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(54) **DENTAL IMPLEMENT FOR TOOTH SURFACE INSPECTION**

DENTALGERÄT ZUR UNTERSUCHUNG DER ZAHNOBERFLÄCHE

INSTRUMENT DENTAIRE POUR L'INSPECTION DE SURFACES DENTAIRES

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Description

BACKGROUND

[0001] The present invention relates generally to devices and methods for inspecting tooth surfaces, and in particular to such devices and methods involving the detection of differential fluorescence emissions from abnormal and healthy tooth surfaces.

[0002] As further background, various devices and methods have been proposed that involve using fluorescence emissions to detect caries or other abnormal conditions. For example, U.S. Patent No. 3,711,700 relates to a disclosing light for inspecting tooth surfaces. The disclosing light is designed for use in conjunction with a fluorescent dye such as sodium fluorescein. The disclosing light includes a light source and a dichroic reflector behind the light source to reflect blue light forward and the remainder backward. A second dichroic filter is positioned in front of the light source and transmits blue light and reflects back infrared radiation. A mirror reflects yellow light to the observer and transmits other wavelengths.

[0003] U.S. Patent No. 4,266,535 disc loses a diagnostic lamp for use in conjunction with a fluorescent dye to inspect tooth surfaces. The lamp includes an incandescent bulb light source used in conjunction with a lens to supply a divergent beam of rays. A blue filter with an applied dichroic filter is used to filter the rays, which are made to impinge upon the fluorescent dye. The resulting fluorescence can be viewed in a folding, adjustable mirror. U.S. Patent No. 5,957,687 discloses another diagnostic unit including a filtered light source and a mirror contained in a housing. Filtered light is concentrated in the blue frequency range and causes fluorescent dye to fluoresce. This can then be viewed in the mirror.

[0004] U.S. Patent No. 4,290,433 discloses a method and device for detecting caries in human teeth using luminescence. The luminescence from teeth is measured at two predetermined wavelengths, one of which is about the same for caries-containing and non-caries-containing surfaces, and another where the luminescence is higher for caries-containing surfaces. A signal is generated corresponding to the difference in the intensities at the two measured wavelengths. A baseline measurement is taken at a non-decayed region, and the probe is then directed to other regions to assess the presence or absence of caries.

[0005] U.S. Patent No. 4,515,476 describes a device for the ocular determination of discrepancies in the luminescence capacity of tooth surfaces. The disclosed device includes an argon laser for generating visible light in a predetermined wavelength range that causes luminescence from tooth surfaces. An absorption filter is used to eliminate reflections and luminescence within the predetermined wavelength range of the laser light. In this fashion, unsound tooth surface areas such as caries can be viewed as dark areas.

[0006] U.S. Patent No. 5,894,620 discloses an electric toothbrush with means for locating dental plaque. The electric toothbrush includes an optical fiber for transmitting excitation radiation to tooth surfaces, and an optical fiber(s) for receiving a return luminescence or fluorescence signal. The return signal is then processed to activate a light or audible signal indicative of the presence of plaque.

[0007] DE 33 45 465 A1 discloses a hand-held dental implement comprising an implement body having an elongated probe portion protruding from a distal end of the implement body. A light source such as a luminescent bulb or a light-emitting diode is housed in the implement body and is connected to a light guide extending through the probe portion to a tip of the implement. Light reflected from the teeth is received by a further light guide to which a light detector is connected. The light detector is also housed in the implement body. A integrated filter may be disposed between the light source and its associated light guide to remove red light components where the light source emits white light. The document also discloses using a GaP diode emitting in the blue region as the light source. In this case, the filter can be omitted. The light detector is connected to evaluation circuitry for calculating a numerical value (percentage) that is displayed as a result in a display window of the implement. The displayed result provides the user a quantitative indication of the plaque affection of his teeth.

[0008] It is an object of the present invention to provide an easy-to-manipulate and compact implement for examining tooth surfaces.

[0009] To achieve this object, the present invention provides a hand-held dental implement according to claim 1. Preferred embodiments are given in the dependent sub-claims.

[0010] In one embodiment, a hand-held dental implement for use in detecting abnormal tooth surface conditions includes an implement body having a proximal handle connected to a distal end, and a mirror mounted on the distal end and adapted for insertion into the mouth of the user. The proximal handle defines a battery chamber for receiving a battery. The battery chamber has a positive electrical connection and a negative electrical connection for electrical contact with respective positive and negative terminals of the battery. At least one light-emitting diode is mounted on the implement and has positive and negative leads electrically connected to the positive electrical connection and said negative electrical connection, respectively, so as to be energizable by the battery. The light-emitting diode is effectively positioned on the implement to illuminate tooth surfaces of the user when the mirror is positioned in the mouth of the user, and is effective to emit radiation that causes visually detectable differential fluorescence emissions from normal tooth surfaces and abnormal tooth surfaces. A switch is provided on the implement and has a first condition wherein the light-emitting diode is energized by the battery, and a second condition wherein the light-emitting diode, is not energized by the battery. The light-emitting

diode is adapted to emit light having a peak intensity in the wavelength range of about 390 nm to about 500 nm. The implement includes a light filter positioned to filter the differential fluorescence emissions for direct visualization by the user.

[0011] Another embodiment of a hand-held dental implement for detecting abnormal tooth surface conditions includes a handle having a proximal end and distal end. A battery chamber is present in the handle for receiving a battery. A light source is mounted on the implement and is electrically connected to the battery chamber, wherein the light source is energizable by a battery received in the battery chamber. The light source is adapted for insertion into the mouth of a user and effective to illuminate tooth surfaces sufficiently to cause visually detectable differential fluorescence emissions from normal tooth surfaces and abnormal tooth surfaces. A filter is included with the implement and is positioned to filter the fluorescence emissions for direct visualization by the user. The light source is desirably adapted to emit light having a peak intensity in the wavelength range of about 390 to about 500 nm, and in one embodiment in the peak intensity is in the wavelength range of 390 nm to about 450 nm. In this lower wavelength range, fluorescence emissions can be directly visualized to detect both carious surfaces (yellow-green emissions) and surfaces containing or covered with bacterial metabolites associated with plaque (red-orange emissions).

[0012] A method for examining tooth surfaces for abnormal surface conditions includes illuminating the tooth surfaces with light from a light-emitting diode having a peak intensity in the wavelength range of about 390 nm to about 500 nm, wherein the illuminating is effective to cause visually detectable differential fluorescence emissions from normal tooth surfaces and abnormal tooth surfaces. Fluorescence emissions from the normal and abnormal tooth surfaces are filtered and the differential fluorescence emissions are visually detected.

[0013] In another embodiment, an apparatus for examining tooth surfaces for abnormal surface conditions includes a light-emitting diode adapted when energized to emit radiation having a peak intensity in a wavelength range from 390 to 500 nm, wherein the emitted radiation is effective to cause detectable differential fluorescence emissions from normal tooth surfaces and abnormal tooth surfaces. Means for energizing the diode are provided, along with at least one filter for filtering the fluorescence emissions to facilitate detection of the differential fluorescence emissions.

[0014] A still further embodiment provides a method for detecting plaque-containing surfaces in the oral cavity (including areas such as tooth surfaces, gums, in interproximal areas, in tooth fissures, or in caries lesions). The method includes illuminating areas of the oral cavity with radiation having a peak intensity at a wavelength in the range of 390 to 450 nm, wherein the radiation is effective to cause detectable fluorescence emissions from bacterial metabolites known to be contained within plaque. The fluorescence emissions are then detected.

[0015] Yet another embodiment provides an electric toothbrush with a plurality of detachable heads. One head functions as an electric toothbrush that uses an interface with a toothbrush handle to provide movement of the toothbrush bristles. Another head uses the same interface to energize a light-emitting diode to emit radiation having a peak intensity between 380 and 500 nm, wherein the emitted radiation is effective to cause detectable differential fluorescence emissions from normal tooth surfaces and abnormal tooth surfaces. At least one filter is provided for filtering the fluorescence emissions to facilitate detection of the differential fluorescence emissions.

BRIEF DESCRIPTION OF THE FIGURES

[0016]

Figure 1 provides a perspective view of one embodiment of a dental implement for inspection of tooth surfaces.

Figure 2 provides a perspective view of an alternative embodiment of a dental implement for tooth inspection having a yellow filter mounted on the implement body.

Figure 3 provides a perspective view of an alternative embodiment of a dental implement for tooth inspection having light sources mounted in a mirror housing.

Figure 4 is a perspective view of an alternative embodiment of a dental implement having both blue and white light sources mounted on the implement body.

Figure 5 provides a perspective view of an alternative embodiment of a dental implement having blue and white light sources mounted in a mirror housing.

Figure 6 provides a perspective view of an alternative embodiment of a dental implement having detachable filter and mirror components.

Figure 7 provides a perspective view of another dental implement having a detachable mirror component.

Figure 8 provides a perspective view of an alternative embodiment having an electric toothbrush with a handle piece, a toothbrush head, and a blue and white light source head.

DESCRIPTION OF VARIOUS EMBODIMENTS

[0017] For the purposes of promoting an understanding of the principles of the invention, reference will now

be made to certain embodiments and specific language will be used to describe the same. It will nevertheless be understood that no limitation other than defined by the scope of the claims is thereby intended.

[0018] As disclosed above, one embodiment provides a hand-held dental implement for use in detecting abnormal tooth surface conditions. Generally, such dental implements of the invention incorporate components enabling the use of Quantitative Light-induced Fluorescence, or "QLF," to provide direct visualization of areas having incipient caries lesions, plaque, stains or other abnormal tooth surface conditions or deposits. Such devices can be used to conduct self-examinations or examinations..of others in household or clinical settings.

[0019] Referring now to Figure 1, an illustrative dental implement is shown. In particular, shown is a dental implement 11 useful for inspecting tooth surfaces to detect abnormal conditions. Dental implement 11 generally includes an implement body having a handle portion 12 connected to a mirror portion 13 through a transitional portion 14. Transitional portion 14 may be contoured to position the mirror portion 13, and in particular the face of mirror 15, at an angle relative to the axis of handle portion 12, so as to facilitate proper positioning of mirror 15 for viewing tooth surfaces. Mirror 15 may be circular or oval as shown or may have any other suitable shape for insertion into the mouth of a user. Mirror portion 13 includes a mirror housing 16 surrounding and mounting the mirror 15. Dental implement 11 also includes a blue light source 17 mounted on the implement 11, and in the illustrative embodiment mounted within the transitional portion 14 of the implement body. Blue light source 17 is preferably adapted to emit light having a peak intensity in the wavelength range of about 390 nm to about 500 nm, more desirably in the wavelength of about 390 nm to about 450 nm. Blue light source 17 advantageously includes a light-emitting diode having the described characteristics. The light-emitting diode may or may not have a collimator optical system integrated therein. Suitable light-emitting diodes for these purposes are commercially available from Cree, Inc., under product codes C405-XB900-x and C405-MB290-E400. Blue light-emitting diodes having a peak wavelength of about 405 nm have been particularly advantageous in work to date.

[0020] Dental implement 11 also includes an on-board battery 18 mounted within a housing 19 defined by the implement body 11, and in the illustrated device defined within the handle portion 12 of the implement body 11. Access to the housing 19 may be provided, for example, by a cap 20 threadable onto the end of handle portion 12 of the implement body. Other access means may also be provided. Battery housing 19 includes a positive battery contact 21 and a negative battery contact 22 for contacting positive and negative terminals of battery 18, respectively. Positive contact 21 is electrically connected to positive wire 23 and negative contact 22 is connected to negative wire 24. Wires 23 and 24 and other components of the electrical system are preferably housed within the implement body 11. Positive wire 23 is connected to a positive lead of the light-emitting diode 17 or other light source and negative wire 24 is connected to a negative lead of the light-emitting diode 17 or other light source. The battery 18 may be replaceable or may be rechargeable. In the latter case, the implement 11 may be provided and electrically matable with a recharging stand or other recharging instrument adapted to be plugged into an electrical outlet in a home or office. Likewise, in another inventive embodiment, a dental implement similar to implement 11 could itself be adapted to be plugged into and powered from such an electrical outlet.

[0021] A switch 25 for energizing and de-energizing the light source 17 with the battery is provided. Switch 25 may be any suitable switch for these purposes including vertically-displaceable push-button switches, or horizontally-displaceable slide switches. Further, other switching mechanisms may be built into the device including for example inertial switches optionally in combination with appropriate circuitry for energizing the light source 17 for a predetermined period of time upon actuation of the inertial switch. These and other switches will be recognized as useful in the present invention by those of ordinary skill in the art.

[0022] Dental implement 11 also includes an opaque or other suitable shield 26 for shielding blue light emitted by blue light source 17 and preventing such blue light from direct visualization by a user of dental implement 11, which could possibly corrupt visualization of the desired fluorescence signal. To this end, shield 26 will be mounted proximal to the blue light source 17 to prevent direct visualization of the emitted blue light by a user of the implement 11.

[0023] Dental implement 11 also includes a light filter 27 for filtering light. Filter 27 may for example filter light based upon wavelength or based upon polarization. When a wavelength-based filter is used, it is preferable that the light source 17 emit no significant amount of light above the cut-off wavelength of the filter. For example, when using a blue light source with an intensity peak in the wavelength range of 390 nm to 450 nm, it is desirable to use a yellow filter with a cutoff of about 520 nm. When using polarization as a means for the filter, the optical filter desirably will eliminate all polarized light originating from the illuminated area as the fluorescence signal will be randomly polarized. In the illustrated embodiment, light filter 27 is coated or layered onto the surface of the mirror 15.

[0024] In use of the dental implement 11, when the mirror portion 13 is inserted into the mouth of a user with the mirror 15 positioned to view tooth surfaces, and blue light source 17 is energized, tooth surfaces will be impinged by the blue light from the blue light source 17 and caused to fluoresce in the green wavelength range. Such green fluorescence from healthy and unhealthy tooth surfaces will pass through the yellow filter 27 prior to visualization by the user. Potentially corruptive light from the

source 17 and fluorescence at wavelengths below the cut-off for the filter 27 will not pass through the filter 27. Because fluorescence from carious tooth surfaces in the green spectrum is less intense than that from healthy tooth surfaces, carious tooth surfaces will appear as dark areas or patches visible to the user of the dental implement 11.

[0025] With reference now to Figure 2, shown is another dental implement 31. Dental implement 31 has similar components to dental implement 11 (Figure 1), except implement 31 has no yellow filter coated onto mirror 15, but rather has a yellow filter 27A mounted on the implement body and in particular on the transitional portion 14 thereof. In this fashion, again, potentially corruptive reflected light and fluorescence emissions will not pass through filter 27A, whereas fluorescence emissions in the green spectrum will pass and be visualized by a user of implement 31 revealing caries lesions as dark areas. Yellow filter 27A can be of circular or oval shape as shown, or of any other suitable shape. Filter 27A is generally sized and positioned to enable visualization of light reflecting from mirror 15 and through filter 27A.

[0026] With reference now to Figure 3, shown is another dental implement 41 having an alternative light source configuration. Implement 41 has features similar to those of implement 31 (Figure 2), except implement 41 has multiple light sources 17A housed within the mirror portion 13 and in particular housed circumferentially within the mirror housing 16 surrounding the mirror 15. Light sources 17 may, for example, be a plurality of blue LEDs as described hereinabove.

[0027] Referring now to Figure 4, shown is an alternative dental implement 51 having features similar to those of dental implement 31 (Figure 2), except having a white light source 52 in addition to the blue light source 17. In dental implement 51 the switch 25 is a three-position switch for selectively energizing the blue light source 17, the white light source 52, or de-energizing both light sources 17 and 52. Dental implement 51 thus enables a selection by the user between fluorescence-based visualization and normal reflected white-light visualization. This assists the user in differentiating among caries-containing tooth surfaces and stained tooth surfaces, both of which can appear as dark areas in the fluorescence-based, visualization.

[0028] Figure 5 shows another dental implement 61. Implement 61 includes both blue light sources 17A and white light sources 62 similar to prior-discussed implement 51 (Figure 4), except having the light sources mounted in the mirror housing 16 in a fashion similar to implement 41 (Figure 3). Switch 25 and implement 61 thus is a three-position switch for selectively energizing the plurality of white light sources 62, the plurality of blue light sources 17A, or for de-energizing all light sources.

[0029] Referring now to Figure 6, disclosed is a dental implement 71 according to the present invention. Implement 71 includes a light source body 72 including a handle portion 73 defining a battery chamber for receiving a battery similar to the corresponding components in implement 11 (Figure 1). Implement body 72 includes a switch 74 for selectively energizing and de-energizing a blue light source 75 with a battery housed in the housing. Implement 71 also includes a yellow filter 76 that is detachable from the implement body 72, for example, having a cut-out portion 77A adapted to mate with a groove 77B in implement body 72 to achieve a friction or snap fit of the filter 76 to the body 72. Implement 71 also includes a detachable mirror unit 78 having a mirror 79, a stem 80 portion, and an attachment portion 81 adapted for friction or snap fit with the implement body 72. Such separate components may be sold together in a kit for assembling the dental implement. In addition to, or as an alternative to, attachable filter 76, dental implement 71 or kits for the same may include glasses 82 or other devices adapted to be worn over the eyes, containing a yellow filter(s) for filtering fluorescence to be viewed. In implement 71, blue light source 75 is advantageously located at or near the tip of the implement body 72 for effective illumination of tooth surfaces with the blue light source (e.g., LED). As well, the detachable mirror unit 78 may be attached to the implement body 72 at varying positions thereby providing flexibility in the configuration of the mirror 79 relative to the handle portion 73, so as to enable user optimization of tooth visualization.

[0030] With reference now to Figure 7, shown is another alternative dental implement 91. Dental implement 91 includes an implement body 92 having a switch 93 for energizing and de-energizing a light-emitting diode 97 with a battery (not shown) located within the body 92. Implement body 92 includes a generally curved handle portion 94 connected to a transitional portion 95 which may be integral with handle portion 94, or as shown may be a separate piece 95 connected to handle portion 94. Transitional portion 95 terminates in a generally cone-shaped terminus 96 defining a concave inner surface, optionally made of or coated with a reflective material, and within which is located a blue light-emitting diode 97. Light-emitting diode 97 may be any one of those identified above. Dental implement 91 further includes a mirror unit 98 connectable to implement body 92 by a snap or friction fit. Mirror piece 98 further includes a mirror surface 99. Mirror unit 98 is adapted so that when attached to implement body 92, light emitted by the diode 97 reflects from the mirror 99 and on to the oral cavity (e.g. tooth) surfaces to be viewed. The fluorescence signals from the surface are then reflected back onto and from mirror 99 for visualization by a user (the mirror unit 78 and implement body 72 of implement 71, Figure 6, can be adapted to similarly direct the paths of the light source and fluorescence signals) . Implement 91 can be used in conjunction with a yellow filter positioned to filter the fluorescence signals reflected from mirror 99 prior to viewing. The yellow filter can be in the form of goggles (e.g. item 82, Figure 6), a separate filter portion mounted on implement body 92 (e.g. such as item 76, Figure 6), a filter adapted to be mounted on another mirror surface in the proximity

of the user (e.g. a bathroom mirror), or the like.

[0031] Additional aspects relate to the discovery that when more energetic (shorter wavelength) blue light is utilized, metabolic products of bacteria that typically reside in plaque, tarter, gingiva (pockets), dental tissue (lesions, cavities, cracks) and unpolished restorative materials (leaks around fillings, unpolished restorative surfaces, and cracks in restorative materials), will be cause to emit visually detectable red to orange fluorescence (about 500 to about 700 nm). In particular aspects, orange to red fluorescence (in the range of about 590 to about 700nm) is emitted by porphyrin materials that are produced primarily by anaerobic bacteria linked to gingivitis and extracellular or intracellular polysaccharides (linked to consumption of sugars such as glucose and saccharose). Preferred excitation radiation for these purposes falls wi thin the wavelength range of about 390 nm to about 450 nm. In certain embodiments, the detection of the red to orange fluorescence is used in conjunction with the dental implements, apparatuses and methods described above. Detection of the red to orange fluorescence can also be used in other systems for monitoring dental tissue. For example, the condition of dental tissue and deposits over time can be monitored by capturing periodic images showing areas of the orange to red fluorescence. These images can be reviewed and displayed to patients alone or in conjunction with fluorescence-based images of carious regions, in slide-show or animated formats. In one mode of operation, tooth fluorescence emissions obtained with a blue excitation source can be digitally acquired and digitally filtered using an appropriate digital processor to separate the yellow-green (carious detection range) and red-orange (bacterial metabolite detection range) fluorescence images. The original and separated fluorescence images can then be displayed concurrently on an interface to facilitate advising patients of their dental health and of the results of their dental hygiene regimen.

[0032] Referring now to Fig. 8, there is shown a kit 100 comprising handle 110, brush head 120, and light head 130. The kit 100 is designed such that either brushhead 120 or light head 130 fits over interface rod 112. When brush head 120 is so positioned, actuation switch 114 in handle depression 116 controls the energizing and actuation of the bristles 122 of brush head 120 in any of a variety of ways known in the art for operating electric toothbrushes . A power source (not shown) in handle 110 supplies energy through interface rod 112 using mechanical, electrical, and/or other transmission techniques that would occur to one skilled in the art.

[0033] When light head 130 is placed over interface rod 112, the power supply in handle 110 provides energy through interface rod 112 to energize one or more lighting elements 132 under control of switch 114 as discussed in relation to other embodiments above. Likewise, various features disclosed in other embodiments can be used in the kit 100 in Fig. 8. For example, switch 114 can be a three-way switch that causes different ones of lighting elements 132 alternately to provide white and blue illumination for use as described in Figure 4 above.

[0034] It will be understood that in dental implements such as those depicted in Figures 1-8, the light-emitting diode or diodes can be mounted in an alternate location, such as within the handle, and an optical fiber or other suitable light guide can be used to transmit the light to an appropriate location external of the implement for illumination of the oral cavity, for example a location consistent with the positions of the light-emitting diodes shown in Figures 1-8. These and other similar adaptations of the light source will be apparent to those of ordinary skill in the art from the descriptions herein.

Claims

1. A hand-held dental implement for examining tooth surfaces for abnormal surface conditions, comprising:

   - an implement body;
   - a light-emitting diode (75) positioned on said implement body and adapted when energized to emit light with a peak intensity in a wavelength range from 390 - 500 nm, said light effective to cause detectable differential fluorescence emissions from normal tooth tissue and abnormal tooth tissue;
   - means for energizing said light-emitting diode; and
   - a filter (76) for filtering said fluorescence emissions to facilitate detection of said differential fluorescence emissions;

   characterised in that said filter (76) is an external filter adapted for detachably attaching to said implement body so as to allow direct visualization of said fluorescence emissions by a user.

2. The dental implement of claim 1, wherein said light-emitting diode (75) is adapted to emit light with a peak intensity in the wavelength range of 390 nm to about 450 nm.

3. The dental implement of one of the preceding claims, wherein said implement body has a proximal handle (73) connected to a distal end, said dental implement further comprising a mirror (79) adapted for detachably attaching to said implement body, said mirror adapted for insertion into the mouth of the user.

4. The dental implement of one of the preceding claims, wherein said implement body has a proximal handle (73) connected to a distal end, said dental implement further comprising:

   - a battery chamber in said proximal handle;

- a positive electrical contact in said battery chamber, and a negative electrical contact in said battery chamber, for electrical contact with respective positive and negative terminals of a battery received in said battery chamber; wherein said light-emitting diode (75) has positive and negative leads electrically connected to said positive electrical connection and said negative electrical connection, respectively, said light-emitting diode energizable by a battery received in said battery chamber; and
- a switch (74) on said implement body, said switch having a first condition wherein said light-emitting diode is energized by said battery, and a second condition wherein said light-emitting diode is not energized by said battery.

5. The dental implement of claim 3 or 4, wherein said light-emitting diode (75) is effectively positioned on said implement body to illuminate tooth surfaces of the user when said mirror (79) is positioned in the mouth of the user.

6. The dental implement of one of the preceding claims, wherein said filter (76) has a cut-off wavelength of about 520 nm.

Patentansprüche

1. Handgeführtes Dentalgerät zur Untersuchung von Zahnoberflächen auf abnormale Oberflächenzustände, umfassend:

- einen Gerätekörper,
- eine Leuchtdiode (75), die am Gerätekörper angeordnet und so ausgeführt ist, dass sie unter Spannung Licht mit einer Spitzenintensität in einem Wellenlängenbereich von 390 bis 500 nm emittiert, wobei das Licht detektierbare differentielle Fluoreszenzemissionen von normalem Zahngewebe und abnormalem Zahngewebe bewirkt,
- Mittel zur Spannungsversorgung der Leuchtdiode und
- ein Filter (76) zum Filtern der Fluoreszenzemissionen, um die Detektion der differentiellen Fluoreszenzemissionen zu erleichtern,

dadurch gekennzeichnet, dass das Filter (76) ein externes Filter ist, das zur abnehmbaren Anbringung am Gerätekörper ausgeführt ist, um eine direkte Betrachtung der Fluoreszenzemissionen durch einen Benutzer zu gestatten.

2. Dentalgerät nach Anspruch 1, bei dem die Leuchtdiode (75) so ausgeführt ist, dass sie Licht mit einer Spitzenintensität im Wellenlängenbereich von 390 bis ca. 450 nm emittiert.

3. Dentalgerät nach einem der vorigen Ansprüche, bei dem der Gerätekörper einen mit einem distalen Ende verbundenen proximalen Griff (73) hat und das Dentalgerät ferner einen Spiegel (79) aufweist, der zur abnehmbaren Anbringung am Gerätekörper ausgeführt ist, wobei der Spiegel so ausgeführt ist, dass er in den Mund des Benutzers eingeführt werden kann.

4. Dentalgerät nach einem der vorigen Ansprüche, bei dem der Gerätekörper einen mit einem distalen Ende verbundenen proximalen Griff (73) hat und das Dentalgerät ferner aufweist:

- eine Batteriekammer in dem proximalen Griff,
- einen positiven elektrischen Kontakt in der Batteriekammer und einen negativen elektrischen Kontakt in der Batteriekammer zur elektrischen Kontaktgabe mit entsprechenden positiven und negativen Anschlüssen einer in der Batteriekammer aufgenommenen Batterie, wobei die Leuchtdiode (75) positive und negative Zuleitungen hat, die elektrisch mit dem positiven elektrischen bzw. negativen elektrischen Anschluss verbunden sind, so dass die Leuchtdiode von einer in der Batteriekammer aufgenommenen Batterie mit Spannung versorgt werden kann, und
- einen Schalter (74) am Gerätekörper, wobei der Schalter einen ersten Zustand hat, in dem die Leuchtdiode von der Batterie mit Spannung versorgt wird, und einen zweiten Zustand, in dem die Leuchtdiode von der Batterie nicht mit Spannung versorgt wird.

5. Dentalgerät nach Anspruch 3 oder 4, bei dem die Leuchtdiode (75) dahingehend wirkend am Gerätekörper angeordnet ist, dass sie Zahnoberflächen des Benutzers beleuchtet, wenn sich der Spiegel (79) im Mund des Benutzers befindet.

6. Dentalgerät nach einem der vorigen Ansprüche, bei dem das Filter (76) eine Grenzwellenlänge von ca. 520 nm hat.

Revendications

1. Instrument dentaire à main pour examiner des surfaces dentaires présentant des états de surface anormaux, comprenant :

un corps d'instrument ;
une diode émettrice de lumière (75) positionnée sur ledit corps d'instrument et destinée, lorsqu'elle est alimentée, à émettre une lumière

ayant une intensité crête comprise dans une plage de longueurs d'ondes de 390 à 500 nm, ladite lumière étant efficace pour provoquer des émissions de fluorescence différentielles détectables à partir d'un tissu dentaire normal et d'un tissu dentaire anormal ;
un moyen permettant d'alimenter ladite diode émettrice de lumière ; et
un filtre (76) servant à filtrer lesdites émissions de fluorescence pour faciliter une détection desdites émissions de fluorescence différentielles ;

caractérisé en ce que ledit filtre (76) est un filtre extérieur destiné à être attaché de manière amovible audit corps d'instrument de façon à permettre à un utilisateur une visualisation directe desdites émissions de fluorescence.

2. Instrument dentaire selon la revendication 1, dans lequel ladite diode émettrice de lumière (75) est destinée à émettre une lumière ayant une intensité crête comprise dans la plage de longueurs d'ondes de 390 nm à environ 450 nm.

3. Instrument dentaire selon l'une des revendications précédentes, dans lequel ledit corps d'instrument comporte un manche proximal (73) relié à une extrémité distale, ledit instrument dentaire comprenant en outre un miroir (79) destiné à s'attacher de façon amovible audit corps d'instrument, ledit miroir étant prévu pour être inséré dans la bouche de l'utilisateur.

4. Instrument dentaire selon l'une des revendications précédentes, dans lequel ledit corps d'instrument comporte un manche proximal (73) relié à une extrémité distale, ledit instrument dentaire comprenant en outre :

un compartiment de pile situé dans ledit manche proximal ;
un contact électrique positif situé dans ledit compartiment de pile, et un contact électrique négatif situé dans ledit compartiment de pile, servant à assurer un contact électrique avec des bornes respectives positive et négative d'une pile reçue dans ledit compartiment de pile ; dans lequel ladite diode émettrice de lumière (75) comporte des conducteurs positif et négatif connectés électriquement respectivement avec ladite borne électrique positive et avec ladite borne électrique négative, ladite diode émettrice de lumière pouvant être alimentée par une pile reçue dans ledit compartiment de pile ; et
un interrupteur (74) situé sur ledit corps d'instrument, ledit interrupteur présentant un premier état dans lequel ladite diode émettrice de lumière est alimentée par ladite pile, et un second état dans lequel ladite diode émettrice de lumière n'est pas alimentée par ladite pile.

5. Instrument dentaire selon la revendication 3 ou 4, dans lequel ladite diode émettrice de lumière (75) est positionnée efficacement sur ledit corps d'instrument pour éclairer des surfaces dentaires de l'utilisateur lorsque ledit miroir (79) est positionné dans la bouche de l'utilisateur.

6. Instrument dentaire selon l'une des revendications précédentes, dans lequel ledit filtre (76) a une longueur d'onde de coupure d'environ 520 nm.

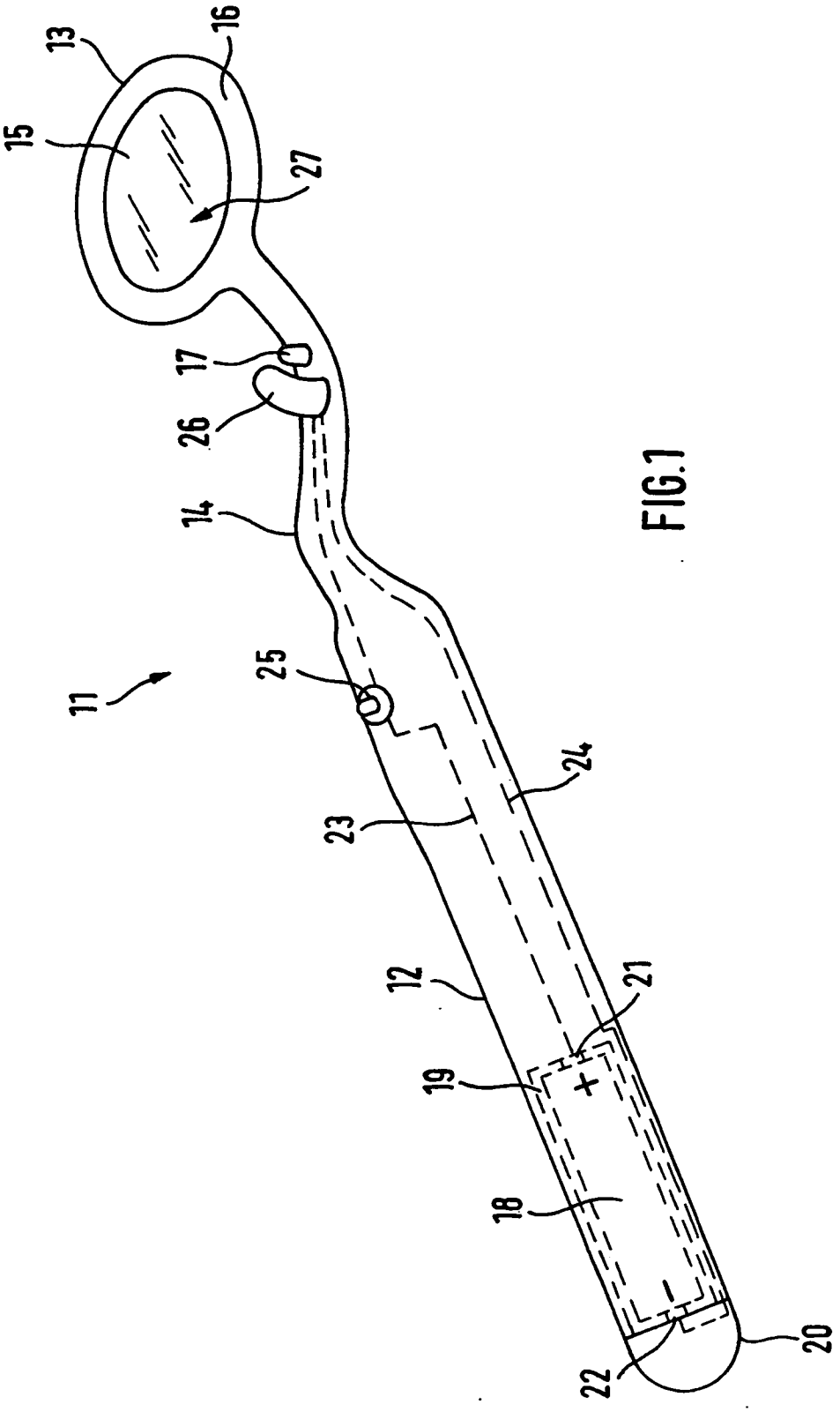

FIG.1

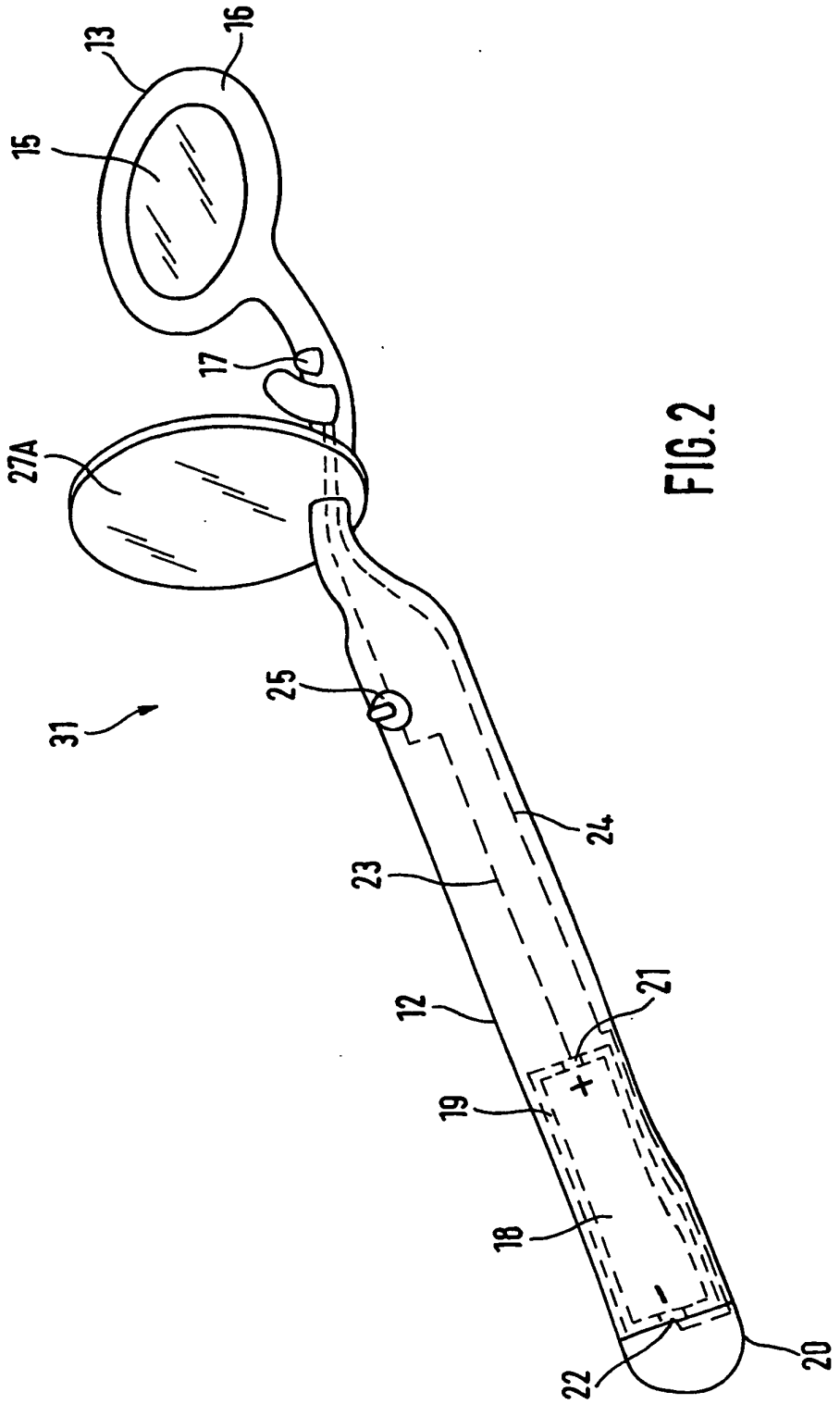

FIG.2

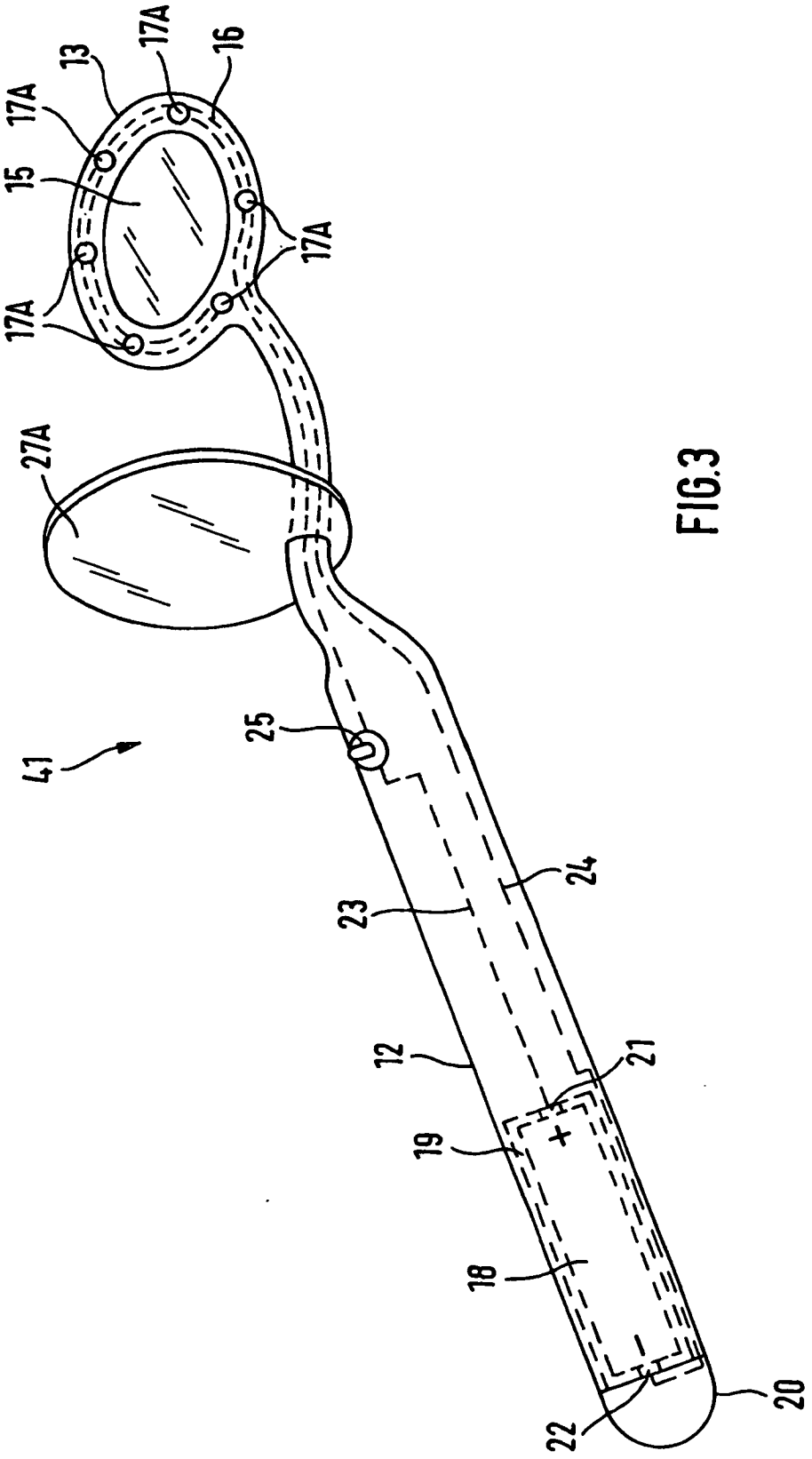

FIG.3

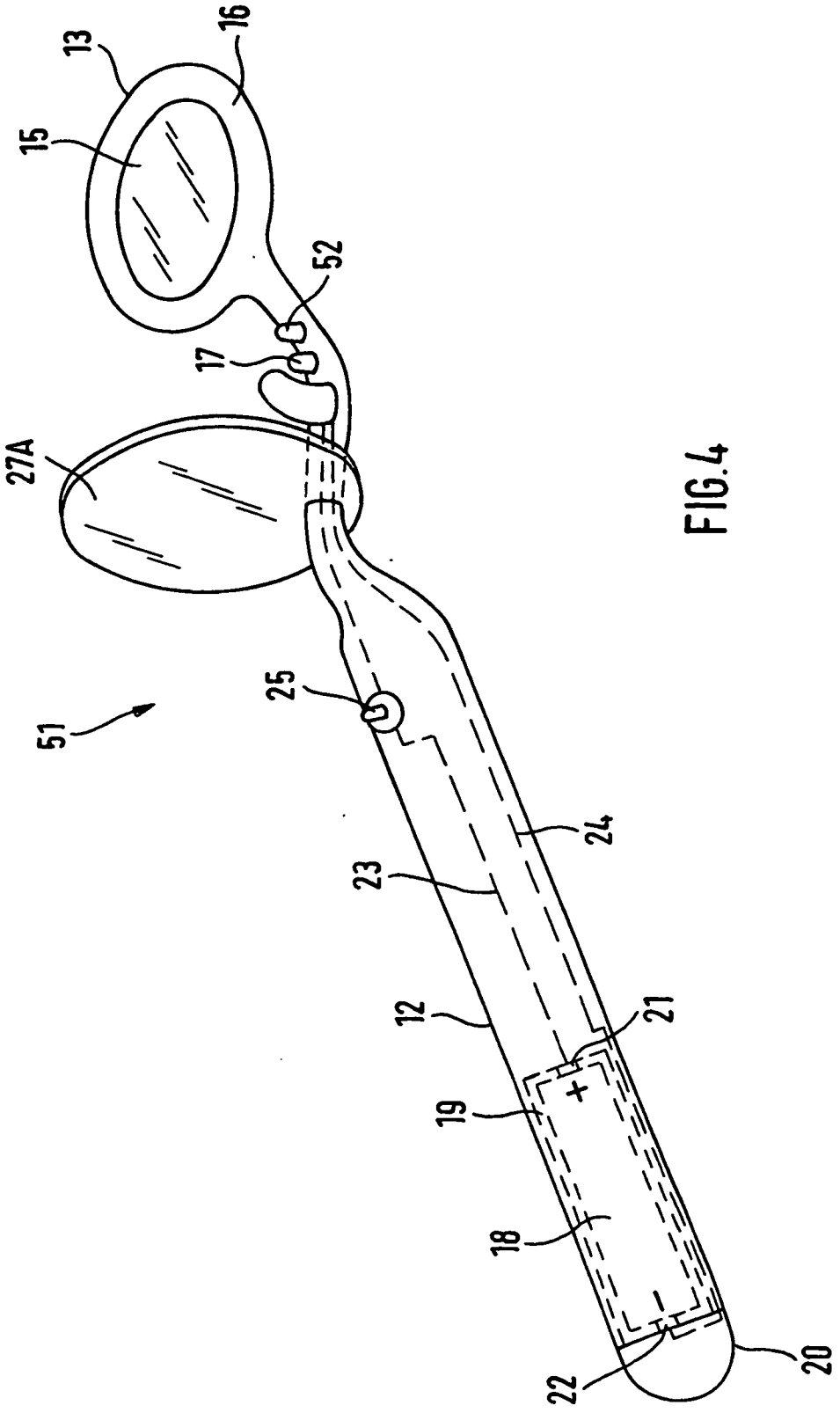

FIG.4

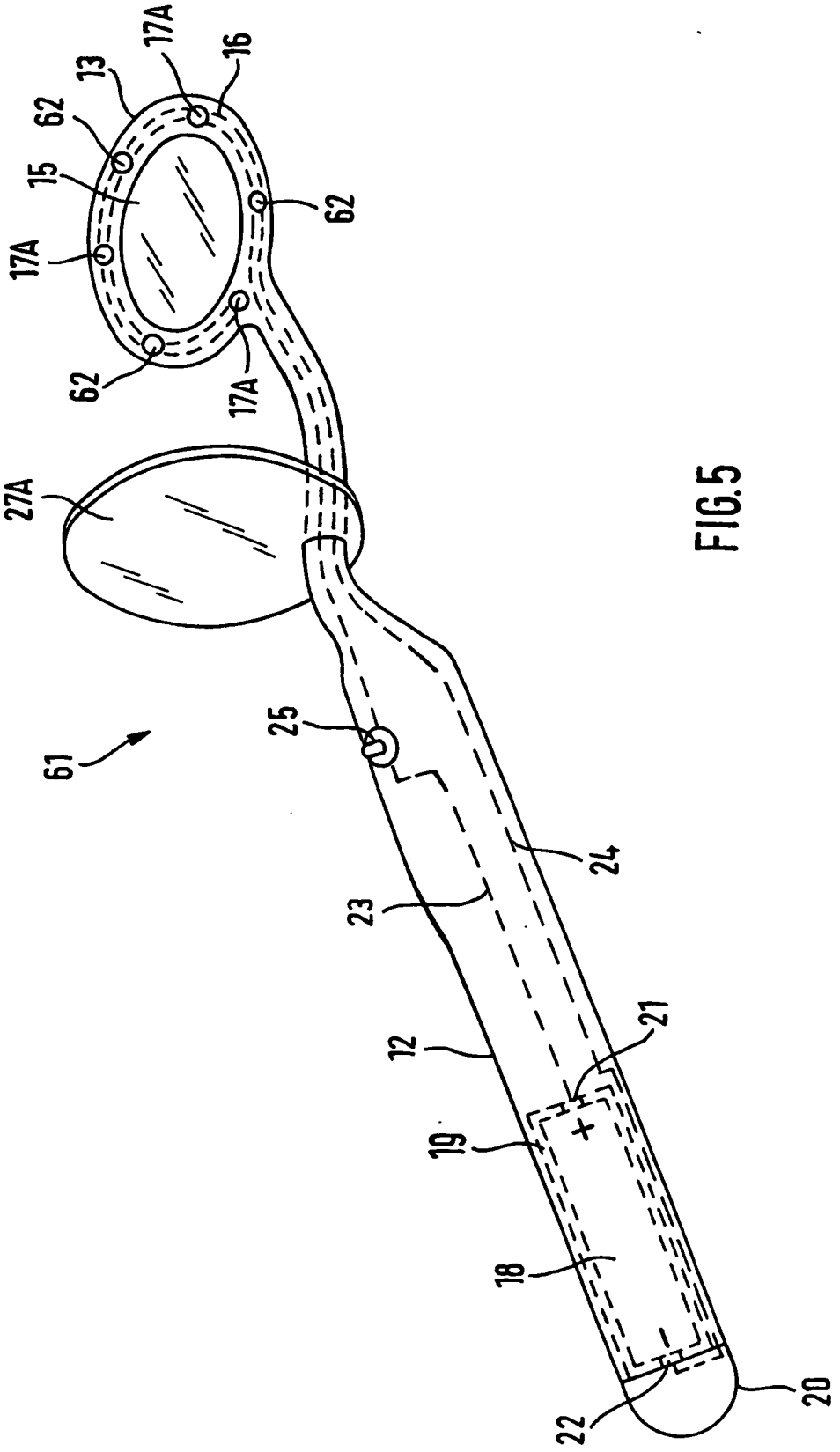

FIG.5

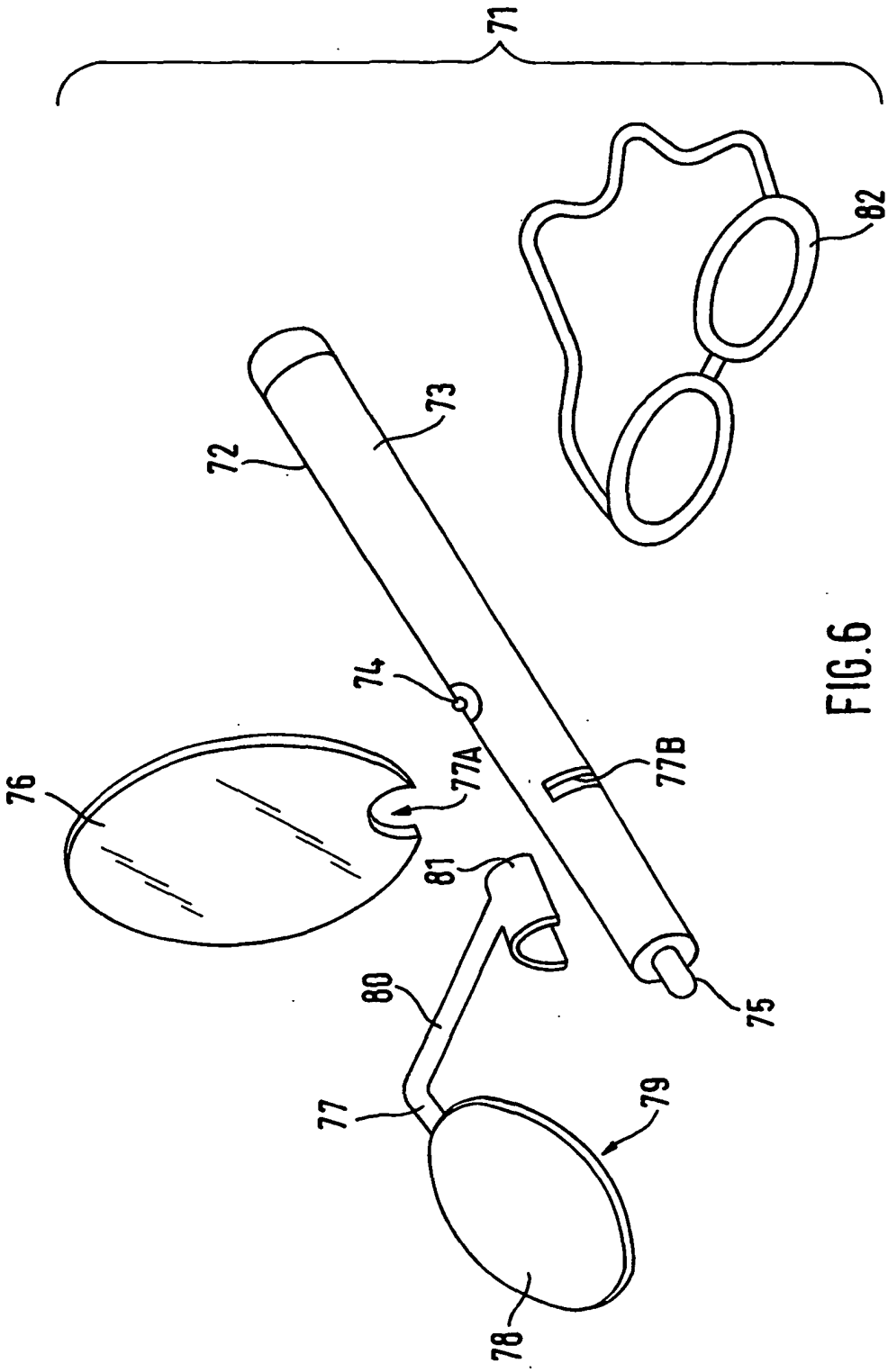

FIG.6

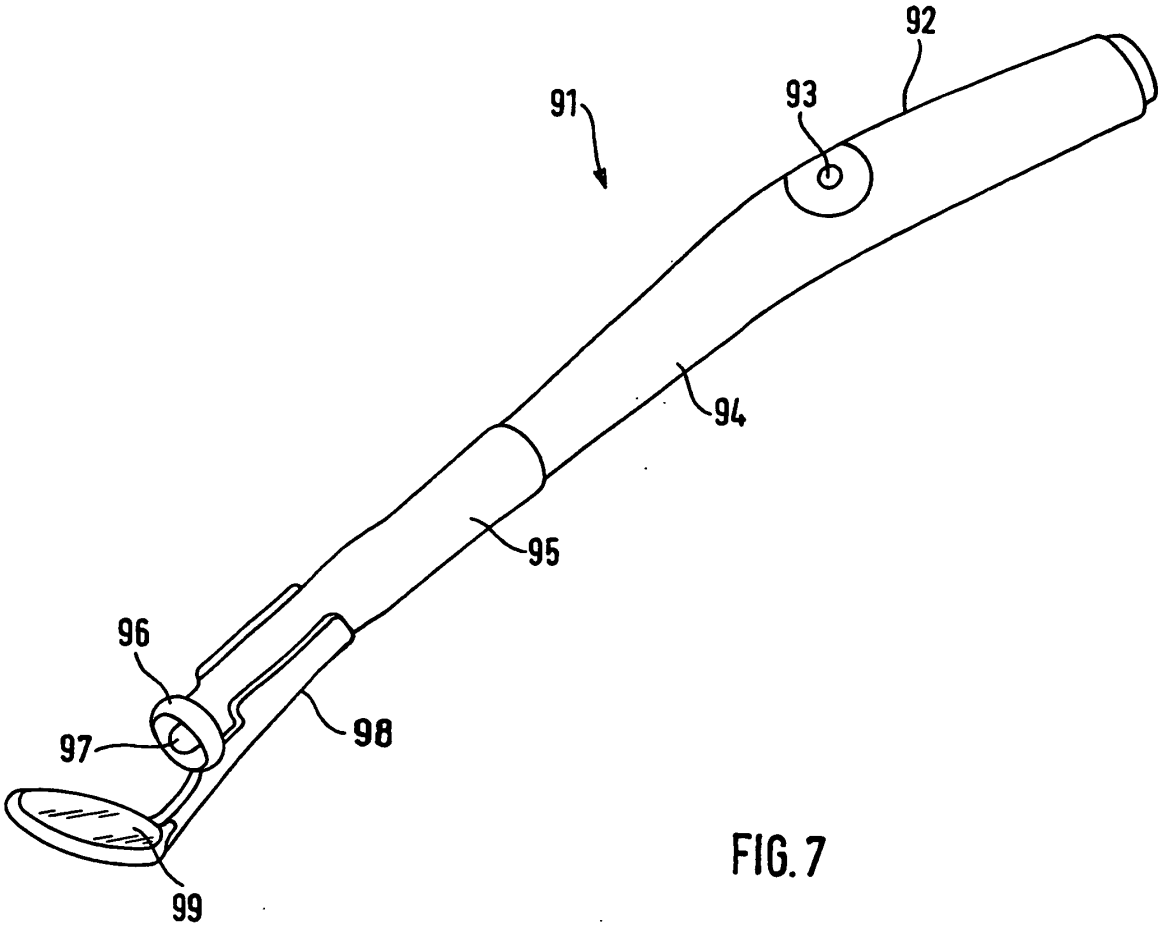

FIG. 7

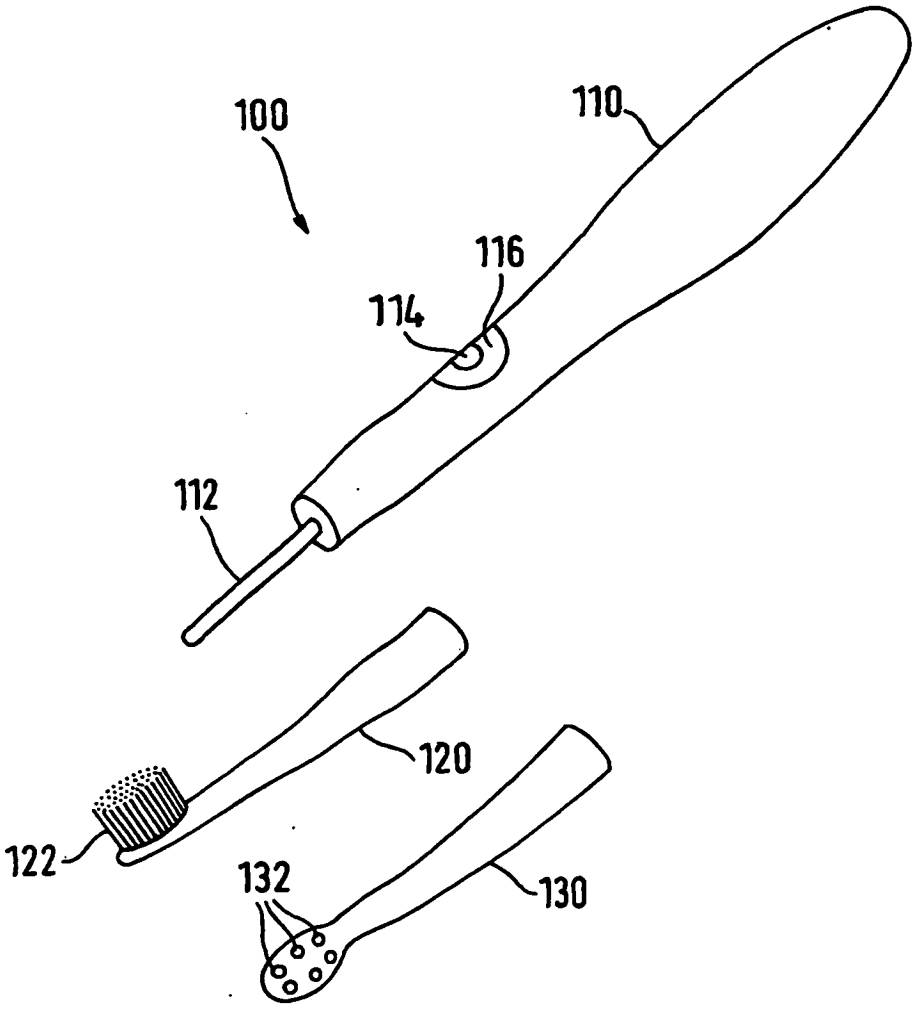

FIG.8

REFERENCES CITED IN THE DESCRIPTION

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专利名称(译)	用于牙齿表面检查的牙科工具		
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当前申请(专利权)人(译)	属性检查器研究系统B.V.		
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IPC分类号	A61B5/00 A61B1/247 A61B1/24 A61B1/00 A61B1/06 A61C17/22 A61C19/04		
CPC分类号	A61B1/247 A61B1/00186 A61B1/0607 A61B1/0676 A61B1/0684 A61C17/22		
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其他公开文献	EP1542583A1		
外部链接	Espacenet		

摘要(译)

描述了用于检查牙齿表面是否存在诸如龋齿或牙菌斑等异常的牙科用具。本发明的优选器具包括安装在器具本体上的发光二极管，该器具本体具有用于插入使用者口中的镜子。这种工具还具有安装在工具手柄中的腔室中的车载电池，以及用于利用电池激励和去激励LED的开关。还描述了用于检查牙齿表面的异常状况的方法，所述异常状况涉及使用波长在390-450nm范围内的辐射照射表面的斑块，其中所述辐射有效地引起已知与斑块相关的细菌代谢物的可检测的荧光发射。包含表面，并检测排放。