(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
6 July 2006 (06.07.2006)

PCT

(10) International Publication Number
WO 2006/071948 A2

(51) International Patent Classification: Not classified

(21) International Application Number:
PCT/US2005/047281

(22) International Filing Date:
28 December 2005 (28.12.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/639,451 28 December 2004 (28.12.2004) US

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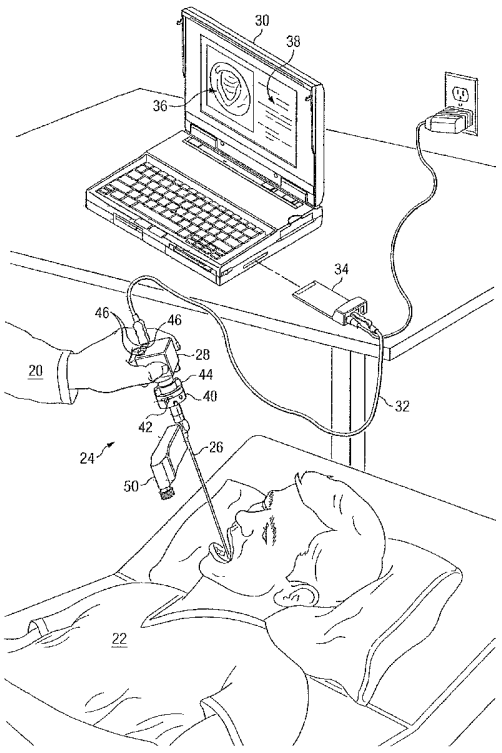
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) **Title:** ENDOSCOPIC IMAGING SYSTEM



(57) **Abstract:** A portable hand-held endoscopy system adapted for interchangeable use with a variety of endoscopes. The system includes an endoscope having a first end and a second end, the first end having an eyepiece and the second end having a viewing end, the endoscope further having a coupler for coupling to a light source; and a battery operated unitary digital camera having an optical input, viewing screen, digital signal processor, memory with embedded software for processing data from the processor and for displaying an image on the viewing screen, and a coupler having a first end and a second end, wherein the first end includes a connector for removably connecting to the eyepiece, and the second end is coupled to the optical input of the digital camera. In one embodiment, an endoscopic imaging system utilizing high speed data transfer and digital technology provides a portable, versatile, and inexpensive system for viewing and recording images of internal organs of the human body. Using a digital camera with high speed data transfer for endoscopic imaging eliminates the need for a camera control unit. An endoscope attaches directly to the camera with no modifications or additional devices required other than an endoscopic image coupler. A high speed data transfer connection cable attaches to the digital camera enabling high speed transfer of the images to a computing device. The digital camera may be equipped with an LCD screen, onboard software, analog output, media storage, and one-touch controls for image enhancement, manipulation, and storage. The digital camera may also be coupled with a personal computing device, wherein a high speed data transfer cable connects the camera directly into a personal computing device. The personal computing device controls the camera and provides a means for viewing, storing, and editing the medical images obtained through the endoscope.

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ENDOSCOPIC IMAGING SYSTEM

Cross-Reference To Related Application

This application claims the benefit of U.S. Provisional Application No. 60/639,451, filed December 28, 2004.

TECHNICAL FIELD

This invention relates generally to endoscopic imaging, and more particularly to an endoscopic imaging system that is adaptable to any endoscope, is less expensive, and is more mobile and portable than the current systems available to physicians.

BACKGROUND OF THE INVENTION

As is well known, various technologies are available to the medical profession for use in viewing and imaging internal organs and systems of the human body. For example, otolaryngologists often require an endoscopic examination of the patient's upper respiratory system. One of the most common tools used by otolaryngologists to view the upper respiratory system is an endoscope. Similarly, endoscopes are used by surgeons and physicians in many fields of medicine in order to view parts of the human body internally for examination, diagnosis, and treatment. Initially, endoscopes included only an eyepiece, through which the physician could view the area being examined and/or treated. However, modernization of medical tools have produced more modern endoscopic systems that include camera assemblies with a camera head attached to the proximal end or eyepiece of the endoscope, typically via a coupler. For example, U.S. Patent No. 4,697,894 issued to Takamura et al and discloses a connection device for connecting an associated unit to an eyepiece section of an endoscope. U.S. Patent No. 4,697,894 is incorporated herein by reference.

Visual documentation is important in medicine, particularly for improved patient care and educational and training purposes. There are several variations of camera systems available to

physicians that attach to the endoscope for imaging what the endoscope is viewing. For still photography a 35mm analog single lens reflex (SLR) camera or a modern digital (SLR and non-SLR) camera can be used. For video photography a camera head, camera control unit, adapters to fit the endoscope onto the camera, and a video system monitor are used for viewing. All methods of endoscopy require a light source for illumination. These systems are commonly used in doctor's offices, emergency rooms, hospital rooms, and operating rooms, but are very expensive, not easily adapted, and not configured to be easily transported between and among multiple locations.

The cameras currently available to medical professionals are not easily configured for endoscopic imaging. A camera control unit is required to control the camera and process the digital or analog image signals received by the camera from the endoscope. Analog images are processed through an analog/digital converter and transmitted as a digital image. Digital images are captured directly to a charged coupled device (CCD) that captures images in pixel format as an electrical charge. This information is then processed with a varying array of filters to produce color images. The images must then be transmitted to a computing device for storage, editing, and further processing of the data.

The camera control unit and accompanying computer and viewing screen are bulky, heavy, and not easily transported to different locations. In addition to the size and transport limitations, the systems currently available can range in cost from $ 10,000 or more for just the camera and camera control unit. In addition to the cost of the camera and camera control unit, the endoscope, and typically a light source must be purchased.

Manufacturers have attempted to produce digital archiving platforms to allow easy integration into the digital age by integrating disc burners and hard drives into the endoscopy units so that exams can be stored directly onto removable media. These alternatives, however, limit editing of the images and are not very dynamic. Other manufacturers have attempted to produce endoscopy units that capture the images directly into a proprietary computer system designed for the specific function of video capturing and archiving. These systems provide better data manipulation, but can cost more than $ 20,000, and thus not affordable for a small or cost-limited practice.

Some alternative systems have been designed with portable components. These portable component systems are smaller in size than the fixed systems, but still require a camera control unit, a monitor, a means for capturing the images, and a light source in addition to the main components of a camera and endoscope. Although these systems are classified as portable, they are heavy, cumbersome, and expensive. U.S. Patent No. 6,432,046 issued to Yarush et al and discloses a hand-held portable camera for producing video images of an object, and has as an object to provide a camera which features a lighting system capable of high-intensity illumination without creating an over abundance of heat. Yarush et al discloses a fixed lens tube which receives a variety of apparently custom probes and, in certain embodiments, further requires one of several adapters to receive certain probes. Additionally, this aforementioned patent is not readily adapted to the standard fittings of the eyepiece of endoscopes used in medical practices.

SUMMARY OF THE INVENTION

The present invention comprises an endoscopic imaging system which overcomes the foregoing and other difficulties. In one embodiment, the present invention provides a portable hand-held endoscopy system adapted for interchangeable use with a variety of endoscopes. The system includes an endoscope having a first end and a second end, the first end having an eyepiece and the second end having a viewing end, a battery operated digital camera having an optical input, viewing screen, digital signal processor and memory with embedded software for processing data from the processor and for displaying an image on the viewing screen, and a coupler having a first end and a second end, wherein the first end includes a connector for removably connecting to the eyepiece, and the second end includes a connector for coupling to the optical input of the digital camera.

In another embodiment, the system may not include the viewing screen. Alternatively, or in addition, the system may include features to provide a high speed digital data transfer protocol port for coupling to an external device, such as a personal computing device.

In another embodiment, the present invention provides a portable hand-held endoscopy system adapted for interchangeable use with a variety of endoscopes. The system having an endoscope having a first end and a second end, the first end having an eyepiece and the second

end having a viewing end. The system further comprising a battery operated unitary digital camera having an optical input, viewing screen, digital signal processor, memory with embedded software for processing data from the processor and for displaying an image on the viewing screen, and a coupler located at the distal end of the camera for removably connecting to the eyepiece of an endoscope.

In another embodiment, the distal end of the endoscope may include a charge coupled device or similar device for obtaining the image. The output of the CCD is coupled to the camera.

In accordance with the more specific aspects of the present invention, one embodiment includes a high speed data transfer component (IEEE 1394, USB and similar methods), which connects directly to the camera for sending signals from the camera to a personal computing device, removable data storage card and/or onboard mini hard-drive or flash memory and onboard controls, enabling more detailed camera control and image manipulation. Another embodiment of the present invention comprises a digital camera equipped with an LCD or similar screen for viewing the images, embedded software and one-touch controls for enhancing, manipulating and editing the images, and a media storage card for storing the images.

The invention described herein requires only a limited number of components, providing physicians with a portable, versatile, and less expensive system for endoscopic examinations and recording the images thereof. The system is easily transported to multiple locations, enabling healthcare providers greater versatility in the applications of endoscopic examinations and flexibility of the locations at which they examine patients. In addition to cost savings and flexibility, the high speed data transfer technology facilitates higher speed, lower cost data translation and manipulation, enhancing and expanding the quality of visual documentation generated without the need for special or costly computer systems.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the present invention may be had by reference to the following Detailed Description when taken in connection with the accompanying Drawings.

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FIGURE 1 is a perspective view illustrating one embodiment of the present invention in use.

FIGURE 2 is a perspective view of another embodiment of the present invention.

FIGURE 3 is perspective view of yet another embodiment of the present invention.

FIGURE 4 is perspective view of yet another embodiment of the present invention.

FIGURE 5 is a perspective view of another embodiment wherein a camera and coupler are provided as a unitary component, and includes a viewing screen.

FIGURE 6 is a perspective view of another embodiment wherein a camera and coupler are provided as a unitary component, and includes a high speed data transfer port.

FIGURE 7 is a perspective view of another embodiment wherein a camera and coupler are provided as a unitary component, and includes a swivel orientation adjuster

FIGURE 8 shows the camera unit of Figure 7 but with the camera unit adjusted to different orientation.

FIGURE 9 is a perspective view of another embodiment wherein a camera and coupler are provided as a unitary component, including a movable viewing screen and a swivel orientation adjuster.

FIGURE 10 and 11 are perspective views of a further embodiment wherein a camera and coupler are provided as a unitary component, including a swivel orientation adjuster.

FIGURE 12 is a schematic of one embodiment of the unitary component.

FIGURE 13 is a functional block diagram of one embodiment of the present invention.

FIGURE 14 is a schematic of one embodiment of the present invention with the charge coupled device at the distal end of the endoscope.

DETAILED DESCRIPTION

Referring to the Drawings, and particularly to FIGURES 1 and 2 thereof, there is shown an endoscopic imaging system comprising a first embodiment of the invention. Referring specifically to FIGURE 1, a physician 20 is shown performing an endoscopic examination of a patient 22 using an endoscopic imaging system 24. An endoscope 26 is inserted into the patient 22. The images seen by the endoscope 26 are received into a portable endoscopic digital camera 28 capable of high speed data transfer and then transmitted to a computer 30 by means of a high speed data transfer connection cable 32, for example a USB cable. The cable 32 connects into a multifunctional interface card 34, which also supplies power to the camera 28. Alternately, the high speed data transfer connection cable can connect directly to a computer or similar computing device without a multifunctional interface card if said high speed data transfer connection is built into the computing device. Examples of the high speed data transfer consistent with the present invention include various protocols such as IEEE 1394, USB, BLUETOOTH and 802ll.b (or similar wireless technology). As a further alternative, the camera 28 may be battery operated. The computer 30 enables the physician 20 to control the camera 28 and further manipulate the data received during the examination. The endoscopic images 36 are displayed on a computer screen 38. The computer screen 38 may either be an on-board screen on a notebook style computer, or an independent monitor networked with the computer 30, or a desktop workstation computer.

Referring specifically to FIGURE 2, there is shown an enlarged view of the endoscopic imaging system 24 shown in FIGURE 1. The endoscope 26 of FIGURE 1 is constructed of a rigid material such as stainless steel, or other materials approved for use in medical applications. The endoscope 52 shown in FIGURE 2 is constructed from a flexible material approved for use in medical applications. The endoscope 52 is coupled to a portable endoscopic digital camera 28 capable of high speed data transfer by a coupler 40. In one embodiment, the coupler 40 includes a standard C or C/S coupler and is equipped with a locking mechanism 42 which holds the endoscope 26 or 52 securely onto the camera 28. Alternately, there is no C or C/S coupler. The coupler 40 receives the images from the endoscope 52. The coupler 40 includes at least one lens assembly that moves to focus the image onto a transducer or other similar device internal to the camera 28. Additionally, the image coupler allows for zooming and magnification of the

images. The coupler 40 couples to the camera 28 and a focus ring 44. The focus ring 44 assists the physician to focus the image to obtain a clearer, better quality image.

In one embodiment, the portable endoscopic digital camera 28 capable of high speed data transfer uses a single charged coupled device (CCD) (described further below) as the image acquisition device, together with a high speed data transfer input/output ports 46. Depending on the camera mode selected by the user at the computer 30, the portable endoscopic digital camera 28 transmits the images to the computer 30 where the images are viewed and stored. A digital camera, based on IEEE 1394 or the like, for use with the endoscopic imaging system 24 may also be equipped with a triple charged coupled device (CCD) and have multiple high speed data transfer input/output ports 46. The multiple high speed ports are beneficial because the additional throughput desired with the triple CCD. Additionally, the portable endoscopic digital camera capable of high speed data transfer may also be equipped with complimentary metal oxide semiconductors (CMOS) for image acquisition. The embodiment shown in FIGURES 1 and 2 include a light source 50 coupled to the endoscope 26, 52 and coupler 40. The light source 50 provides additional lighting for a better view of the area being examined by the endoscope 52. The light source 50 shown is battery operated. However, the light source may be operated by an external power source. Alternatively, an external light source and light guide cable may be provided as the light source. Still further, certain endoscopes are equipped with a light source.

Referring now to FIGURE 3, there is shown an endoscopic imaging system 60 comprising a second embodiment of the invention. Many of the component parts of the endoscopic imaging system 60 are substantially identical in construction and function to component parts of the endoscopic imaging system 24 illustrated in FIGURES 1 and 2 and described hereinabove in conjunction therewith. Such identical component parts are designated in FIGURE 3 with the same reference numerals utilized above in the description of the endoscopic imaging system 24, but are differentiated there from by means of a prime (') designation.

The endoscopic imaging system 60 differs from the endoscopic imaging system 24 of FIGURES 1 and 2 in that the endoscopic imaging system 60 includes a camera 28' with an on-board LCD screen 64 and on-board one-touch camera controls with embedded software for

manipulating, enhancing, and adjusting the data. It will be appreciated that the screen may be an LCD screen, LED screen or any other similar monitor. Installed into the camera 28' is embedded memory in the form of a mini hard-drive or flash memory and/or a digital media storage card which stores the images from the endoscopic examination until the camera 28' can be downloaded into a personal computing device through the high speed connection cable 32'. Such memory is described further below.

Referring now to FIGURE 4, there is shown an endoscopic imaging system 70 comprising another embodiment of the invention. Many of the component parts of the endoscopic imaging system 70 are substantially identical in construction and function to component parts of the endoscopic imaging system 24 illustrated in FIGURES 1 and 2 and described hereinabove in conjunction therewith. Such identical component parts are designated in FIGURE 4 with the same reference numerals utilized above in the description of the endoscopic imaging system 24, but are differentiated there from by means of a prime (' ') designation.

The endoscopic imaging system 70 differs from the endoscopic imaging system 24 of FIGURES 1 and 2 in that the endoscopic imaging system 70 is equipped with a hand-held personal computing device 72. The hand-held personal computing device 72 may be an iPod® as manufactured by Apple Computer, Palm Pilot™, or other similar personal computing devices known to those skilled in the art.

FIGURE 5 is a perspective view of another embodiment wherein a camera 28''' and coupler 40''' are provided as a unitary component, including a viewing screen 64'''. The viewing screen may be a liquid crystal display (LCD) or thin film transistor (TFT) screen. The viewing screen is mounted to the unitary camera unit via a swivel pivot point hinge 80. The camera unit includes user input controls82 (a,b,c) for manipulating, enhancing and adjusting data, via embedded software. The unitary camera unit also includes an endoscope coupler 40''' for coupling to an endoscope such as that shown in FIGURE 1-4. In addition, the unitary camera unit includes a focus ring 44 and a zoom ring 84 so that the physician may adjust the image for display on the viewing screen. However, the function of focus and zoom may also be accomplished via the embedded software and the user input controls 82. A slot 86 is provided for

connection of a removable flash memory card (see FIGURE 15). The removable flash memory card allows the data to be transferred to another device in order to view or store the data, as desired.

FIGURE 6 is a perspective view of another embodiment wherein a camera 28''' and coupler 40''' are provided as a unitary component, including a high speed data transfer port 46 (not seen in FIGURE 6). The high speed data transfer port 46 allows connection to the various external devices as noted above, such as a handheld PC device.

FIGURE 7 is a perspective view of another embodiment wherein a camera 28'''' and coupler 40'''' are provided as a unitary component, including a swivel orientation adjuster or elbow joint 90. The swivel orientation adjuster 90, in one embodiment, is a series of one or more sleeves 92 having a certain profile such that twisting or rotating the camera unit allows the camera unit to assume various orientations, such as the one shown in FIGURE 7 and in FIGURE 8.

FIGURE 9 is a perspective view of another embodiment wherein a camera 28'''' and coupler 40'''' are provided as a unitary component, including a hinged coupled flip viewing screen 64'''' and a swivel orientation adjuster 90. It will be appreciated from FIGURE 9 that the handle or camera body 94 assumes one orientation with respect to the coupler portion 40'''' and the flip viewing screen 64'''' assumes another and independent orientation with respect to the coupler portion.

FIGURES 10 and 11 show a variation of the adjuster 90. In this instance, the camera body 94 is coupled to an extension portion 96 at a pivot point which includes a pin 98. The camera body 94 includes a plurality of recesses 99 which receive a detent or pawl 100 to lock the body 94 and extension portion 96 in position. FIGURE 10 shows an in-line orientation, wherein FIGURE 11 shows an offset orientation of 90 degrees.

FIGURE 12 is a schematic of one embodiment of the unitary component. The endoscope coupler 40 is shown adjacent to the focus ring 44 which is adjacent to the zoom ring 84. The zoom ring 84 is adjacent to the image ring 102. The elbow joint 90 is shown connected to the body 94. The distal end of the body 94 of the camera unit contains the optical lens mechanism

108 which accommodates the focus and zoom functions, in order to direct the image onto the CCD or CMOS chip 110. The chip 110 is connected to the input of an analog-to-digital converter 112 via the ribbon wire 114. The output of the A/D converter 112 is coupled to a digital signal processor/ camera processor 120. The user input controls 82 are coupled to the processor 120, or alternatively to a controller 122 such as shown in FIGURE 13. The proximal end of the body 94 also includes a battery 124 and a connector 126 for external DC. The proximal end of the body 94 also includes an I/O high speed data transfer port 128 and a connector 86 for a removable flash memory card 130 (see FIGURE 13). The body 94 also includes on board flash memory 132. Finally, a wireless radio transceiver 134 is shown for wireless downloading of data and wireless control of the camera unit. A power on peg 136 is shown. The power on peg 136 includes a switch 138 (see FIGURE 13) which is coupled to the controller 122. The memory 132 includes a code for a sleep mode and power up routine, or similar battery saving features. The unit is normally in a sleep mode as one skilled in the art will appreciate. Upon the coupler 40 engaging an endoscope, the power on peg 136 is engaged and the power up routine is initiated. As is shown, ribbon wire 114 or other conductors extend within the elbow joint 90 from the distal coupler end to proximal body.

FIGURE 13 is a functional block diagram of one embodiment of the present invention. The image acquisition device 140 may be an CCD chip 110, for example. The high speed data transfer port 142 is shown coupled to the on board screen 64 and the port 128 for connection to an external device. An analog output 144, such as audio S, is provided for coupling to an external device.

FIGURE 14 is a functional block diagram of one embodiment of the present invention with the charge coupled device 150 or other image acquisition device at the distal end of the endoscope. Conductors 152 are coupled to the device 150 and extend within the endoscope. The coupler 40 includes an electrical and mechanical connector 154 for coupling to an electrical and mechanical connector 156 having the ribbon connector wire 114. The electrical and mechanical connector 154 is also adapted for coupling to the endoscope and the conductors 152. For example, the connector 154 may include a portion connected to the endoscope and a portion connected to the coupler 40. The system of FIGURE 14 is otherwise similar to that shown in FIGURE 12.

Although preferred embodiments of the invention have been illustrated in the accompanying Drawings and described in the foregoing Detailed Description, it will be understood that the invention is not limited to the embodiments disclosed, but is capable of numerous rearrangements, modifications, and substitutions of parts and elements without departing from the spirit of the invention. For example, it is also anticipated that the viewing screen on the camera may be a commercially available twin LCD display having a backlight and a system LSI (large-scale integrated circuit) chip between two LCD screens, allowing both sides of the display to work at the same time. Further, the system may include an audio input for accommodating stroboscopic analysis.

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CLAIMS

1. A portable hand-held endoscopy system adapted for interchangeable use with a variety of endoscopes, comprising:

an endoscope having a first end and a second end, the first end having an eyepiece and the second end having a viewing end;

a battery operated digital camera having an optical input, viewing screen, digital signal processor and memory with embedded software for processing data from the processor and for displaying an image on the viewing screen ; and

a coupler having a first end and a second end, wherein the first end includes a connector for removably connecting to the eyepiece, and the second end includes a connector for coupling to the optical input of the digital camera.

2. The system according to claim 1 wherein the endoscope is selected from the group consisting of flexible endoscopes and rigid endoscopes.

3. The system according to claim 1 wherein the coupler includes an adjustable portion which is adjustable between a first position and a second position, wherein the first position aligns the digital camera in-line with the endoscope, and wherein the second position aligns the digital camera in an angular arrangement with respect to the endoscope.

4. The system according to claim 1, wherein the first end of the coupler includes a power switch button extending outwardly, whereby coupling an endoscope to the first end depressing the button and initiates a power up mode via the embedded software.

5. The system according to claim 1 wherein the digital camera is equipped with at least one removable digital media storage card for storing data thereon.

6 The system according to claim 1 wherein the digital camera is equipped with on board memory for data storage.

7. The system according to claim 1, further comprising means for tagging images and data for relational cataloging during image and data transfer to an archiving system (local or remote) , or electronic health record, and includes embedded normal reference video and images/data for teaching and review.

8. The system according to claim 1 wherein the digital camera is equipped with high speed digital data transfer protocol input/output port, whereby the port may be coupled to any one of a variety of devices, such as a personal computer, a tablet personal computer, and storage media, and wherein the high speed data transfer protocol port is capable of providing live image data transmission and store/forward capability

9. The system according to claim 1 wherein the digital camera produces an analog output coupled to an output connector, whereby the analog output is capable of being coupled to an external device such as an S-video connector of a monitor.

10. The system according to claim 1 wherein the digital camera includes a wireless high speed data transfer input/output interface, whereby data from the processor may be coupled to an external device such as a laptop.

11. The system according to claim 1 further comprising a focus ring coupled to the coupling means for facilitation of more focused, better quality images.

12. The system according to claim 1 further comprising a zoom ring coupled to the coupling means for facilitation of enlarging images.

13. The system according to claim 1 wherein the digital camera includes memory with embedded software and user controls for manipulating, enhancing, and adjusting data.

14. The system according to claim 1, further comprising means for providing one-finger, electrical focus control, and means for providing one-finger, electrical zoom control.

15. The system of claim 1, further comprising a foot pedal, connected from one of the group consisting of wireless and wire connection, the foot pedal having means for controlling data manipulation and image acquisition.

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16. The system according to claim 1 wherein the digital camera is equipped with a single charged coupled device.

17. The system according to claim 1 wherein the digital camera is equipped with a complimentary metal oxide semiconductor (CMOS) chip.

18. The system according to claim 1 wherein the digital camera is equipped with a triple charged coupled device.

19. The system according to claim 1 wherein the viewing screen is selected from the group consisting of an LCD and LED viewing screen for viewing images directly thereon.

20. The system according to claim 19, wherein the viewing screen is removable and pivotally mounted to the digital camera.

21. The system according to claim 19, wherein the viewing screen includes a front viewing side and a rear viewing side, and further, the viewing screen provides a transparent display which may be viewed from either the front or rear viewing side.

22. The system according to claim 1 wherein the endoscope includes a coupler for coupling to a light source for increased illumination of an area being examined using the endoscope, and the light source is a battery operated light source.

23. The system according to claim 1 wherein the endoscope includes a coupler for coupling to a light source for increased illumination of an area being examined using the endoscope, and the light source is a remote powered light source.

24. The system according to claim 1, wherein a system power supply may be provided by either batteries or a DC power supply.

25. The system according to claim 1, further comprising means for stroboscopic analysis of an area being examined.

26. The system according to claim 1, further comprising means for attaching a high fidelity microphone and means for attaching a high fidelity laryngeal stethoscope.

27. A portable hand-held endoscopy system comprising:

an endoscope having a first end and a second end, the first end having an eyepiece and the second end having a viewing end;

a digital camera having a lens portion and a high speed data transfer protocol and port;

a coupler having a first end and a second end, wherein the first end includes a connector for removably connecting to the eyepiece, and the second end includes a connector for coupling to the lens portion of the digital camera;

a personal computing device for manipulating and storing data, the device having a high speed data transfer protocol and port; and

a high speed data transfer cable coupled between the digital camera and the personal computing device for transmitting data between the digital camera and the personal computing device.

28. The system according to claim 27 wherein the endoscope includes a coupler for coupling to a light source, and further comprising a light source coupled to the endoscope for increased illumination of an area being examined using the endoscope.

29. The system according to claim 27 further comprising a focus ring for enhanced image quality coupled between the coupling means and the digital camera.

30. The system according to claim 27 further comprising a zoom ring coupled to the coupling means for facilitation enlarging images.

31. The system according to claim 27 wherein the digital camera is equipped with embedded software and controls for manipulating, enhancing, and adjusting data.

32. The system according to claim 27 wherein the digital camera is equipped with a viewing screen, and wherein the viewing screen is selected from the group consisting of an LCD screen and an LED screen.

33. The system according to claim 27 wherein the digital camera is equipped with at least one removable digital media storage card for storing data thereon.

34. The system according to claim 27 wherein the digital camera is equipped with on board memory for data storage (Flash memory or mini-hard drive).

35. The system according to claim 27 wherein the personal computing device is a portable notebook style computer.

36. The system according to claim 27 wherein the personal computing device is personal hand-held computing device.

37. The system according to claim 27 wherein the digital camera is equipped with a single charged coupled device.

38. The system according to claim 27 wherein the digital camera is equipped with a complimentary metal oxide semiconductor (CMOS) chip.

39. The system according to claim 27 wherein the digital camera is equipped with a triple charged coupled device.

40. The system according to claim 27 wherein the digital camera is a battery operated digital camera.

41. The system according to claim 27 wherein the digital camera includes an interface for an external power source, such as through an external PC device.

42. A portable hand-held endoscopy system adapted for interchangeable use with a variety of endoscopes, comprising:

an endoscope having a first end and a second end, the first end having an eyepiece and the second end having a viewing end; and

a battery operated unitary digital camera having an optical input, viewing screen, digital signal processor, memory with embedded software for processing data from the processor and

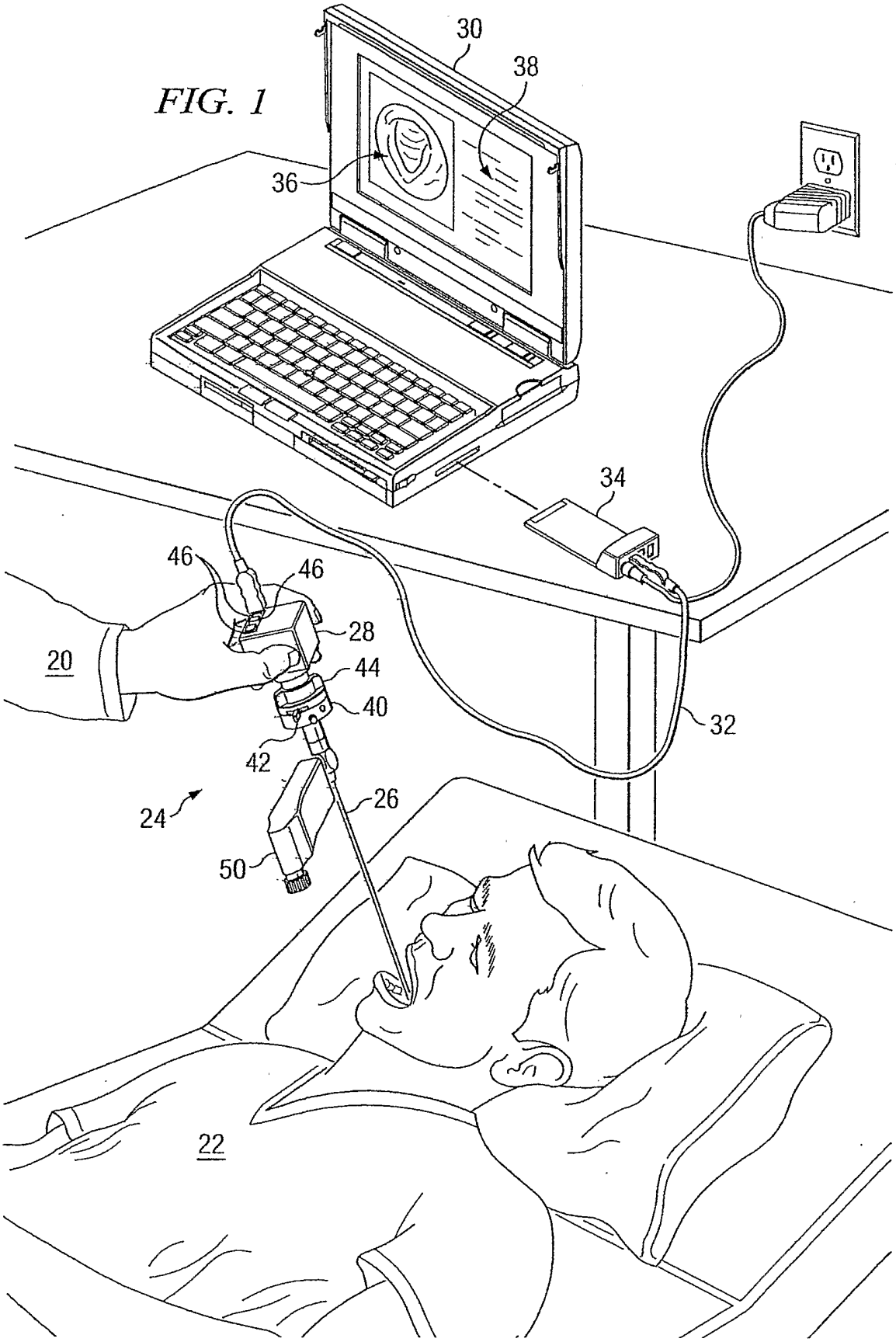
for displaying an image on the viewing screen, and a coupler located at the distal end of the camera for removably connecting to the eyepiece of an endoscope.

43. A portable hand-held endoscopy system adapted for interchangeable use with a variety of endoscopes, comprising:

an endoscope having a first end and a second end, an electrical connector located at the first end, a device for receiving optical images located at the second end and having an output, the endoscope having conductors extending through the endoscope, the conductors having a first end and a second end, the first end of the conductors coupled to the output of the device and the second end connected to the electrical connector; and

a battery operated digital camera having an electrical connector, an analog-to-digital converter having an input and an output, the converter input coupled to the electrical connector, a digital signal processor having an input coupled to the output of the A/D converter, memory with embedded software for processing data from the processor and for providing a high speed digital data, and a coupler having a first end and a second end, wherein the coupler first end is adapted for removably connecting to the endoscope first end and for removably connecting the camera electrical connector to the endoscope electrical connector, and the coupler second end is coupled to the digital camera.

FIG. 1



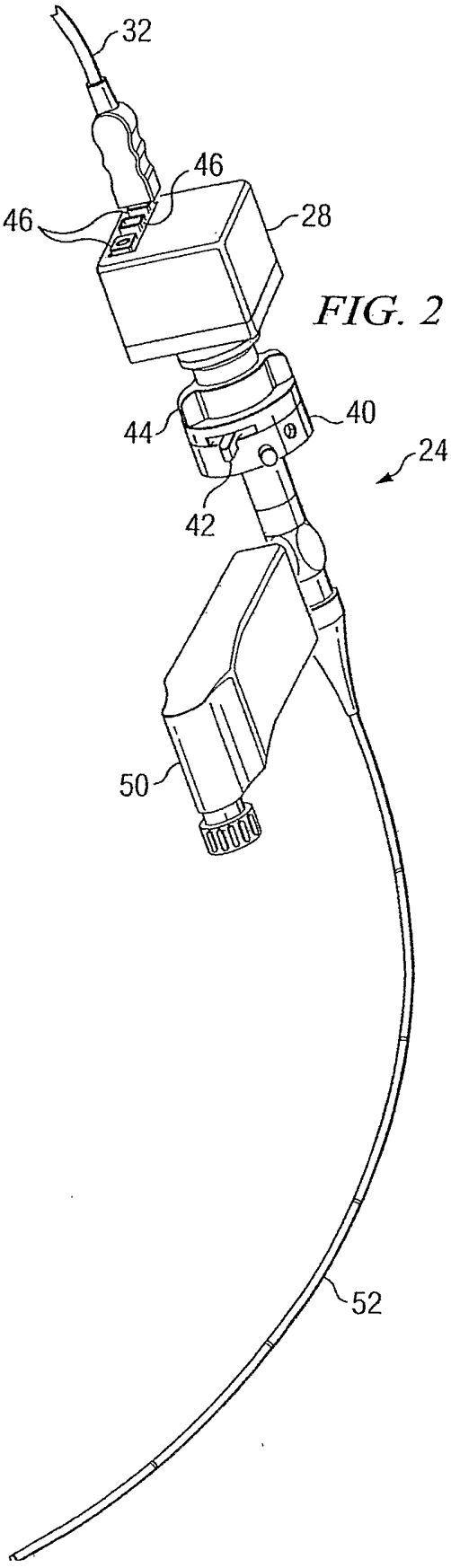


FIG. 2

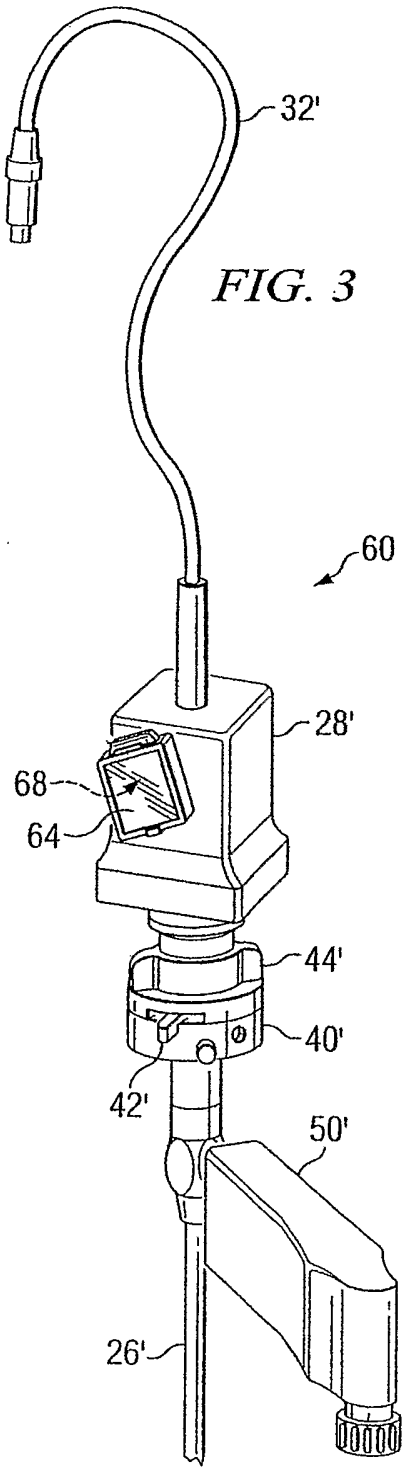


FIG. 3

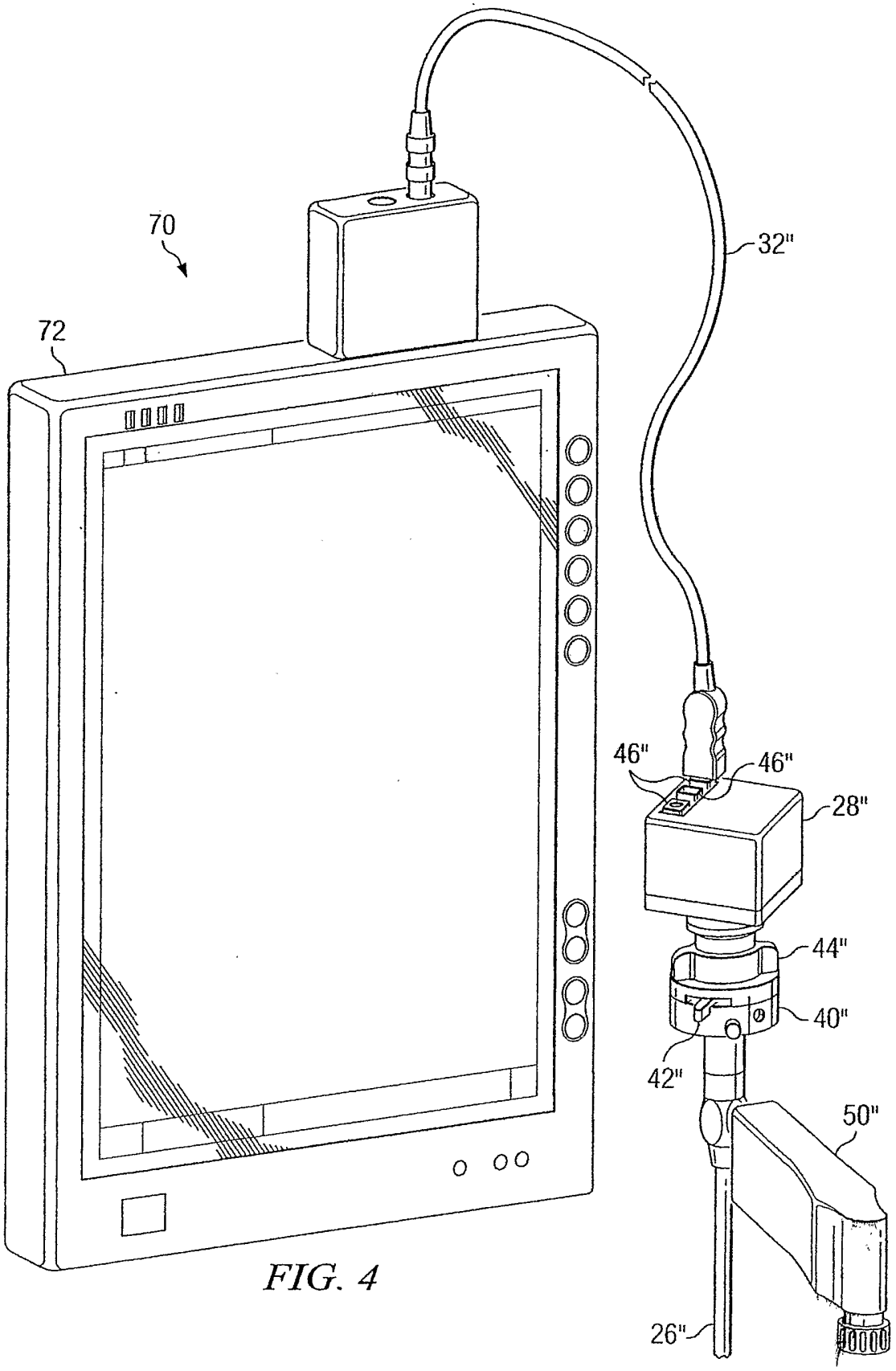


FIG. 4

Figure 5

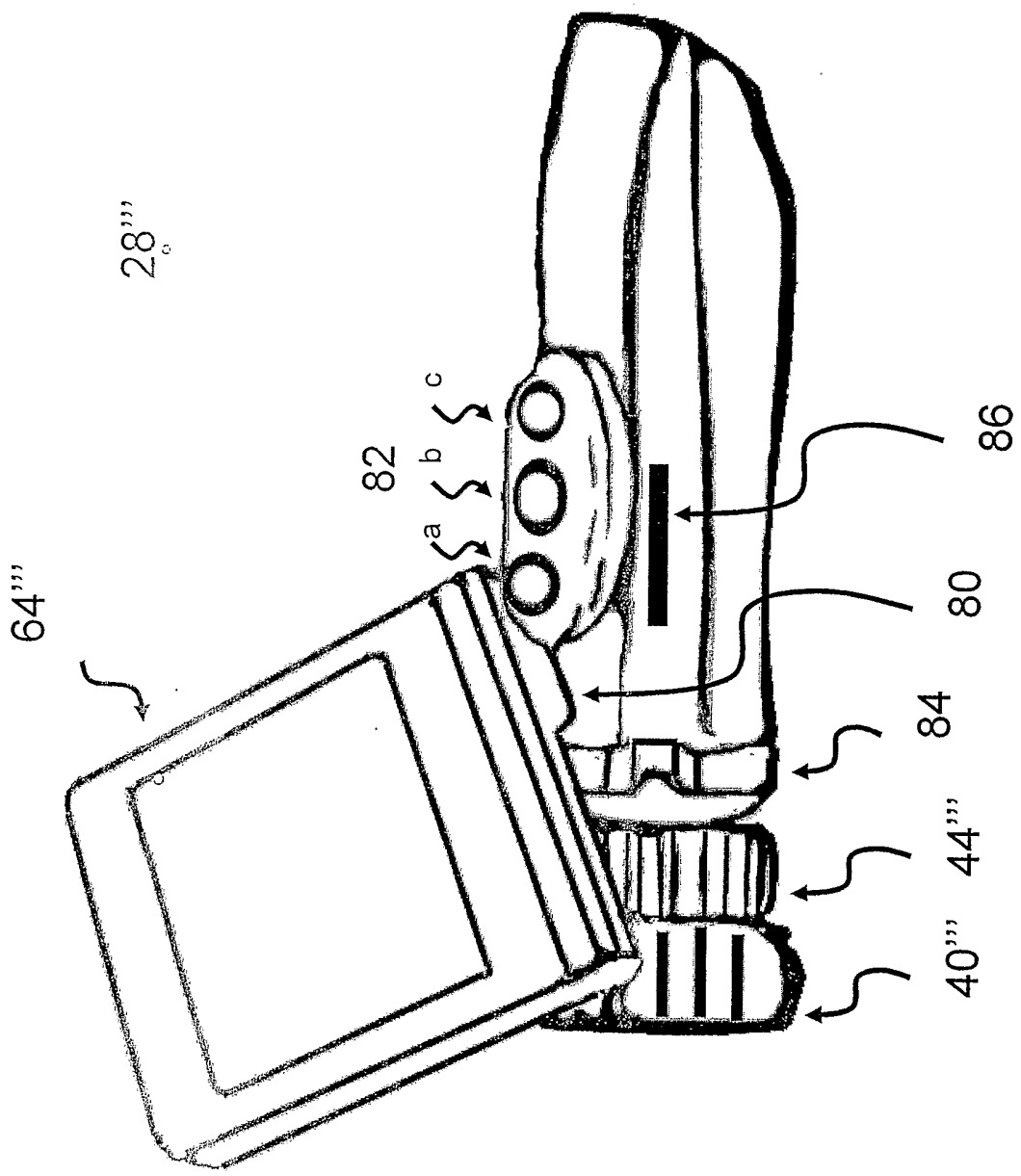


Figure 6

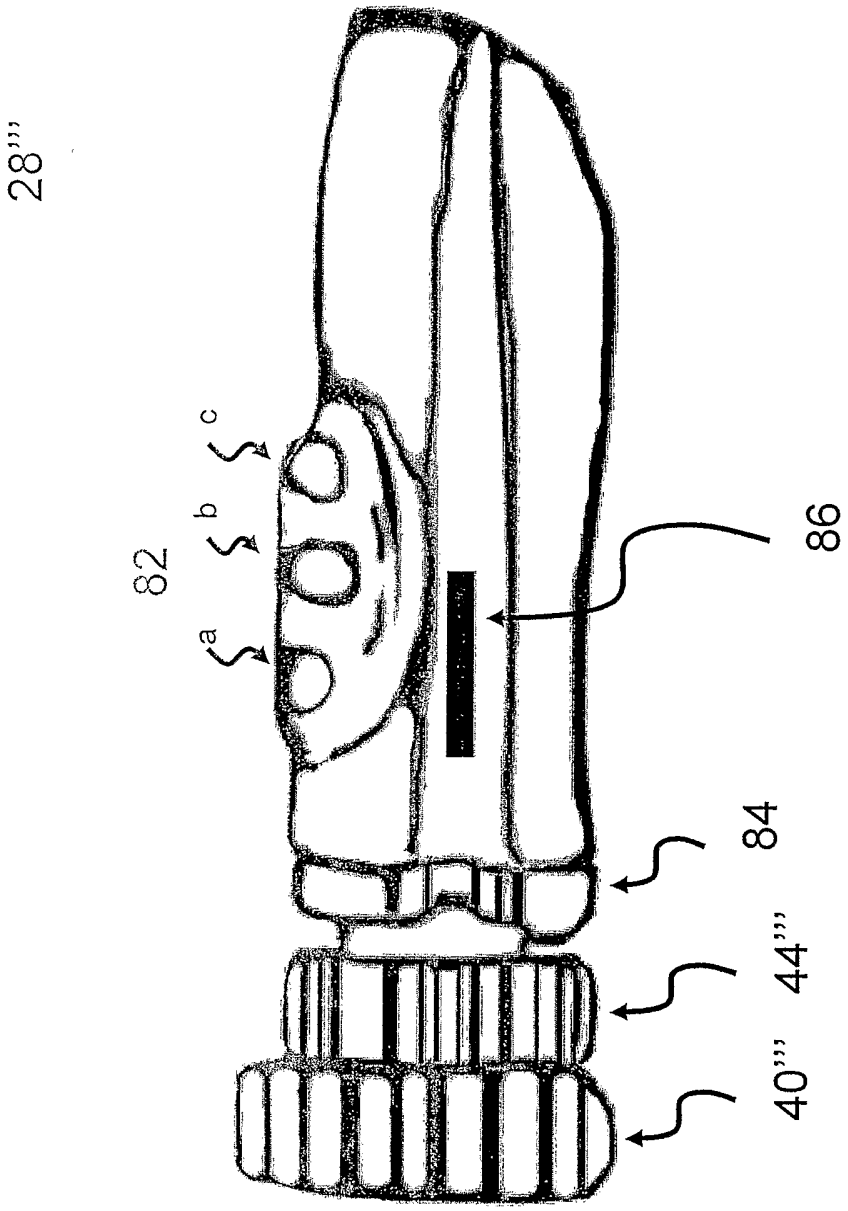


Figure 7

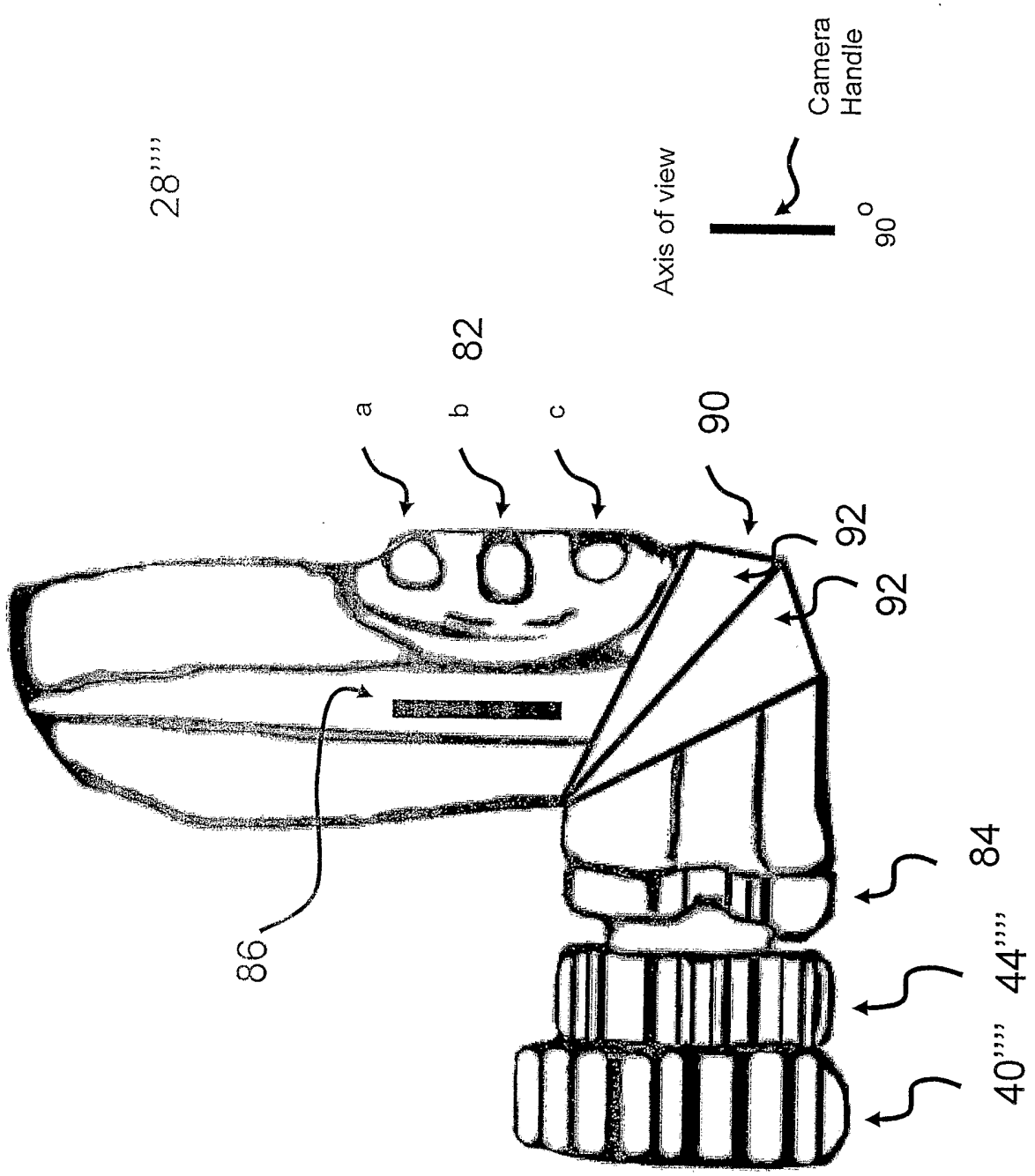
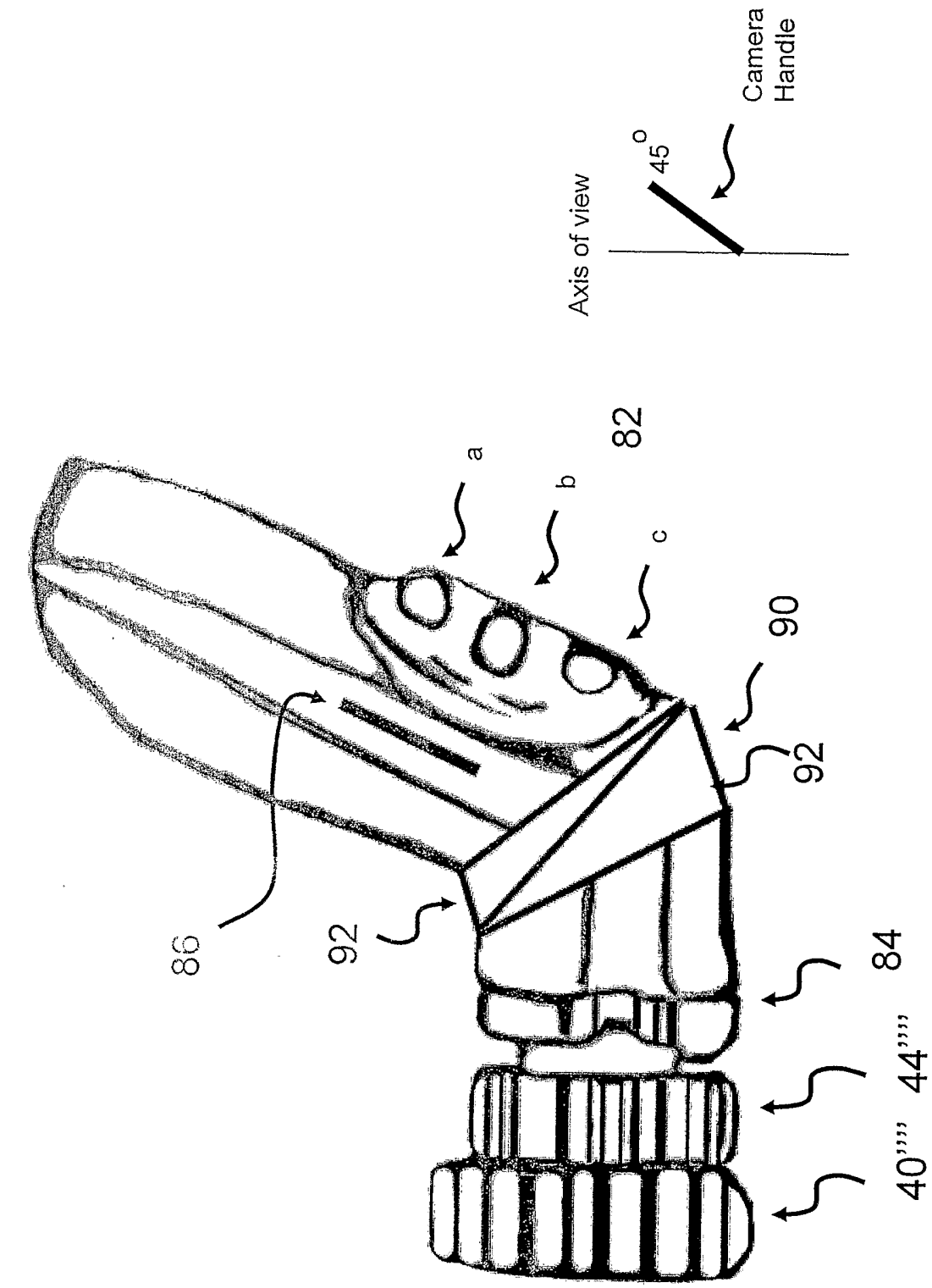


Figure 8



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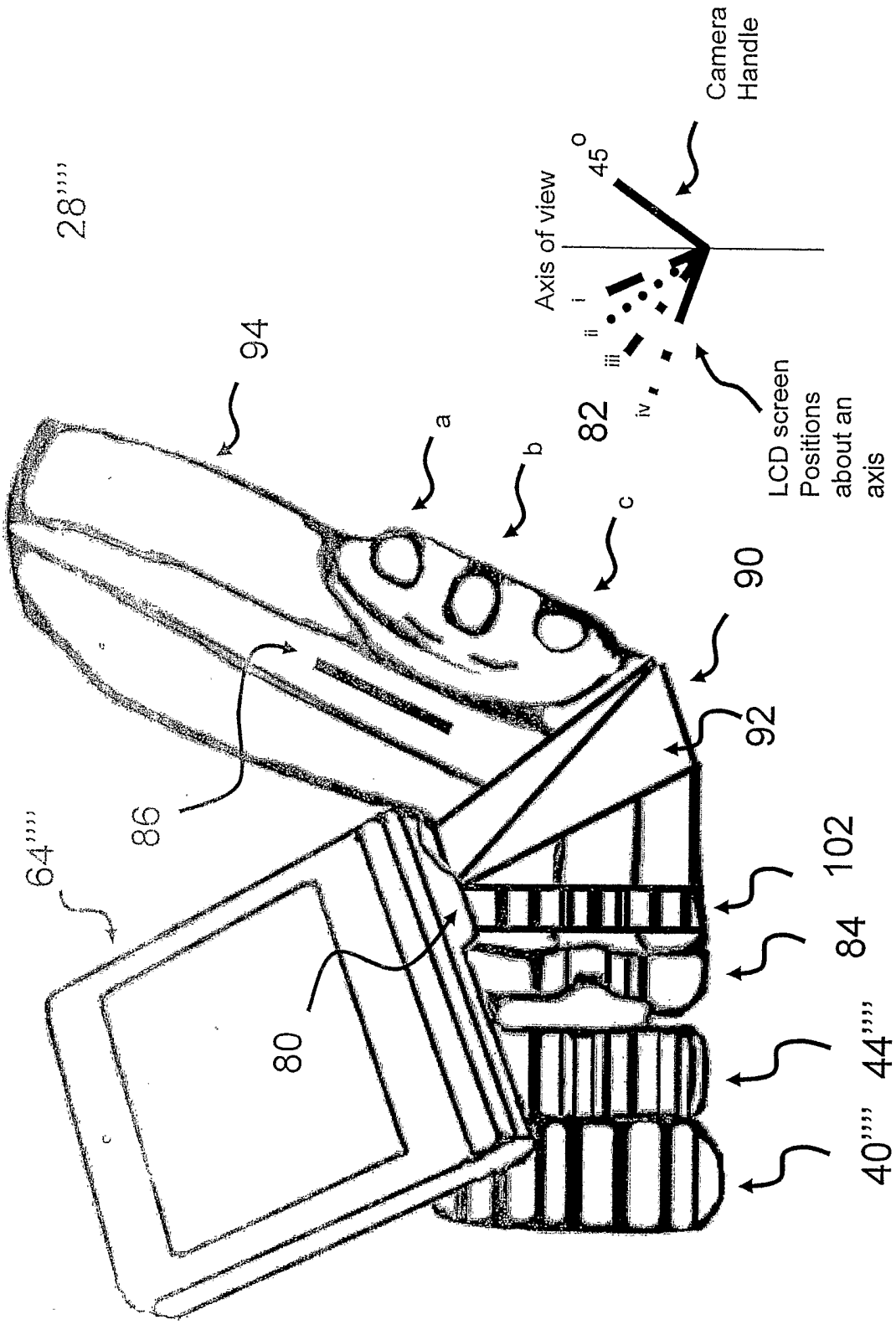

28''''
94
a
b
c
82
i
ii
iii
iv
Axis of view
45°
Camera Handle
LCD screen Positions about an axis
90
92
86
64''''
80
102
84
44''''
40''''

Figure 11

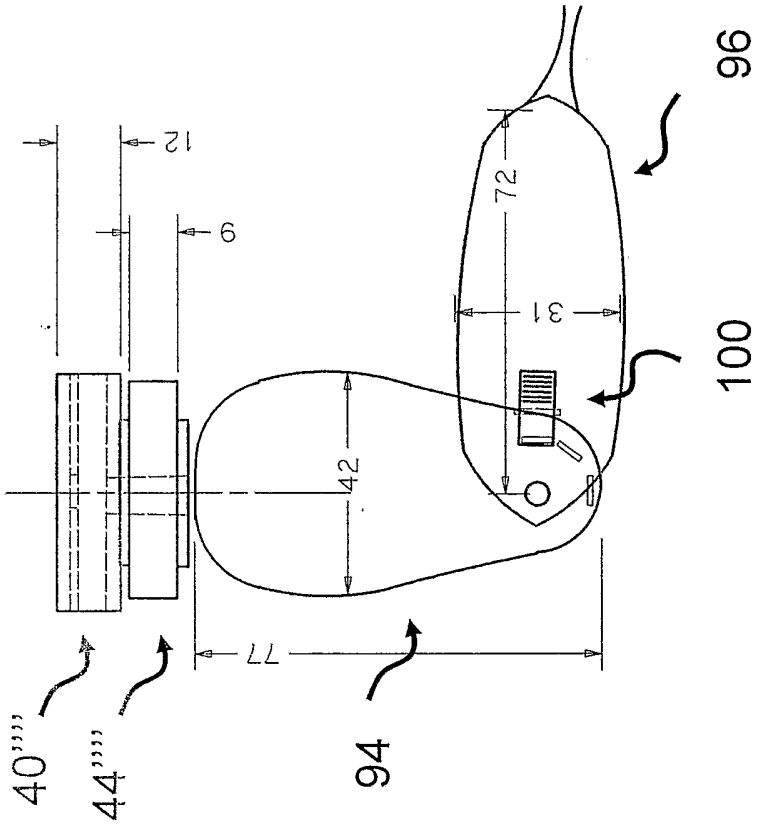


Figure 10

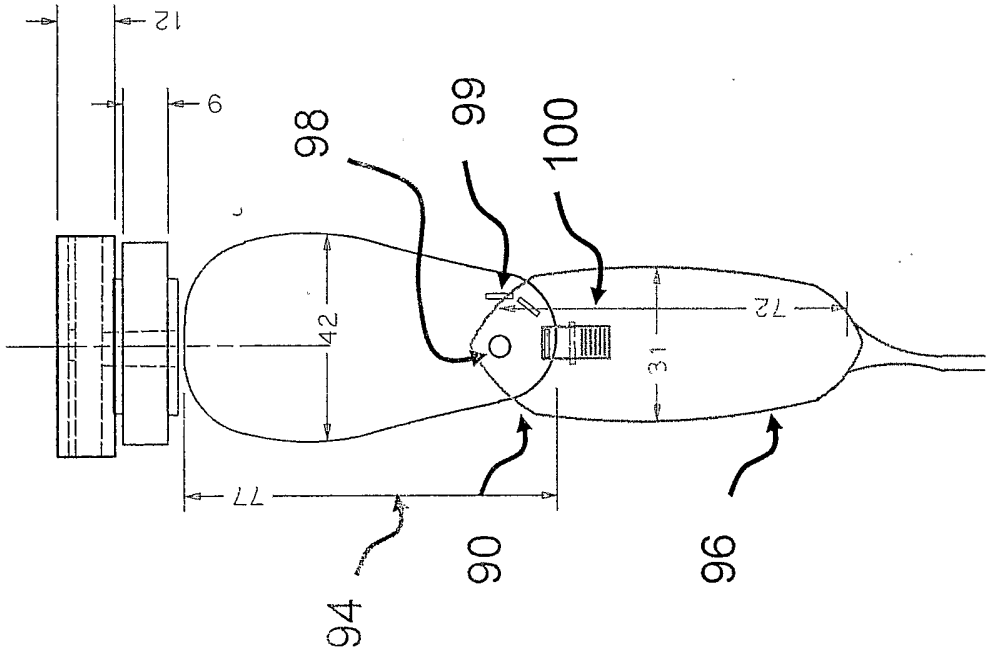
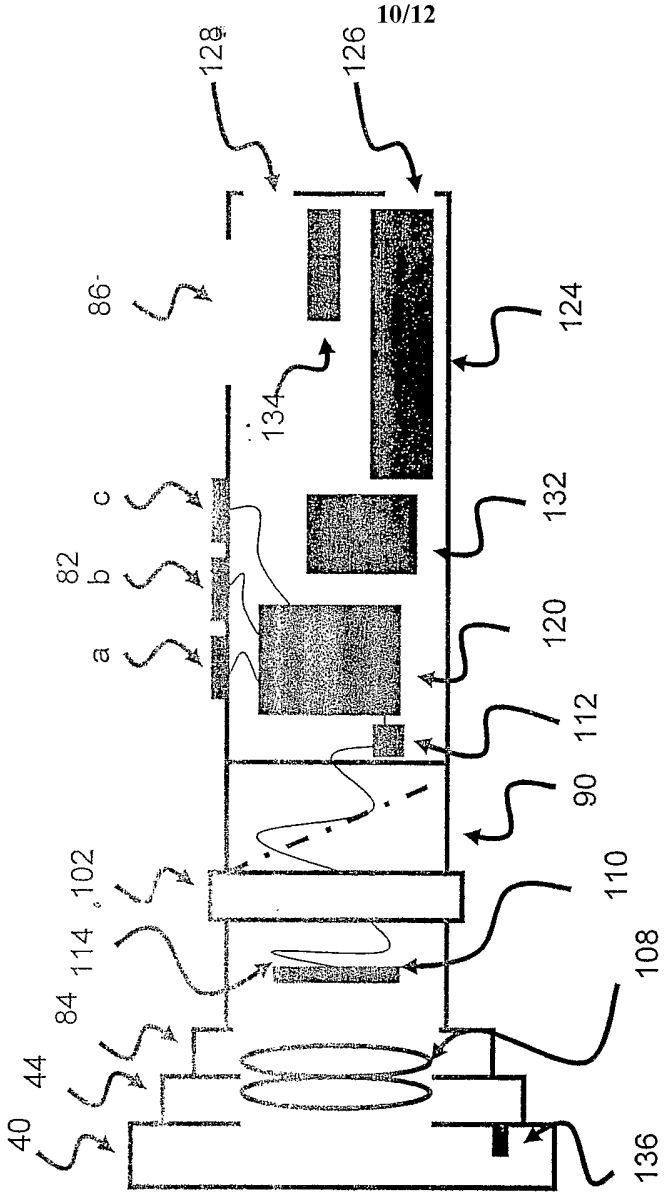


Figure 12


128
126
86
124
134
132
c
b
a
82
120
112
90
102
110
114
108
84
44
40
136

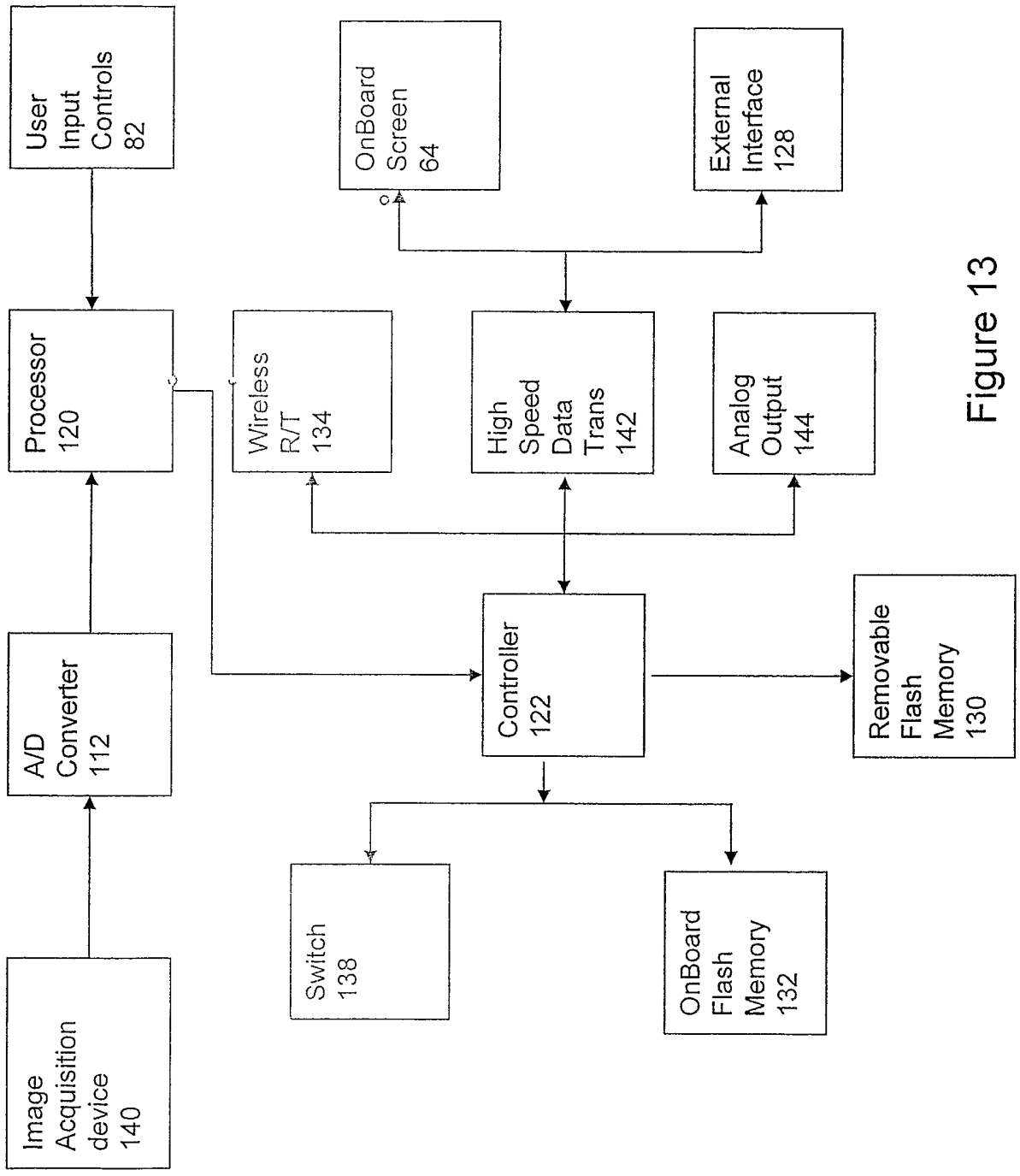
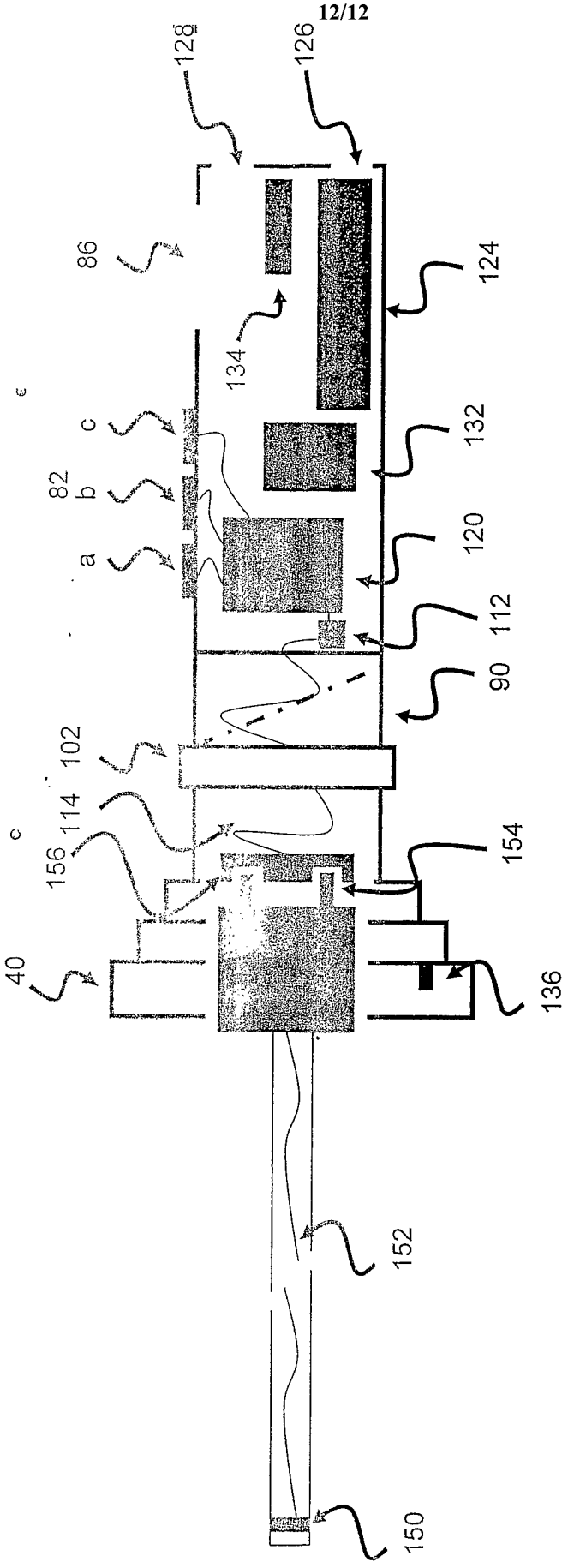

User Input Controls 82
OnBoard Screen 64
External Interface 128
Processor 120
Wireless R/T 134
High Speed Data Trans 142
Analog Output 144
A/D Converter 112
Controller 122
Removable Flash Memory 130
Switch 138
OnBoard Flash Memory 132
Image Acquisition device 140

Figure 13

Figure 14


128
126
86
124
134
132
c
b
a
82
120
112
90
102
114
156
154
40
136
152
150