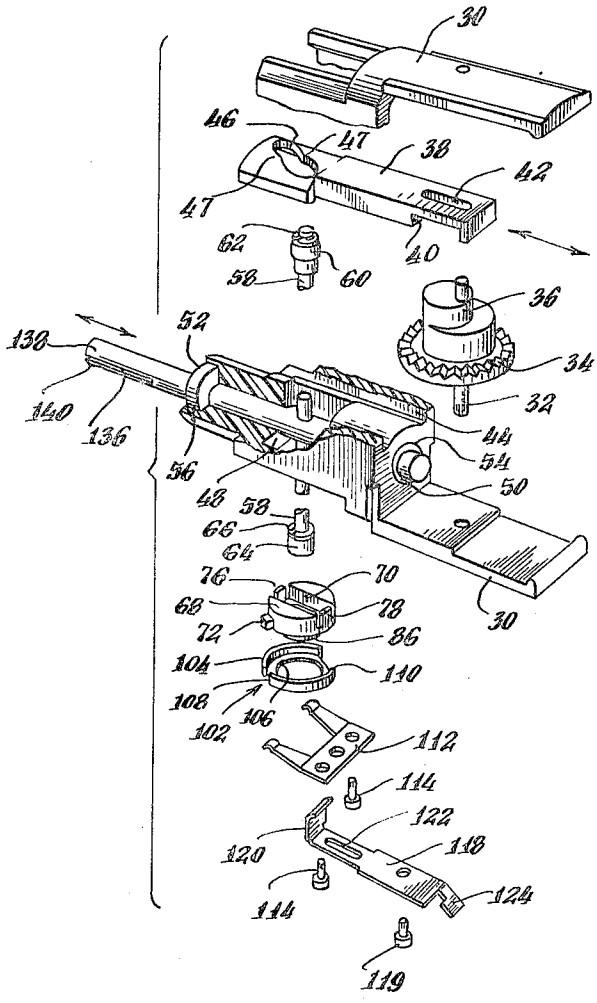


Fig. 6.

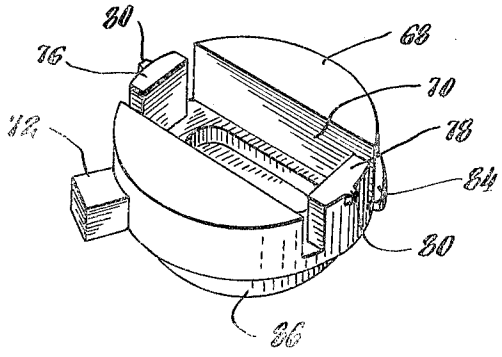


Fig. 7.

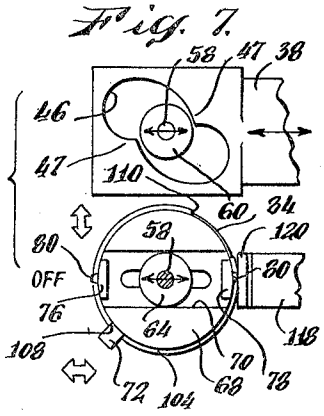


Fig. 8.

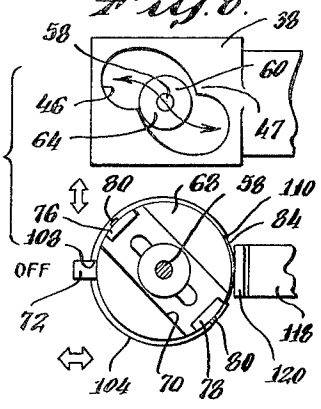
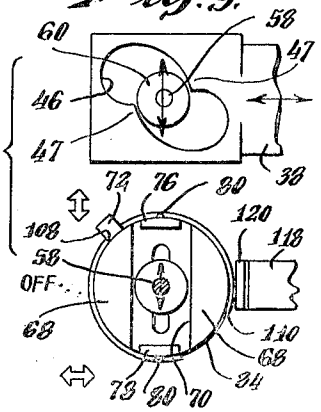


Fig. 9.



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TOOTHBRUSH WITH MOTION SELECTOR BUTTON

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Int. Cl. H02k 7/14
U.S. Cl. 310—47 9 Claims

ABSTRACT OF THE DISCLOSURE

An electric toothbrushing device having an electric motor, a motion converting mechanism and an operator shaft upon which a toothbrush may be mounted, the device being controlled by a switch button which may be selectively angularly positioned to cause the operator shaft to impart a back-and-forth or an up-and-down motion to a toothbrush mounted thereon.

Background of the invention

My invention relates to an electric toothbrushing device and more particularly to a motion converting mechanism and selector for allowing manual selection of the mode of travel of a toothbrush which may be mounted on the device.

In recent years electrical toothbrushing devices have been widely accepted for home use. Manufacturers of these devices have met the public demand and have attempted to generate a further demand for electric toothbrushes by constructing them with various modes of toothbrush travel. Therefore, prior art devices are available which impart various motions to the toothbrush bristles such as: longitudinal reciprocation, oscillation, elliptical motion and orbital combinations of reciprocation and oscillation. Although several of these generated motions may be efficient for removing food particles from between the teeth while concomitantly being beneficial to the gingiva, a user may prefer one mode of bristle travel over another.

The disadvantage of such prior art devices in general becomes readily apparent to a prospective purchaser who prefers a specific mode of bristle travel since he is required to make his purchase on the basis of this factor alone and must disregard other factors which ordinarily may influence his judgment. Furthermore, such devices are generally used by several members of a family and there may be different preferences among its members.

Summary of the invention

Accordingly, it is the primary object of my invention to provide an electric toothbrushing device which will generate both back-and-forth and up-and-down output motions and will allow the user to selectively determine the mode of travel of the toothbrush.

Another object of my invention is to provide a novel motion converting mechanism including a driving means and a motion selector for generating plural output motions.

A further object of my invention is to provide a unique combined ON-OFF switch and motion selector for the above device.

To accomplish these objects, in one form, an electric toothbrush device is provided which comprises a body, an electric motor disposed within the body, an operator shaft carried by the body upon which a toothbrush may be mounted, a switch for controlling the energization of the motor, and a selectively positionable motion selector for allowing a user to determine the mode of travel of the operator shaft.

Brief description of the drawings

Other objects and further details of that which I believe to be novel and my invention will be clear from the following description and claims taken with the accompanying drawings wherein:

FIG. 1 is a side elevational view of the electric toothbrushing device of my invention shown partially in section;

FIG. 2 is a perspective view of the improved motion converting mechanism and switch of my invention;

FIG. 3 is a plan view of the motion converting mechanism and switch shown in the back-and-forth "ON" position;

FIG. 4 is a plan view similar to that of FIG. 3 showing the switch and motion selector in the "OFF" position;

FIG. 5 is an exploded perspective view of the motion converting mechanism and switch of my invention;

FIG. 6 is an enlarged perspective view of the motion selector disc;

FIG. 7 is an enlarged schematic view of a portion of the drive link and the motion selector shown in the back-and-forth motion generating position;

FIG. 8 is an enlarged schematic view of a portion of the drive link and the motion selector shown in the "OFF" position; and

FIG. 9 is an enlarged schematic view of a portion of the drive link and the motion selector shown in the up-and-down motion generating position.

Description of the preferred embodiment

With particular reference to the drawings there is illustrated in FIG. 1 the improved electrical toothbrushing device of my invention which includes a body **10** constructed so as to be held in one hand and adapted to receive a toothbrush upon the external portion of the operator shaft **12**. The body **10** comprises a generally cylindrical casing half **14** within which are disposed a usual rechargeable battery **16** and a small D.C. motor **18** and further includes a generally cylindrical casing half **20** within which is disposed a motion converting mechanism **22** (shown in FIGS. 2 and 5). After assembly of the operating components the casing halves **14** and **20** which are preferably formed of an electrically insulating plastic material which is relatively strong and lightweight may be secured together in a suitable manner, such as by ultrasonic welding. Energization of the motor **18** may be controlled by the external thumb operable ON-OFF switch button **24** which is simultaneously used to select the mode of travel of a mounted toothbrush, as will become apparent.

The motion converting mechanism **22** shown in perspective in FIG. 2 and exploded in FIG. 5 translates the rotational output of the motor **18** through its shaft **26**, carrying pinion **28**, to either longitudinally reciprocating (hereinafter referred to as "back-and-forth") or rotationally oscillating (hereinafter referred to as "up-and-down") motion of the operator shaft **12**. The mechanism **22** includes a support bracket **30** upon which is mounted a shaft **32** carrying a face gear **34** and adapted to be driven by the pinion **28**. An eccentric boss **36** formed on one face of the face gear **34** extends parallel to the axis of the shaft **32** and perpendicular to the longitudinal axis of the handle **10**. Thus the rotational output of pinion **28** is translated into circular movement of the boss **36** in a plane perpendicular to the rotational plane of pinion **28**.

The circular motion of the boss **36** is translated into axial movement of a drive link **38**. This may be accomplished by disposing the eccentric boss **36** within a seat **40** formed on the drive link **38**. A slot **42** formed in the drive link **38** is adapted to receive the shaft **32** as the drive link reciprocates. The forward portion of the drive

link **38** is arcuately formed in cross-section and is received for reciprocation within a passage **44** of similar cross-section formed in the support bracket **30**. An S-shaped cam slot **46** having shoulders **47** is disposed in drive link **38** at the forward portion thereof adjacent a chamber **48** formed in the support bracket **30**.

The operator shaft **12** is mounted for rotation and reciprocation relative to the support bracket **30** in bearings **50** and **52** which are press-fit in seats **54** and **56** adapted to receive them. A drive pin **58** passing through the chamber **48** is secured to the operator shaft **12**, being mounted through and perpendicular thereto. At one end the drive pin **58** carries a first cam follower roller **60** held thereon by a snap ring **62** and carries at its other end a second cam follower roller **64** secured in position by a snap ring **66**. The first cam follower **60** is adapted to be disposed within the S-shaped cam slot **46**. Thus as the pinion **28** rotates, the resulting circular motion of the eccentric boss **36** causes the drive link **38** to reciprocate and the locus of the centerline of the cam follower roller **60** moves in an S-shaped path as indicated by the arrow in FIG. 8, for imparting a combined back-and-forth and up-and-down motion to the operator shaft **12**.

A motion selector disc **68**, clearly seen in perspective in FIG. 6 is mounted in a seat **69** formed therefor in the support bracket **30** adjacent the chamber **48**. The disc **68** is made of a suitable plastic insulating material and includes a selector cam groove **70** formed in one face and adapted to receive the second cam follower **64**. A radially extending lug **72** projecting from the circumferential wall of the disc **68** is adapted to travel within an arcuate recessed portion **74** of the seat **69** thus limiting the degree of angular movement of the disc **68** to an arc of approximately 90° (note FIGS. 3 and 4). The wall portions **76** and **78** defining the ends of the cam groove **70** include radially outwardly extending detent protrusions **80** adapted to cooperate with indents **82** formed in the seat **69** for defining a positive stop in each of three positions—viz. back-and-forth, "OFF," and up-and-down. The circumferential wall of the disc **68** opposite the radial lug **72** is formed with a diametrally enlarged portion **84** whose function will become apparent. A central boss **86** having a coupling slot **88** is formed on the face of the disc opposite the cam groove **70** for receiving a mating portion of the switch button **24**.

The switch buton **24** includes an external portion **90** which may be in the form of a pointer for being directed to suitable indicia formed upon the body **10** for designating the mode of motion of the operator shaft **12**. A cylindrical shaft portion **92** of the button is passed through an opening **94** in the body **10**, and the button terminates in a coupling projection **96** for engagement with the coupling slot **88** of the motion selector disc **68**. The opening **94** is sealed to prevent the introduction of foreign materials into the body by means of an O-ring **100** which may be disposed within a circumferential groove **98** formed in the cylindrical shaft portion **92**.

The novel ON-OFF switch of my invention is mounted upon the motion selector disc **68** and operates substantially simultaneously with the manual selection of the mode of travel of the operator shaft **12**. The switch which includes a metallic contact disc **102** having a circular planar wall and a depending circumferential skirt **104** is mounted upon the electrically insulating plastic disc **68** and is further formed with a central aperture **106** in the planar wall adapted to receive the boss **86**, a cutout **108** in the skirt **104** adapted to receive the radial lug **72** and a cutout **110** in the skirt **104** adapted to receive the diametrally enlarged portion **84**. A metal contact fork **112** mounted upon the support bracket **30** by means of a pair of staking pins **114** is normally biased so as to be in contact with the planar wall of the contact disc **102** and may be connected to the battery **16** by a lead wire **116**. A second metal contact member **118** mounted upon the support bracket **30** by means of a staking pin **119** includes a

contact blade **120** which is normally radially biased against the skirt **104**, a slot **122** for passage of the lead wire **116**, and an ear **124** formed at its rearward end for receiving a suitable contact strip **126** which may in turn be secured to the motor **18**.

To insure proper operation of the toothbrushing device, it is necessary to prevent moisture and solid particles from entering the body **10** at its forwardmost end from which the operator shaft **12** extends. For this purpose there is provided a flexible shaft seal **128** made of rubber or similar material having at one end a circumferential bead **130** adapted to be clamped between the forwardmost end of the support bracket **30** and a shoulder **132** formed at the forward end of the casing half **20** and at the other end a collar **134** for tightly surrounding the operator shaft **12**.

The end **136** of the operator shaft **12** upon which toothbrushes may be mounted is generally D-shaped in cross-section thus acting as a key for receiving toothbrushes having a longitudinal passage of substantially similar cross-section. Thus, the user may manipulate the switch button **24** with his thumb and the bristles will always face in the proper direction for ease of use. The operator shaft also includes a longitudinal slot **138** formed therein and a lip **140** formed at its end for insuring firm frictional engagement of the shaft in the toothbrush for preventing the toothbrush from inadvertently falling off of the shaft.

As previously mentioned, rotation of the pinion **28** is translated to longitudinal reciprocation of the drive link **38** which in turn generates a combined back-and-forth and up-and-down motion of the operator shaft **12** through cam follower **60**, mounted on drive pin **58**. Motion selection is accomplished by manually moving the external pointer of the switch button **24** in the direction of the desired motion generating position as indicated by the indicia on the body. As the button **24** and the selector disc **68** are coupled, this movement may rotate the motion selector disc **68** from its normal central OFF position 45° in either a clockwise or a counterclockwise direction, causing the selector cam groove **70** to be located in one of the positions shown in FIGS. 7 and 9. The second cam follower **64** which is received in the selector cam groove **70** is constrained therein and may be moved in only one direction thus limiting the movement of cam follower **60** and the operator shaft **12**. When the motion selector disc **68** is in the FIG. 7 position the selector cam groove **70** is disposed parallel to the longitudinal axis of the body and the operator shaft **12** may only move back-and-forth. With the motion selector disc **68** in the FIG. 9 position the selector cam groove **70** is disposed perpendicular to the longitudinal axis of the body and the operator shaft **12** may move only up-and-down.

It has been found that the unique S-shaped cam slot **46** is a highly efficient configuration for imparting to the cam follower **60** the desired combined motion. The shoulders **47** located at the central portion of the slot are substantially perpendicular to the longitudinal axis of the drive link and thereby impart a large axial component to the cam follower **60** in the back-and-forth mode. This configuration minimizes side thrust on the drive link **38** which would tend to hang it up and may cause sluggish operation of the operator shaft **12**. This slot configuration also generates the proper angular movement of the operator shaft in the up-and-down mode.

The ON-OFF switch operates substantially simultaneously with the above described motion selection. The normal central OFF position can best be seen in FIG. 8 wherein the contact blade **120** does not engage the skirt **104** of contact disc **102**, but engages the diametrally enlarged portion **84** of the plastic electrical insulating motion selector disc **68**. Thus the circuit through the battery **16** and the motor **18** is open. As the selector disc **68** is rotated to the FIGS. 7 or 9 positions, as described above with respect to motion selection, the skirt **104** is moved

into engagement with the contact blade **120** closing the circuit and energizing the motor **18**.

The simultaneous energization of the motor **18** and motion selection yields another advantage in the operation of my novel toothbrushing device. As the selector disc **68** is moved from its central position either clockwise or counterclockwise, the circuit is closed prior to locating the selector cam groove **70** in either the FIG. 7 or FIG. 9 position. This advance energization while the cam groove **70** is somewhat angularly removed from its end position causes the second cam follower **64** to be constrained in alternate paths which generate combined back-and-forth and up-and-down modes of travel of the operator shaft **12**. These alternate modes may be preferred by some users.

It is understood that the present disclosure has been made only by way of example and that numerous changes in details of construction and the combination and arrangement of parts may be resorted to without departing from the true spirit and the scope of my invention as hereinafter claimed.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electrical toothbrushing device comprising:
a body;
an electrical motor disposed within said body;
an operator shaft carried by said body upon which a toothbrush may be mounted;
switch means for energizing said motor;
selectively angularly positionable motion constraining means and driving means mounted in said body and driven by said motor for driving said operator shaft; and
control means coupled with said motion constraining means for controlling said operator shaft to cause it to move back-and-forth or up-and-down with respect to said body.

2. The electrical toothbrushing device defined in claim **1** wherein said driving means comprises: a longitudinally reciprocable drive link defining a cam slot therethrough; means for translating the rotary output of said motor to a longitudinal reciprocation of said drive link; and a cam follower carried by said operator shaft for movement in said cam slot, said cam slot being formed so as to impart to said cam follower and said operator shaft the combined back-and-forth and up-and-down motion.

3. The electrical toothbrushing device defined in claim **2** wherein said cam slot is generally S-shaped.

4. The electrical toothbrushing device defined in claim **3** wherein said selectively angularly positionable motion constraining means comprises: an angularly adjustable motion selector disc coupled with said control means and defining a cam slot therein; and a second cam follower for movement in said cam slot, being carried by said operator shaft for limiting the freedom of movement of said operator shaft.

5. The electrical toothbrushing device defined in claim **2** wherein said selectively angularly positionable motion constraining means comprises: an angularly adjustable motion selector disc coupled with said control means and defining a cam slot therein; and a second cam follower for movement in said cam slot being carried by said operator shaft for limiting the freedom of movement of said operator shaft.

6. The electrical toothbrushing device defined in claim **5** wherein said switch means for energizing said motor is actuated substantially simultaneously with and by movement of said control means and comprises: an electrically conductive disc mounted on said motion selector disc, the latter being made of electrical insultating material, said conductive disc having a circumferential skirt with a cutout portion defined therein for passage of a portion of said insulating motion selector disc; a first contact member normally biased against said conductive disc and in electrical contact with said motor; and a second contact member normally biased against said skirt and in electrical contact with said said motor, for opening and closing the electrical circuit in response to the angular orientation of said conductive disc mounted on said motion selector disc, whereby the circuit is open when said second contact member is biased against said portion of said motion selector disc which passes through said cutout portion, and the circuit is closed when said second contact member is biased against said skirt.

7. The electrical toothbrushing device defined in claim **1** wherein said selectively angularly positionable motion constraining means comprises: an angularly adjustable motion selector disc coupled with said control means and defining a cam slot therein; and a second cam follower for movement in said cam slot, being carried by said operator shaft for limiting the freedom of movement of said operator shaft.

8. The electrical toothbrushing device defined in claim **7** wherein said switch means for energizing said motor is actuated substantially simultaneously with and by movement of said control means and comprises: an electrically conductive disc mounted on said motion selector disc, the latter being made of electrical insulating material, said conductive disc having a circumferential skirt with a cutout portion defined therein for passage of a portion of said insulating motion selector disc; a first contact member normally biased against said conductive disc and in electrical contact with said motor; and a second contact member normally biased against said skirt and in electrical contact with said motor, for opening and closing the electrical circuit in response to the angular orientation of said conductive disc mounted on said motion selector disc, whereby the circuit is open when said second contact member is biased against said portion of said insulating motor selector disc which passes through said cutout portion, and the circuit is closed when said second contact member is biased against said skirt.

9. The electrical toothbrushing device defined in claim **1** wherein said switch means for energizing said motor and said control means are substantially simultaneously actuated by a single switch button mounted on the exterior of said body.

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U.S. Cl. X.R.

310—50, 80