June 14, 1955 B. H. WOODRUFF 2,710,610

ELECTRODE-SWITCH FOR DENTAL APPARATUS

Original Filed May 18, 1949 3 Sheets-Sheet 1

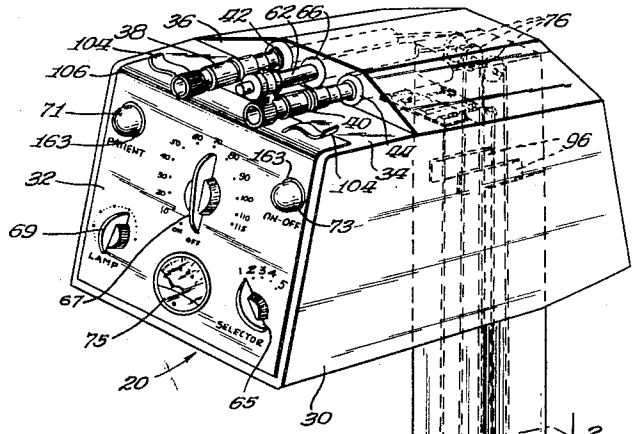


Fig. 1.

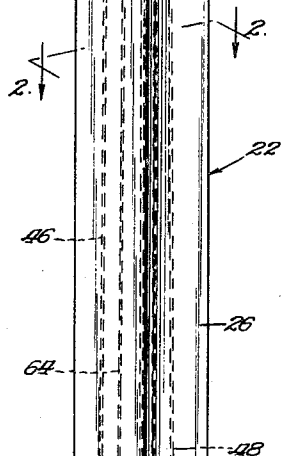
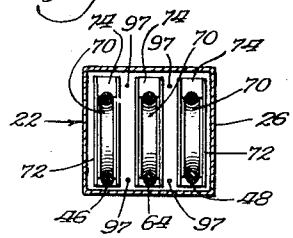


Fig. 2.



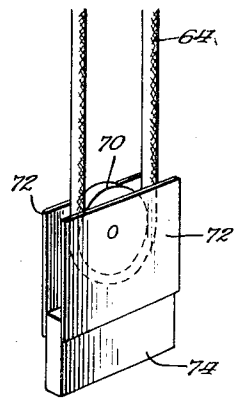
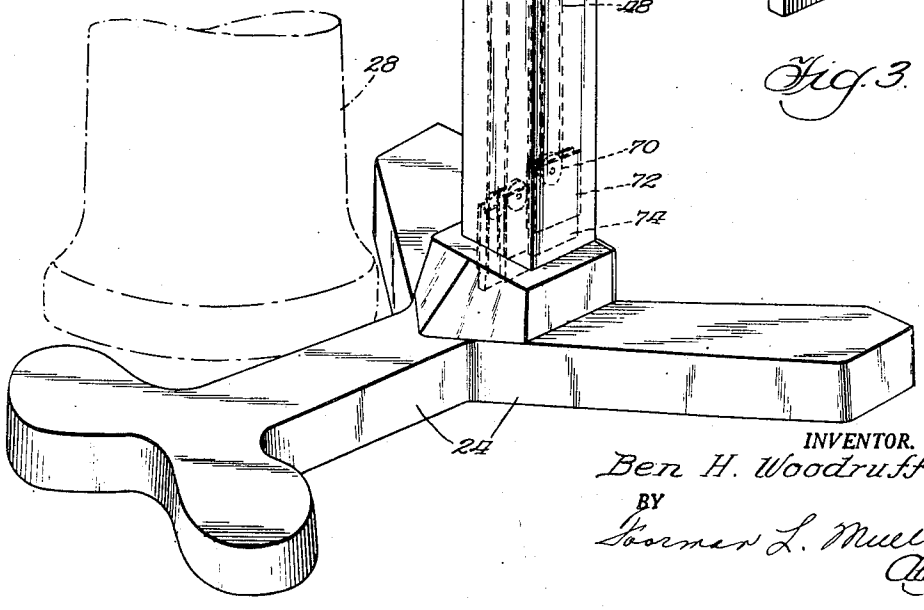


Fig. 3.



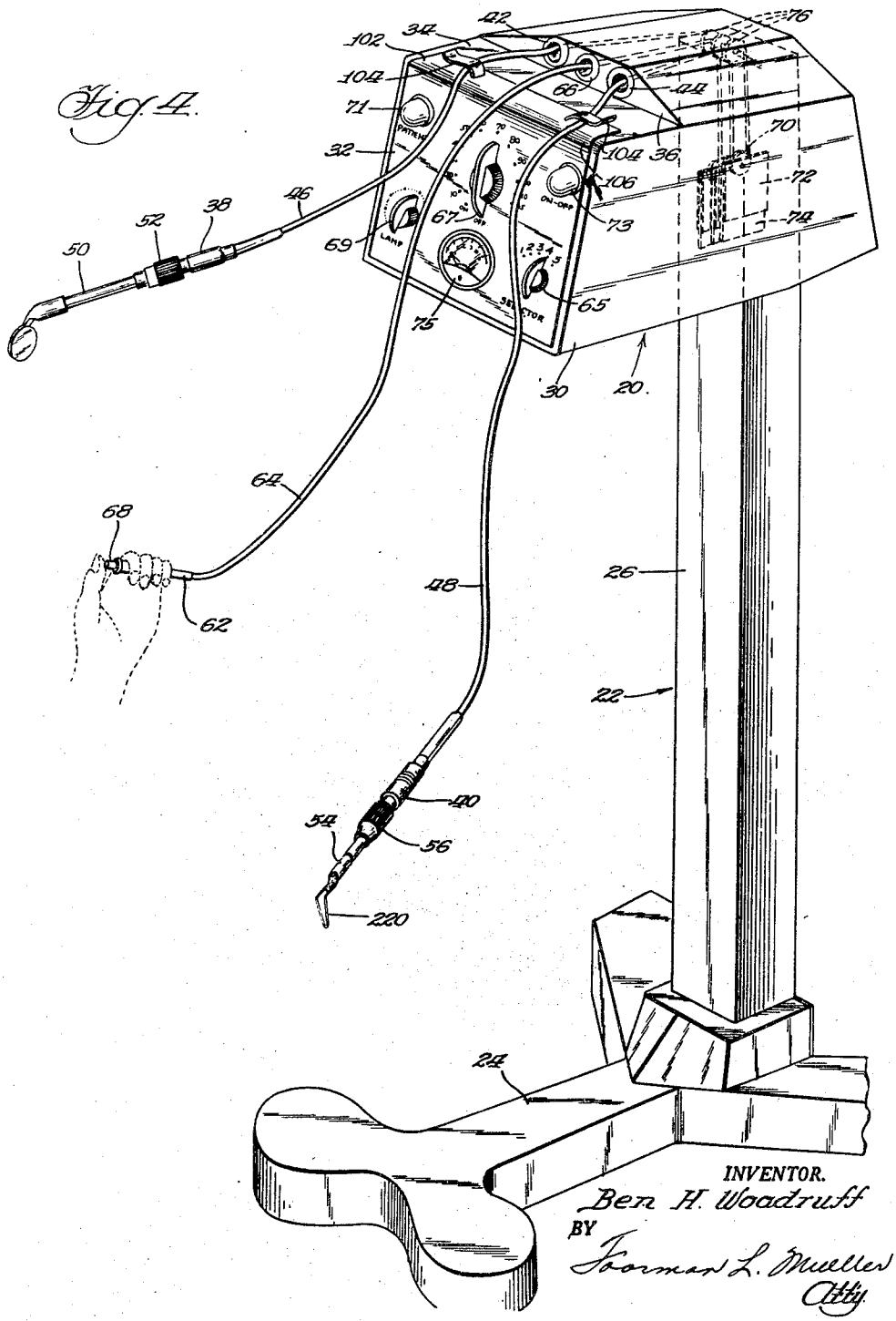
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ELECTRODE-SWITCH FOR DENTAL APPARATUS

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Fig. 4.



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ELECTRODE-SWITCH FOR DENTAL APPARATUS

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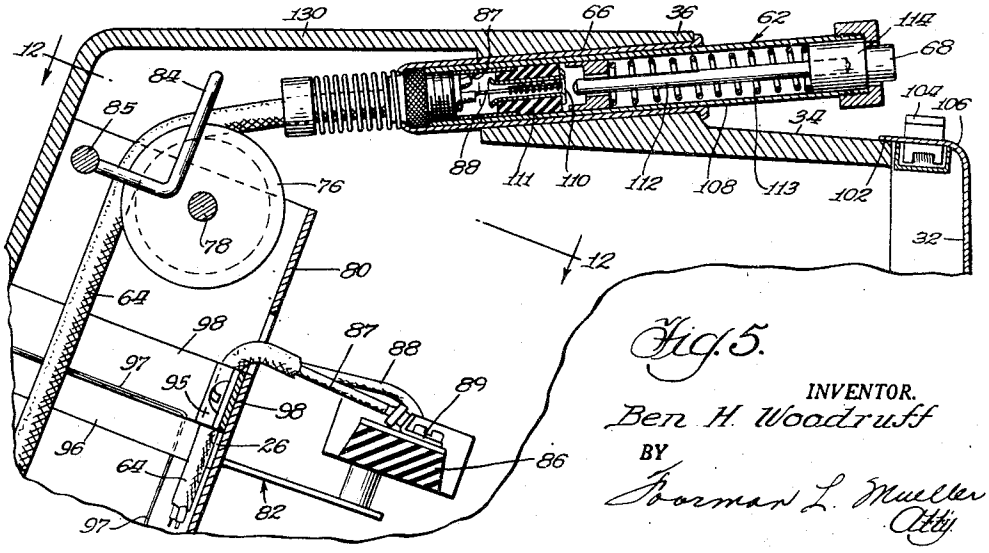


Fig. 5.

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ELECTRODE-SWITCH FOR DENTAL APPARATUS

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Original application May 18, 1949, Serial No. 93,904, now Patent No. 2,650,990, dated September 1, 1953. Divided and this application June 3, 1953, Serial No. 359,335

3 Claims. (Cl. 128—406)

This invention relates to improvements in dental apparatus for administering various electrical treatments, and in particular to an electrode-switch for such apparatus. This application is a division of copending application Serial No. 93,904, filed May 18, 1949, in the name of Ben H. Woodruff, and entitled "Dental Apparatus," now Patent 2,650,990.

Standard dental installations do not always include facilities for administering certain frequently required electrical treatments. Such facilities usually are available only in the more expensive installations. Hence, in many cases, a dentist is not likely to equip his office with needed electrical apparatus until such time as he is in a position to afford a complete new installation. Meanwhile he msut limit his operations and thereby handicap his practice. There is a definite need for auxiliary low cost equipment adapted to administer electrical treatments orally, to supplement the standard installations in most dentists' offices.

Prior dental equipment for administering electrical treatments has been complicated by a multiplicity of controls, particularly voltage controls. In many instances these controls have not provided as high a degree of smooth variation as desired, resulting in unsatisfactory operation or discomfort to the patient. Moreover, because of the complexity of such equipment, the dental practitioner may inadvertently apply abruptly an unintended voltage to a patient or to a piece of equipment such as a cautery tool or improperly adjust the controls for administering the required treatment. Also, such equipment, as constructed heretofore, has not been well adapted to overcome the patient's normal fear of having "live" electricity applied to his body.

An object of the invention is to provide improved dental apparatus for applying various electrical treatments, such apparatus being priced within the means of the average dental pracitioner, in a separate fixture designed for mobility for use in more than one place.

Another object of the invention is to provide such apparatus that is constructed to give the patient a greater feeling of security and a greater degree of control over the dental operation which is being performed.

A feature of the invention is the provision of a novel hand electrode with a push button therein which enables the patient to signal the dentist his perception of pain resulting from the operation which is being performed upon him.

The foregoing and other objects and features of the invention will be apparent from the following description taken in connection with the accompanying drawings, wherein:

Figure 1 is a perspective view of a portable dental apparatus constructed in accordance with and embodying the principles of the invention;

Figure 2 is a cross section of the supporting stand for such apparatus, taken on the line 2—2 in Figure 1;

Figure 3 is a perspective view of a detail in the apparatus of Figure 1;

Figure 4 is a perspective view similar to Figure 1, indicating the manner in which the apparatus is used; and

Figure 5 is a fragmentary longitudinal section through the apparatus.

In practicing the invention, apparatus is provided with three extensible cords, two of which terminate in receptacles for a dental instrument and a dentist's hand lamp, respectively. The receptacle for the dental instrument is adapted to receive a wide variety of instruments for use in the various operations which the apparatus is designed to perform. The third cord carries at its tip a hand electrode with a specially designed push-button switch included therein for the patient's use. This electrode, in addition to its normal function of establishing electrical contact with the patient's body, enables the patient to signal the dentist by flashing a lamp, operating a relay or buzzer, or actually effecting a control operation to interrupt the treatment that is being administered.

Having described in a general way the salient features of the invention, the detailed construction of the illustrated embodiment will now be described with reference to the accompanying drawings. Referring first to Figure 1, the apparatus proper, indicated at 20, preferably is mounted upon a portable stand 22. It should be understood, however, that many features of the invention are not limited to portable equipment, but may be incorporated in fixed installations as well. The stand 22 comprises a base 24 supporting a column 26. The legs of the base 24 are adapted to fit around the pedestal 28 of a standard dental installation, as indicated. In this way, the apparatus 20 may be placed close to the fixed installation so that it can conveniently be manipulated by the dentist, and if desired, the apparatus 20 may have an operative connection with the dentist's drilling equipment under certain circumstances, as will be explained hereinafter.

The apparatus 20 is enclosed by a box-like housing 30, on the front of which is disposed a control panel 32. At the top of the housing, near the front edge thereof, is a horizontal ledge 34, and at the rear of this ledge 34 is a vertical shoulder 36. Two handles 38 and 40, which serve as receptacles for electrical implements, normally are seated in sockets 42 and 44, respectively, which are provided in the shoulder 36. These handles 38 and 40 are of a type commonly used in the dental profession and, as shown best in Figure 4, they are connected respectively to extensible electric cords 46 and 48. The handle 38 is adapted to receive a dentist's hand lamp 50 which is plugged into the handle 38 and is secured thereto by a standard screw coupling 52. The handle 40 is adapted to receive a dental instrument, such as the cauterizing tool 54 shown in Figure 4 which is plugged into the handle 40 and is secured thereto by a screw coupling 56.

A hand electrode 62, Figures 1, 4 and 5, connected to an extensible cord 64 normally is received in a socket 66 in the shoulder 36 as shown in Figure 1. This electrode 62 is adapted to be grasped in the patient's hand, as indicated in Figure 4, and in certain operations it forms part of an electrical circuit through the patient's body. A push button 68 is mounted in the end of the electrode 62 for use by the patient under certain conditions, as will be explained more in detail presently.

The front panel 32 of the apparatus 20, as shown in Figure 1, has a number of control knobs projecting therefrom. The knob 65 designated "selector" actuates a selector switch of the rotary step type having five positions. For clarity of illustration, these positions are designated 1 to 5, inclusive, opposite the pointer of the knob 65. In actual practice, however, these five positions would be designated on the panel 32 as follows:

1—Electrolysis
2—Pulp test No. 1
3—Pulp test No. 2
4—Cautery
5—External load

A central control knob 67 on the panel 32 has positions designated "off" and "on" and is associated with numerals which indicate various voltage values. This knob 67 actuates a variable auto-transformer control shaft, described hereinafter, and is mechanically interlocked with the selector knob 65 so that the knob 65 cannot be moved except when the knob 67 is in its "off" position.

Still another knob 69, designated "lamp" regulates the brilliance of the dentist's hand lamp 50, Figure 4. Also projecting through the front panel 32 are a patient's light 71 and an on-off light 73. The light 71 is used as a signalling device by the patient, and the light 73 indicates whether the apparatus 20 is turned on or off. A small direct current milliammeter 75 is used in the electrolysis operation of the apparatus 20.

When the apparatus 20 is mounted on the stand 22, the cords 46, 48 and 64 extend down into the interior of the column 22. Each of these cords is supported in substantially the same way, and therefore a description of one, for example the cord 64, will suffice for all. As shown in Figures 2 and 3, the cord 64 at its lowermost point is looped beneath a pulley 70 which is journaled between two parallel plates 72. At their lower ends the plates 72 are secured to a lead weight 74. Each of the other two cords 46 and 48, of course, likewise is held down by a pulley 70 bearing a weight such as 74.

As shown in Figure 5, one of the two upper ends of each cord 64 passes around a pulley 76 within the housing 30. There are three pulleys 76, one for each of the cords 46, 48 and 64. These pulleys are mounted loosely on a stationary shaft 78, which extends between and is secured to the sides of a channel-shaped member 80, Figure 5, that is part of a chassis generally designated 82 secured within the housing 30 at the rear thereof. Guide rods or wires 84 for the various pulleys 76 and the cords passing thereover are supported by a pin 85 extending between the sides of the channel member 80. The conductors in the upper end of each cord are connected to the respective implement attached to that cord, as the conductors in the cord 64 are connected to the hand electrode 62 in Figure 5.

The opposite end of each cord 64 is secured to a terminal block 86, Figure 5, mounted on the chassis 82. Thus, in the case of the cord 64, the two conductors 86 and 88 are connecetd respectively to terminals 89 and 90. Similarly, the conductors in the cord 46 are connected respectively to terminals 91 and 92, and the conductors in the cord 48 are connected respectively to terminals 93 and 94 on the terminal block 86. For mechanical strength, the fixed ends of the cords are secured to the channel member 80 by clamping devices 95, Figure 5.

As each of the cords 46, 48 and 64 is pulled out (in the manner indicated in Figure 4), the weighted pulley 70 associated with that cord rises within the column 26, and as the cord is released, the pulley 70 descends to take up the slack. Small separators 96, Figures 1 and 8, secured in the upper end of the column 26 support vertical guide wires 97, Figures 2 and 5, which divide the space within the column into three portions to prevent the pulleys 70 from interfering with each other. Preferably, the pulleys 70 are positioned slightly off-center with respect to the weights 74 so that the pulley structures tend to hug the front wall of the column 26. This prevents the weights from bumping and swinging about within the column 26 as they ascend and descend, and keeps the part of the cord having vertical movement with respect to the column from rubbing against the wall of the column.

The upper end of the supporting column 26 is received in the lower end of the channel-shaped member 80, which member adjoins the rear face of the housing 30 as shown in Figure 5. Small metal strips 98, Figures 8 and 13, secured to the sides of the channel member 80 rest upon the top edges of the column 26. The channel member

80 grips the column 26 at the upper end thereof and thereby supports the housing 30 on the column 26 without any additional fastening means being required.

As shown in Figure 4, the panel 32 has a transverse lip 102 at the top thereof which seats on the ledge 34 at the top of the housing 30. Conventional cord clips 104 carried by the panel 32 protrude from the lip 102 and are respectively adapted to hold the cords 46 and 48 when the same are inserted under these clips. The junction between the lip 102 and the vertical portion of the panel 32 is rounded, as indicated at 106 in Figures 1, 4 and 5, so that the cords 46, 48 and 64 will not become frayed by constant rubbing over this edge.

The internal construction of the patient's hand electrode 62 is shown in Figure 5. The part which is grasped by the patient's hand consists of a metallic tube or shell 108. The conductor 87 in the cord 64 is connected or grounded to the inside of this tube 108. The end of the conductor 88 in the cord 64 is soldered to a fixed contact 110 supported in the center of the tube 108 by an insulating bushing 111. The contact 110 is aligned with a plunger or contact rod 112 which is secured to the push button 68 at the outer end of the electrode 62. Normally a spring 113 coiled about the plunger 112 maintains it separated from the contact 110. When the push button 68 is pressed inwardly, the plunger 112 engages the contact 110, causing an electrical connection to be established from the contact 110 to the plunger 112. The plunger 112 is connected electrically to the tube 108 by a metal collar 114 sliding within this tube.

The conductors 87 and 88 in the cord 64, it will be recalled, are respectively connected to the terminals 89 and 90, Figure 5, on the terminal block 86. Hence, whenever the button 68 is pushed in, it serves to bridge these terminals 89 and 90. The effects of such action are described subsequently. At all times when the electrode 62 is grasped by the patient, as indicated in Figure 4, the patient's hand is connected electrically through the tube 108 and the conductor to the terminal 89. Under certain conditions (namely, in performing pulp test No. 1) electric current is caused to travel through the patient's body by way of the electrode 62. Under other conditions the electrode 62 is not used for this purpose. In all operations performed upon a patient, however, he or she may be given the electrode 62 to grasp in order that the push button 68 may be manipulated by the patient, to signal the dentist at his or her option.

Functions of hand electrode

The outer contact portion or shell 108 of the patient's hand electrode 62, Figures 4 and 8, has a permanent electrical connection to the terminal 89, Figure 16, on the chassis 82. The center contact 110 of the electrode 62 is connected to the companion terminal 90. For any of the various types of treatments administered to the patient, the patient has control of the light 71 and the relay 176. Whenever the patient presses the button 68 on the electrode 62, the light 71 flashes and the relay 176 opens the external circuit making an audible click. In this way the patient is able to signal the dentist. The relay 176 may be used also to govern other dental equipment such as a drill. Thus, if the drill is causing pain, the patient merely presses the button 68, thereby interrupting the work circuit of the drill and stopping the drill.

A highly advantageous feature of the hand electrode 62 arises from the fact that it has a use entirely independent of its function as an electrode. That is to say, the patient must grasp the electrode 62 in order to operate the push button 68 by which he signals the dentist. This tends to direct the patient's attention away from the fact that the electrode 62, under certain conditions, actually establishes a circuit through the patient's body. (This function of electrode 62 is utilized only when performing pulp test No. 1, described below.) Not all patients object to the idea of grasping a "live" electrode, but in the case

of those patients who are likely to have such objections, the dentist need call attention only to the function of the push button 68 carried by the electrode 62 and intentionally omit to mention any other purpose of the electrode 62, if he deems such a procedure advisable.

The push button 68 may be used also to indicate loss of consciousness when a general anesthetic is being administered to the patient. This can be accomplished by having the patient continuously push the button in and release it. When the patient becomes unconscious, he will stop actuating the button.

The invention provides, therefore, an improved hand electrode for use in conjunction with dental apparatus for any medical operation requiring the passage of an electric current through a patient's body, and which incorporates an improved push button switch enabling the patient to provide a signal or interrupt the operation at will.

Many modifications of the illustrated embodiment are possible without departing from the principles of the present invention, and the appended claims therefore should not be construed to have any limitations other than those expressly set forth therein.

I claim:

1. A structure for use in conjunction with dental apparatus including in combination, an elongated tubular metallic electrode member adapted to be grasped in the hand of a patient, a fixed contact supported within said electrode and insulated therefrom, a contact rod slidably supported within said electrode in electrical connection therewith and movable from a first position displaced from said fixed contact to a second position in contact with said fixed contact, spring means for biasing said contact rod to said first position, and a push button secured to said contact rod protruding from one end of said electrode and adapted to be pushed by the thumb of the patient to move said contact rod against said spring means from said first to said second position.

2. A structure for use in conjunction with dental apparatus including in combination, an elongated tubular metallic electrode adapted to be grasped in the hand of a patient, a fixed contact supported within said electrode and insulated therefrom, a contact rod slidably supported within said electrode in electrical connection therewith and movable from a first position displaced from said fixed contact to a second position in contact with said fixed contact, spring means coiled around said contact rod for biasing said contact rod to said first position, a push button secured to said contact rod protruding from one end of said electrode and adapted to be pushed by the thumb of the patient to move said contact rod against said spring means from said first to said second position, and a pair of electrical conductors respectively connected to said tubular electrode and to said fixed contact.

3. A structure for use in conjunction with dental apparatus including in combination, an electrically conductive electrode member adapted to be grasped in the hand of a patient to complete an electrical circuit through the body of the patient, retractable cord means connected to said electrode including at least first and second conductors, a switch actuator secured to said electrode member, and an electric switch mounted within said electrode having a first contact insulated from said electrode and a second contact connected to said electrode, said first switch contact being connected to said first conductor of said cord means and said second switch contact and said electrode being connected to said second conductor of said cord means, and a push button protruding from one end of said electrode adapted to be pushed by the thumb of a patient to actuate said switch and close said first and second contacts to complete an electrical signaling circuit through said conductors of said cord means.

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