

[54] **DENTAL DESENSITIZER**

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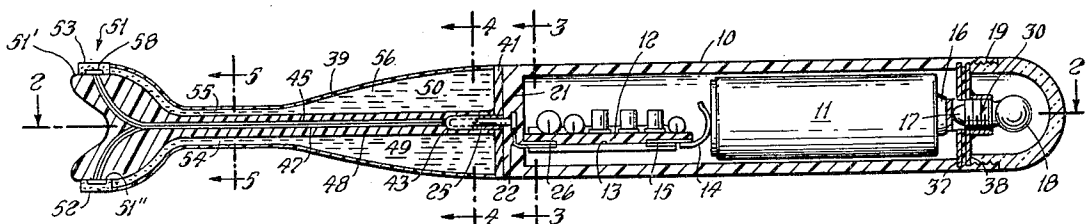
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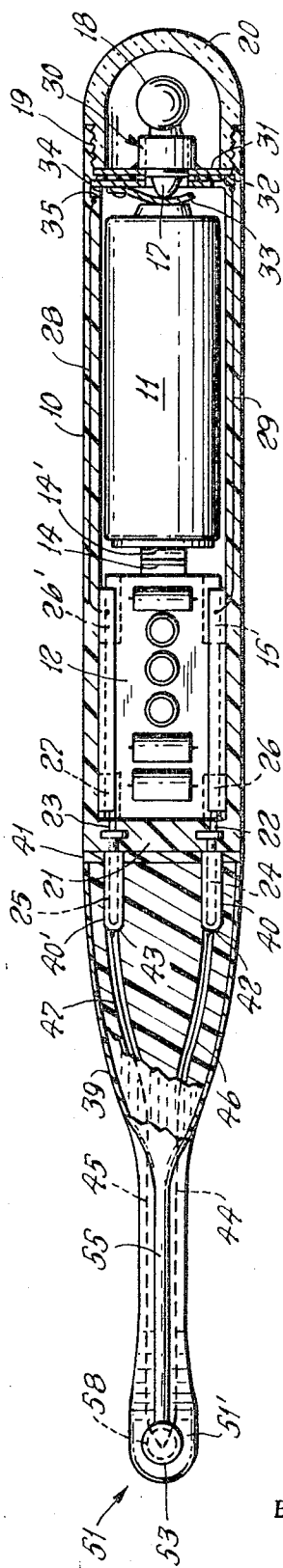
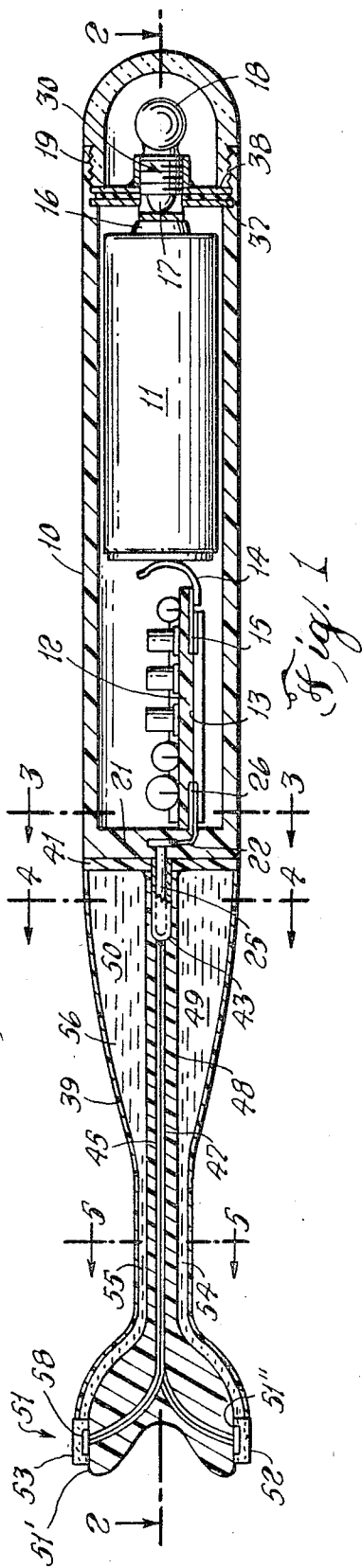
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[57] **ABSTRACT**

A dental desensitizer apparatus which includes a hollow dielectric housing having therein a source of electrical energy connected to a current regulating means connected to and for activating a lamp carried at one end of said housing. Said means being operative to light said lamp only when the current output of the regulating means is of a selected amperage. A translucent cover closing said housing across said lamp and an oral operating extension selectively separable from said housing attached to the other end of said housing. Said extension being of a translucent soft and flexible dielectric material and having formed therein a pair of cavities each communicating with a separate porous spongelike pad disposed on opposite sides of the tip of the extension. Electrical connection is made between each of said pads and the output of said regulating means.

9 Claims, 6 Drawing Figures

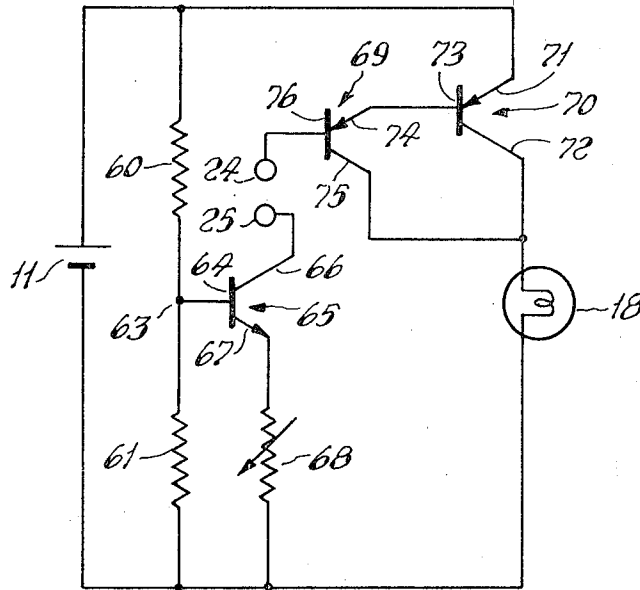
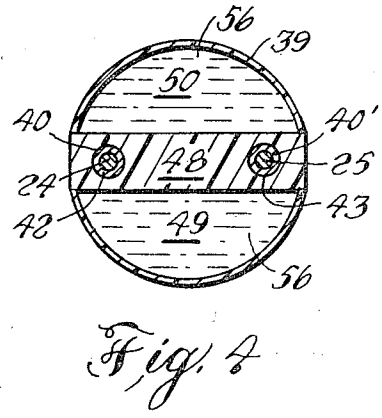
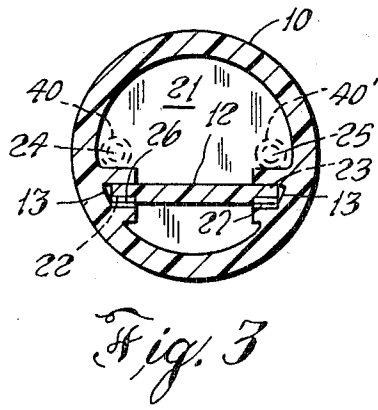
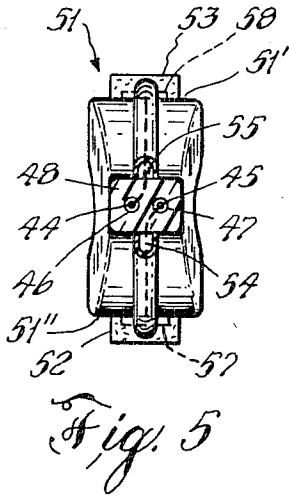




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DENTAL DESENSITIZER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to oral and dental instruments and apparatus and more particularly pertains to electrical desensitization of the teeth in conjunction with fluoride solutions wherein the oral current supplied is regulated and proper operation is visually indicated.

2. Description of the Prior Art

In the field of electrical dental desensitization, it has been the general practice to employ a separate apparatus for providing the electrical energy after the fluoride solution has been applied to the teeth without any control over the applied current. This procedure not only requires two separate operations but generally necessitates the presence of at least a dental technician. Additionally, it is apparent that the activating current must pass through a good portion of the patients body thus limiting its control and effectiveness without any indication of proper operation. Since it is necessary to provide an electrical current to ionize the fluoride, which, serves as the electrolyte, this being established through the patient, a definite psychological difficulty is created in that the patient is aware of the electrical energy passing through his body. This suggests, in the patients mind, the feeling of pain and discomfort and precludes any relaxation on his part during the desensitization procedure. Applicants apparatus overcomes these problems by providing a regulated self-contained unit which also indicates proper operation and restricts the electrical energy to the oral area.

SUMMARY OF THE INVENTION

The general purpose of this invention is to provide an improved dental desensitizer that has all the advantages of similarly employed prior art devices and has none of the above described disadvantages. To attain this, the present invention provides a unique arrangement, structure and current regulating circuit in which the source of electrical energy and the regulating means are housed in a hollow dielectric body having connected at one end an indicating lamp which is activated only when the proper current is being applied to the patient. Separably connected at the opposite end of the body is an operating extension which carries an oral tip provided with a pair of opposed porous pads which, independently communicates, with two cavities formed within the extension. The extension is of a soft deformable, translucent dielectric material and provides a passage there through for electrical connection between the pads and the regulating means. When the cavities are filled with a fluoride solution or paste and the extension compressed by the fingers of the patient, while in his mouth, a small amount of solution will fill the pads. One of the pads will be in direct contact with the dentine of the patients tooth while the other will directly engage the inner surface of the cheek, lips, tongue or jaw so as to provide a short, low resistance internal path with positive electrical contact.

An object of the present invention is to provide a reliable, simple, inexpensive, efficient, compact, lightweight, self-contained electrolytic dental desensitizer.

Another object is the provision of a dental desensitizer having a constant regulated current supply with a visual indication of proper operation.

Still another object is to provide a dental desensitizer which may be readily operated by the patient and in which the supply of fluoride solution is also controlled by the patient.

A further object is to provide a dental desensitizer wherein the operating contract portion containing the fluoride solution is easily replaceable.

A still further object is the provision of a dental desensitizer which is hand held and in which the entire electrical path is within the oral area for minimizing the circuit resistance.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed

description when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of an embodiment made in accordance with the principle of the present invention;

FIG. 2 is another cross-sectional view taken approximately along line 2—2 of FIG. 1,

FIG. 3 is a cross-sectional view taken approximately along line 3—3 of FIG. 1,

FIG. 4 is a cross-sectional view taken approximately along line 4—4 of FIG. 1;

FIG. 5 is a cross-sectional view taken approximately along line 5—5 of FIG. 1; and

FIG. 6 is a schematic of the electronic current regulating and indicating circuits employed in the embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the illustrated embodiment of FIGS. 1 through 5, a hollow housing or body 10 of a relatively rigid, dielectric, molded plastic such as ABS or polyethylene has disposed therein a source of electrical energy such as a battery 11 and a printed circuit board 12 which also includes various electrical components. The circuit board 12 is supported within the housing by a pair of longitudinal grooves 13 (see FIG. 3) formed by the body wall into which it slides while similar recesses can be provided for the battery 11 where necessary which is electrically coupled to the board by spring contact 14 at battery terminal 14'. The board components are, where necessary, connected to the spring contact 14 through a metal runner 15 carried along the edges of the board and embedded therein. Disposed at the rear end of the housing proximate, and in electrical spring contact with the other terminal 16 of the battery is a lamp holder 17 which carries lamp 18. Internal threads 19 on the rear end of the housing permit the mounting of the threaded translucent lens cap 20 over the lamp 18 as well as closing the end of the housing. The opposite housing end is closed by an end wall 21 into which are embedded coupling contacts 22 and 23 and through which they pass and are supported therein, a pair of metallic electrode plugs 24, 25 are integral with the couplings and extend outwardly thereof. These plugs are electrically connected via the couplings 22', 23' to the forward runners 26 and 27 against which they tightly and slidably abut within the grooves for connection to the board 12 so as to couple to the current output thereof. Wires 28, 29 which may be molded into the housing serve to connect the board to both the opposite end of the battery and the lamp for completion of the circuit. Wire 29 connects the lamp base 30 to the battery terminal 14' via the spring base 31, ring contact 32, runner 15 and spring contact 14. The board is connected to terminal 16 through the lamp spring contact 33, base contact 34 and ring 35, wire 28 and board runner 26'. These parts are securely held in position when the lens cap 20 is threaded into the body since they are compressed between the body shoulder 37 and the cap shoulder 38.

A separable and replaceable extension 39 which is provided with a pair of inwardly extending recess 40, 40' that are formed as part of the rear wall 41 thereof to receive and mate with the plugs 24, 25, is carried by and affixed to the body or housing. The innermost portion of each of the recesses is provided with coupling means as for example, a metallic sleeve 42, 43, from which wires 44, 45 extend through tubular openings 46, 47 in extension divider 48. The central divider 48 separates the extension into two parts to form with the outer shell a pair of cavities 49, 50. Since the extension terminates in an oral operating tip 51 to be placed in the patients mouth, its general configuration is one such that proximate the tip it is quite narrow crosswise but Y-shaped in the perpendicular plane so as to provide spaced faces 51' and 51''. Disposed on and supported by the tip faces 51' and 51'' are a pair of opposed, spaced-apart, foam rubber, spongelike pads 52, 53 which are in direct communication with their respective cavi-

ties through communicating channels 54,55 so as to be accessible to sodium fluoride solution 56 or paste or any other suitable dental formula within the cavities. Since the outer shell of the extension 39 is formed of any suitable soft, flexible, deformable, dielectric material, the compression of the cavities, as by the patients fingers, will force the paste into the pads. Disposed intermediate the tip and each of the pads and in intimate contact therewith is a metallic coupler 57,58 which terminates the wire 44, 45 so that the board current output is connected thereto. Thus it is clear that a complete circuit connection exists between the output leads of the circuit board 12 and each of the pads whereby when the operating tip is placed in the patients mouth with one pad in contact with the dentine or cementum the opposite pad will be against some tissue portion of the mouth, usually the inner surface of the cheek. Since the pads are spread apart as illustrated, the liquids in the patients mouth will not short circuit the path directly between the pads. Low resistance is thereby maintained between the electrodes or pads. It should be observed that for operability only one of the pads (on dentine) need be supplied with the fluoride but, as a practical matter, since both sides of front and back teeth should be readily accessible without excessive manipulation both pads are activated. With the extension replaceable and the tip portion extremely flexible due in part to its small cross section intermediate the tip and the wall 41, the device is extremely versatile and easily employed. Additionally, it should be noted that the polarity of the pads could be reversed by merely reversing the extension but, if it is to be fixed, the plugs could be polarized by enlarging one of them. The electronic circuit of the board 12 is fully illustrated in FIG. 6 where the battery 11 is connected across a voltage divider consisting of series resistors 60 and 61 whose junction 63 is connected to the base 64 of transistor 65 so as to provide a constant fixed base bias. The collector 66 of this transistor is connected to one of the plugs 25 and therefore effectively to one of the pads within the patients mouth. The emitter 67 of the current control transistor 65 is connected to negative side of the battery via variable emitter resistor 68 which can be of the fixed type where a set current is desired. Transistors 69 and 70 in a Darlington configuration provide the necessary DC current amplification and supply the current to electrode 24 through the patient, collector 66, emitter 67, and resistor 68 from the battery. This current is effectively controlled by the value of resistor 68 and kept constant by the biases on transistor 65 and is independent of the battery voltage and tooth impedances below 800,000 ohms. A suitable patient current for desensitization has been found to be approximately 10 microamperes. Transistor 70 has its emitter 71 connected to the positive battery terminal and its collector 72 in series with the lamp 18 and battery negative. The base 73 of transistor 70 is tied to the emitter 74 of transistor 69 whose collector 75 is grounded through the lamp and whose base 76 in turn is connected to the electrode 24. Thus it is clear that for the constant current to flow through the patient's tooth, it must likewise flow through the base 76 of transistor 69 which permits current to flow through the lamp that is effectively across the battery when transistor 70 is fully on. The lamp will only ignite when the desensitizer is operating and it will only operate when the pads are electrically connected through some circuit (patients mouth) so the necessity of any on-off switch is eliminated.

Although the above-described circuit has been illustrated in conjunction with the desensitizer, it can also be employed quite independently to supply a selectable constant current. One such use to which is has already been successfully applied is as a "pulp" tester. The current, will, however, be slightly reduced where the impedance exceeds 800,000 ohms and in either the case of the tester or the desensitizer, the performance will not be seriously degraded. On the other hand, higher currents 15 to 20 microamps will cause the patient varying degrees of discomfort depending on his sensitivity and the applied current. The present invention limits the current and obviates these discomforts.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that numerous modifications or alterations may be made therein without departing from the spirit and the scope of the invention as set forth in the appended claims.

We claim:

1. An electric electrolytic desensitizer and decay inhibitor which comprises:
 - a hollow rigid dielectric body having supported therein, a battery
 - a lamp directed outwardly and having one terminal thereof detachably coupled to one terminal of said battery, constant current regulating means having its power input terminals connected across said battery and having a pair of output terminals, the other terminal of said lamp connected to said regulating means whereby when said regulating means are operative said lamp will be ignited, an oral operative extension of a flexible dielectric material formed so as to provide therein a pair of cavities, and being closed by a wall at one end, the opposite end of said extension formed to converge toward a tip portion,
 - a pair of applicators disposed on opposite faces of said tip portion,
 - a pair of channels communicating directly between said applicators and their respective said cavities,
 - electrical and support coupling means partially carried by said extension and said body detachably coupling said oral extension thereto, and electrically coupling said output terminals to said applicators,
 - whereby when said extension is coupled to said body, said cavities filled with a dental medicant electrolyte, and one of said applicators disposed against a patient's tooth, a constant selectable current will flow through said applicator, said electrolyte, said tooth, patient's oral tissue and the other of said applicators and said lamp will be ignited to indicate proper operation.
2. The desensitizer according to claim 1 wherein said couplings include:
 - a pair of pronglike electrodes supported in and extending out of said body at the end opposite said lamp,
 - a pair of recesses in said wall of said extension mating with and receiving said electrodes,
 - said recesses being provided with electrical contact means therein contacting said electrodes,
 - electrically conducting means disposed intermediate said applicators and said tip faces and connected to said electrical contact means.
3. The desensitizer according to claim 2 wherein said current regulating means comprises:
 - a pair of series connected resistors forming a divider network,
 - a second resistor
 - a first transistor having its base electrode connected to the junction of said series resistors, and an emitter and collector electrodes,
 - second and third transistors each having base, emitter and collector electrodes,
 - a series loop path having connected therein
 - said series resistors
 - said second resistor
 - said emitter and collector electrodes of said first transistor
 - said output terminals,
 - said base and emitter of said second transistor and
 - said base and emitter of said third transistor,
 - said collectors of said second and third transistors connected to the other terminal of said lamp,
 - said power input terminals connected across said series resistors,
4. The desensitizer according to claim 3 wherein said second resistor is a variable resistor for selectively adjusting the current of said regulating means.

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5. The desensitizer according to claim 4 wherein said applicators are foamlike pads.

6. The desensitizer according to claim 5 further including a detachable lens cap threaded into said body over said lamp.

7. The desensitizer according to claim 6 wherein said body and said extensions are circular in cross section.

8. The desensitizer according to claim 7 further including a circuit board having connected and supported thereon said

regulating means components,

said body being provided with a pair of opposed grooves and supporting therein said circuit board.

9. The desensitizer according to claim 8 wherein said tip is Y-shaped and said applicator are carried by the arms of said Y-shaped tip and directed outwardly.

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