

[54] **SONIC TEETH-CLEANING APPARATUS AND METHOD**

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[58] Field of Search **128/62 A, 65, 66, 128/24 A; 32/DIG. 4**

[56] **References Cited**

UNITED STATES PATENTS

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[57] **ABSTRACT**

Apparatus for cleaning teeth with liquid dentifrice, optionally mixed with dental-disease-inhibiting agents, comprising: a transducer of a size and nature adapted to be held in the mouth for producing ultrasonic (or subsonic) vibrations in the mouth-inclosed liquid; a handle attached to the transducer; a circuit leading to the transducer, including an electric oscillator, an optional automatic time control, a switch actuator (optionally a pushbutton), and an electric cord that goes thru the handle. The portion of the transducer assembly that fits between the lips is sufficiently small in vertical thickness to allow the lips to seal around this portion against escape of the dental solution. The invention includes a simple and efficient method of cleaning teeth comprising filling the mouth with liquid dentifrice and sonically (ultrasonically or subsonically) agitating and circulating the liquid into all areas of the mouth.

8 Claims, 2 Drawing Figures

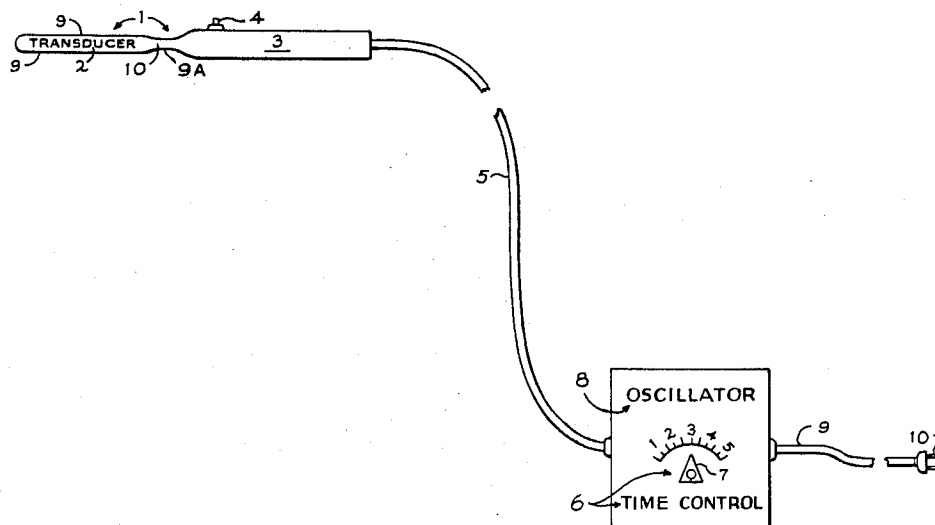


FIG. 1

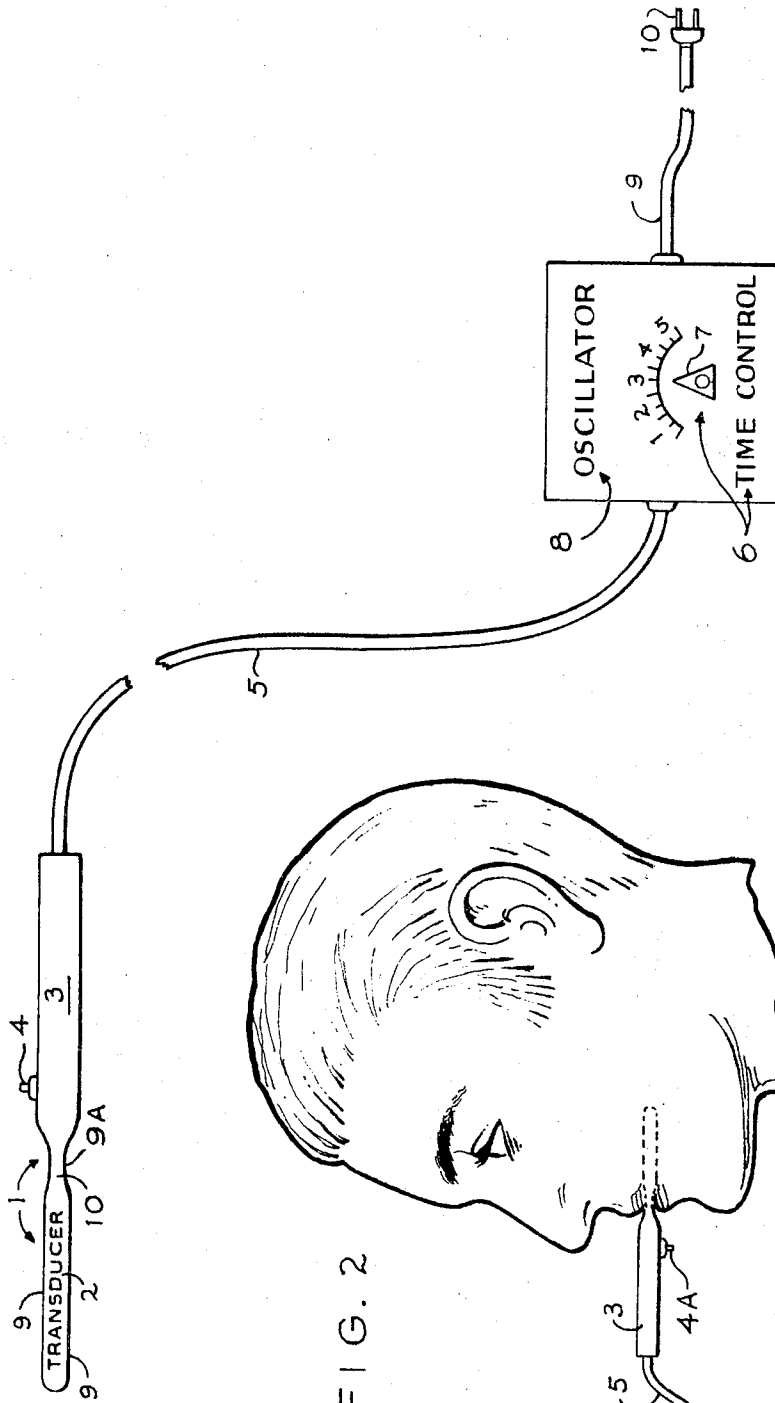
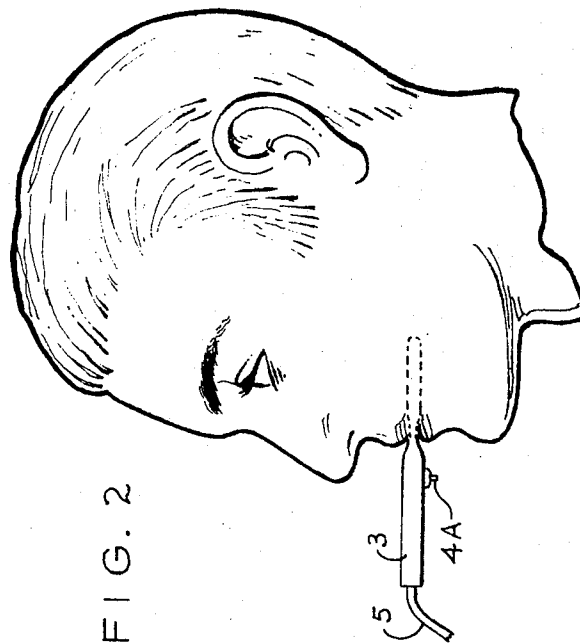


FIG. 2



SONIC TEETH-CLEANING APPARATUS AND METHOD

This application pertains to a sonic system for cleaning teeth, having an oscillator and a mouthpiece that comprises a transducer. When the mouthpiece is inserted into liquid dentifrice in the user's mouth the sonic waves from the transducer agitate and circulate the dentifrice over and thru the teeth.

Some objects of the invention are to provide: (1) an effective system for cleaning teeth by means of a liquid that is conducted under sonic (preferably ultrasonic) agitation over the teeth; (2) an easily and quickly operated teeth-cleaning system, enabling the user to fill his mouth with dentifrice and then sonically and rapidly circulate the dentifrice; (3) a method of cleaning teeth comprising placing of liquid dentifrice in the mouth and sonically (ultrasonically or subsonically) agitating the liquid, thus cleanly bathing the teeth. Other objects of the invention will be apparent in consideration of the following specification and the accompanying drawings.

In these drawings:

FIG. 1 is an elevational view of one form of the invented apparatus; and

FIG. 2 is an elevational view, on a scale reduced from that of FIG. 1, partly broken away, illustrating the mouthpiece as clamped between the lips of the user, in mouth-sealed operative position.

In FIG. 1 the apparatus is shown as comprising: a mouthpiece 1, having a transducer 2 which transforms electrical oscillations into sonic (preferably ultrasonic) waves; a handle 3; an electric switch and switch-operating means 4, 4A (optionally a pushbutton switch); an electricity-conducting cord or cable 5, connected to and extending thru the handle 3; a time-controlling means 6, comprising a rotatable pointer or arm 7; an electric oscillator 8; a flexible electrical conductor 9; and an electrical connector (plug) 10, adapted to connect the apparatus to a house-current line.

The main parts of the transducer 2 are of known general type of construction; but it is different from the usual transducer in that its proportions and size are adapted to fit in the mouth. Optionally, it produces subsonic vibrations; but preferably its radiation is ultrasonic. When the system is designed for subsonic frequency the mouth-enveloped transducer that is utilized may comprise an electromagnetically driven diaphragm. And when the desired sonic vibrations are ultrasonic, having frequencies too high for the human to hear — above approximately 18,000 cycles per second — the mouth-size transducer, for example, may utilize the magnetostrictive effect of nickel, or the piezoelectric effect in quartz or synthetic-ceramic crystals (for example, of barium titanate). The invention thus optionally comprises: (1) in a system utilizing ultrasonic vibrations, a relatively small transducer, dimensioned and shaped to fit inside the human mouth, having an input of electrical oscillations and an output of vibrations above 17,500 cycles per second; or (2) in a system utilizing subsonic vibrations, such a dimensioned and shaped transducer that transforms electrical oscillations into sound waves of a frequency capable of being sensed by the human ear — for example, a transducer like a phonograph's loudspeaker (but much smaller, of a size and shape adapted to fit in the mouth).

The criteria for the construction of the transducer comprise the following features: (1) At least its electrical portion is waterproofed and electrically insulated from the dental solution in the mouth (for example, its electrical part or, as illustrated in FIG. 1, both of its electrical and mechanical parts may be snugly sheathed in an envelope or skin (9, 9A) of flexible, waterproof, insulating plastic, this flexible plastic being in close-enough juxtaposition with the mechanically resonant part to transmit the vibrator's vibrations to the dental liquid). (2) The transducer has a horizontal width in the mouth that is less than the horizontal span between jaw teeth of any prospective user. (3) It has a vertical thickness in the mouth that is less than the distance between the roof and the tongue of the closed mouth of the user. (4) The vertical thickness of the transducer assembly at its neck portion between the lips is small enough for the lips to seal around this part of the assembly against escape of the dental liquid in the mouth. Optionally, this part 10 may be thinner than the main, mouth-inclosed transducer portion; or the parts 9 and 9A of the envelope may be of about the same height, and in this case this height has a maximum dimension of about three-sixteenths of an inch.

In manufacture of the handle-and-transducer assembly: the handle 3 is preferably made of molded rigid or semi-rigid plastic; and the combined envelope parts 9 and 9A are integrally formed of molded flexible plastic, and thereafter bonded to 3 by bonding material (epoxy cement, silicone sealant, or heat-fused plastic when the material is thermoplastic).

The oscillator 8 is of any commercially obtainable type — for example: (1) for subsonic frequencies, comprising an inductance, capacitor and optional vacuum tube; (2) for ultrasonic frequencies, having a quartz or synthetic-ceramic crystal in the circuit.

The spring-biased switch-actuating means (4, 4A) may be placed: on and above the handle 3, movable by the index finger, as indicated at 4 in FIG. 1; below the handle, movable by the thumb, as at 4A in FIG. 2; or on either side of the handle. When this switch actuator is a pushbutton that is continuously urged outward by its spring the operator continues to hold it in switch-actuating position while the dentifrice is being circulated. But when it is with a common switch of the type that is moved once for effecting a circuit and again for opening it the operator optionally may move this switch for stopping the vibration, or this may be ended automatically by the time control 6-7. This optional automatic control means may be any known type of time control of electric motors or the like, comprising, for example, a time clock and a switch-operating solenoid. The time clock and the period of operation of the transducer are set by the rotatable pointer or arm 7, and the indicia above seven (0 to 5) represent the minutes of operation. With the quickly operating device of this invention one-half to one minute is ordinarily sufficient.

The cleaning solution or dentifrice may contain detergents and such dental-disease-inhibiting agents as are available and deemed beneficial.

TEETH-CLEANING METHOD

The invented apparatus is of use in a method of cleaning and/or treating teeth, comprising the following steps:

1. The person whose teeth are to be cleaned takes a mouth full of liquid dentifrice mixture.

2. The sonic transducer is inserted in the mouth and thus into the liquid dentifrice.

3. The lips are tightly closed over the portion of the transducer assembly that is between the lips, thus sealing against escape of the liquid.

4. The switch actuator (4 or 4A) is manually actuated, closing the switch.

5. The sonic (preferably ultrasonic) vibrations in the liquid cause it to bathe and cleanse all surfaces of the teeth and beneath gum margins and into gum pockets. This vibrating circulation penetrates the most remote and difficult-to-cleanse mouth areas.

6. The circuit is opened — either by manual or by time-controlled switch actuation.

7. The transducer is taken from the mouth.

8. The cleaning liquid is removed from the mouth.

In the following claims, unless otherwise qualified: the term "sonic vibrations" refers either to subsonic or ultrasonic vibrations; and the word "plastic" means any natural or synthetic plastic, including rubber or any other plastic.

I claim:

1. Teeth-cleaning apparatus, comprising:

a transducer assembly for transforming electrical pulses into sonic vibrations, adapted for insertion into the space between the roof and tongue of the mouth of a user and into mouth-held dentifrice placed in the mouth before said insertion, including: a transducer; a transducer sheath comprising waterproof and electrically-insulating material around the transducer, having a vertical thickness that is less than the distance between the roof and the tongue of the closed mouth of the user and a horizontal width that is less than the horizontal span between jaw teeth of any prospective user; and a transducer-assembly neck, comprising waterproof material, the said neck having a vertical thickness that is less than that of said transducer sheath and sufficiently small to permit sealing of the lips around the neck against escape of dentifrice from the mouth;

a handle, rigidly connected to said neck, adapted to be manually held outside the mouth; and

an electrical circuit, connected to said transducer, including: an electrical oscillator, for producing electrical pulses; electricity-conducting means,

comprising conductors connected to said oscillator, extending thru the said handle and thru said neck, and connected to said transducer; current-transmitting connecting means, connected to said oscillator and adapted to be connected to a source of electric current; and

switching means for opening and closing the circuit.

2. Apparatus as set forth in claim 1, in which said sonic vibrations are ultrasonic.

3. Apparatus as set forth in claim 1, in which said switching means comprises time-control means for automatically opening the said circuit on expiration of a desired teeth-cleaning period.

4. Apparatus as set forth in claim 1, in which said switching means comprises a manually operable switch on said handle.

5. Apparatus as set forth in claim 1, in which said switching means comprises: a manually operable switch on said handle for closing said circuit and beginning a desired period of operation of said transducer; and time-control means for automatically opening said circuit at the end of said period.

6. Apparatus as set forth in claim 1, in which said waterproof material of the sheath and the waterproof material of said neck are integral, and comprise plastic.

7. A method of cleaning teeth, comprising:

1. filling the mouth with liquid dentifrice, providing freedom for its circulation over all the teeth and gums;

2. inserting an electrically connected sonic transducer into space between the roof and tongue in the mouth, and thus into the dentifrice;

3. sealing the lips and mouth against escape of the dentifrice, by clamping the lips around the electrical connection to the transducer;

4. sending electric pulses thru the electrical connection, thus vibrating the transducer and liquid dentifrice, agitating and circulating the dentifrice over the teeth and gums;

5. stopping the electrical pulses;

6. taking the transducer from the mouth; and

7. removing the dentifrice out of the mouth.

8. A method as set forth in claim 7, in which step (4) comprises the production of ultrasonic vibrations in the mouth and dentifrice.

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