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REVERSING MEANS FOR ELECTRICAL ROTARY TOOTHBRUSHES

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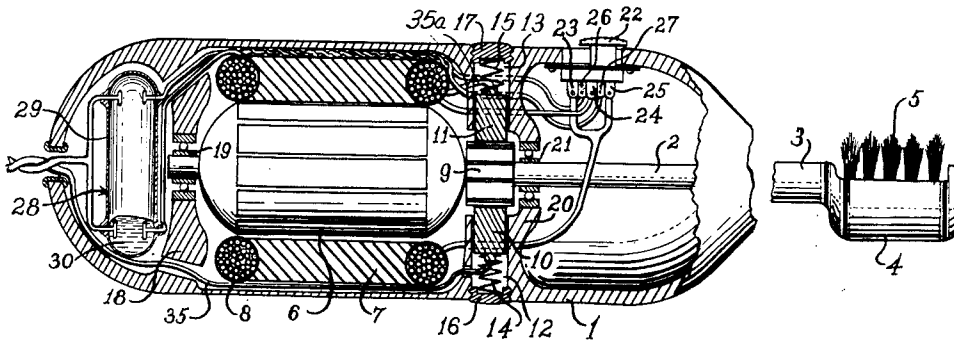


Fig. 1

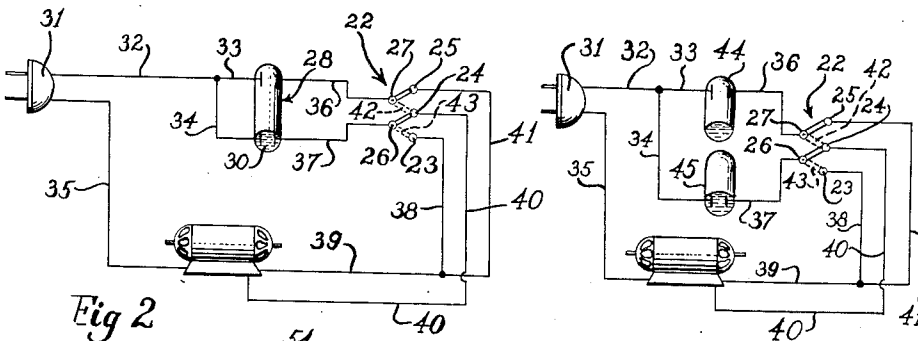


Fig. 2

Fig. 3

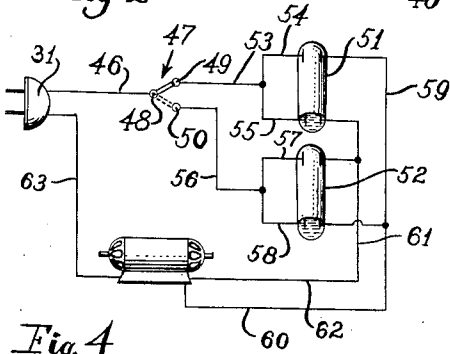
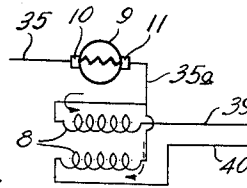


Fig. 4

Fig. 5



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REVERSING MEANS FOR ELECTRICAL
ROTARY TOOTHBRUSHES

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6 Claims. (Cl. 15—23)

1

This invention relates in general to electrically operated rotary toothbrushes, and more particularly to a novel form of electrical means for automatically reversing the direction of the rotating brush.

It is always desirable, and dentists so advise, that the teeth be brushed away from the gums. Brushing teeth away from the gums aids in removing food particles from between the teeth, which food particles would otherwise be packed against the gums and eventually form food pockets. Such food pockets are the primary cause of tooth decay, and brushing the teeth away from the gums materially aids in preventing the formation of these food pockets.

Rotary toothbrushes in general comprise a handle portion, which is held in the hand of the operator, and a spindle or shaft extending therefrom on which the brush is mounted. Any suitable means may be provided for rotating the spindle and brush, and in this particular case, a small electric motor is utilized which is positioned within the handle portion. It will be evident that when the rotating brush is held in the proper position for cleaning the outer surface of the lower teeth, the brush must necessarily rotate in a predetermined direction for properly brushing the teeth away from the gums. When the brush is then moved either to a position for cleaning the inner surfaces of the lower teeth or the outer surfaces of the upper teeth, the direction of rotation of the brush must then be reversed for the purpose of brushing the teeth away from the gums.

Manual switch means may be provided for thus reversing the direction of rotation of the brush, but inasmuch as the entire brush and handle portion must be rotated through approximately 180° when changing from the position assumed for cleaning the front surfaces of the teeth to a position for cleaning the inner surfaces of the teeth, it has been found highly desirable to provide automatic means for reversing the direction of rotation of the brush when the entire brush and handle portion are so moved.

It is, therefore, the principal object of the present invention to provide means whereby the direction of rotation of the brush in a rotary toothbrush may be automatically reversed by merely changing the position of the entire brush and handle portion.

Another object of the invention is to provide electrical means, as distinguished from mechanical means, for automatically reversing the direction of rotation of the brush in a rotary tooth-

2

brush when the position of the brush is changed in a predetermined manner.

A further object of the invention is to provide electrical switch means in a rotary toothbrush for automatically reversing the direction of rotation of the brush when the brush and handle portion are moved or rotated through approximately 180° as, for example, when the position of the brush is changed from that which is proper for cleaning the outer surfaces of the teeth to that which is proper for cleaning the rear or inner surfaces of the teeth.

Still another object of the invention is to provide electrical means in the form of a mercury switch which will operate to reverse the direction of rotation of the brush in a rotary toothbrush by reversing the direction of rotation of the motor shaft when the brush and handle portion are moved or rotated in a predetermined manner.

A still further and more specific object of the invention is to provide, in a rotary toothbrush, an electrical circuit which includes one or more mercury switches whereby a glob of mercury will be located in one position for carrying current to the motor for rotating the motor shaft and brush in one direction, and which mercury may be moved to another position to break the first contact and make a second contact for causing the motor shaft and brush to rotate in the opposite direction by merely changing the position of the brush and handle portion.

Other objects and advantages of the invention will become apparent upon reading the following description taken in conjunction with the accompanying drawing in which:

Fig. 1 is a vertical longitudinal sectional view through the handle portion of the rotary toothbrush of the present invention;

Fig. 2 is a wiring diagram showing the electrical circuit utilized in the structure shown in Fig. 1;

Fig. 3 is a wiring diagram showing a slightly modified form of electrical circuit from that shown in Fig. 2; and

Fig. 4 is a still further modified form of wiring diagram.

Fig. 5 is a detail wiring diagram of the motor illustrating the connections between the armature and field windings which enables the motor to be reversed.

The present invention embodies not only automatically operated electrical switch means for reversing the direction of rotation of the brush in a rotary toothbrush, but also utilizes a man-

3

ually operated switch which is to be used in conjunction with the automatic switch means. As stated above, it is usually necessary to change the position of the brush and handle portion when moving the brush from a position for cleaning the outer surfaces of the teeth to a position for cleaning the inner surfaces of the teeth. The position of the brush and handle, however, will be the same for cleaning the outer surfaces of the upper and lower teeth, but the direction of rotation of the brush should be reversed. Likewise, the position of the brush will be substantially the same when cleaning the inner surfaces of both the upper and lower teeth. Therefore, when the brush is changed from a position for cleaning the outer surfaces of the lower teeth to a position for cleaning the outer surfaces of the upper teeth, the position of the brush relative to the teeth will be substantially the same, but the direction of rotation of the brush should be reversed for proper cleaning action. For this reason a manually operated switch is utilized and may be placed in a convenient position on the handle to be easily moved in either of two directions by the thumb or a finger of the hand in which the toothbrush is being held.

The automatic electrical switch means, however, will operate to reverse the direction of rotation of the brush regardless of the position of the manual switch means.

It is to be understood that for a complete cleaning of the inner and outer surfaces of the upper and lower teeth, both the manual and automatic switch means will be utilized.

Referring now more particularly to the drawings and especially to Fig. 1, the handle portion of the toothbrush is indicated by the numeral 1. A spindle or shaft 2 extends through the handle and outwardly at one end thereof through a sleeve portion 3 to which a shield 4 may be attached or may be made integral therewith. This shield 4 may assume any suitable construction and is for the purpose of preventing toothpaste or toothpowder on the brush from being thrown outwardly and splattered about during the cleaning of the teeth.

A brush 5 has a suitable spindle or shaft (not shown) which may be mounted on the outer end of shaft 2 for rotation therewith.

The means for rotating the shaft 2 and brush 5 includes an electric motor located within the handle 1 and consists generally of an armature 6, iron core 7, field winding 8, and commutator 9. A pair of brushes 10 and 11 are suitably located on opposite sides of the commutator 9 and may be inserted through openings 12 and 13, respectively, in the handle 1. Coil springs 14 and 15 bear against the brushes 10 and 11 and are held in place by caps 16 and 17, which caps threadedly engage the outer ends of the openings 12 and 13.

A partition 18 may be provided adjacent the rear of handle 1, which partition has an opening in the center thereof to receive a bearing 19 in which the rear end of the shaft 2 is journaled. Another partition 20 may be located adjacent the front end of the handle and may have a central opening within which a bearing member 21 is located in which the forward part of the shaft 2 is journaled.

The manual switch is indicated at 22 and may have any suitable and well known construction, but is preferably a type of double-pole double-throw switch having the contacts 23, 24 and 25 at one side thereof and which are connected to one side of the motor, and the contacts 26 and

4

27 at the other side thereof which are connected to the automatic switch means.

The preferred embodiment of the invention includes a mercury switch 28 which, in the illustrated form, is located at the rear of the handle in the space provided between the partition 18 and the rear end of the handle. This mercury switch 28 comprises a tube 29 within which a small amount of mercury 30 is located and which is free to move from one end of the tube 29 to the other when the position of the handle 1 is changed.

A power supply or source of electrical energy is indicated at 31 and which may be in the form of a simple electrical plug adapted to be inserted into a wall socket. One side of the line, indicated at 32 in Figs. 2 and 3, is connected to the mercury switch 28. The line 32 is split into two branches 33 and 34, so that one branch is connected to one end of the mercury tube 29 and the other branch is connected to the other end of the tube 29. It will be evident that the mercury 30 will contact one branch 33 when the handle of the toothbrush is in one position, and will contact the other branch 34 when the handle is in another position.

The other side of the line, indicated at 35, is connected to the motor through the brush 10.

It will be understood that any suitable type of reversible motor may be utilized in connection with this invention. The form shown however is a commutator motor having two brushes 10 and 11. One side of the line or source of electrical energy is connected to the armature through the brush 10 and the other brush 11 is connected to the two field windings 8 as illustrated in Fig. 5 by means of the line 35a. Current flowing through the windings 8 sets up a rotating field. When the manual switch 22, presently to be described, is in one position, the current will flow through one of the windings 8 in the direction indicated by the solid arrow in Fig. 5. When the manual switch 22 is switched to its other connection, then the current will flow through the field in the opposite direction as indicated by the dotted arrow in Fig. 5. This direction of flow of the current through the field is also controlled by the mercury switch 28, and it will be evident that since the field rotates, it will carry with it the armature in the particular direction of rotation at any moment as shown in Fig. 5. The switches will, in this manner, enable the motor and shaft connected therewith to be reversed.

The other side of the mercury switch 28 is connected directly to the manual switch 22, and the manual switch 22 is then connected to the other side of the motor. Thus, branch 36 is connected from one end of the mercury switch 28 to the contact 27 of the manual switch 22. The other branch 37 is connected between the other end of the mercury switch 28 and the contact 26 of the manual switch 22. Contact 23 of the manual switch 22 is connected to the motor through the lines 38 and 39. Contact 24 of the manual switch 22 is connected directly to the motor through the line 40. Contact 25 of the manual switch 22 is connected directly to the motor through the lines 41 and 39.

Referring to Fig. 2 it will be seen that the positions of the manual switch 22 and mercury switch 28, are such that current will pass from the source of electrical energy 31 through one side of the line which includes the branches 32 and 34 to the mercury 30 in the switch 28. The current will then pass through the mercury and

5

through line 37 to contact 26. The position of the manual switch 22 is such that the contacts 26 and 24 are connected together so that the current will then pass through the line 40 to the motor and line 35 back to the other side of the source of electrical energy 31 to complete the circuit.

If the manual switch 22 is allowed to remain in the position shown in Figs. 1 and 2, and the position of the handle 1 is changed to move the mercury 30 to the opposite end of the tube 29, the contact between the lines 34 and 37 will be broken and a contact will be made between the lines 33 and 36. The contacts 27 and 25 of the manual switch 22 are connected together so that current will then pass from the source of electrical energy 31 through the branch 33 and mercury 30 to the line 36 and will be carried to the motor through lines 41 and 39. The circuit is then completed through the line 35 back to the other side of the electrical source. The direction of rotation of the motor will thereupon be reversed as well as the shaft 2 and brush 5 connected therewith.

If, however, the handle 1 is allowed to remain in its original position and it is desired to reverse the rotation of the brush 5 manually, the manual switch 22 may be actuated, whereupon the contacts 27 and 24 will be connected as indicated by the dotted lines 42, and the contacts 26 and 23 will be connected as indicated by the dotted lines 43. In this case the mercury 30 will remain in the position shown in Fig. 2 whereupon current will pass through the branch 34 and mercury 30, through line 37 and contacts 26 and 23 back to the motor through lines 38 and 39.

If the manual switch 22 is then allowed to remain in its new position as shown by the dotted lines 42 and 43, reversal of the brush 5 may again be accomplished by turning or rotating the handle 1 so that the mercury 30 will move to the other end of the tube 29, whereupon current will pass through branch 33, mercury 30, line 36, contacts 27 and 24, and line 40 to the motor.

Thus it will be evident that a reversal of the brush 5 may take place either automatically by means of the mercury switch 28, or manually by operation of the manual switch 22.

Fig. 3 illustrates a slightly modified form of the invention wherein the electrical circuit is identical with that shown in Fig. 2 except that, instead of the single mercury switch 28, two separate mercury switches 44 and 45 are utilized. In Fig. 3 each of the switches 44 and 45 have branches of the circuit passing through one end only so that in one position of the handle 1 the mercury in switch 44 will have no current passing therethrough, and the mercury in switch 45 will have current passing therethrough. When the position of the handle 1 is reversed, the contact through switch 45 will be broken and the contact through switch 44 will be made. The operation of this form of the invention is identical with that above described with respect to the electrical circuit shown in Fig. 2.

Fig. 4 illustrates a further modified form of the invention wherein connection is made directly from the source of electrical energy through the manual switch and then to one or the other of two mercury switches. In this case, the manual switch is a single-pole switch and each of the mercury switches has contacts at both ends thereof.

The source of electrical energy may again be

6

indicated by the numeral 31, but the current from one side of the line will then pass through branch 46 to the manual switch 47 which includes a single contact 48 at one side thereof and the other contacts 49 and 50 at the other side thereof. The manual switch is connected to the mercury switches 51 and 52. The line 53 which extends from contact 49 is divided so that one branch 54 is connected to one end of the mercury switch 51 and the branch 55 is connected to the other end of mercury switch 51. The other contact 50 of the manual switch 47 is connected to the other mercury switch 52 through line 56, which is also divided and has one branch 57 connected at one end of the mercury switch 52 and the other branch 58 connected to the other end of mercury switch 52. Mercury switch 51 has one end thereof connected to the motor through lines 59 and 60, while the other end of mercury switch 51 is connected to the motor through lines 61 and 62.

One end of mercury switch 52 is connected to the motor through the lines 61 and 62 and the other end of the same switch is connected to the motor through the lines 59 and 60. The other side of the motor is then connected to the source of electrical energy through the line 63.

In this form of the invention then, in the position of the switches as shown in Fig. 4, current will pass from one side of the line through the branch 46 to contact 48 and thence through branches 53 and 55, through the mercury in tube 51 and to the motor through lines 61 and 62. When reversal of the direction of rotation of brush 5 is accomplished through movement of the handle 1, the mercury in both switches 51 and 52 will be moved to the opposite ends thereof, but the movement of mercury in switch 52 will have no effect because the manual switch 47 is not in a position to direct current therethrough. This movement of mercury in switch 51 will connect together the branches 54 and 59, whereupon current will pass to the motor through the lines 59 and 60 and thereupon reverse the direction of rotation of the motor.

The position of the various switches as shown in Fig. 4 may also cause a reversal of direction of rotation of the motor and brush 5 without changing the position of the handle 1, but by moving the switch 47 so that the blade thereof will connect the contacts 48 and 50. In this position of the switch 47 current will then pass through the branches 56 and 58, through the mercury in switch 52 and thence to the motor through lines 59 and 60. With the manual switch 47 in the position where the blade connects the contacts 48 and 50, the direction of rotation may again be reversed by movement of the handle 1 causing the mercury in switch 52 to make contact between the lines 57 and 61.

All forms of the invention illustrated herein are directed to the accomplishment of a common result by electrical means, and both the automatic and manual switches cooperate to attain a unitary result. In following through the actions of a user in cleaning the teeth, it may be assumed that the position of the brush and handle in Fig. 1 is such as to cause proper rotation of the brush 5 for cleaning the outer surfaces of the lower teeth when the brush is held in the right hand. It may further be assumed that the positions of the switches are as shown in Fig. 2. If the user, after completing the cleaning of the outer surfaces of the lower teeth, then changes the position of the handle and brush to clean the inner

surfaces of the lower teeth, it will be necessary to rotate the handle about its longitudinal axis through approximately 180° so that the brush 5 will then be facing outwardly. This change of position of the handle will automatically cause a movement of the mercury 30 to move to the other end of switch 23, thus breaking the contact between branches 34 and 37 and making contact between branches 33 and 36. This then changes the direction of rotation of brush 5 by reversing the direction of rotation of the motor, and rotates the brush in a direction proper for cleaning the inner surfaces of the lower teeth away from the gums. The direction of rotation of the brush 5 for cleaning the inner surfaces of the lower teeth will be the same as that for cleaning the outer surfaces of the upper teeth. However, when the brush is removed from the lower teeth and applied to the outer surfaces of the upper teeth, the position of the handle 1 will again be changed to reverse the direction of rotation of the brush. To avoid this change of direction, the manual switch 22 is actuated which will thereupon cause another reversal and the brush will then be rotating again in the same direction it had been for cleaning the inner surfaces of the lower teeth. When the position of the handle is changed from that necessary to clean the outer surfaces of the upper teeth to that necessary for cleaning the inner surfaces of the upper teeth, the position of the handle is again changed, whereupon the direction of rotation of the brush 5 will automatically be reversed for proper cleaning.

With the manual switch in one position, the mercury switch or switches function automatically to afford a cleaning of both inner and outer surfaces of the upper teeth, and with the manual switch in the other position, the mercury switch or switches, function automatically to afford a cleaning of both inner and outer surfaces of the lower teeth.

Changes may be made in the form, construction and arrangement of parts from that disclosed herein without in any way departing from the spirit of the invention or sacrificing any of the attendant advantages thereof, provided, however, that such changes fall within the scope of the claims appended hereto.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. Motor reversing means for an electric rotary toothbrush operable upon connection with a source of electrical energy, and having a handle, an electric motor in said handle, a rotatable shaft connected to said motor and having a brush thereon, said reversing means comprising mercury switch means connected to one side of the source of electrical energy, manually operable switch means electrically connected between said mercury switch means and said motor, and an electrical connection between said motor and the other side of the source of electrical energy, said mercury switch means being operable upon reversing the position of said handle to reverse the direction of current flow through the motor and reverse the direction of rotation of said motor and shaft, and said manual switch being operable to reverse the direction of rotation of said motor and shaft when the position of the handle is unchanged.

2. Motor reversing means for an electric rotary toothbrush operable upon connection with a source of electrical energy, and having a handle,

an electric motor in said handle, a rotatable shaft connected to said motor and having a brush thereon, said reversing means comprising an electrical circuit connecting one side of the source of electrical energy with said motor, mercury switch means in said circuit and connected to the other side of the source of electrical energy operable to automatically reverse the direction of rotation of said shaft and brush when said handle is rotated in a predetermined manner, and manually operable switch means also in said circuit between said mercury switch means and said motor and operable to reverse the direction of rotation of said shaft and brush.

3. Motor reversing means for an electric rotary toothbrush operable upon connection with a source of electrical energy, and having a handle, an electric motor in said handle, a rotatable shaft connected to said motor and having a brush thereon, said reversible means comprising an electrical circuit connecting the source of electrical energy with said motor, mercury switch means in said circuit operable to automatically reverse the direction of rotation of said motor, shaft and brush when said handle is rotated in a predetermined manner, and manually operable switch means also in said circuit and interposed between said mercury switch means and said motor, and operable to reverse the direction of rotation of said motor, shaft and brush.

4. Motor reversing means for an electric rotary toothbrush operable upon connection with a source of electrical energy, and having a handle, an electric motor in said handle, a rotatable shaft connected to said motor and having a brush thereon, said reversing means comprising an electrical circuit connecting the source of electrical energy with said motor, mercury switch means in said circuit operable to automatically reverse the direction of rotation of said motor, shaft and brush when said handle is rotated in a predetermined manner, and manually operable switch means also in said circuit and interposed between said mercury switch means and the source of electrical energy, and operable to reverse the direction of rotation of said motor, shaft and brush.

5. Motor reversing means for an electric rotary toothbrush operable upon connection with a source of electrical energy, and having a handle, an electric motor in said handle, a rotatable shaft connected to said motor and having a brush thereon, said reversing means comprising gravity actuated switch means connected to one side of the source of electrical energy, manually operable switch means electrically connected between said gravity actuated switch means and said motor, and an electrical connection between said motor and the other side of the source of electrical energy, said gravity actuated switch means being operable upon reversing the position of said handle to reverse the direction of current flow through the motor and reverse the direction of rotation of said motor and shaft, and said manual switch being operable to reverse the direction of rotation of said motor and shaft when the position of the handle is unchanged.

6. Motor reversing means for an electric rotary toothbrush operable upon connection with a source of electrical energy, and having a handle, an electric motor in said handle, a rotatable shaft connected to said motor and having a brush thereon, said reversing means comprising an electrical circuit connecting the source of electrical energy with said motor, gravity actuated switch means in said circuit operable to automatically reverse the direction of rotation of said motor,

shaft and brush when said handle is rotated in a predetermined manner, and manually operable switch means also in said circuit and interposed between said gravity actuated switch means and the source of electrical energy, and operable to reverse the direction of rotation of said motor, shaft and brush.

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