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(54) Title: MULTI-USE ELECTRONIC DEVICE FOR USE WITH AN ENDOSCOPE

(57) Abstract: A system for coupling and transmitting data taken at a distal end of an endoscope to a non-dedicated multi-use electronic device (e.g., a mobile camera telephone). The system includes an element for holding a multi-use electronic device relative to a proximal end of the endoscope and an adapter between the proximal end of the endoscope and the multi-use electronic device to transfer data (e.g., an image) from the distal end of the endoscope into the multi-use electronic device.



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MULTI-USE ELECTRONIC DEVICE FOR USE WITH AN ENDOSCOPE**Field of the Invention**

[0001] The invention generally relates to multi-use electronic devices, such as a mobile camera telephone or a personal digital assistant (PDA), used in combination with an endoscope. In particular, the invention relates to a system for transferring data (e.g., images) from an endoscope to a multi-use electronic device.

Background of the Invention

[0002] Endoscopes are devices used for viewing a region of an object that has limited access (e.g., inside a human being or animal, inside a pipe, inside an engine). In general, endoscopes include an endoscope body having a distal or viewing end and a proximal or analyzing/control end. An endoscope operator can position the distal end of the endoscope in an area of interest remotely by actuating controls on the proximal end of the endoscope. Once in position, the operator can gather data, such as images or temperature readings, from the distal end. This data is transmitted through the endoscope to the proximal end where the operator is located for analysis.

[0003] To see and review images captured at the distal end, conventional endoscopes include an eyepiece or a video camera disposed on the proximal end of the endoscope. The eyepiece and/or video camera are dedicated equipment and thus are only used in combination with the endoscope.

The dedicated eyepieces and video cameras are typically expensive and serve no other purpose than to view endoscopic images.

Summary of the Invention

[0004] In general, in one aspect, the present invention features an endoscope system which does not include a dedicated eyepiece or video camera, but rather incorporates a portable multi-use electronic device to capture and transmit data at the proximal end of the endoscope. Specifically, the system includes a multi-use electronic device and a cradle or other holder that holds and orients a camera within the multi-use electronic device in optical alignment with the proximal end of the

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endoscope. An adapter, such as a coupling lens system or a USB connector, couples the proximal end of endoscope with the multi-use electronic device so that data can be transferred between the endoscope and the multi-use electronic device. In some embodiments, after the camera within the multi-use electronic device captures still or video images, the operator can then use the multi-use
5 electronic device to transmit (e.g., wirelessly) those images to a second location, such as, for example, to another electronic multi-use electronic device.

[0005] In another aspect, the invention features a system for an endoscope. The system includes an element for holding a multi-use electronic device (e.g., a mobile camera telephone, a PDA with a camera) relative to a proximal end of the endoscope and an adapter between the
10 proximal end and the multi-use electronic device to transfer data (e.g., an image) from the distal end of the endoscope into the multi-use electronic device.

[0006] Embodiments of the invention can include one or more of the following features. The element for holding the multi-use electronic device can be a rigid holder or a cradle connected to the proximal end of the endoscope. The adapter of the system can comprise a coupling lens
15 system. In certain embodiments, the adapter can include an electronic data connector, such as for example, a USB connector or serial connector. The adapter can be disposed within the holder or cradle. Alternatively or additively, the adapter can be disposed within the proximal end of the endoscope.

[0007] In another aspect, the invention features an endoscope system including an
20 endoscope including a distal end and a proximal end free of a dedicated eyepiece or dedicated video camera, an energy source for emitting a signal transmitted about the distal end of the endoscope, and an adapter for coupling the proximal end of the endoscope to a multi-use electronic device, such as, for example, a mobile camera telephone.

[0008] Embodiments of the invention can include one or more of the following features.

25 The endoscope system can further include the multi-use electronic device, such as a mobile camera telephone, or a PDA. The endoscope of the system can include a rigid endoscope shaft disposed between the distal and proximal ends. Alternatively, the endoscope of the system can include a flexible shaft. The endoscope can include one or more lenses for transmission of data from the distal end to the proximal end. Alternatively or additionally, the endoscope can include one or more
30 fiber optic or copper cables for transmission of data from the distal end to the proximal end of the

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endoscope. The adapter of the system can include a coupling lens system. The adapter of the system can include a USB connector. The adapter can be disposed in the holder. Alternatively or additionally, the adapter can be included in the proximal end of the endoscope. In certain embodiments, the energy source in the endoscope system is a light source and the data captured are one or more images. In other embodiments, the data captured by the multi-use electronic device includes at least one of the following: sound, temperature, vibration, eddy current, ultrasound, and mapping coordinates.

[0009] In another aspect, the invention features a method of capturing an image with an endoscope system. The method includes connecting a mobile camera telephone to an endoscope, illuminating an object at a distal end of the endoscope, and activating a camera within the mobile telephone to display and/or capture the image. In some embodiments, the method can further include transmitting the captured image from the camera to a processing unit or other multi-use electronic device. The image may be transmitted over the internet or it may be transmitted wirelessly, such as for example using Bluetooth technology.

[0010] In another aspect, the invention features an endoscope. The endoscope includes a body having a distal end and a proximal end, and an adapter for transmitting data to a multi-use electronic device. The adapter of the endoscope is disposed about the proximal end of the endoscope.

[0011] Embodiments of the invention can include one or more of the following features. The multi-use electronic device used with the endoscope can include a mobile camera telephone. In certain embodiments, the multi-use electronic device includes a PDA with a camera. In some embodiments, the adapter includes coupling lens system. In certain embodiments, the adapter includes an electronic data connector, such as for example, a USB connector or a serial connector.

[0012] In general, the endoscope system capable of connection and data transmission to a multi-use electronic device can include one or more of the following advantages. The multi-use electronic device can capture many different types of data from the endoscope. For example, the multi-use electronic device can capture images, sound, ultrasound, GPS coordinates, and temperature. As a result, this one device (i.e., multi-use electronic device) replaces multiple single-use dedicated devices, thereby decreasing the complexity of the system and providing a low cost alternative to expensive dedicated equipment. In addition to capturing data, the multi-use electronic

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device can store data and transmit data to a second location. As a result, the multi-use electronic device provides an efficient and reliable system of storing and transmitting data from the distal end of the endoscope. Further, the multi-use electronic device can include a monitor/video display, thereby obviating the need for additional displays and monitors to be connected to the endoscope.

5 [0013] In addition to the advantages described above, the multi-use electronic device can be used to perform other tasks and methods not associated with an endoscope. For example, the multi-use electronic device can be a mobile camera telephone. As a result, the multi-use electronic device can be used to place and receive calls even when separated from the endoscope. Thus, the multi-use electronic device provides the user with greater utility than dedicated equipment, which can only be
10 used in connection with the endoscope.

Brief Description of the Drawings

[0014] The foregoing and other aspects, features, and advantages of the invention, as well as the invention itself, will be more fully understood from the following illustrative description, when
15 read together with the accompanying drawings which are not necessarily to scale.

[0015] FIG. 1A is a side view of a system for use with an endoscope in accordance with one embodiment of the invention.

[0016] FIG. 1B is a front view of the system of FIG. 1A without an attached endoscope and energy source.

20 [0017] FIG. 2A is a side view of a portion of the system shown in FIG. 1A.

[0018] FIG. 2B is a side view of a portion of a system for use with an endoscope in accordance with another embodiment of the invention.

[0019] FIG. 3 is a side view of a portion of a system for use with an endoscope in accordance with further embodiment of the invention.

25

Description

[0020] The present invention provides devices, systems, and methods for capturing data from an endoscope (i.e., medical endoscope, industrial endoscope). Specifically, the devices, systems and methods described herein provide a low cost, efficient, and reliable means of data
30 capturing, storage, and transmission using a multi-use (i.e., non-dedicated) electronic device, such

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as, for example, a video telephone, a mobile camera telephone, a PDA with a camera, or a portable video player.

[0021] Current multi-use electronic devices are portable and can be used for purposes not associated with endoscopic data collection, storage, and/or transmission. As a result, these devices are cost effective and provide more utility and value than dedicated single-use equipment, such as an eyepiece or a video camera. Moreover, multi-use electronic devices can capture both still and video images, sound, GPS coordinates, and other digital information. Some multi-use electronic devices can capture ultrasonic, temperature, vibration, and/or eddy current information. The data captured by these multi-use electronic devices can be stored on the multi-use electronic devices themselves and/or transmitted to other devices via the internet or wirelessly (e.g., through use of Bluetooth technology). The captured data, in some embodiments, can be sent to a second location away from the point of image capture, such as, for example, a command center, a central office, or to a remote location via the internet without the use of a personal computer.

[0022] Devices, systems and methods of the present invention do not use conventional, dedicated eyepieces and/or dedicated video cameras. Rather, the devices, systems and methods described herein include an adapter to couple the proximal end of an endoscope to a multi-use electronic device. Data sampled from an area of interest (i.e., the location of the distal end of the endoscope) is transmitted through the endoscope to the proximal end using traditional means (e.g., lenses, fiber optics, electrical cables). The adapter allows the data at the proximal end to efficiently and effectively be transferred to the multi-use electronic device. For example, in one embodiment, the adapter is disposed within a cradle that holds a mobile camera telephone. The cradle orients the endoscope's proximal end with respect to the phone's camera detector (e.g., CCD or CMOS sensor) so that the camera's detector and the proximal end are in optical alignment. As a result, images taken at the distal end of the endoscope and transmitted to the proximal end can be transferred to the camera in the mobile phone. These images are displayed on the phone's viewfinder and can be captured as still images or video images.

[0023] FIGS. 1A and 1B illustrate an embodiment of a system 10 used to couple a multi-use electronic device 15, such as, for example, a mobile camera telephone 20 to an endoscope 25. The system includes an element to hold or a holder 30 for the multi-use electronic device 15 and an adapter 35 to couple a proximal end 40 of the endoscope 25 to the multi-use electronic device 15. In

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this embodiment, the adapter 35 is a coupling lens system disposed within the holder 30. The coupling lens system 35 transfers an image of the environment surrounding the distal end 42 of the endoscope and transmitted to the proximal end 40 to an image sensor in the camera 20. (Energy source 44 supplies a high intensity light to illuminate the area of interest 48 surrounding the distal end 42.) The coupling lens system 35 conditions the image data transmitted through the endoscope 25 to produce a collimated output, which the human eye and a video camera focused at infinity can utilize. As a result, the image of the environment about the distal end 42 of the endoscope is efficiently and accurately transferred to the multi-use electronic device 15, which displays the image on its view screen 46.

[0024] Once the image is transferred to the camera 20 of the multi-use electronic device 15, the image can be captured as a still image or as a video image. An endoscope operator after capturing the image can decide whether or not to save the image on the multi-use electronic device 15 or discard the image using the available technology on the multi-use electronic device 15. In addition, the endoscope operator can transmit the images captured by the camera 20 to remote locations wirelessly (e.g., via Bluetooth technology) or by connecting the multi-use electronic device 15 to the internet.

[0025] The coupling lens system 35 conditions the image data from the endoscope 25 to a form that can be accommodated by the multi-use electronic device 15. Referring to FIG. 2A, in some embodiments, the coupling lens system 35 is a dedicated optical system disposed within the holder 30, which can be a cradle or other rigid type holder designed to accommodate a specific type or brand of multi-use electronic device 15. In general, the coupling lens system 35 produces a collimated image from the image data transmitted from the proximal end 40 of the endoscope 25.

[0026] In other embodiments, such as the embodiment shown in FIG. 2B, the coupling lens system 35 is integrated into the endoscope 25 at the proximal end 40. The endoscope 25 of FIG. 2B includes a proximal end 40 that has a focusing lens and a coupling lens that together form the coupling lens system 35. The focusing lens is adjustable (e.g., electronically adjustable, manually adjustable) so that the operator can vary the focus of the image data transmitted from the distal end 42 of the endoscope 25. The coupling lens collimates the image data to a form that can be accommodated by the camera 20 of the multi-use electronic device 15. Alternatively, the coupling lens system can form an image (e.g., a magnified image, demagnified/reduced image) of the image

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formed at the proximal end 40 of the endoscope 25 on the camera 20 of the multi-use electronic device.

[0027] The multi-use electronic device 15 can capture, process, store and transmit images of the environment 48 surrounding the distal end 42 of the endoscope. In addition, the multi-use electronic device 15 can collect, store, and transmit other data collected at the distal end 42 of the endoscope 25. For example, the endoscope 25, such as the endoscope shown in FIG. 3, can include one or more probes to collect the following types of data from its distal end 42: sound, temperature, vibration, eddy current, ultrasound, spatial mapping coordinates (e.g. latitude and longitude information), and picture mapping coordinates (e.g., pixel locations on a picture, a mosaic of pictures, a panorama) by linking the probes in the endoscope 25 to the multi-use electronic device 15 via an electronic connector 50. Connector 50, such as a USB cable or serial cable, extends from the probe within the distal end 42 of the endoscope through the proximal end 40 and connects with an electrical interface 52 on the multi-use electrical device 15. The data received through the electrical interface 52 can be captured, analyzed, stored, and/or transmitted by the multi-use electrical device 15. As a result, the multi-use electric device 15 provides a lower cost, less cumbersome alternative to single-use, dedicated systems for data capturing, analysis, storage, and transmission.

[0028] To capture data with system 10, an operator connects a multi-use electronic device 15, such as a mobile camera telephone or a PDA to an endoscope 25. The connection is made by simply placing the multi-use electronic device 15 into the holder 30 and inserting the proximal end 40 of the endoscope 25 into the holder 30 as well. The operator activates the energy source 44 connected to the endoscope, such as, for example a light source or ultrasound source to transmit energy to the distal end 42 of the endoscope 25. The energy transmitted to the distal end 42 interacts with the environment 48 surrounding the distal end and data sampled from the distal end 42 via probes or view finders is transmitted back to the proximal end 40 via fiber optic cables, lenses, and/or electrical cables. This data is captured by the multi-use electronic device 15, which is coupled to the proximal end 40 of the endoscope 25 via the coupling lens system 35 and/or connector 50. The multi-use electronic device 15 can be used to display, store, analyze, and/or transmit the captured data to a remote location.

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[0029] In one particular embodiment, the system 10 is used to collect images from the distal end 42 of the endoscope 25. After the endoscope 25 is positioned within the area of interest 48 and the multi-use electronic device (i.e., a mobile camera telephone) 15 is connected to the proximal end 40 via holder 30, the operator activates light source 44 to illuminate the area of interest surrounding the distal end 42. Image data from this illuminated region is transmitted through the endoscope 25 using fiber optic cable or a lens system as in convention endoscopes. Using the view screen 46 on the mobile telephone 15, the endoscope operator can visualize the area of interest and can capture representative still images and/or a video image of the environment. The operator can then analyze the images directly on the mobile telephone 15 using software contained therein or transmit the images to another multi-use electronic device or central processing station not connected to system 10. The images can be transmitted wirelessly through the use of Bluetooth technology to another device or can be sent over the internet. Alternatively, the mobile telephone 15 can be disconnected from the system 10 and carried to another location where it is electronically connected through means of a USB cable, serial cable or the like, to another electronic device. The images stored on the mobile telephone 15 can then be downloaded to this other electronic device.

[0030] In another embodiment, a PDA including CCD or a CMOS sensor, can be connected via holder 30 and electrical connector 50 to an endoscope which includes a temperature probe 50. The endoscope operator after positioning the distal end 42 in the area of interest 48 using the view screen 46 on the PDA activates the temperature probe to collect temperature data at the distal end 42 of the endoscope. The temperature data is transmitted through the probe to electrical connector 50 and into PDA 15 through electrical interface 52. The captured temperature data can be stored on the PDA and/or transmitted to another electric device.

[0031] In addition to eliminating expensive, dedicated equipment and reducing the complexity of data capturing from the distal end 42 of an endoscope 25, the system 10 in accordance with the present invention provides time-saving and convenience advantages. For example, the multi-use electronic device 15 used with the system 10 can send images or other data to a remote location while an endoscope operator is investigating an area of interest. As a result, the endoscope operator can obtain feedback or instructions from another person or electronic analyzer. Specifically, an endoscope operator investigating a patient's kidney or an internal engine compartment can send collected data to a physician or engine expert not physical present at the

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examination. The expert, who is not physically present at the location of the endoscope, can review the transmitted images and provide advice or guidance to the operator performing the investigation.

[0032] Variations, modifications, and other implementations of what is described herein will occur to those of ordinary skill without departing from the spirit and scope of the invention.

5 Accordingly, the invention is not to be defined only by the preceding illustrative description.

[0033] What is claim is:

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CLAIMS

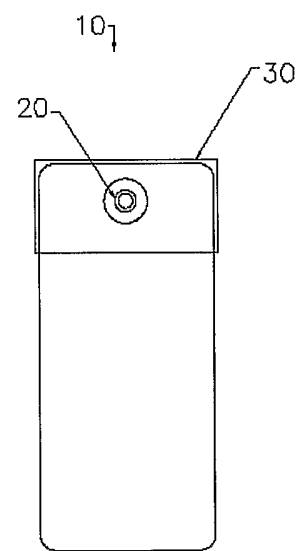
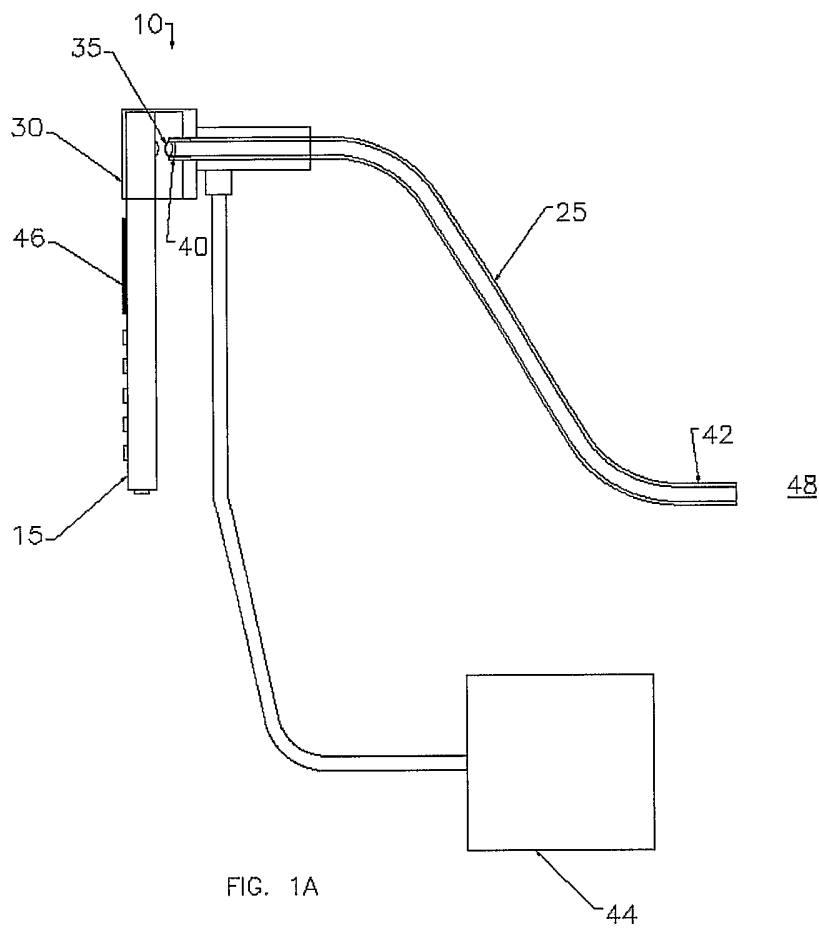
1. A system for an endoscope comprising:
an element for holding a multi-use electronic device relative to a proximal end of the endoscope; and
an adapter between the proximal end of the endoscope and the multi-use electronic device to transfer an image from the distal end of the endoscope into the multi-use electronic device.
2. The system of claim 1, wherein the element for holding the multi-use electronic device comprises a rigid holder connected to the proximal end of the endoscope.
3. The system of claim 1, wherein the adapter comprises a coupling lens system.
4. The system of claim 1, wherein the adapter is disposed within the element for holding the multi-use electronic device.
5. The system of claim 1, wherein the adapter is disposed within the proximal end of the endoscope.
6. The system of claim 1, wherein the multi-use electronic device is a mobile camera telephone.
7. The system of claim 1, wherein the multi-use electronic device is a personal digital assistant including a camera.
8. An endoscope system comprising:
an endoscope including a distal end and a proximal end, the proximal end being free of a dedicated eyepiece or a dedicated camera;
an energy source for emitting a signal transmitted about the distal end of the endoscope; and
an adapter for coupling the proximal end of the endoscope to a multi-use electronic device.
9. The endoscope system of claim 8 further comprising the multi-use electronic device.

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10. The endoscope system of claim 8, wherein the endoscope includes a rigid endoscope shaft.
11. The endoscope system of claim 8, wherein the endoscope includes a flexible endoscope shaft.
12. The endoscope system of claim 8, wherein the endoscope includes one or more lenses for transmission of data from the distal end to the proximal end of the endoscope.
13. The endoscope system of claim 8, wherein the endoscope includes one or more fiber optic fibers for transmission of data from the distal end to the proximal end of the endoscope.
14. The endoscope of claim 8, wherein the adapter comprises a coupling lens system.
15. The endoscope of claim 8, wherein the adapter comprises a USB connector.
16. The endoscope system of claim 8, further comprising a holder for maintaining the multi-use electronic device in a position relative to the proximal end of the endoscope.
17. The endoscope system of claim 16, wherein the holder includes the adapter.
18. The endoscope system of claim 8, wherein the proximal end of the endoscope includes the adapter.
19. The endoscope system of claim 8, wherein the multi-use electronic device comprises a mobile camera telephone.
20. The endoscope system of claim 8, wherein the multi-use electronic device comprises a personal digital assistant including a camera.

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21. The endoscope system of claim 8, wherein the energy source comprises a light source and the data comprises images.
22. The endoscope system of claim 8, wherein the data comprises at least one of sound, temperature, vibration, eddy current, ultrasound, and mapping coordinates.
23. A method of capturing an image with an endoscope system, the method comprising:
connecting a mobile camera telephone to an endoscope;
illuminating an object at a distal end of the endoscope; and
activating a camera within the mobile telephone to display or capture the image.
24. The method of claim 23, further comprising:
transmitting the image from the camera to processing unit.
25. The method of claim 24, wherein the image is transmitted over the internet.
26. The method of claim 24, wherein the image is transmitted wirelessly.
27. An endoscope comprising:
a body having a distal end and a proximal end; and
an adapter for transmitting data to a multi-use electronic device, the adapter being disposed about the proximal end of the endoscope.
28. The endoscope of claim 27, wherein the multi-use electronic device comprises a mobile camera telephone.
29. The endoscope of claim 27, wherein the adapter comprises a coupling lens system.



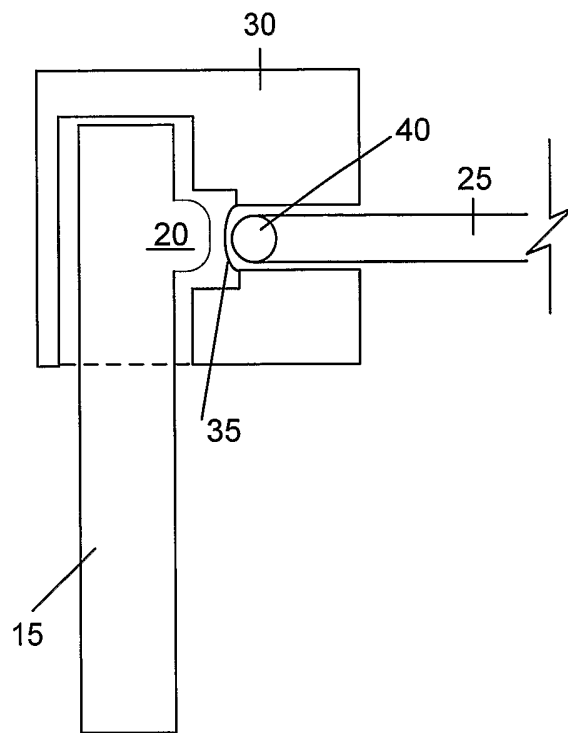


FIG. 2A

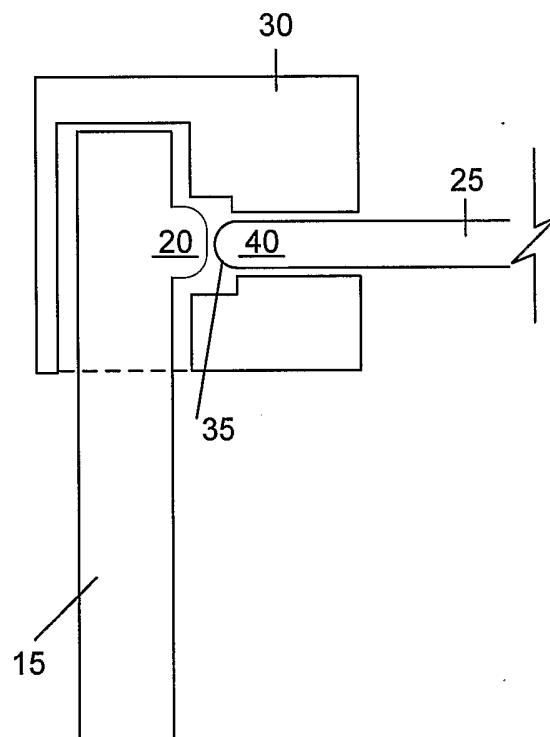


FIG. 2B

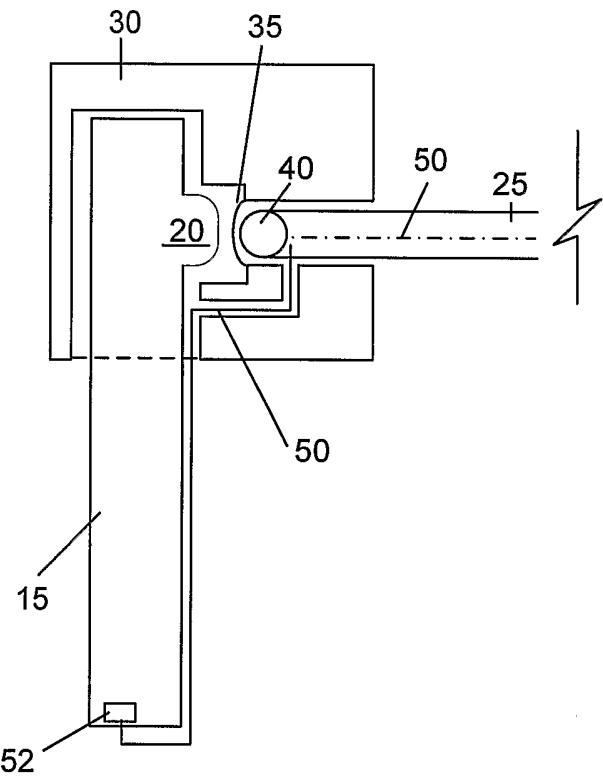


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No

PC US2005/042272

A. CLASSIFICATION OF SUBJECT MATTER

A61B1/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	NL 1 024 115 C2 (P.J.M.J. BEHEER B.V) 1 October 2004 (2004-10-01) page 3, lines 4-7 page 3, line 32 page 4, lines 15-30 page 5, lines 15-21	1-14, 16-21, 23-29
X	US 2003/236446 A1 (EINO TERUO) 25 December 2003 (2003-12-25) paragraphs [0020], [0021], [0023], [0059]	1,2,5, 7-9,11, 15,16, 18,21
X	WO 2004/068840 A (EVEREST VIT, INC) 12 August 2004 (2004-08-12) paragraphs [0046], [0058], [0124]	8,22



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See patent family annex.

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Date of the actual completion of the international search

24 March 2006

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03/04/2006

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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