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ELECTROPHORETIC TOOTHBRUSH

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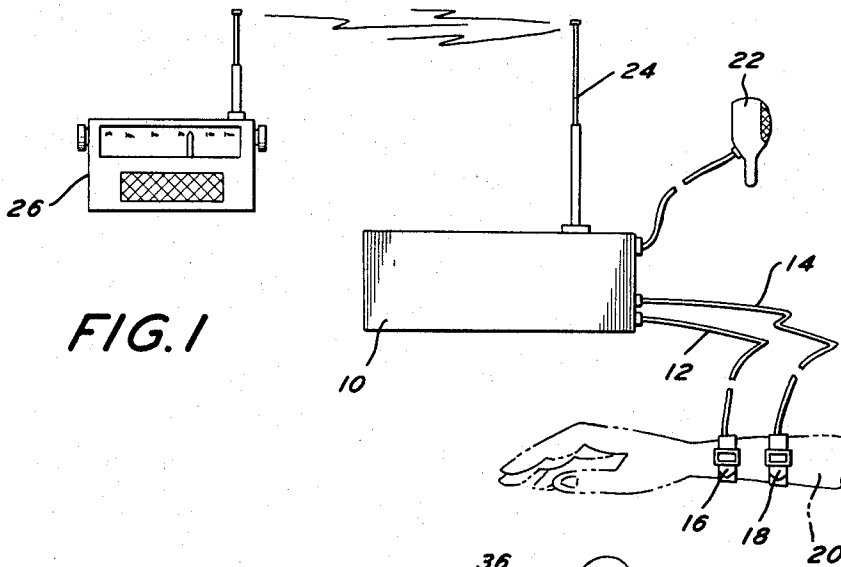


FIG. 1

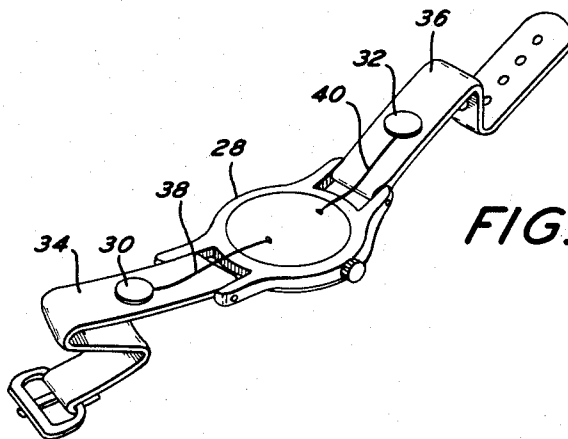


FIG. 2

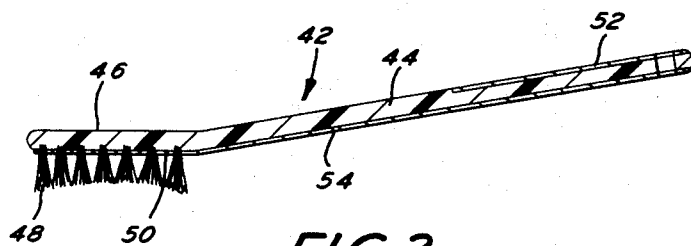


FIG. 3

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ELECTROPHORETIC TOOTHBRUSH
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ABSTRACT OF THE DISCLOSURE

An electrophoretic toothbrush is described having connecting electrodes in the handle and brush head which provides a flow of current when the head is inserted in the user's mouth so that fluoride ions when present in the user's mouth will flow to the user's teeth. Similarly, this electrical source is described as useful to power other devices such as a radio transmitter and an electric wrist watch.

The present invention relates to a source of electrical power, and more particularly to an electrical power source for low power operated portable devices.

With the advent of miniaturized electrical components and low power operated electrical circuits, there has been developed many portable electrical devices, such as radio receivers, radio transmitters, toothbrushes, hearing aids, watches, shavers, etc. However, all of the devices have one common drawback. The power source for operating these devices is a battery which has a limited useable life. Thus, the batteries must be replaced from time to time, or, if rechargeable, must be accompanied by devices for recharging the battery. The need for replacing the batteries or for a special device to recharge the battery not only adds to the expense of the device, but makes the device unreliable since it cannot always be determined with certainty when the battery will go bad. Therefore, it is desirable to have a power source for such portable devices which is reliable, has a long life and is inexpensive.

An object of this invention is the provision of an electrophoretic toothbrush.

Other objects will appear hereinafter.

For the purpose of illustrating the invention, there is shown in the drawings forms which are presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIGURE 1 is a schematic view of an audio transmitter having the power source of the present invention.

FIGURE 2 is a view of an electric wrist watch having the power source of the present invention.

FIGURE 3 is a view of an electrophoretic toothbrush having the power source of the present invention.

In general, the electrical power source of the present invention is based on the principal that, when two different metals of the electromotive sources are placed in

an electrolyte, there is created a cell which provides an electrical current. Table I is an abbreviated list of these metals. When a cell is made of two of these metals in a uniform electrolyte, the EMF of the cell is determined from the individual potential values of the metals used. For example, if the metals are magnesium (−1.55) and

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silver (+0.80), the cell has a theoretical voltage of 2.35 volts. Thus, the highest voltages are obtained by using metals spaced the furthest apart on the electromotive series.

TABLE I

Element:	Normal electrode potential (volts) referred to hydrogen electrode
K	−2.92
Na	−2.71
Mg	−1.55
Zn	−0.76
Fe	−0.44
Sn	−0.13
Pb	−0.12
H	0.00
Bi	+0.26
Cu	+0.34
Hg	+0.80
Ag	+0.80

I have discovered that, when two electrodes of different metals on the electromotive series are placed in spaced relation on the epidermal surface of an animal, including a human, the body of the animal acts as a solid electrolyte and a cell is created which provides a low voltage current. The metals for such electrodes should be as far apart on the electromotive series as possible so as to provide maximum voltage, but must be metals which do not adversely react with the skin of the animal; for example, electrodes of silver and magnesium. Although solid metal electrodes are preferred, the electrodes may also be organic or inorganic compounds of the metals.

Although, as stated above, the theoretical calculated EMF for a silver-magnesium couple is 2.35 volts, experiments showed that the open circuit voltage for this couple when attached to the human skin is 1.2 to 1.4 volts. This reduction in voltage is believed to be caused by an imperfect electrical function at the interface of the electrodes and the epidermis, and by the fact that the epidermis does not provide a uniform electrolyte. The electrical power obtainable with a silver-magnesium pair of electrodes secured in spaced relation on the human skin was calculated by connecting known resistances across the circuit and measuring the voltage drop. From these data, the current was calculated. The current multiplied by the voltage gave the power output. It was found that a maximum power of 250 micro watts was obtained at 0.5 volt and 500 micro amps.

It has been found that the size of the electrodes and the spacing between the electrodes affects the power output obtainable. Table II shows the variation in the power output with variations in the size of the electrodes and the spacing between the electrodes. The electrodes used were a silver-magnesium couple. It can be seen from Table II that the larger the area of the electrodes and the closer they are, the higher the power output.

TABLE II

Location	Electrode area (cm. ²)	Voltage (volts)	Current (micro amps)	Resistance (ohms) (K.)	Power (micro watts)
Forearm 1 cm. apart.....	24.5	0.5	500	1	250
Forearm 4 cm. apart.....	24.5	0.24	510	475	120
One on each arm.....	24.5	0.45	450	1	202
Forearm 2 cm. apart.....	9.6	0.30	300	1	90

Referring to FIGURE 1 of the drawing, there is shown an audio transmitter 10 using the power source of the present invention. The electrical circuitry of the transmitter 10 may be any well-known audio transmitter circuit which will operate from a low power source. The power input terminals of the transmitter 10 are connected

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by wires 12 and 14 to flat disc or strip electrodes inserted on the inner surface of straps 16 and 18. As stated above, the electrodes are of two different metals of the electromotive series, such as silver and magnesium. The straps 16 and 18 are secured in spaced relation around the arm 20 of a person with the electrode contacting the surface of the skin. The transmitter 10 is provided with a microphone 22 and an aerial 24 in the manner well known in the art. The signal from the transmitter 10 can be received by a radio, generally indicated as 26, which is tuned to the frequency of the transmitter.

Referring to FIGURE 2, there is shown an electrical wrist watch 28 using the power source of the present invention. Wrist watch 28 can be of any well-known construction for a watch operated by a battery. However, instead of a battery, a pair of electrodes 30 and 32 of the present invention were secured on the inner surface of the straps 34 and 36 respectively. The electrodes 30 and 32 are connected to the power input terminals of the electrical circuit operating the watch by wires 38 and 40 which extend along the straps 34 and 36 and through the case of the watch. Thus, when the watch 28 is secured to the user's arm, the electrodes 30 and 32 contact the skin of the user at spaced points to complete the electrical circuit and provide the power to operate the watch.

Referring to FIGURE 3, there is shown an electrophoretic toothbrush 42 which uses the power source of the present invention. It is known that when a direct electrical current is passed through a solution, the ions in the solution will migrate toward the side of the charge opposite to that of the ions. It is also known that fluorides are effective to prevent decay of teeth and that the better the penetration of the fluorine into the teeth, the more effective the fluoride is. An electrophoretic toothbrush is a toothbrush which provides an electrical current through the fluoride so as to cause migration of the fluorine ions into the teeth.

Toothbrush 42 of the present invention comprises a handle 44 having a head 46 at one end thereof. The handle 44 and head 46 are of an electrically insulating material, such as a plastic. Bristles 48 are provided on the head 46. A negative electrode 50, such as a strip of magnesium, is secured to the surface of the head 46 at the bottom of the bristles 48. A positive electrode 52, such as a strip of silver, is secured to the end of the handle 44. A wire 54 extends along the handle 44 and electrically connects the positive electrode 52 and the negative electrode 50.

To use the toothbrush 42, toothpaste containing fluoride is placed on the bristles 48. The user holds the handle 44 so that the positive electrode 52 contacts the skin of the user's hand. When the head 44 of the toothbrush 42 is placed in the user's mouth, the negative electrode 50 contacts the user so as to complete the electrical cir-

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cuit and provide a flow of current through the fluoride toothpaste. Thus, the fluorine ions migrate from the bristles to the positive charged teeth so as to cause greater contact between the fluorine and the teeth. It is believed that the flow of electricity also stimulates the gingiva and provides a beneficial effect.

The power source of the present invention can be used to operate any other electrical devices which operate on low power. Since the power source of the present invention includes an animal, such as a human, it is preferably used for portable devices, or any such electrical devices it is only necessary to replace the batteries which are normally used to operate the device with a pair of the electrodes of the present invention. The electrodes are connected to the power input terminals of the electrical circuit of the device and are provided with means, such as straps, for using the electrodes to the skin of the animal. The power source of the present invention has the major advantage that it is extremely reliable in that it provides a steady output and has a long life.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. An electrophoretic toothbrush comprising a handle of an electrical insulating material, a head of an electrical insulating material at one end of said handle, bristles secured to said head and extending from a surface of said head, an electrode secured to said handle, a second electrode secured to said surface of said head, said electrodes being of different metals of the electromotive series, and means extending along said handle and electrically connecting said electrodes to each other.

2. An electrophoretic toothbrush in accordance with claim 1 in which one of said electrodes contains silver and the other electrode contains magnesium.

3. An electrophoretic toothbrush in accordance with claim 2 in which the electrode on the handle contains silver.

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