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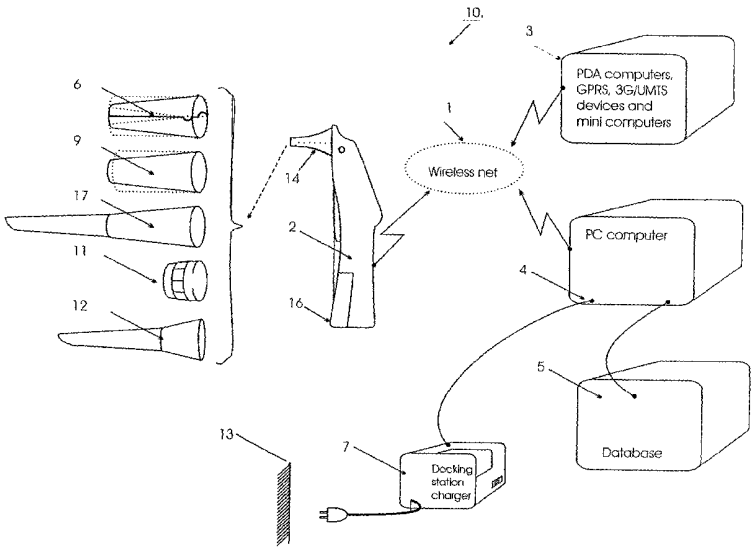
(54) Title: DIGITAL IMAGING DIAGNOSTIC AND MEDICAL TREATMENT INSTRUMENT



(57) Abstract: The present invention relates a wireless hand-held digital imaging diagnostic instrument for medical treatment of patient with variable tubular opening. Wireless digital imaging instrument for medical use is disclosed. The imaging instrument consists of a fully wireless digital imaging device, computer connection and software for image viewing and image filing instrument. The instrument is capable of distributing live imaging through the Internet for remote medical assistance. The computer interface uses state of the art technology to handle the digital imaging signal and to deliver live, high quality images to a computer. The digital imaging instrument is of a modular design to fit to different applications like otoscope and other medical devices.

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Digital Imaging Diagnostic and Medical Treatment Instrument

This application claims a priority from a US provisional application Nr. 60/262,339

Field of the invention

The present invention relates a wireless hand-held digital imaging diagnostic instrument for medical treatment of patient with variable tubular opening.

Description of the Prior Art

Hand-held diagnostic instrument for medical treatment of patients are commonly known. An example of such instruments is the otoscope, ophthalmoscopes, laryngoscope, colposcope and scopes to examine the skin surface. In the latest version a video camera such as a miniatures CCD camera with a light source has been positioned either within the instrument or adjacent thereto. Typically the electronic sensor includes an image plane, which receives the image of the object to be examined from an optical viewing system, which is capable of focusing said image. Above-mentioned diagnostic instruments have been developed, such as those described in U.S. Pat. No. 6,319,199, issued to Sheehan, et al., U.S. Pat No. 6,152,873, issued to Rogers, U.S. Pat. No. 5,919,130, issued to Monroe, et al. and U.S. Pat. No. 5,879,289, issued to Yarush, et al.

Furthermore, remote hand-held instruments with processing means have been developed where a programmable logic to capture and store images has been developed and wherein said images can be transferred along with audio/or annotation data relating to a captured image. Such a system is described in U.S. Pat. No. 6,106,457, issued to Perkins, et al. This patent describes a system of imaging instruments, and particularly an imaging instrument system having interchangeable instrument heads selectively used with a single instrument body or family of instrument bodies. This patent describes instrument that can allow imaging, audio and other form of data (multimedia) to be selectively captured, stored and utilized.

One prior art otoscope is described in U.S. Pat. No. 5,961,441, issued to Plumb, et al. This patent describes otoscope system for use for examining and operating upon the external ear canal and the eardrum. More particularly, the invention relates to an otoscope, which combines visual diagnostic features with surgical instruction and a method for operating upon the external ear canal and the eardrum. This invention describes extendable and retractable instrument, which are operated using the same hand that holds the otoscope. Including a port for insertion of special instruments for performing examination and surgical operation.

These hand-held instruments have however the disadvantage that they are not wireless, which can be of crucial importance wherein the conditions where the patient is located can be such that consulting an expert on-line can be difficult. Furthermore, these systems have no variable tubular opening that can give access to the target point with standard instruments, which prevents the usability and flexibility of the examination and surgical operation that can be performed.

A hand-held digital imaging diagnostic instrument for medical treatment of patient is needed, where one embodiment combines imaging capture and processing system, imaging visualisation, user interface and plurality of exchangeable instrument heads for multiple examination. Where the imaging system and the variable tubular opening are combined in such a way, that it will allow access with standard surgical instruments simultaneously with inspection by the digital imaging device.

General description of the invention

It is an object of the present invention to present a hand held wireless digital imaging diagnostic instrument with variable tubular opening for medical treatment

of a patient. The instrument is capable of distributing live images through a communication channel such as the Internet for remote medical assistance.

According to the first aspect, the present invention relates to a digital hand-held imaging instrument for medical examination and/or treatment of patients, said instrument comprising:

- a housing,
- a digital imaging system for capturing digital images and imaging processing,
- a conical shaped instrument head mounted to the housing with a tubular opening extending axially there through, and
- means for adjusting the radial size of the instrument head and thereby of the tubular opening,

thereby facilitating the accessability to the area to be examined and/or treated.

In one embodiment the area of said instrument head is, prior to accessing the area to be treated, covered with a disposable cap. Therefore, after treating a patient the cap is simply exchanged with a new one before treating the next patient. In another embodiment the instrument head is divided into one or two exchangeable bodies with the imaging system inside. Accordingly, the operator can choose between different imaging system for different application, such as a examination and/or treatment in the ear, the nose or the mouth. Also it facilitates the cleaning of the instrument head.

Adjusting the radial size of the instrument head is in one preferred embodiment provided through a displacement of one of the two bodies in a direction proximately perpendicular to the other body, which can for example be performed mechanically or electronically. The adjustment can also be through extending the radius of the narrower end of the conical shaped instrument head. For enabling

to examine the area to be treated and/or examined through the tubular opening extending axially through the instrument head it is in one preferred embodiment mounted on top of the housing. Preferably the variable tubular opening comprises a guiding means adapted to guide a surgical instrument and an aiming means for aiming the surgical instrument at a target point visualised in the captured image.

The electronic image sensor may be a digital video camera such as CMOS miniature camera, wherein said video camera or image sensor such as CMOS miniature camera or a CCD camera is enclosed within the instrument along with a light source such as light emitting diode (LED). The light source with the lens system, such as a rod lens with an imaging lens at the end of the instrument opening, is preferably situated in the instrument head, wherein at the wider end the light source may be attached to the instrument head. The optical imaging system comprises for example an image sensor, light bundle, lens system and light emitting diode (LED).

By using a plurality of light sources, sufficient light could be focused to the outlet where the fibre optic is connected. The light is transferred through a fibre-optical bundle from the wider end, where the light source is situated, to the narrower end of the instrument head, where an optical lens is at the opening. The image sensor would preferably be placed horizontally in the instrument head near the lens with a mirror situated so that the light from the lenses at the end will be reflected to the sensor. By using such arrangement the size of the instrument can be minimized. Therefore such an instrument could be of a modular design to fit to different applications like otoscope and other medical devices.

The image sensor is preferably a miniature CMOS colour VGA digital image camera with built in control logic, such as the Kodak digital science KAC-0310 image sensor. The lens system may also comprise a focal instrument for focusing the captured image, wherein the instrument may be remotely operated

from the viewing means or from an external agent and a magnifying instrument for magnifying the captured image, wherein they may be remotely operated from the viewing means or remotely from an external agent.

In order to view the captured images the system is provided with a viewing means such as 2.5" TFT display monitor to display the captured images, a microphone to enable voice recording and/or means for voice storage and/or voice control, and at least one push button for menu driven use. The display monitor may be mounted on for example a stainless steel ring, so it can be moved around this ring in any position that best fits the user. Furthermore, a scroll button with click ability and a menu driven use is provided. A preferred embodiment of the present invention is wherein the viewing means comprises a touch button screen so as to provide a user configurable menu instrument and wherein a processing means is further being adapted to the instrument. Preferably the processing means comprises a storage means for storing digital images and linking said images to a patient registration, means for comparing images to known images in a database in the storage means and means for transmitting and receiving images. Preferably the processing means may be adapted, in response to commands from a computer program, to control the screen so as to display the captured image in a pre-selected orientation defined from the orientation of the hand-held instrument.

In one preferred embodiment the instrument comprises means for wirelessly transmitting the captured images through a communication channel, wherein likewise the instrument could comprise a remote viewing means adapted to receive a wirelessly transmitted images through a communication channel and means for displaying the received images, wherein the communication channel is for example be the Internet.

By means of integrating a wireless data transceiver in the instrument a wireless network may be interconnected. Preferably the network comprises for example at least one PC computer, at least one portable computer and at least one UMTS telephone. The means for receiving the wirelessly transmitted images may be adapted for communication with the Bluetooth™ protocol. In order to prevent disturbance of other equipment in the surroundings the communication frequency of the transmitting and receiving images should preferably lie in the range off 2,4-2,48GHz. The means for receiving the wirelessly transmitted images could furthermore be adapted for communication with the protocol for Home-RF or IEEE 802.11 communication. The instrument further comprises a DC power plug for connection with portable charger and power source, an On/Off push button and a button for pre programmable use, wherein if said button is pressed the instrument will go from standby mode to active mode.

A further aspect of the present invention is to provide a method for medical treatment of a patient, said method comprising means of using a hand-held device with tubular opening, a digital camera and a viewing means adapted to display the captured digital image taken from the area to be examined, the method comprising the steps of:

- selecting an instrument head relative to the area to be examined,
- aiming the instrument at a target point visualised in the captured image,
- means for approaching the target point through the tubular opening,
- means for capturing and processing a digital images for the area to be examined, and
- treating the patient through the tubular opening while frequently taking an digital image of the examined area.

Preferably, the hand held device is wireless.

Detailed description of the invention

In the following the present invention, and in particular preferred embodiments thereof, will be described in greater details in connection with the accompanying drawings in which

Fig. 1 shows a diagrammatic view of a digital imaging diagnostic and medical treatment instrument,

Fig. 2 shows an illustration of the hollow tubular opening mechanism.

Fig. 3 shows a hand-held digital imaging instrument,

Fig. 4 shows the main blocks of the instrument,

Fig. 5 shows an illustration of two imaging heads,

Fig. 6 shows another device of a hand-held digital imaging instrument.

FIG. 1 shows a diagrammatic view of a hand-held digital imaging instrument for medical treatment of patients. This diagram shows the first preferred embodiment of the present invention, including a primary instrument body or housing **2** having a front or distal face **14**. A plurality of instrument heads **6,9,17,11** and **12** are interchangeably and releasably mounted to the front face **14**, (will be described later). Each instrumental embodiment includes a wireless data transceiver that interconnects each instrument in a wireless network **1**. This network can connect several instruments together simultaneously (this could mean use of wireless data protocol's like, Bluetooth™, Home RF™ or IEEE 802.11). This includes a connection to a PC computer **4** and different type of

portable computer devices **3** such as PDA computers, GPRS and 3G/UMTS telecommunication instruments through the wireless network.

For the instrumental embodiment **2** comes a docking station **7** with a built in battery charger and data communication cable-connection with PC computer. This docking station is powered by conventional wall outlet **13.** There is also included in the embodiment **2** at the bottom, a DC power plug **16** for connection with portable charger and power source. The computer **4** connects to the instrument in use through the wireless network or through the docking station **7**. Its main function is to handle image data that it receives from the instrument in use. One of several features of the computer software is to handle the patient records and link the images to it. Other functions that are incorporated in the computer software, is the capability of comparing images to known images in a database **5** to assist in getting the best diagnosis. Several other features are incorporated in the software program such as the possibility of getting a remote assistance with diagnosis of images. One unique feature of the software, gives the user the ability to select and keep the orientation of the image fixed on the PC screen regardless of how the imaging instrument is orientated. This is possible because the hand-held instrument can sense its orientation and transmit this information to the receiving device. The receiving device can use this orientation information to correct the orientation of each image it receives.

One feature that is unique for this system is the possibility for the user to select between visual imaging and infrared heat imaging of the object of interest. This is partly utilized by mechanical filtering and partly digital signal processing.

Other functions that will be incorporated in this imaging system is a laser scanning of the object under inspection. The laser scanning of the object will be used to build a digital 3 dimensional imaging representation of the object. This is done by include a modular laser in to the embodiment that will illuminate the object under inspection with horizontal lines. The image that these lines represent on the surface of the object can be used to build a 3 dimensional digital imaging representation of the object by simple trigonometry calculation.

A plurality of instrument heads **6,9,17,11** and **12** are interchangeably and releasably mounted to the front face **14**. The otoscope head **6** is made of two pieces that can open up to increase the radial size. The otoscope head **9** is made of special arrangement that allows it to increase its radial size without any openings in between the two pieces. It is made of a single item that opens up radially. The laryngoscope head **17** is made of one long hollow material with the imaging system inside it. The digital imaging sensor is at the tip of the laryngoscope head and gives an angular view rectangular to the longitude axis of the instrumental head. The angle of view is adjustable. The imaging head for skin surface imaging **11** is principally an imaging lens with a focusing capability, including digital image sensor and a light source. The dental intraoral head **12** is made of hollow material with the imaging system inside it. The digital imaging sensor is at the tip of the head and gives an angular view rectangular to the longitude axis of the instrumental head. The angle of view is adjustable.

FIG. 2 shows an illustration of the otoscope head. These drawings show how the opening mechanism for the speculum works **90,91**. The instrument head is made of two bodies **100**, **101**. One that is a fixed body **100** mounted to the housing of the imaging device **102**. This body includes the imaging system **93**. The other part of the instrument head body, is fastened to the fixed body part by two rods **98**. These two rods can move perpendicular **98,99** to the fixed body inside a hollow slider guides. The movement of the two rods, move's the second part of the body perpendicular as well **101**. The rods are fastened to an adjustable opening mechanism **105,103**. The opening mechanism is made of two main items, one that is fastened to the rods **105** and has a small bearing item that fits in a guiding track in the manual slider **104**. **90** show's the mechanical opening in a closed position (minimum opening **96**), where the manual slider **103** is far right (front view). **90** show's the mechanical opening in its mid position. Moving the manual slider **103** further to the left will give maximum opening **97**. Instead of using manual opening mechanism the possibility of using electronically controlled opening system is optional. The speculum cap's **94,95** are made of two

symmetrical shaped bodies. These bodies are fastened two the instrument head by a junction/latching mechanism. This junction is basically an engraved **106** circular latching mechanism on the instrumental side. Where the speculum cap's has a circular latching **92** that fits in to the circular engraving of the instrumental head **106**. This speculum cap's (sometimes referred to as safety speculum), can be made of reusable, autoclaveable material such as stainless steel or plastic, or disposable material for single use only.

FIG. 3 shows a hand-held digital imaging instrument. This hand-held instrument **20** includes a 2.5" TFT display with a touch screen possibilities **21**, a microphone **22** to enable voice recording (this includes voice control of the instrument and voice processing, see later in detail), two push buttons for menu driven use **24**, a scroll button with click capability also for menu driven use **25**, an On/Off button **31**. One long button **28** for pre programmable use, if this button is pressed the imaging device will go from standby mode to active mode, a function to save battery power. One of the main features of this imaging device is the hollow tubular opening **23** that allows access through the speculum **27**. The changeable speculum is made of two symmetrical shaped bodies and fastened by a latching mechanism **26**.

An electronic sensor, vision chips or a smart vision sensor, such as a CMOS miniature camera, is enclosed within the embodiment along with the light source. The light is transferred through fibre-optical bundle to the distal tip. The image sensor receives an optical image of the target through a lens system, such as a rod lens in conjunction with imaging lenses at the end. The digital imaging device, the lens system, the light source and the fibre-optical bundle are all merged into one item and kept in the lower half of the speculum **36**, (in this text we will refer to this system as the imaging system). This compact bundle of imaging system is kept in a protection shield made of stainless steel **29**. The stainless steel protection as well as the imaging system can be replaced as one item. The latching mechanism is not shown here. This hand-held imaging instrument comes with a docking station (fig 1, **7**) for recharging the battery, with

an extra socket for a spare battery, (not shown) and a data connection socket for PC connection by wire (not shown). At the bottom of the embodiment are several contacts, two for recharging the battery in the docking station **32**, one male mini jack plug for portable battery charger **33,** an slot for a memory card **34,** this memory card can store images and voice message. There are several contacts **37** for data transfer when used with the docking station. The battery is placed at the bottom behind a removable slider **35**.

FIG. 4 shows the main blocks of the instrument **40**. The handheld instrument is made of two integrated sections **49a, 49b**, the instrument body having a separable two-part housing, which is attached by two screws behind the battery (not shown on the drawing). The interior of the instrument section is large enough to contain the electronics and the required sensors and imaging devices. The power for this instrument comes from a Li-Ion battery pack in the bottom of the instrument **48** behind a removable slider. Also in the bottom of the instrument is a slot for the optional memory card **43**. This memory card is plugged in to the instrument from the bottom of the instrument trough a small opening. The memory for the internal mini computer, both RAM and ROM is located at the bottom of the main PCB **42.** The transceiver **44** is also on the main PCB **50.** This transceiver is used for connecting the instrument to the local wireless network. The transceiver will be based on the Bluetooth™ specification, although in some cases this could be altered if required. Therefore the transceiver **44** is plugged to the main PCB. By this means, it will be easy to change the transceiver module. The antenna **45** for the transceiver lies beside the imaging display.
The CPU module is placed on the main PCB beside the transceiver **41**. The interface and I/O module **46** are on the opposite site of the main PCB **50.** This module interconnects all the parts to the CPU module **41**. This includes the imaging display **21** and the imaging sensor not shown on this drawing, also the user interface, i.e. buttons **47** and touch screen **21**. The main user interface is through the three buttons **47** on the front of the instrument, where the user can interact with the instrument trough a menu driven dialog (not shown here).

FIG. 5 shows an illustration of two imaging heads. Both of the illustrated imaging heads have a variable tubular opening and a movable imaging system. This opening allows access with surgical instruments simultaneously with inspection by the digital imaging device. The first imaging head **60** includes a light source **51,** where several white LED's are combined in an arrangement that focuses the light to the outlet where the fibre optic is connected **52**. The fibre-optic lies in a bundle to the end where the optical lens and the opening are **55,36.**

The image sensor **53** is placed horizontal near the lenses, with a mirror arrangement **54** that reflects the image to the sensor surface coming from the lenses in the end. The image sensor **53** is a miniature CMOS colour VGA digital image camera with built in control logic, such as the Kodak digital science KAC-0310 image sensor.

The end lens **55** has an outer diameter of 1 mm and gives an angular view. The fibre optical bundle **52** that transfers the light to illuminate the object surrounds the lens.

The fibre-optical bundle, the imaging sensor, the lenses and the light source are combined in one item (referred to as the imaging system) that can be moved forward and backward inside the protection shield made of stainless steel **29.** This unit also contains the control lines (wires) for the imagine sensor (not shown). The stainless steel protection as well as the imaging system can be replaced.

The latching mechanism for replacing the imaging head is not shown.

The image head **70** is similar to the head in **60** except that the imaging sensor **57** is placed horizontal outside the conical body and the protection shield. The imaging sensor **57** is a miniature CMOS colour VGA digital image camera with built in control logic, such as the Kodak digital science KAC-0310 image sensor.

The light source **51** is made of several white LED's that are combined in an arrangement that focuses the light to the outlet where the fibre-optic is connected

59. This fibre optical bundle transfers the light to the end, where it surrounds the lens **61,36**.

The image sensor is connected to a fibre-optical bundle and the lens arrangement that focuses the light on the sensor-imaging surface **63,62**, at the end of this fibre-optical bundle is a lens that gives an angular view **61**. The image sensor receives an optical image of the target through a lens system, made of two imaging lenses and long rod lens **63,61,62**. The fibre optical bundle, the imaging sensor, the lenses and the light source are combined in to one item, (called imaging system) that can be moved forward and backward inside the protection shield made of stainless steel **29**. The stainless steel protection as well as the imaging system can be replaced as one item. The latching mechanism for replacing the imaging head is not shown.

FIG. 6 shows another embodiment of the hand-held digital imaging device. This hand-held instrument **80** includes a 2.5" TFT display **73**, a microphone **75** to enable voice recording (will be described later in detail), two push buttons for menu driven use **78**, a scroll button with click capability also for menu driven use **77**, an On/Off button **79,** a 1" character display for instrument information's. The 2.5" TFT colour display **73** is mounted on a stainless steel ring **72** and can be moved around this ring in to any position that best fits the user **71.** When the display is not used it can be folded down to the side of the instrumental embodiment **74** to protect it from damage.

One of the main features of this image device is the tubular opening **85** that allows access through the speculum **87**. The changeable speculum is fastened by a latching mechanism (not shown in detail). The image head used for this instrument is the same as described in the earlier section see **60, 70.**

This hand-held imaging instrument comes with a docking station for recharging the battery, with an extra socket for a spare battery, (not shown) and a data connection socket for a PC connection by wire (not shown). At the bottom of the embodiment are several contacts, two for recharging the battery in the docking station **82**, one male mini jack plug for portable battery charger **84,** a slot for a

memory card **83,** this memory card can store images and voice message. There are several contacts **86** for data transfer when used with the docking station. The battery is placed at the bottom behind a removable slider **81.**

It should be understood that the above description and the related figures are only intended to illustrate the present invention. Different variation and modifications of the invention will be evident for those skilled in the art without departing from the scope and spirit of the invention disclosed in the appended claims.

Claims

1.A digital hand-held imaging instrument for medical examination and/or treatment of patients, said instrument comprising:

- a housing,
- a digital imaging system for capturing digital images and imaging processing,
- a conical shaped instrument head mounted to the housing with a tubular opening extending axially therethrough, and
- means for adjusting the radial size of the instrument head and thereby of the tubular opening,

thereby facilitating the accessability to the area to be examined and/or treated.

2.An instrument according to claim 1, wherein the area of said instrument head is, prior to accessing the area to be treated, covered with a disposable cap.

3.An instrument according to claim 1 or 2, wherein the instrument head is divided into two exchangeable bodies.

4. An instrument head according to any of the preceding claims, wherein at least one of the two exchangeable bodies comprises the digital imaging system.

5.An instrument head according to any of the preceding claims, wherein adjusting the radial size of the instrument head comprises displacement of one of the two bodies in a direction proximately perpendicular to the other body.

6.An instrument head according to any of the preceding claims, wherein the displacement is performed mechanically through an external force.

7.An instrument according to any of the preceding claims, wherein the displacement is performed electronically.

8.An instrument according to any of the preceding claims, wherein the instrument head is mounted on top of the housing.

9. An instrument according to any of the preceding claims, further comprising viewing means adapted to display the captured image.

10. An instrument according to any of the preceding claims, wherein the instrument further comprises means for wirelessly transmitting the captured image through a communication channel.

11. An instrument according to any of the preceding claims, wherein the instrument comprises a remote viewing means adapted to receive wirelessly transmitted images through a communication channel and means for displaying the received images.

12. An instrument according to any of the preceding claims, wherein the communication channel is the Internet.

13. An instrument according to any of the preceding claims, wherein the instrument comprises a wireless data transceiver wherein said data transceiver interconnects at least one system in a wireless network.

14. An instrument according to any of the preceding claims, wherein the means for receiving the wirelessly transmitted images are adapted for communication with the protocol for Bluetooth™ communication.

15. An instrument according to any of the preceding claims, wherein the wireless network comprises at least one PC computer and/or at least one portable computer and/or at least one UMTS telephone.

16. An instrument according to any of the preceding claims, wherein the means for wirelessly transmitting and the means for receiving the wirelessly transmitted images are adapted for communication with a frequency in the range of 2,4-2,48 GHz.

17. An instrument according to any of the preceding claims, wherein the means for receiving the wirelessly transmitted images are adapted for communication with the Home-RF communication protocol.

18. An instrument according to any of the preceding claims, wherein the means for receiving the wirelessly transmitted images are adapted for communication with the IEEE 802.11 protocol.

19. An instrument according to any of the preceding claims, wherein the imaging system is interchangeable.

20. An instrument according to any of the preceding claims, wherein the imaging system comprises a light emitting diode (LED) as an illuminating means.

21. An instrument according to any of the preceding claims, wherein the imaging system comprises an imaging sensor and/or light bundle and/or lens system and/or light emitting diodes (LED).

22. An instrument according to any of the preceding claims, wherein the light emitting diodes emit light with the wavelength from 450 to 750 nm.

23. An instrument according to any of the preceding claims, wherein light from the illuminating means is transferred to the instrument head through fibre optics.

24. An instrument according to any of the preceding claims, wherein the instrument comprises a DC power plug for connection with portable charger and power source.

25. An instrument according to any of the preceding claims, wherein the instrument further comprises an electronic image sensor and/or vision chips and/or a smart vision sensor for capturing the images.

26. An instrument according to any of the preceding claims, further comprising an infrared heat imaging system for displaying infrared heat images of the object to be examined and/or treated.

27. An instrument according to any of the preceding claims, further comprising a laser scanning system for building a 3-dimensional imaging representation of the object to be examined and/or treated.

28. An instrument according to any of the preceding claims, wherein the electronic image sensor is a CMOS miniature camera.

29. An instrument according to any of the preceding claims, wherein the captured image is transferred from the instrument head to an imaging sensor through a rod-lens system.

30. An instrument according to any of the preceding claims, wherein the electronic image sensor captures an optical image of a target through an imaging system.

31. An instrument according to any of the preceding claims, wherein the imaging instrument comprises a rod lens in conjunction with imaging lens at the end of the instrument head.

32. An instrument according to any of the preceding claims, wherein an image sensor is situated at the opening end of the lens system.

33. An instrument according to any of the preceding claims, wherein the lens system comprises a focal instrument for focusing the captured image.

34. An instrument according to any of the preceding claims, wherein the focal instrument may be remotely operated from the viewing means.

35. An instrument according to any of the preceding claims, wherein the focal instrument may be remotely operated from the external agent.

36. An instrument according to any of the preceding claims, wherein the lens system comprises a magnifying instrument for magnifying the captured image.

37. An instrument according to any of the preceding claims, wherein the magnifying instrument may be remotely operated from the viewing means.

38. An instrument according to any of the preceding claims, wherein the magnifying instrument may be remotely operated from an external agent.

39. An instrument according to any of the preceding claims, wherein the tubular opening comprises a guiding means adapted to guide a surgical instrument.

40. An instrument according to any of the preceding claims, wherein the guiding means comprises aiming means for aiming the surgical instrument at a target point visualised in the captured image.

41. An instrument according to any of the preceding claims, wherein the instrument further comprises processing means and/or storage means.

42. An instrument according to any of the preceding claims, wherein the captured image from the instrumental system are wirelessly transmitted to processing means, wherein the images are processed.

43. An instrument according to any of the preceding claims, wherein the processing comprises means for receiving the digital images, wherein said images are stored and linked to patient registration.

44. An instrument according to any of the preceding claims, wherein the processing comprises means for comparing received digital images to known images in a database.

45. An instrument according to any of the preceding claims, wherein the viewing means comprises a screen and wherein the processing means is further being adapted, in response to commands from a computer program, to control the screen so as to display the captured image in a pre-selected orientation.

46. An instrument according to any of the preceding claims, wherein the pre-selected orientation is automatically adjusted according to the orientation of the hand-held device.

47. An instrument according to any of the preceding claims, wherein the viewing means comprises a touch button screen and wherein the processing means is further being adapted, in response to commands from said computer program, to control the touch button screen so as to provide a user configurable menu instrument.

48. An instrument according to any of the preceding claims, wherein the instrument comprises a movable viewing means, wherein said viewing means is mounted so that it can be moved in a plane.

49. An instrument according to any of the preceding claims, wherein the instrument comprises at least one push button for menu driven use.

50. An instrument according to any of the preceding claims, wherein the instrument comprises at least one scroll button for menu driven use with a click capability.

51. An instrument according to any of the preceding claims, wherein the instrument comprises a button with On/Off functionality.

52. An instrument according to any of the preceding claims, wherein the instrument comprises a microphone to enable voice recording and/or voice storage and/or voice processing and/or voice control.

53. An instrument according to any of the preceding claims, wherein the instrument is a otoscope.

54. A method for medical treatment of a patient, said method comprising means of using a hand-held device with tubular opening, a digital camera and a viewing means adapted to display the captured digital image taken from the area to be examined, the method comprising the steps of:

- selecting an instrument head relative to the area to be examined,
- aiming the instrument at a target point visualised in the captured image,
- means for approaching the target point through the tubular opening,
- means for capturing and processing a digital images for the area to be examined, and

– treating the patient through the tubular opening while frequently taking an digital image of the examined area.

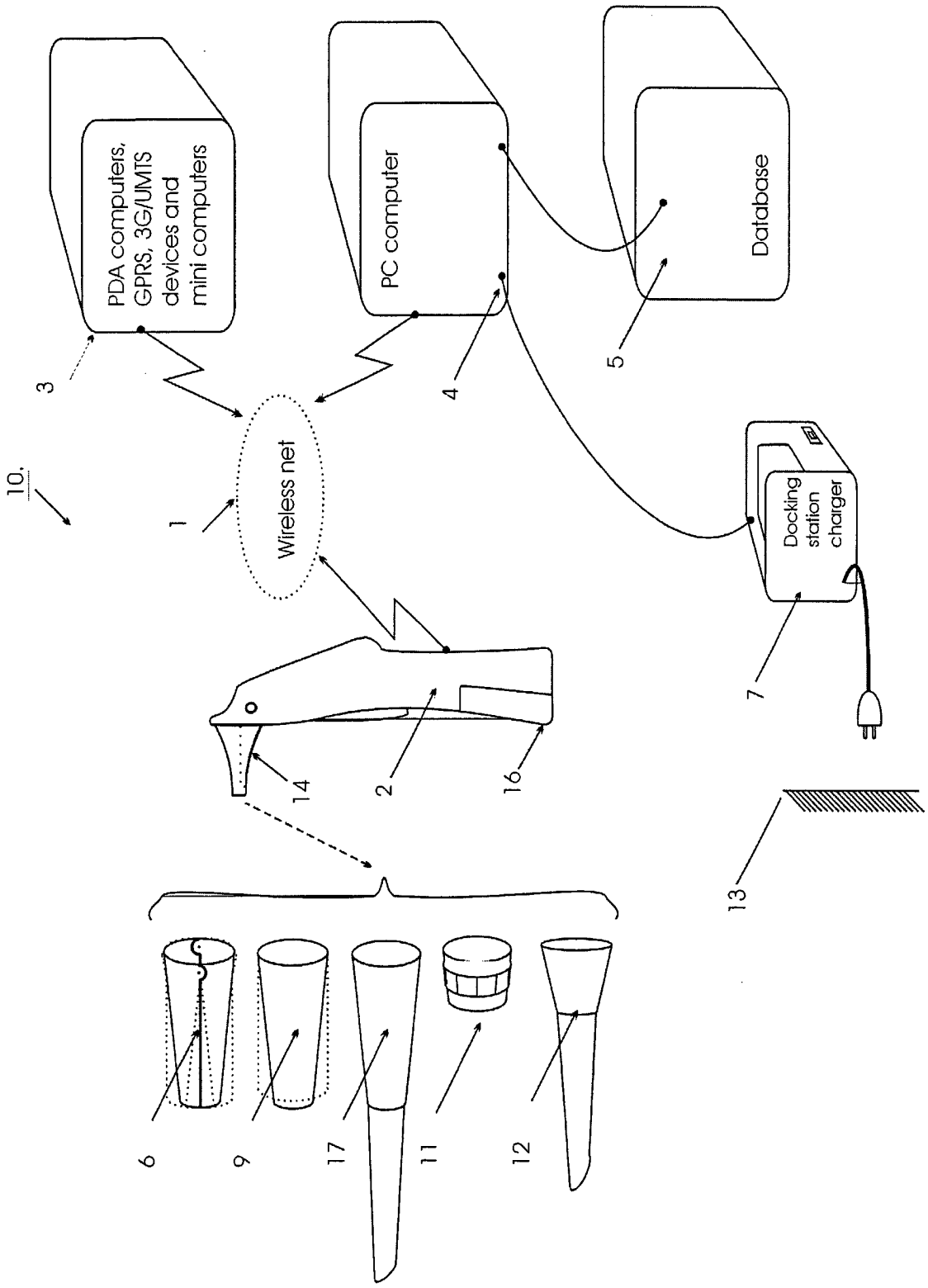
PDA computers, GPRS, 3G/UMTS devices and mini computers
PC computer
Database
Wireless net
Docking station charger
10
1
3
4
5
7
13
2
14
16
6
9
17
11
12

FIG. 1.

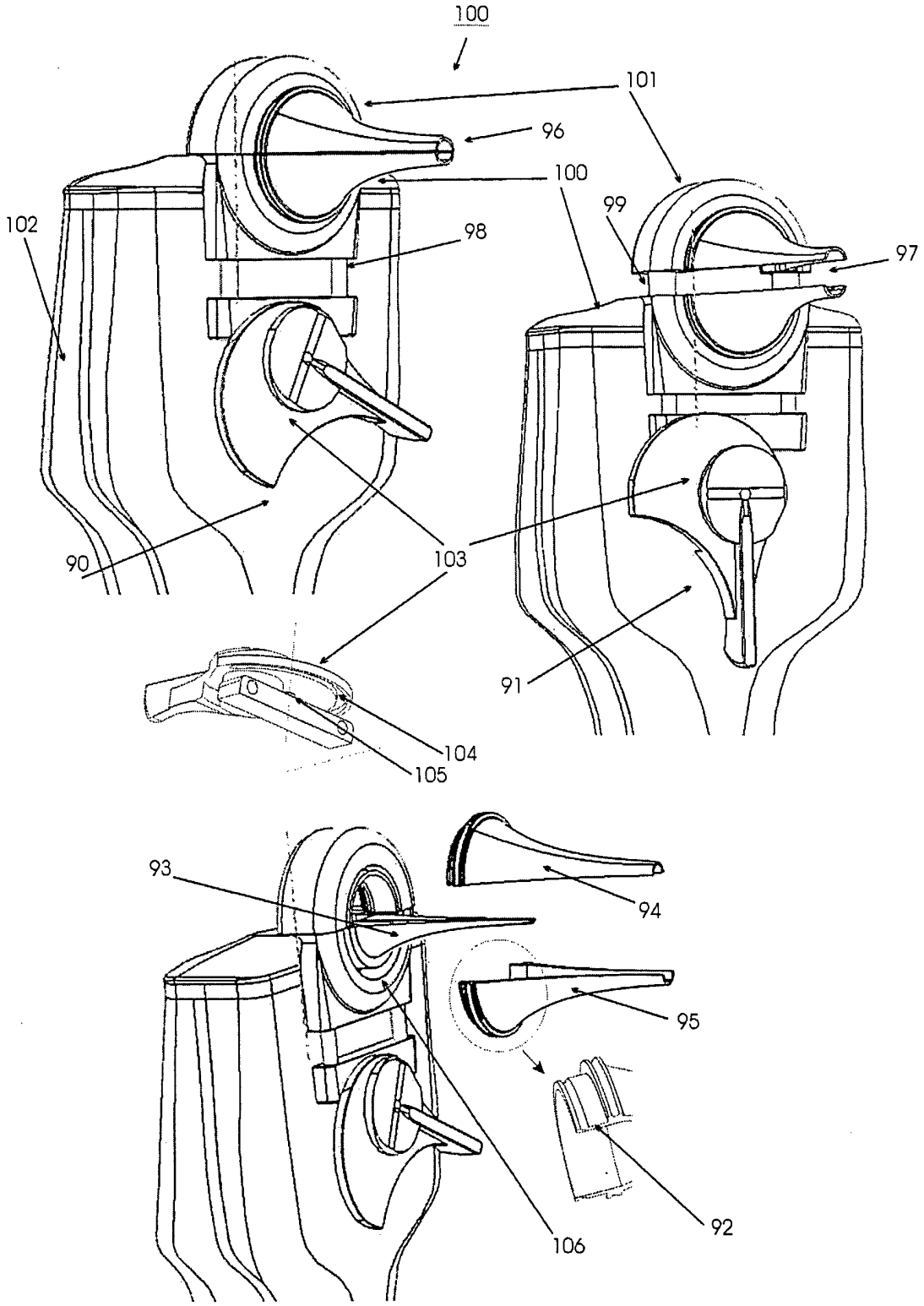

FIG. 2

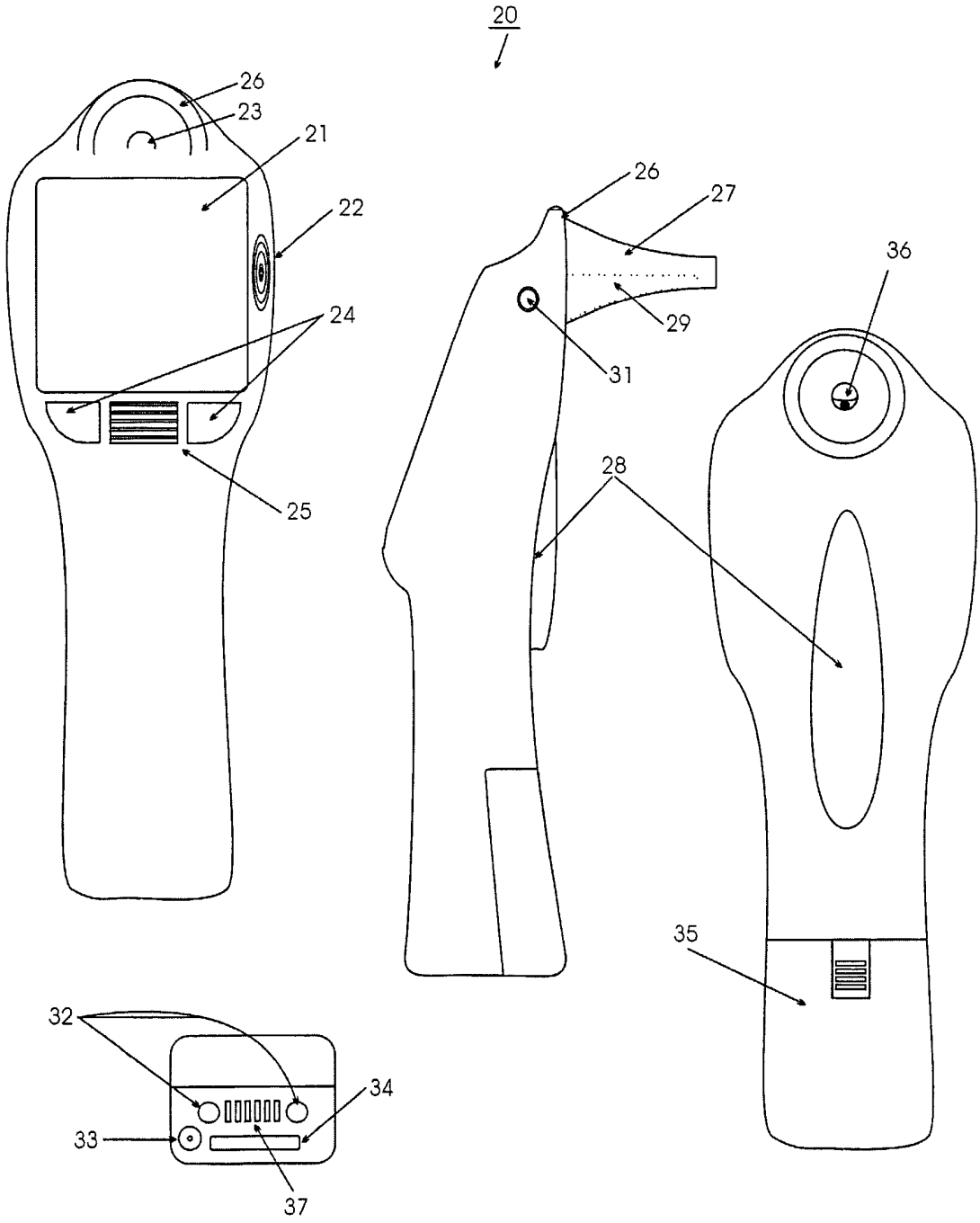

FIG. 3

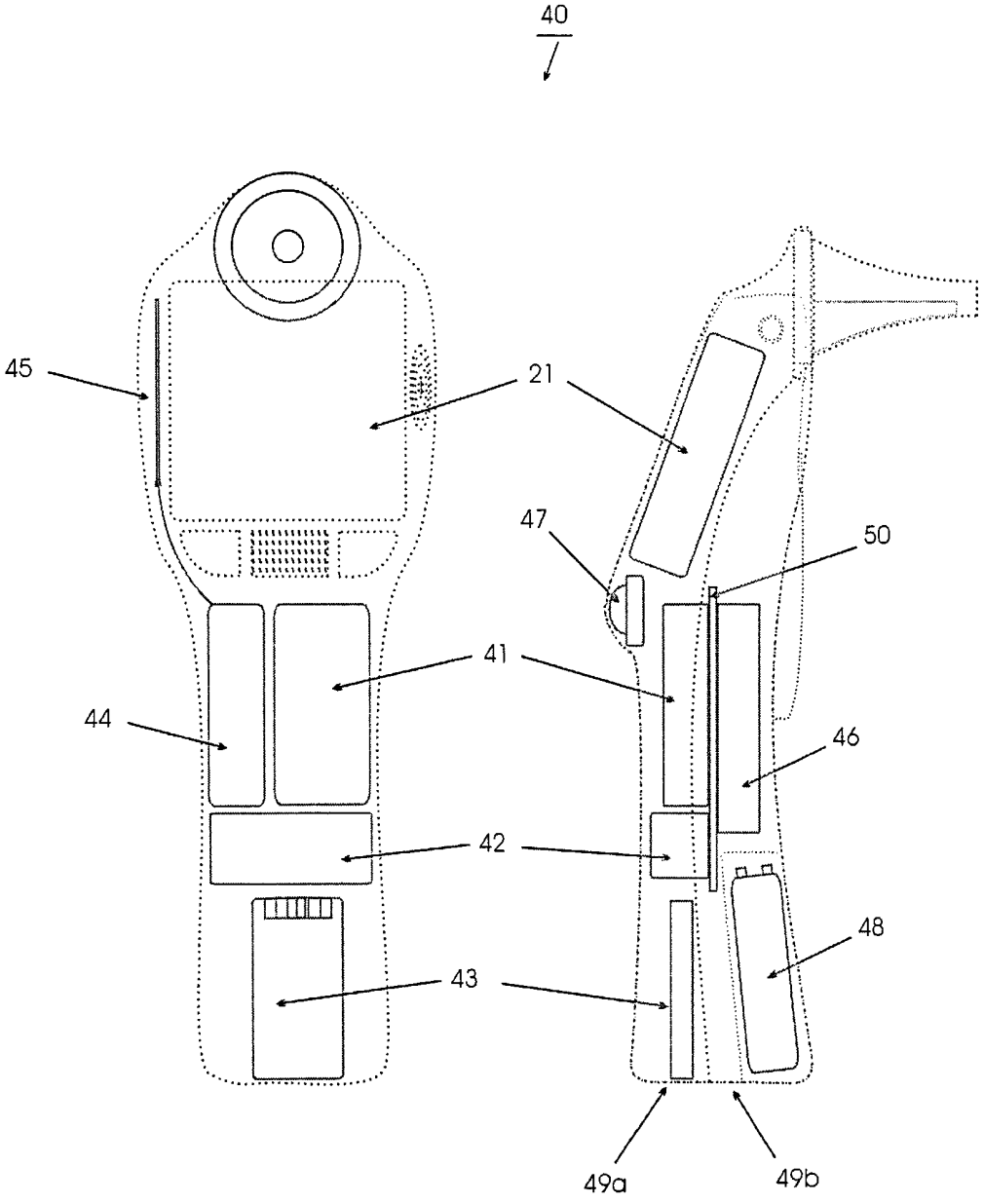

FIG. 4

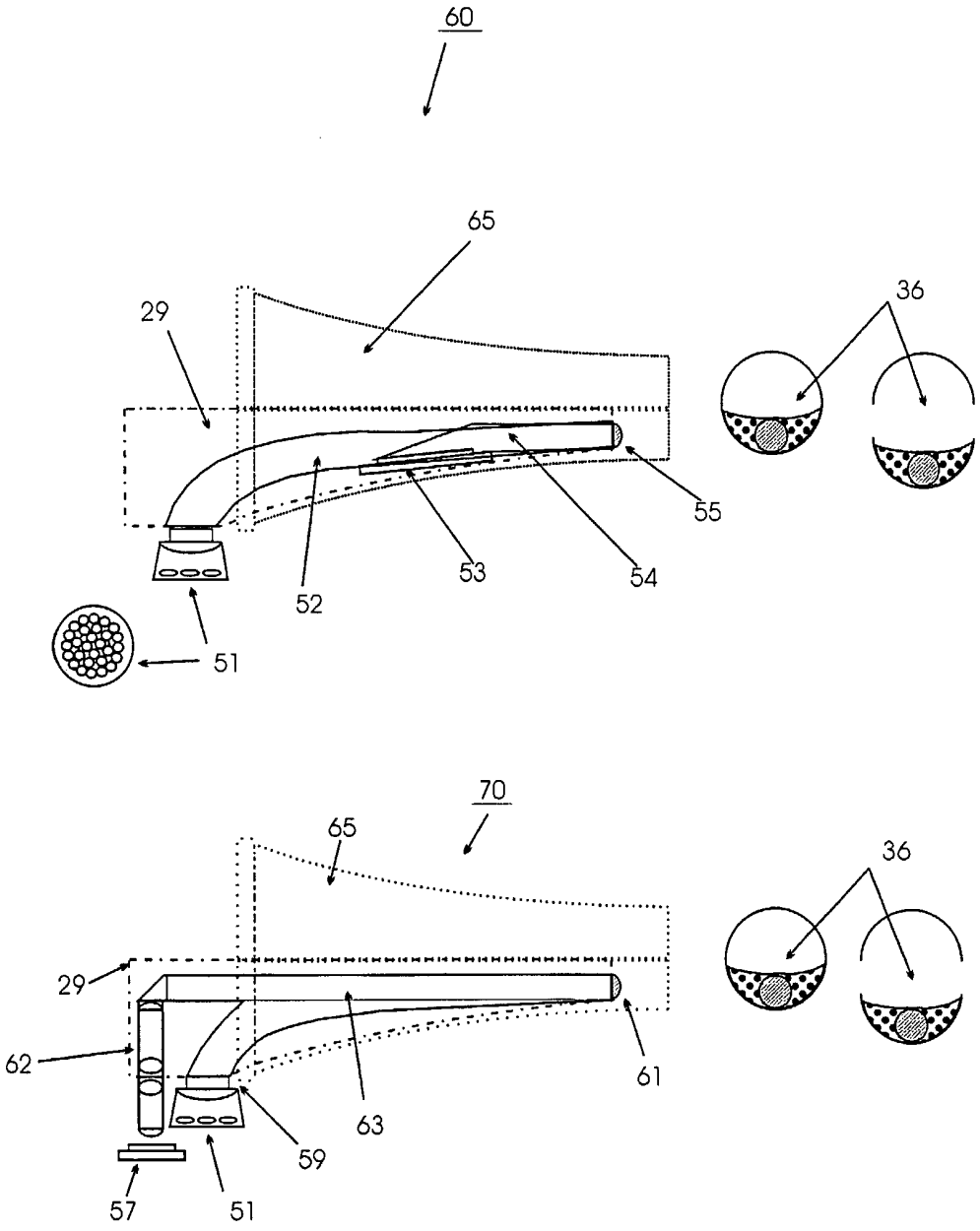

FIG. 5

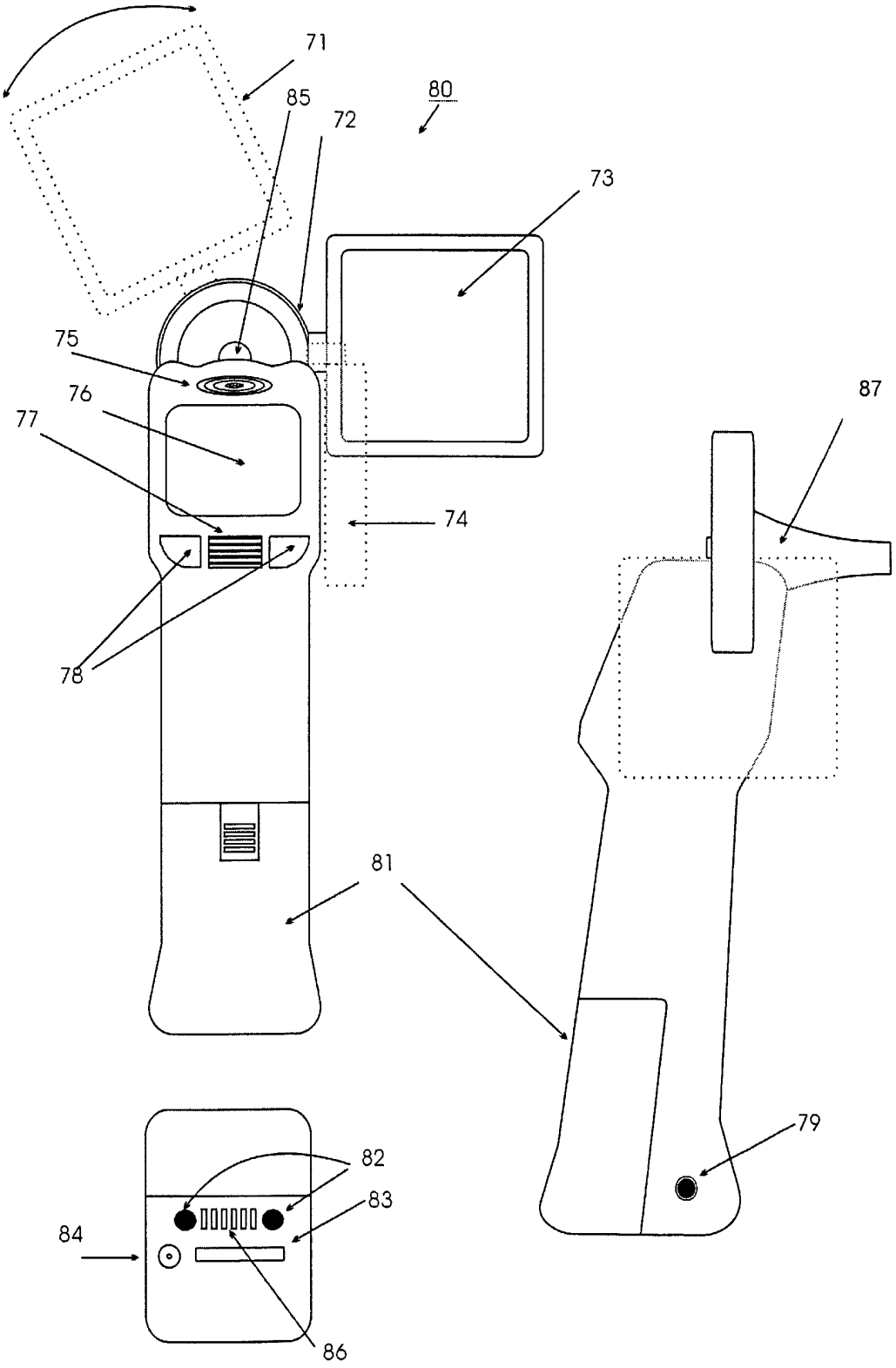

FIG. 6