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Brooks et al.
[11] 3,731,384
[45] May 8, 1973

[54] MEDICAL INSTRUMENT

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[52] **U.S. Cl.** 32/27
[51] **Int. Cl.** A61c 1/10
[58] **Field of Search** 128/409; 32/27, 26, 32/48

[56] **References Cited**

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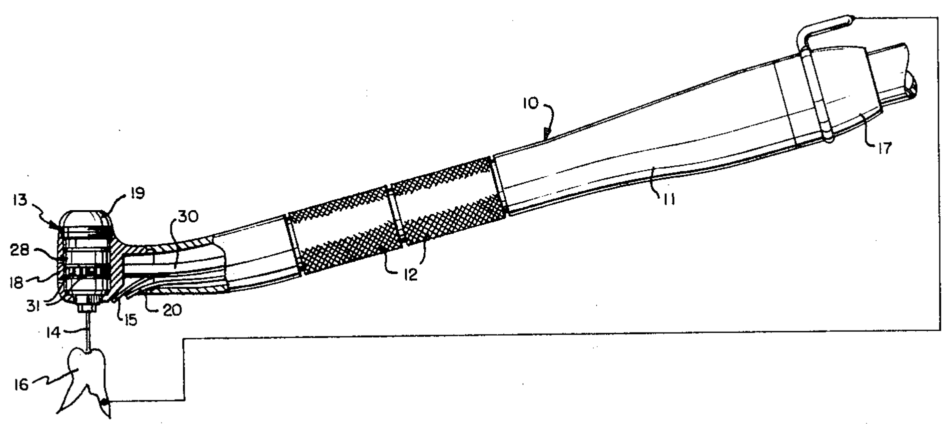
[57] **ABSTRACT**

A medical device is disclosed, which employs a form of electric desensitization in connection with the use of pain-producing medical tools. The device is particularly useful in connection with dental drilling operations and includes, in the preferred embodiment, a coil mounted within a dental handpiece and a rotating permanent magnet mounted so that its magnetic flux overlaps the coil windings. Rotation of the magnet induces an electric current in the coil which flows through the drill and into the tooth to desensitize the nervous system of the tooth upon contact.

9 Claims, 8 Drawing Figures



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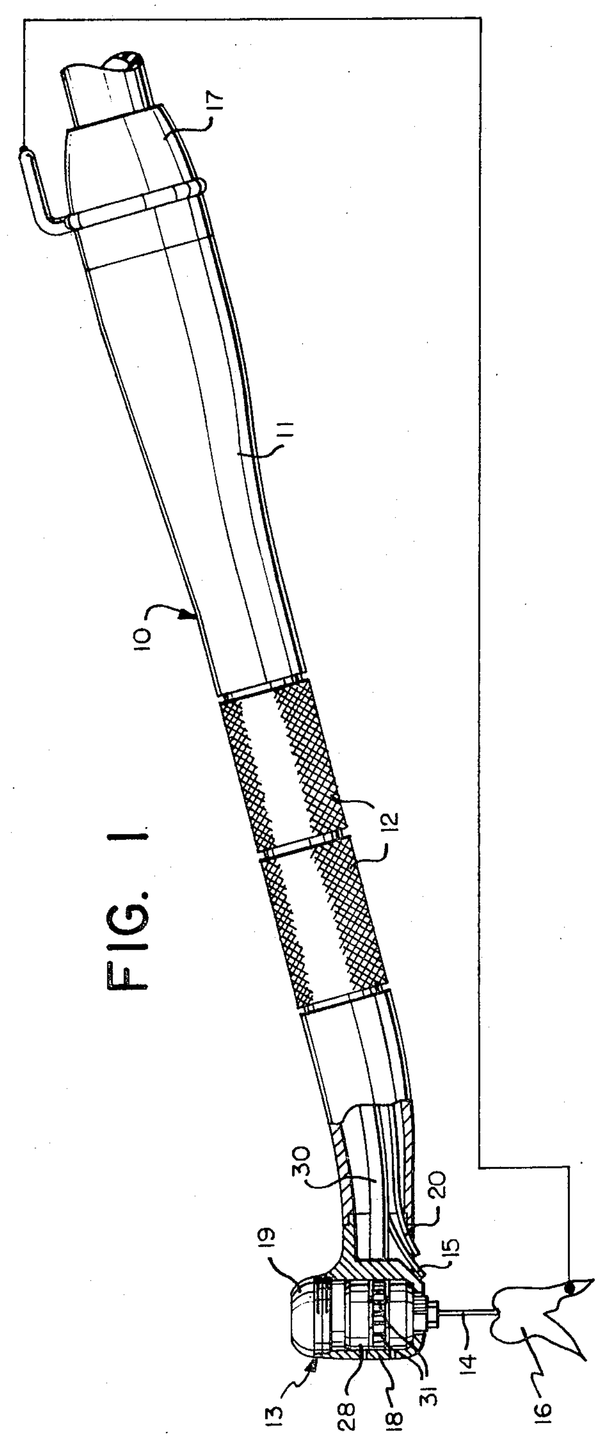

FIG. 1

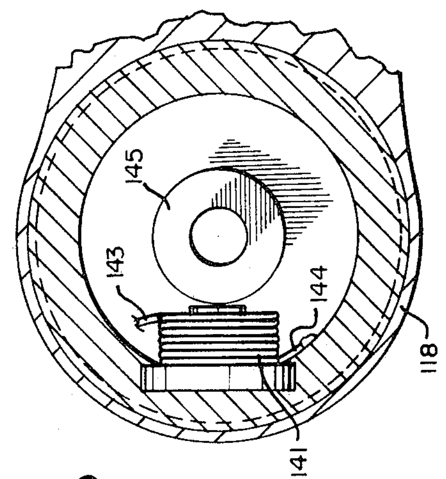

FIG. 5

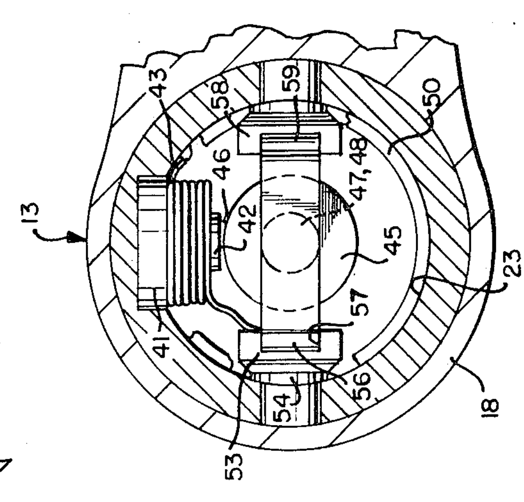

FIG. 3

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FIG. 2

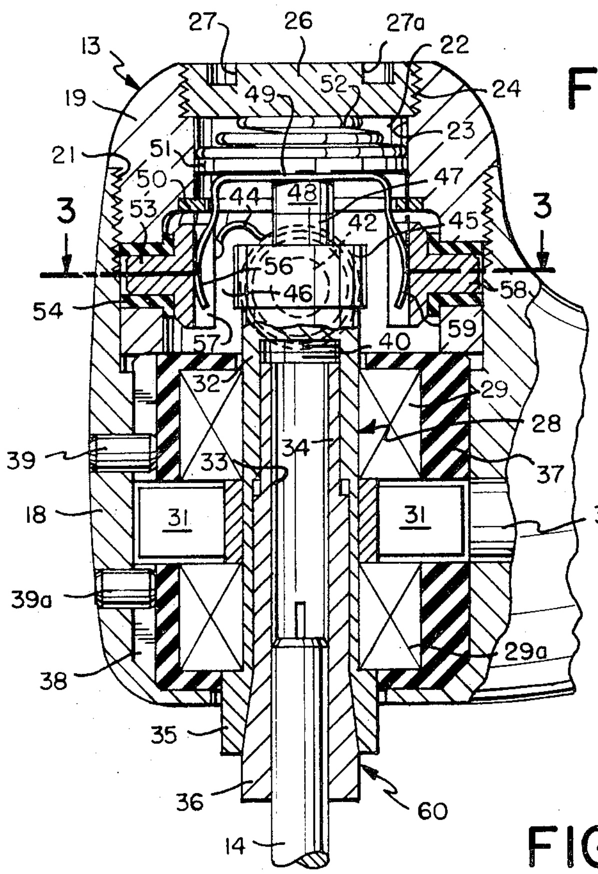


FIG. 4

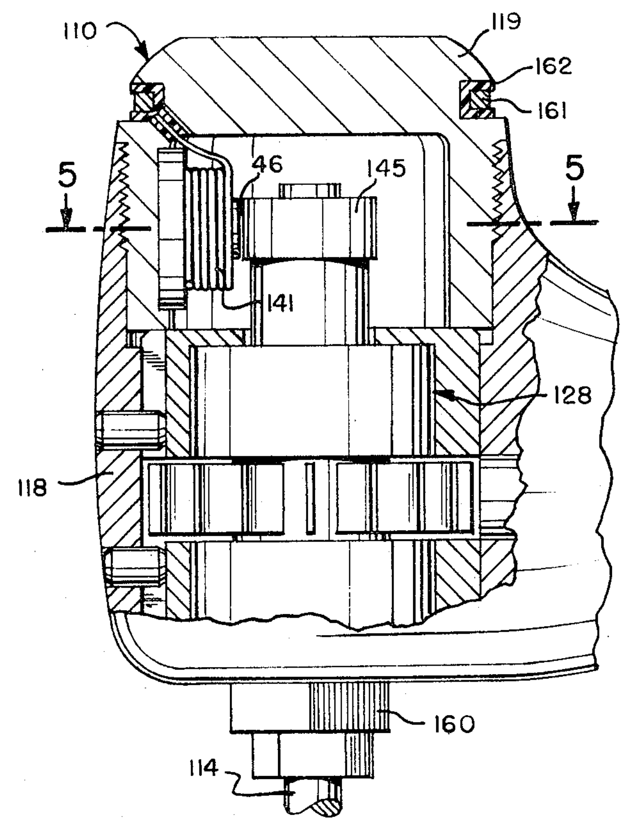


FIG. 6

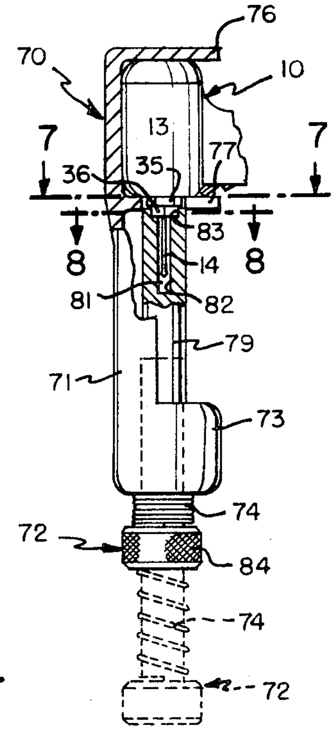


FIG. 7

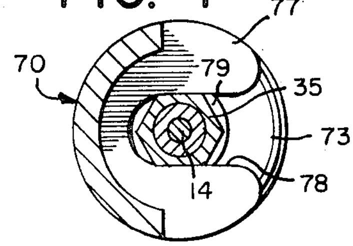
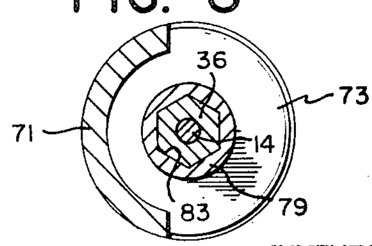


FIG. 8



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MEDICAL INSTRUMENT

BACKGROUND OF THE INVENTION

The invention relates to pain producing dental and medical tools, and more particularly to apparatus for relieving pain from the use of such tools by a form of electric desensitization which is administered through the tool directly at its point of contact with the patient.

Heretofore, electric analgesia in dental drilling operations, particularly as disclosed in the U.S. Pat. No. 3,083,463 to B. Brooks et al., has been achieved by placing an external unidirectional magnetic field across the affected area of the tooth. The drilling operation is then performed so that the bur rotates in the field. Current is thereby generated in the bur, and this current works directly on the nervous system of the affected tooth. Somewhat better results have been obtained by utilizing a special bur embedded with an insulated coil of fine wire. One of the leads of the coil is connected to the bur tip, and the other to the bur shank. The additional conductor embedded in the bur shank can generate higher currents in lower strength fields for more effective analgesic action on the dentinal nerves.

Certain attendant disadvantages, however, have rendered the prior devices impracticable, and significantly reduce their effectiveness. One such disadvantage is the observed variation in the level of desensitizing current, depending upon the orientation of the drilling bur with respect to the magnetic flux crossing the affected area of the patient. Dependable current levels have been difficult to maintain owing to the natural field distribution of the magnetic flux density.

Earlier devices have been found to be impractical because of the large size of the permanent magnet and the large size of the coil wound on the drilling bur. In addition, the operation of such devices depended upon the use of special drilling burs embedded with the appropriate turns of wire. This necessitated replacement or doubling of an operator's entire stock of plain drilling burs. Furthermore, lack of concentricity between the drilling bur and the coil embedded therein tended to effect uneven rotation of the bur. Such irregularity becomes especially apparent at relatively high turbine drive rotational speeds and resulted in undue vibration and other operational difficulties which significantly shortened the life of such prior apparatus. It has also been necessary to take special precaution to obviate side effects of the powerful magnetic field, for example eyeglasses with metal frames and patient's wristwatches had to be removed. Occasionally, serious psychological aversion to the unusual equipment set up around the patient's head has been observed.

Another disadvantage of prior dental drilling apparatus is that upon deactivation of the drive means, usually a high speed turbine, the drilling bur continues to rotate under its momentum. It is necessary therefore, that the operator exercise extreme caution in removing the still rotating bur from the tooth to avoid inadvertent contact with otherwise healthy portions of the tooth or the mouth of the patient.

Servicing of prior drilling apparatus has heretofore been costly and time consuming. Transmittal of the defective device to the manufacturer for repair is often required which results in a substantial loss in operating time and other expenses.

Accordingly, the present invention provides a self-contained and compact unit which requires none of the complicated preparation and maintenance of the prior apparatus. The invention discloses preferably at least one coil mounted within a handpiece, one lead being electrically connected to the handpiece casing, or circuit common, and the other being electrically connected to a pain-producing tool such as a dental drilling bur. It will be understood however that other forms of conductors, such as a wire grid or the like, may be used in place of the coil, as desired, without departing from the scope of the invention. A magnet, preferably a permanent magnet, is also mounted within the handpiece in the vicinity of the coil. The usual fluid-operated turbine-bearing assembly may be provided, preferably for rotating the magnet relative to the coil, although the coil may be rotated without departing from the scope of the invention. Rotation of the permanent magnet causes its magnetic flux lines to move across the coil thereby inducing a predetermined electric potential at the tool. Upon contact between the tool and the patient's body, current flows through the patient to the common, thereby desensitizing the contacted area.

For dental drilling operations, the invention provides a plurality of component units, or modules, which may be easily removed from the apparatus for replacing or other servicing. One such unit contains the electrical system for connecting the preferably fixed conductor, or coil for example, to the rotating drilling bur. Another unit may contain the turbine bearings, collet and magnet. Worn bearings or electrical contacts may therefore be easily serviced on location by simply replacing the deficient unit with a new one.

A further advantage of the present dental handpiece is that it does not require the use of special drilling burs. Accordingly, there is no necessity for costly replacement or doubling of an entire supply of such burs, as was required by the prior apparatus. The present device may be easily assimilated into otherwise standard dental systems.

The invention also provides for braking means to act upon the rotating drilling bur, whereby upon deactivation of the turbine drive, the bur will be rapidly decelerated to its stop mode. This arrangement serves to minimize the danger of inadvertent injury to the patient upon removal of the bur from the affected tooth.

It is one object of the present invention to provide a readily usable and highly effective medical apparatus for producing an electric analgesic effect simultaneously with the use of pain-producing medical tools.

Another object of the present invention is to provide a dental drilling apparatus which produces an electric analgesic effect simultaneously with its use.

Still another object of the present invention is to provide a self contained dental drilling apparatus for producing electric analgesia.

A further object of the present invention is to provide a dental drilling apparatus for producing electric analgesia which is simple to use and minimizes any adverse psychological reaction in patients.

A still further object of the present invention is to provide a dental drilling apparatus which generats a predetermined subliminal current in the dental drilling bur by the movement of a magnetic field across a coil having a predetermined number of windings.

A yet further object of the present invention is to provide a dental drilling apparatus for producing electric-analgesia which utilizes the usual type of dental drilling bur.

Another object of the present invention is to provide a dental drilling apparatus having braking means rapidly to decelerate the rotating drilling bur to its stop mode upon deactivation of the turbine.

Still another object of the present invention is to provide a modular dental drilling apparatus which may be readily serviced at its operating location.

Yet another object of the present invention is to provide a simple and inexpensive apparatus for manipulating a rotatable chuck such as may be used in connection with a dental drilling handpiece.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, reference may be had to the accompanying drawings, in which:

FIG. 1 is a side elevation, partially cut away, of a preferred dentl handpiece embodying the principles of the invention;

FIG. 2 is an enlarged, fragmentary, vertical sectional view of the head of the handpiece shown in FIG. 1;

FIG. 3 is a view taken along the line 3—3 of FIG. 2;

FIG. 4 is an enlarged, fragmentary, vertical sectional view of the head of an alternate embodiment of the present invention.

FIG. 5 is a view taken along the line 5—5 of FIG. 4;

FIG. 6 is a fragmentary side elevational view of a wrench implement to aid in replacement of dental tools in the handpiece;

FIG. 7 is a view taken along the line 7—7 of FIG. 6; and

FIG. 8 is a view taken along the line 8—8 of FIG. 6.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, and in particular to FIGS. 1 and 2, there is shown, by way of example, a dental handpiece, generally indicated by reference numeral 10, having an elongated handle 11 with knurled gripping portions 12, and a head 13. A pain-producing tool 14, which in the present embodiment is a dental drilling bur, protrudes from the head 13 for operating upon a tooth 16. It should be understood, however, that the invention may be used in connection with different types of medical pain-producing tools, and is not to be limited to dental drilling apparatus.

FIG. 1 is, by way of example, a schematic illustration of the electrical circuit for producing electric desensitization during a dental drilling operation. As will be described below, current is generated within the head 13 during the drilling procedure. Upon contact between the tooth 16 and the drilling bur 14, such current will flow into the tooth provided that the tooth is effectively connected to a circuit common, which is preferably the casing 17 of the handpiece 10. It has been observed that a current of approximately 2 microamps is sufficient to desensitize the nervous system of the tooth. The effect of such desensitization is limited to the specific tooth involved and only for such a duration of time as that tooth is in contact with the drilling bur 14.

The handpiece 10 may also contain a conventional cooling system, including a tube 15 for directing a water spray against the tooth while the drilling is being carried out. Fiber optic techniques, embodied in a light-conducting tube 20, for illuminating the drilling area may also be contained within the handpiece.

As shown in FIG. 2, the head 13 is preferably composed of a plurality of interconnecting housing portions, each of which may be formed from stainless steel, or other electrically conductive materials suitably rigid to form a proper housing structure. A cap 19 forms an enclosure for the open end of the turbine casing 18 and may be connected thereto by means of cooperating threaded portion 21. The removable cap 19 provides easy access to the internal components of the device to simplify assembly and repair.

The cap 19 is also provided with a central bore 22 having a reduced diameter portion 23 and a larger diameter portion 24. An insert cap 26, preferably having a threaded engagement with the larger diameter portion 24 of the bore 22, may be provided to allow easy access to, and replacement of, certain component parts subject to frictional erosion, as will be described in detail below.

Since the head of a dental handpiece is intended for use within a patient's mouth, the outer surface area must be smooth and free from edges which might cause inadvertent injury. Accordingly, the insert 26 fits within the bore 22 so that its upper surface is flush with the outer edge of the cap 19. Under such circumstances, it has been found convenient to provide the insert 26 with a pair of recesses 27 and 27*a*, which may be used to apply the necessary rotational torque.

Located within the turbine casing 18 is a fluid turbine 28 which is mounted on upper and lower bearings 29 and 29*a*. A conventional feed tube 30 carries the driving fluid, usually air or water, to the turbine from a remote source. In operation, the fluid is directed over drive blades 31, thereby forcing them to rotate. An exhaust tube (not shown) or other exhaust means, such as vents (not shown) for evacuating from the head fluid which has passed over the blades 31, may also be provided in the handpiece. In the present embodiment, such residual fluid, especially air, has proved to be a useful coolant for components subject to high frictional temperatures during operation.

A preferably elongated rotor shaft, or hub, 32 is connected to the turbine blades 31 so as to be driven thereby, and contains a central bore 33 which extends inward from its lower or external end almost to the top thereof so that the hub is, in effect, substantially tubular. The upper end of the bore is threaded, as indicated by reference numeral 40, so as to connect with a correspondingly threaded collet member 34. The rotor shaft 32 and collet 34 have external extensions 35 and 36 respectively, each with a preferably hexagonal outer surface. The rotor shaft and collet function together as a rotary chuck, generally indicated by reference numeral 60, for gripping the drilling bur 14. As indicated in FIG. 2 the bur may be inserted into the chuck to any desired depth of penetration.

The turbine-bearing assembly 28 may be mounted within a preferably hard rubber or neoprene enclosure 37 electrically to insulate the assembly from the casing 18 and otherwise to secure the turbine tightly within the casing 18. The hard rubber enclosure is preferably provided with a longitudinal slot 38 for the purpose of engaging a pair of guide pins 39 and 39*a* which may extend laterally inwardly from the turbine casing 18. The pins 39 and 39*a* serve both to orient the turbine 28 within the casing and to anchor the hard rubber enclosure so as to prevent the cartridge from rotating along with the turbine blades and rotor shaft during the drilling operation.

Electrical conductor means, preferably a coil 41 (FIG. 3) having a predetermined number of windings may be mounted within the casing 18. This coil may be mounted on an armature or coil form 42. The mumber of windings may vary. By way of example,however, where 0.005 inch diameter wire is used, it has been found that 21 turns is suitable, although these requirements may be varied depending upon whether more or less voltage is desired.

It is important to not that the present invention is not to be limited by either the configuration or the number of conductive elements operative within the head 13. Conductor configurations, other than a coil, such as a grid or similar arrangement, may also be suitable. In the preferred embodiment however, one coil has been found suitable, although other coils, for example two or more connected in series or in parallel, may be utilized respectively to increase voltage or dependability, as desired, without departing from the scope of the invention. One lead 43 of the coil, arbitrarily referred to as the "common" lead, is electrically connected to the casing 18, while the other lead 44, or "hot" lead, is preferably electrically connected to the drilling bur 14 through contact means to be described in detail below.

Magnet means, consisting of a permanent magnet rotor 45 of preferably ceramic material, may be mounted for rotation on the turbine rotor shaft 32 proximal to the coil 41, but separated therefrom by an air gap 46 (FIG. 4). The rotor 45 is preferably annular, having permanently magnetized areas of alternating polarity spaced around its circumference. During operation of the dental turbine, rotation of the rotor shaft 32 and the rotor 45 will cause each of the magnetized areas of the rotor to move successively past the coil windings 41. In accordance with known principles, an electric potential will be induced in the coil as the magnetic flux lines cross the windings. By way of example, suitable analgesic results are obtained when this induced voltage is approximately 0.6 volts, yielding an AC current of substantially 2 to 10 microamps. The air gap 46 may be adjustable to aid in determining suitable voltage levels, as desired.

It is to be understood that numerous changes in the details of construction and the combination and arrangement of the generator parts may be resorted to without departing from the scope of the invention. For example, the specific location of the magnet and coil windings need not be the same as specifically described herein. Suitable voltages have been generated when the windings are mounted for rotation on the turbine drive shaft and are encircled, or partially encircled, by a fixed permanent magnet. In addition, other conductive means may be used in place of the coil 41 to cut the lines of magnetic flux. The present embodiment is preferable because it is mechanically more efficient to rotate at high speeds a body of uniform density, such as the permanent magnet rotor 45, and it has been found that more dependable voltages may be generated in this manner, and by the use of the coil 41.

The rotor 45 is preferably mounted coaxially with the shaft 32 so that its axis of rotation is substantially perpendicular to the longitudinal axis of the coil. It is also preferable that the coil form 42 and the rotor 45 are substantially laterally aligned. Under such conditions, the coil windings 41 are aligned to intersect magnetic flux lines of maximum density originating with the rotor 45.

Electrical contact between the drilling bur 14 and the coil 41 may be accomplished in several ways, such as by using conventional brushes. Contact may also be made through the bearing races of the turbine assembly. Such an arrangement, however, has been found to be somewhat inefficient. Furthermore, fluid turbine drills may rotate at approximately 300,000 to 400,000 revolutions per minute. For such high rotational speeds it has been discovered that suitable electrical connection is afforded by means of continuous contact between a pair of juxtaposed contact buttons 47 and 48. The contact button 47 is preferably formed of hardened silicon carbide, but may be composed of other materials such as stainless steel, and is connected to the innermost end of the rotor shaft 32. The contact surface 49 of button 47 is preferably machine flat; however, a substantially convex contact surface has also been found suitable.

The contact button 48 is connected to one side of a support member or circuit board 51 which is slidably arranged within the reduced diameter portion 23 of the bore 22 in cap 19. The button 48 is also electrically conductive and is preferably composed of a material such as silver graphite. The contact surface 49 of button 47 abuts against the button 48 during operation of the handpiece. It should be noted that a spindle contact (not shown) has also been found to provide an effective connection, and may be employed where desired, in place of either of the contact buttons 47 and 48.

The extremely high rotational speeds achieved by the turbine will cause constant erosion of the silver graphite button 48. To insure that there is continuous contact between the buttons 47 and 48, a spring 52 is positioned on the other side of the circuit board 51, between the board 51 and the insert 26, so that the former is continuously biased toward the button 47. The spring 52 is preferably a conical coil spring so that it collapses to the width of one of its coils. When the contact button 48 is new, the spring 52 is compressed between the circuit board 51 and the insert 26, thereby storing energy. As the button 48 begins to erode from rotational friction, the spring 52 gradually releases its stored energy, the effect of which urges the circuit board 51 and the eroding contact 48 longitudinally along the bore 22. When the button 48 has worn away completely, further movement of the circuit board is prevented by a stop 50 preferably protruding laterally from the side walls of the bore 22. The insert 26 may then be unscrewed from the cap 19 and the circuit board 51 simply replaced by a new circuit board and contact button. Alternatively, the cap 19, having the coil 41 and circuit board 51 connected thereto, may simply be replaced as a modular unit.

At least one contact shoe **53** may be mounted on the inner side wall of the casing **18**. A lining or bushing **54** is provided to insulate the shoe **53** from electrical contact with the casing. A resilient contact arm **56** is fixed to the board **51** and is electrically connected to the contact button **48**. The arm **56** is biased against the shoe **53** to complete the circuit between the coil windings **41** and the drilling bur **14**, as will be described below. As the board **51** moves under impetus from the spring **52**, the arm **56** slides along the contact surface of the shoe to maintain the electrical connection between the coil **41** and the button **48**. This sliding contact between the arm **56** and the shoe **53** is inherently self-cleaning, and therefore minimizes the possibility of operational failure due to dirty and inefficient electrical connections.

In the event that a source of electricity such as an alternating current source (not shown) external to the medical handpiece **10**, is desirable, the component unit consisting essentially of the circuit board **51** and the contact button **48** may be employed to connect the external source to the pain-producing tool. The lead from the source may be connected to the contact button **48** in any manner known to those skilled in the art. Current from the source will therefore flow into the button **47** and from there through any appropriately insulated conductor to the pain-producing tool. It should be noted that a direct current source such as a battery cell may also be employed either externally of or within the handpiece, as desired, to provide the desensitizing current for application to the tooth or other affected area of the patient. Where a dental handpiece such as that indicated by reference numeral **10** is employed, current may flow from the button **47** into the turbine rotor **32**, the collet member **34** and drilling bur **14**. When an appropriate return connection from patient to the external source is provided to complete the electrical circuit, contact between the bur and the patient will allow current to flow from the bur and through the affected tooth to desensitize the same and return to the source. It should be noted that the lead from the external source may also be connected in any suitable manner to the contact shoe **53**. In this event the resilient contact arm **56** may be utilized as described above.

In the operation of the preferred form of dental handpiece **10** the desensitizing current will flow along the following circuit: from the coil **41** through the "hot" lead **44** to the contact shoe **53**; into the contact arm **56**; to the button **48**; to the button **47**; to the rotor shaft **32**, and hence into the drilling bur **14**. When the tooth **16** has been properly connected to the circuit common **17**, the current will flow into the tooth upon contact with the drill bur, thereby to desensitize the dentinal nerves.

The connection between the tooth and the "common" to complete the electrical circuit may be accomplished in several ways. For example, a wire lead extending from the handpiece housing to the patient may be provided. A metal clip (not shown) may be used to connect the lead to the patient's lip. In the absence of a wire lead, the operator, or dentist, may complete the circuit by touching the patient while holding the dental handpiece. Patient and handpiece may be otherwise connected to a common ground. It should be noted that other techniques known to those skilled in the art may be utilized without departing from the scope of the invention.

Since, in the preferred embodiment, electrical connection between the coil **41** and the button **48** is easily broken simply by withdrawing the board **51** and its contact arm **56** and button **48** from the housing **18**, such component unit may be easily replaced by the operator when the button **48** has become ineffective. Such an arrangement serves to minimize time loss and the usual expenses of maintaining operational dental equipment.

The contact shoe **53** is preferably provided with a vertical guide slot **57** to be engaged by the contact arm **56**. The slot **57** serves to prevent the circuit board **51** from beginning to rotate under impetus from rotational forces transmitted through the button **48** during operation of the turbine.

Stability may be enhanced by providing a second contact shoe **58** symmetrically arranged within the casing **18** with respect to the shoe **53**. A second resilient contact arm **59**, similar to the contact arm **56**, may be provided on the circuit board **51** for engagement with the shoe **58**. Although one contact shoe and contact arm have been found suitable for present purposes, others may be utilized in the present device without departing from the scope of the invention.

It should be noted that the continuous contact between the buttons **47** and **48** generates substantial frictional forces during operation of the turbine. The retarding effect of such friction on the speed of rotation of the turbine rotor **32** is relatively insignificant when the turbine is being activated. Upon deactivation of the turbine however, such frictional forces act as a brake rapidly to decelerate the rotational speed of the rotor **32** until it stops rotating. This arrangement serves to minimize the chances of an injury occurring to the patient's tooth or mouth when the handpiece is being removed from the affected area.

FIGS. **4** and **5** illustrate an embodiment of the present invention in which miscellaneous pain-producing medical tools, and particularly dental tools such as picks, probes, excavators and other similar tools may be used interchangeably in connection with the handpiece **110**. The arrangement of magnetoelectric components is essentially the same as has been described above in connection with FIGS. **1** through **3**. In this embodiment, however, the turbine-bearing assembly **128** is used only for rotating the permanent magnet rotor **145**. Accordingly, the coil **141** may be electrically connected through the casing **118** to a known type of non-rotating metal chuck **160** which is adapted to accept a plurality of different medical tools. Contact between the coil **141** and the chuck **160** may be made in any convenient manner; however, it has been found preferable to connect one lead **144**, arbitrarily designated the "return" lead, to the cap **119**, which in the preferred embodiment serves as a circuit common. A lead **143**, arbitrarily designated as the "hot" lead, may be soldered to a metal ring **161** which is insulated from the cap **119** by a nylon or teflon bushing **162**.

In the preferred arrangement, current generated in the coil by movement of the magnet rotor **145** will flow from the coil **141** through the "hot" lead **143** to the ring **161**. Any convenient electrical connection between the ring **161** and the patient, as described above, may be utilized to construct the appropriate electrical circuit. Upon contact between the tool 114 and the patient the circuit is complete, and current will flow through the drilling bur and into the tooth to the circuit common thereby desensitizing the affected dentinal nerve.

It should be noted that it is within the scope of the present invention to utilize the same dental handpiece 10 with either drilling burs or other pain-producing dental and medical tools. For example, if the coil 41 and shoe 53 of the embodiment of FIG. 2 were fixed to the cap 19, then the handpiece of FIG. 4 could be converted to the drilling mode simply by replacing the turbine-bearing assembly 128 with the bearing assembly 28 having a rotatable chuck, and by replacing the cap 119 with the cap 19. Such interchangeability may be easily and inexpensively accomplished in accordance with the present invention.

In the event that the pain-producing medical tool, or drilling bur, is formed of non-electrically conductive material, it is within the scope of this invention to supply current from the coil 41 to the affected area of the patient through electrical conduits other than the tool itself. Accessory probes, formed of electrically conductive material, may be utilized, or other means such as electrically conductive straps or clips may be provided, as desired, to contact the affected area.

Referring now to FIGS. 6,7 and 8, there is illustrated a wrench implement generally indicated by reference numeral 70, and intended particularly for use in manipulating the rotatable chuck 60 to aid in replacement of dental medical tools in the handpiece 10. The wrench 70 preferably consists of a shank or handle portion 71 having a plunger member 72 mounted at one end for longitudinal movement relative to the handle. The plunger may be connected to the handle in any suitable way; however, it has been found convenient to support the plunger within the bore of a hollow enlarged portion 73, so that the plunger is free to slide back and forth, as desired, when the implement is being used. A coil spring 74 serves to bias the plunger outward to the position illustred by the broken lines in FIG. 6.

A pair of laterally extending members 76 and 77 may be provided at the other end of the shank 71 for gripping the handpiece 10. Preferably, these members consist of integral wall members separated by a fixed predetermined distance substantially equal to the longitudinal dimension of the head 13 of the handpiece. It should be noted, however, that the invention is not to be limited by such wall members, and that other types of gripping means may be provided without departing from the scope of the invention. The wall members 76 and 77 need not be immobile. Adjustable members capable of gripping several different types and sizes of dental handpieces may also be utilized.

A radial slot 78 may be provided in the wall member 77 (FIG. 7). The slot 78 is adapted to fit securely over the hexagonal extension 35 of the rotor shaft 32, when the head of the handpiece 10 is positioned between the gripping members 76 and 77, as illustrated in FIG. 6. The purpose of the slot 78 is to hold the rotor shaft against rotation during manipulation of the chuck.

The interior end 79 of the plunger 72 is provided with a central bore 81 having a reduced diameter portion 82 and a recessed portion 83 (FIG. 8) of larger diameter. The configuration of the recessed portion 83 is such as to correspond to the shape of the collet extension 36 so that the latter may be engaged for movement independent of the rotor shaft 32.

In operation, the plunger 72 is pressed inward against the bias of the spring 74 until the recessed portion 83 engages the collet extension 36. The drilling bur 14 extends harmlessly into the remainder of the bore 81. The bur 14 is released by appropriately rotating the plunger 72 which in turn rotates the collet 34. As the collet rotates, it moves axially relative to the rotor shaft 32 by virtue of the motion translating characteristics of threaded portion 40. When the collet moves axially outward, it relaxes its grip on the drilling bur according to known principles of chuck design. The bur may then be removed and another inserted. The replacement bur may be secured in the chuck simply by reversing the direction of rotation of the collet. A knurled portion 84 is provided on the plunger to facilitate manual turning of the plunger and collet.

What is claimed is:

1. Dental drilling apparatus, comprising:

a handpiece including a high-speed fluid turbine assembly and a source of alternating electrical potential mounted within said handpiece and adapted to be actuated by energization of said fluid turbine, said fluid turbine having an elongated rotary hub with inner and outer ends, said inner end protruding axially inwardly of said turbine assembly, said outer end forming part of a rotary chuck assembly adapted for securing to said turbine an electrically conductive dental drilling bur, said source including a stator element mounted inwardly of said fluid turbine and a rotor element secured to said hub for rotation therewith adjacent said inner end and substantially in alignment with said stator element; and

means substantially concentric with said rotary hub for electrically connecting said source to said bur, whereby upon actuation of said turbine, the electrical potential generated by said source passes to said bur to effect the flow of an electric current upon contact between the bur and a patient's tooth.

2. The device as recited in claim 1, wherein said rotor element comprises a substantially annular sleeve of magnetic material mounted concentrically with said hub and having permanent magnetic pole areas of alternating polarity spaced around its circumference.

3. The device as recited in claim 2, wherein said stator element comprises at least one coil element having a predetermined number of windings and being secured to the interior wall of said hand-piece.

4. The device as recited in claim 3, wherein the rotational axis of said rotor is substantially perpendicular to the longitudinal axis of said coil.

5. The device as recited in claim 1, wherein said electrically connecting means comprises:

first electrical contact means mounted on the inner end of said hub and electrically connected to said bur; and

second electrical contact means electrically connected to said source and biased against said first contact means to form an electrical connection therebetween.

6. The device as recited in claim 5, wherein said first and second contact means comprise first and second contact buttons, each of said buttons having a contact surface.

7. The device as recited in claim 6, wherein said second contact means comprises in addition:

a support member movable longitudinally relative to said first button, said second button being mounted at one end of said support member; and

biasing means engaging the other end of said support member for continuously urging said contact surfaces together as said bur rotates.

8. The device as recited in claim 7, wherein at least one of said first and second contact buttons is formed of silver graphite material.

9. The apparatus of claim 5 in which said second contact is adapted to engage said first contact at a point lying substantially along the rotational axis of said hub.

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