



(54) **METHOD AND APPARATUS FOR COMMUNICATING WITH MEDICAL DEVICE SYSTEMS**

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(52) **U.S. Cl.** ..... **600/300; 607/60; 607/32; 607/5; 607/9; 607/63**

(58) **Field of Search** ..... 600/300, 517, 600/515, 508, 509, 523, 437; 128/903; 607/60, 32, 30, 2, 3, 4, 5, 9, 25, 62, 63

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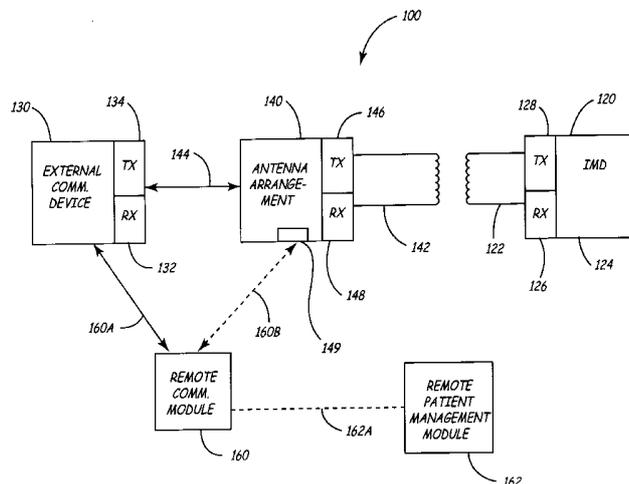
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(57) **ABSTRACT**

A wearable telemetry arrangement is used with a medical information communications device in a telemetry system for communicating with an implantable medical device. In an example embodiment, the telemetry arrangement includes an article configured and arranged to be physically coupled to and donned on a body. In addition, an antenna member is located on the article that is configured and arranged to establish a communications link between the implanted device and the medical communications system. The telemetry arrangement of the present invention provides a reliable and non-invasive system that conveniently and chronically collects cardiac and other implanted medical device data. Further, the system is adaptable to patient management modules and portals to provide remote connectivity to web-based platforms and data management systems.

**44 Claims, 3 Drawing Sheets**



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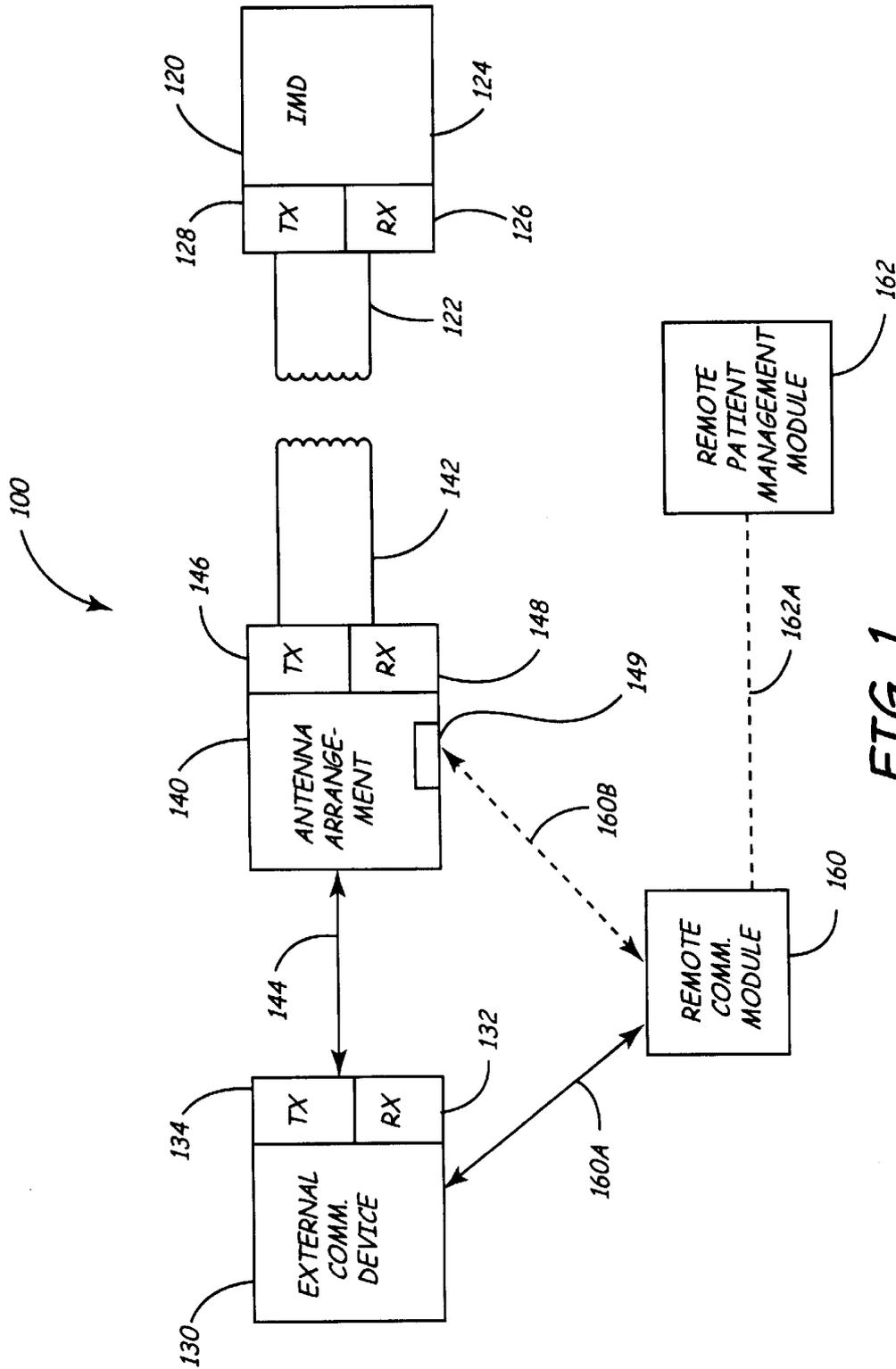


FIG. 1

FIG. 2

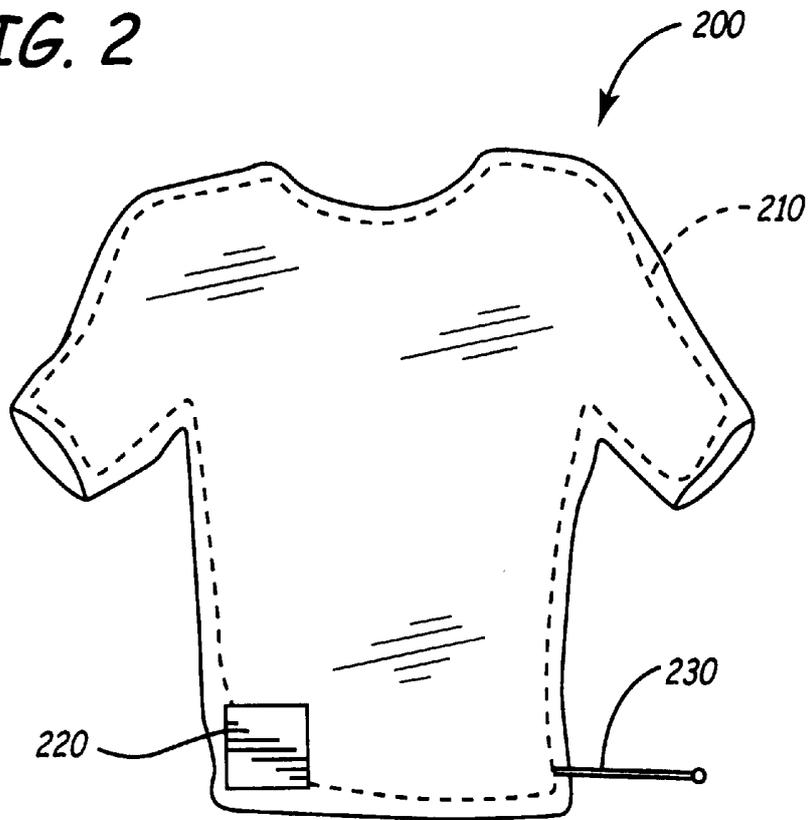
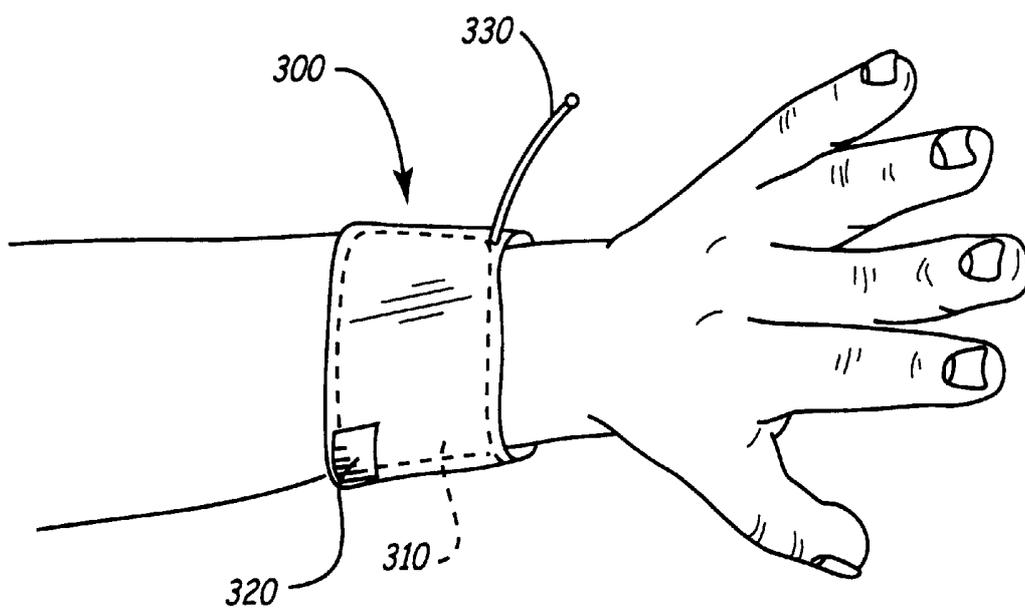


FIG. 3



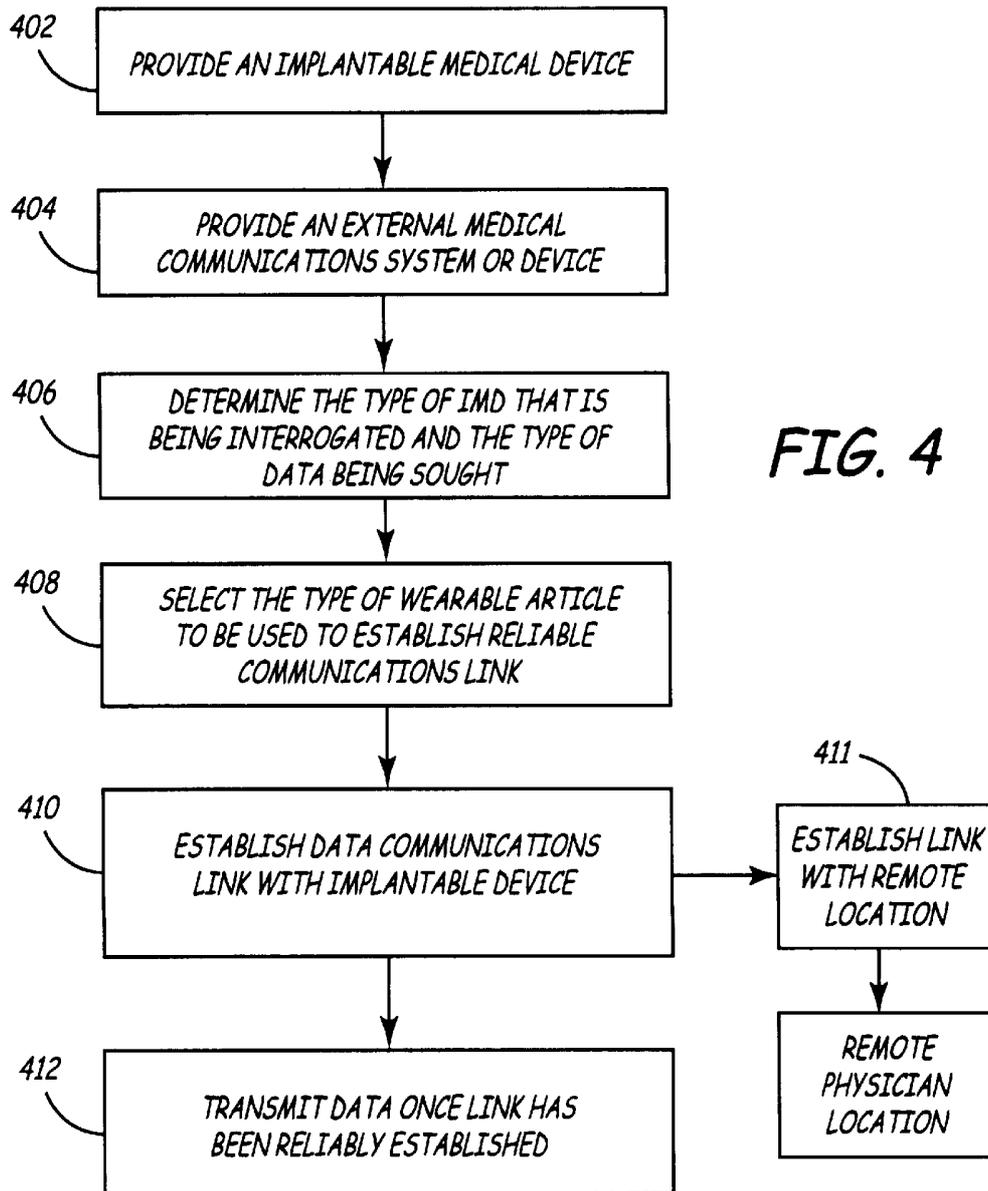


FIG. 4

**METHOD AND APPARATUS FOR  
COMMUNICATING WITH MEDICAL  
DEVICE SYSTEMS**

RELATED PATENT DOCUMENTS

This application claims priority to and is a conversion of U.S. Provisional Application Ser. No. 60/197,753, filed on Apr. 19, 2000, entitled "ECG and RF Apparatus For Medical Device Systems", which is incorporated herein by reference in its entirety. The current application relates to, and incorporates common subject matter therein, U.S. Ser. No. 09/218,946, now U.S. Pat. No. 6,115,636 to Ryan. The present invention is adaptable to remote patient management and chronic systems as illustrated and described in applications assigned to the assignee of record entitled "System and Method for Transferring Information Relating to an Implantable Medical Device to a Remote Location," filed on Jul. 21, 1999, Ser. No. 09/358,081, now U.S. Pat. No. 6,250,309; "Apparatus and Method for Remote Troubleshooting, Maintenance and Upgrade of Implantable Device Systems," filed on Oct. 26, 1999, Ser. No. 09/426,741, now U.S. Pat. No. 6,442,433; "Tactile Feedback for Indicating Validity of Communication Link with an Implantable Medical Device," filed Oct. 29, 1999, Ser. No. 09/430,708; "Apparatus and Method for Automated Invoicing of Medical Device Systems," filed on Oct. 29, 1999, Ser. No. 09/430,208, now U.S. Pat. No. 6,385,593; "Apparatus and Method for Remote Self-Identification of Components in Medical Device Systems," filed Oct. 29, 1999, Ser. No. 09/429,956, now abandoned in favor of continuation application Ser. No. 10/010,406, filed Dec. 7, 2001; "Apparatus and Method to Automate Remote Software Updates of Medical Device Systems," filed Oct. 29, 1999, Ser. No. 09/429,960, now U.S. Pat. No. 6,363,282; "Method and Apparatus to Secure Data Transfer From Medical Device Systems," filed Nov. 2, 1999, Ser. No. 09/431,881; "Implantable Medical Device Programming Apparatus Having an Auxiliary Component Storage Compartment," filed Nov. 4, 1999, Ser. No. 09/433,477, now U.S. Pat. No. 6,411,851; "Remote Delivery of Software-Based Training for Implantable Medical Device Systems," filed Nov. 10, 1999, Ser. No. 09/437,615, now U.S. Pat. No. 6,386,882; "Medical System Having Improved Telemetry," filed Jul. 19, 1999, Ser. No. 09/356,340, now U.S. Pat. No. 6,298,271; "Apparatus and Method for Remote Therapy and Diagnosis in Medical Devices Via Interface Systems," filed Dec. 14, 1999, Ser. No. 09/460,580, now U.S. Pat. No. 6,418,346; "Virtual Remote Monitor, Alert, Diagnostics and Programming for Implantable Medical Device Systems" filed Dec. 17, 1999, Ser. No. 09/466,284, now U.S. Pat. No. 6,497,655; "System of Notification of Recalled Components for a Medical Device," filed Dec. 29, 1999, Ser. No. 09/474,694; "A Communications System for an Implantable Device and a Drug Dispenser," filed Dec. 30, 1999, Ser. No. 09/475,709, now U.S. Pat. No. 6,471,645; "Instrumentation and Software for Remote Monitoring and Programming of Implantable Medical Devices (IMDs)," filed Dec. 20, 1999, Ser. No. 09/745,112; "An information Network Scheme for Interrogation of Implantable Medical Devices (IMDs)," filed Dec. 18, 2000, Ser. No. 09/740,128, now U.S. Pat. No. 6,480,745; "Medical Device GUI for Cardiac Electrophysiology Display and Data Communications," filed Dec. 21, 2000, Ser. No. 09/746,230, now U.S. Pat. No. 6,473,638; Integrated Software System for Implantable Medical Device Installation and Management," filed Dec. 18, 2000, Ser. No. 09/740,078; "Dynamic Bandwidth Monitor and Adjuster for Remote Communications with a Medical Device," filed Dec. 20,

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FIELD OF THE INVENTION

The present invention generally relates to communicating via telemetry with implantable medical devices and instruments. Specifically, the invention relates to a method and an apparatus for enabling the sensing of outputs, and/or real time communication with, various medical devices for chronic patient management.

BACKGROUND OF THE INVENTION

In recent years, implantable electronic device technology has rapidly advanced. Sizes and weights of implantable devices have decreased; while functionality has increased. These advances have created a corresponding demand for two-way communication or telemetry between the implantable electronic device and an external device, (e.g. a programmer). In a pacemaker system, a programmer downloads to an implanted pacemaker, data such as operating parameters. Likewise, data may flow in the opposite direction; that is, from the implantable device to the programmer for analysis. In fact, modem pacemakers are capable of storing significant amounts of data about the patient (e.g.,

average heart rate) and the pacemaker itself (e.g. battery voltage), which may need to be frequently transmitted to the programmer for, evaluation by the physician.

A programmer used during a telemetry procedure is typically positioned remotely from the patient's implanted device. A programming head of the programmer unit, e.g., a wand or some other extendible head, containing at least an antenna, is connected to the remainder of the programmer unit via a stretchable coil cable and is positioned over the patient's implanted device site for programming or telemetry interrogation of the implanted device. The programmer typically consists of one or more microprocessors and contains programmable memory capable of storing executable programs under the control of the operator via a user interface. The implantable medical device may receive command instructions from the programmer. Such command instructions are referred to herein as "downlink transmissions", i.e., transmissions from the external device to the implanted medical device. In one example, the received command instructions may include program instructions or steps for directing the operation of the implantable medical device or may also include data such as program limits and timing data.

Similarly, the implanted medical device may transmit data to the external device (e.g., programmer unit) and the transmissions are referred to herein as "uplink" transmissions. The programmer may function to receive data from the implanted medical device as well as to transmit the commands to the implanted device. Communication between the implanted device and the external device may be limited to one-way transmissions or alternatively may include two-way transmissions. The communication between the implanted medical device and the external device is facilitated by corresponding receiving and transmitting circuitry included within the implanted medical device and the external device. Both the implanted medical device and the external device include antenna structures coupled to the receiver and transmitter-circuitry for transmitting and receiving electromagnetic energy.

Conventional telemetry systems typically enclose the antenna or antennas of the implanted medical device inside the housing or case of the implanted device. Such housings are typically metallic in nature and may be made of titanium or titanium alloys. The metal housings may act as low pass filters to limit the bandwidth of signals transmitted from and received by the implanted medical devices. In addition, telemetry systems that have antennas enclosed in the housing generally have undesirably low transmission rates.

With respect to conducting actual telemetric communications with implanted devices, it is preferable to use the near H field from the coil antenna rather than the E field. This is because the H field wave impedance is much less than the E field wave impedance, thereby allowing lower loss signal transmission through the metal housing and through the patient's skin (the near field is generally considered to be less than  $\frac{1}{6}$ th of the wave length of the carrier wave). Therefore, uplink telemetry range depends upon the near field magnetic field strength or amplitude. The magnetic field strength, in turn, depends on the number of coil turns in the antenna, the area of the coil, and the coil current. The uplink transmitter efficiency depends on the coil quality factor "Q". To increase the telemetry uplink range, the magnetic field intensity must be maintained at an increased distance from the implanted device. The magnetic field may be increased by: adding more turns to the coil; making the coil antenna larger in area, winding it with a larger radius or by driving the coil with a larger coil current. The larger the

coil Q, the more efficient the uplink transmitter circuit becomes. It should be noted that, for either uplink or downlink, it would be desirable to utilize only near-field magnetic fields (H fields), which do not require federal licensing since their amplitude falls off rapidly with link range.

Existing telemetry or equivalent systems rely on programming heads that must be precisely placed and positioned on the patient's IMDs (implanted medical devices) in order to transmit data. This is because the antenna is disposed in the moveable programmer head and the antenna must be placed in close proximity to the implantation site to effect agreeable data transmission link. The inability of the physician to see the IMD makes it even more difficult to establish the data link while the reliability of the data link is highly dependent on the signal strength that is obtained by proper: programming head orientation. A further complicating factor involves the physician handling the programming head while performing other important tasks. Constant repositioning of the programming head in order to maximize received signal strength makes completing the, telemetry functions undesirably difficult. Finally, establishing the telemetry in the exact location for a patient or a healthcare practitioner may be difficult if they have limited dexterity or if they need to hold the programming head in one position for extended periods of time.

#### SUMMARY OF THE INVENTION

Various embodiments of the present invention are directed to addressing the above and other needs in connection with providing a reliable, economical and non-invasive system for conveniently and chronically collecting cardiac and other IMD (implantable medical device) data. According to one aspect of the invention, collecting IMD data is simplified in order to promptly initiate, modify or control therapy and diagnosis in connection with chronic patient monitoring. In an example embodiment, a component of a telemetry or equivalent communications system includes a wearable article such as a vest, a wrist attachment or similar apparel or accessory that facilitates communication with an IMD to exchange clinical information from the IMD in the patient.

According to one embodiment of the invention, a telemetry arrangement for communicatively coupling an implanted medical device with a medical communications system has been discovered. The telemetry arrangement includes an article configured and arranged to be physically coupled to and donned on a body. The arrangement further includes an antenna member located on the article and configured and arranged to establish a communications link between the implanted device and the medical communications system.

According to another embodiment of the invention, a method and a system of establishing a telemetric communications link between an implantable device and a medical information communications system includes donning an article having an antenna member located thereon. A data communications link is then established between the implantable device and the medical communications system wherein a portion of the communications link is physically coupled to a body.

The above summary of the present invention is not intended to describe each illustrated embodiment or every implementation of the present invention. The figures in the detailed description that follow more particularly exemplify these embodiments.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The invention may be more completely understood in consideration of the following detailed description of vari-

ous embodiments of the invention in connection with the accompanying drawings, in which:

FIG. 1 illustrates a block diagram of a telemetry medical system for communicatively coupling an implantable medical device with a medical information communication system in accordance with an example embodiment of the invention;

FIG. 2 illustrates an article with an antenna member thereon configured and arranged to be donned on a body in accordance with an example embodiment of the invention;

FIG. 3 illustrates another article with an antenna member thereon configured and arranged to be donned on a body in accordance with another example embodiment of the invention; and

FIG. 4 is a flowchart illustrating the manner of coupling the implantable medical device with the medical communications system via the antenna member of the article in accordance with an example embodiment of the invention.

While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

#### DETAILED DESCRIPTION

The present invention is generally directed to a telemetry system and method for establishing a data link between an implanted device and an external medical, communications device. While the present invention is not necessarily limited to such an application, the invention will be better appreciated using a discussion of example embodiments in such a specific context.

In an example embodiment, the telemetry system is an integration of external monitors with IMDs to enable a continuous and reliable data feedback of physiological measurements upon which the therapeutic, diagnostic responses and operations of the IMD are based. In this regard the invention enables a closed-loop system that is structured to provide real-time continuous feedback to the IMD and medical care provider.

Referring now to the figures, FIG. 1 illustrates a block diagram of an implantable medical device telemetry system **100** that includes an implantable medical device **120**, an external medical communications system **130** and an RF antenna arrangement **140** communicatively coupled to communications system **130**. In this example embodiment, medical communications system **130** is a programming device capable of downloading information to implanted device **120** or uploading information from implanted device **120**. Implanted device **120** and medical communications system **130** communicate via an inductive link provided by a first antenna **122** and RF antenna arrangement **140** that includes an antenna member **142**. Antenna arrangement **140** is communicatively coupled to communications system **130** via a communications link **144**. Communications link **144** can include a cabling system, an RF wireless link, an infrared link, an optical link or any other means that permits one or two way communications between arrangement **140** and system **130**. When antenna member **142** of RF arrangement **140** is brought into proximity with the implanted device antenna **122**, a current flow through either antenna **122** or antenna member **142** causes an inductive current in the corresponding antenna **122** or **142**.

In this example, implanted device **120** is a cardiac pacemaker, and RF arrangement **140** operates much like a programming head device used by a physician to place, in close proximity to and to communicate with, the pacemaker. Implanted device **120** includes a housing **124**, typically made of titanium or a titanium alloy, having a receiver **126** and a transmitter **128** that are electrically coupled-through a coupling network to antenna **122**. A typical up-link telemetry path (information transmitted from the implanted device to the external communications system) begins with a request by RF antenna arrangement **140** for information from implanted device **120**. In response, implanted device **120** enables transmitter **128** to transmit data through antenna **122** by inducing a current in antenna member **142**. Information is then transmitted from antenna member **142** to a receiver **132** of communications system **130** via link **144**, thereby completing the telemetry path.

In a related embodiment, telemetry system **100** includes a remote communications module **160** that provides a communications link to networks outside the immediate location of external medical communications system **130**. For instance, module **160** provides a communications link to a telecommunications network, via a cellular link or hardwire connection, or a link to the Internet (World Wide Web) via a PC network or a wireless link to a global satellite communications network. The remote communications module would be coupled to medical communications system **130** via a remote communications link **160A**, which can be hardwired or can be performed wirelessly.

In another related embodiment, all of the telemetry electronics from medical communications system **130** can be integrated with RF arrangement **140** in a telemetry electronics module **149**, thereby providing greater mobility of RF arrangement **140**. In another embodiment, RF arrangement **140** includes a module **149** that establishes a link via **160B** with a remote communications module **160** to transmit/receive information over various communications networks including remote patient management modules **162** having a link via **162A**. These remote patient management modules may include a web-enabled system that would supplement a doctor's care through device-specific education and tools for self-monitoring, immediate feedback or continuous health coaching and management for chronic patients.

In the context of cooperating with the remote patient management systems described in the patent applications listed above, various embodiments described herein enable a bi-directional communications system between the wearable telemetry system and a remote expert or doctor station. In one example application, the telemetry system or similar equivalent wireless system is structured to transmit the IMD data to a programming device and ultimately to a data center. At the data center, a healthcare specialist provides remote analysis of the IMD data and approves changes in therapy or diagnosis from the information received via the telemetry wearable article. Yet another embodiment of the present invention contemplates the use of one or more telemetry wearable articles for communicating with various IMDs implanted in the patient for various diagnostic and therapeutic activities. In a related application, external medical devices are programmed to continuously transfer data to an expert data center as well to the IMD(s). In yet another embodiment, the telemetry wearable articles are equipped with warning alarm systems to notify the patient and the remote physician about critical developments or impending problems based on anomalies in the readings or other physiological data trends.

Referring now to FIG. 2, an example embodiment of RF antenna arrangement **140**, in the form of a wearable article

**200**, establishes a data transmission link between implanted device **120** and medical communications system **130** of FIG. 1. Wearable article **200** includes a telemetry vest, for example, a shirt or similar type of vestment or apparel that includes an antenna member. In this example, the antenna member is in the form of a telemetry antenna band **210**, disposed along the perimeter of the vestment that couples the medical communications system with antenna **122** of implanted device **120**. Antenna band **210**, coupled with the programming device, aids in providing a continuous real-time accurate measurement of clinically significant information collected from the implanted device (or various other IMDs) located in the patient.

Prior to implanted device **120** screening, the patient places telemetry vest **200** over the torso. Telemetry vest **200** is coupled to medical communications system **130**, either via a hardwired cabling system or wirelessly (e.g., RF, infrared or optical). Medical communications system **130** then engages implanted device **120** through inductive coupling with antenna band **210** of telemetry vest **200**. Once antenna **122** and antenna band **210** are inductively coupled, one or two way communications can take place between implanted device **120** and communications system **130**. In an example application, telemetry vest **200** is formed with at least a pair of ECG (electrocardiogram) electrodes and with a telemetry electronics module **220**. The telemetry electronics module (or circuit) **220** can include part or all of the components of the medical communication device thereby providing more mobility for the patient. In another example embodiment, antenna band **210** may be formed in such a manner to provide mobility of the antenna band within vest **200** to improve the proximity placement of the antenna band to implanted device **120**. In yet another example application, telemetry vest **200** includes a telescoping antenna **230** that is coupled to module **220** for wireless communication to a remote data center or a remote medical communications system **130**.

In an example embodiment, the wearable article has integrated electrodes for monitoring cardiac signals. A wearable article, configured and arranged to be physically coupled to and donned on the body, includes at least one pair of ECG electrodes disposed on the article that are configured and arranged to sense cardiac signals from a patient's heart. Where the wearable article is a vest, electrocardiograms can be easily conducted when the vest is donned by the patient. The ECG electrodes can be quickly and effortlessly placed proximate the patient's heart. The ECG electrodes are coupled to the medical information communications system either by cable or via a wireless circuit arrangement. A printing device is coupled to the medical information communication system to provide an ECG chart for the patient.

In another embodiment, the wearable vest includes an antenna member that is adapted to establish a communications link with a patient's implanted device. The antenna member is coupled to the medical information communications system either by cable or a wireless connection. A circuit module is coupled to the antenna member and located on the vest to provide wireless communication capabilities.

Referring now to FIG. 3, another example embodiment of an RF antenna arrangement in the form of a wristband or wrist attachment **300** is illustrated. Wristband **300** aids in establishing the data link between the external medical system **130** and the implanted device **120**. The antenna member is in the form of a telemetry antenna band **310** and is disposed along the perimeter of the wristband. Antenna band **310** couples the medical communications system **130** with antenna **122** of implanted device **120** to provide a one

or two way real time communications link with the implanted device (or various other IMDs) located in the patient.

Prior to implanted device **120** screening, the patient places telemetry wristband **300** over the wrist. Telemetry wrist band **300** is coupled to medical communications system **130**, either via a hardwired cabling system or wirelessly through a telescoping antenna **330** (or other forms of wireless communication as indicated earlier). Medical communications system **130** then engages implanted device **120** through inductive coupling with antenna band **310** of telemetry wristband **300**, similarly as described with respect to the telemetry vest **200**. In an example application, telemetry wristband **300** is coupled to a wearable telemetry electronics module **320** or an, electronics module that can be hardwired (or coupled wirelessly) to the wristband and then worn. The telemetry electronics module **320** has similar functionality to module **220** described above. In another example embodiment, telemetry wristband **300** includes a telescoping antenna **330** that is coupled to module **320** for wireless communication to a remote data center or a remote medical communications system **130**. Telemetry module **320** and **220** in a related application can include the receiver and transmitter modules of communications system **130**.

In an example embodiment, the wristband includes an antenna member that is adapted to establish a communications link with a patient's implanted device. The antenna member is coupled to the medical information communications system either by cable or a wireless connection. A circuit module is coupled to the antenna member and located on the wristband to provide the wireless communication capabilities.

Other wearable articles, or articles that can be donned on the body of the patient, that house an antenna band include, but are not limited to, a belt, a patch that adheres to a patient, a sheet that lays on a patient, a portable module and an article of jewelry. The communications link is also established where these articles are draped on the body of the patient, such as where the antenna member is located on a sheet member.

In a related application, the communications link with the implanted device is established with an article that is attached to an article of apparel such that the antenna member is in close proximity to the patient's body. The article having the antenna member can be attached to the shirt or top of the patient or removably attached to the belt or other article of clothing.

In another related embodiment, telemetry system **100** can couple with an implanted device **120** where device **120** uses the body as an antenna and is described in U.S. Ser. No. 09/218,946, now U.S. Pat. No. 6,115,636 to Ryan, and is incorporated by reference in its entirety. Since RF arrangement **140** would be positioned in the near-field communications volume **20** by using, for example, the vest or wrist band embodiments, a communications link is established between the external communication device **130** and implanted device **120**.

Some of the advantages provided by the various embodiments of the present invention include increased flexibility of patient, movement while improving programmer proximity placement about the implant site without corrupting the data transferred; and increased accuracy of data being communicated between the implanted device and the external medical device. In addition, the present invention provides for a comfortable distance between patient and clinician or physician when performing telemetry and eliminates

the necessity of a lengthy time period in which the programmer must be held in a particular position to accomplish adequate and accurate communication.

Referring now to FIG. 4, flowchart 400 illustrates the manner of establishing a telemetric communications link between an implanted medical device and an external medical communications system or device via a wearable RF antenna arrangement (hereinafter wearable article). At 402, an implanted medical device is provided that is configured and arranged to communicate with an external medical communications system. At 404, an external medical communications system external to the body is provided that is configured and arranged to communicate with the implantable device. At 406, a determination is made of the type of implanted device that is within the patient (e.g. pacemaker, defibrillator, etc.) for purposes of initiating the proper level of communication. At 408, a determination is made of the type of wearable article to be used that will be most effective in establishing a reliable communications link with the implanted device. At 410, a data communications link is established between the external medical communications system and the implanted medical device via the selected wearable article. Depending on where the physician is located, a remote communications link may need to be established at 411 before any transmission of data occurs with the implanted device. Once the data link is established and reliability is assured, uplink or downlink communications can commence at 412.

The present inventions provides, in an example application, non-invasive clinical data measurements for (or control of) various IMDs including but not limited to drug pumps, neurological implants, nerve stimulators, various cardiac implants and equivalent medical devices. The present invention is compatible to a number of techniques for interrogating implanted medical devices. In addition, embodiments described are compatible with remote patient management: systems that interact with remote data and expert data centers and compatible with a data communication system that enables the transfer of clinical data from the patient to a remote location for evaluation, analysis, data reposition and clinical evaluation. Other communications systems can be integrated into the present invention including wireless, microwave and global satellite communications.

Various modifications, equivalent processes, as well as numerous structures to which the present invention may be applicable will be readily apparent to those of skill in the art to which the present invention is directed upon review of the present specification. The claims are intended to cover such modifications and devices.

We claim:

1. A telemetry arrangement for communicatively coupling an implanted medical device with a medical information communications system, the telemetry arrangement comprising:

an article configured and arranged to be physically coupled to and donned on a body; and

an antenna member disposed on the article and configured and arranged to establish a communications link between the implanted device and the medical communications system;

a pair of ECG electrodes disposed on the article in an arrangement to sense cardiac signals from a patient's heart; and

means for coupling the ECG electrodes to the medical communications system.

2. The telemetry arrangement of claim 1, wherein the telemetry arrangement further includes a circuit module disposed on the article and coupled to the antenna member configured and arranged to communicate with the medical information communications system.

3. The telemetry arrangement of claim 2, wherein the circuit module includes a receiver module coupled to the antenna member configured and arranged to provide an uplink data transmission link between the implanted device and the medical communications system.

4. The telemetry arrangement of claim 3, including a vest that is electrically coupled to the receiver module.

5. The telemetry arrangement of claim 2, wherein the circuit module includes a transmitter module coupled to the antenna member configured and arranged to provide a downlink data transmission link between the implanted device and the medical communications system.

6. The telemetry arrangement of claim 5, wherein the circuit module includes a receiver module coupled to the antenna member configured and arranged to provide an uplink data transmission link between the implanted device and the medical communications system.

7. The telemetry arrangement of claim 2, wherein the circuit module includes means for providing an alert advising of a problem with the implanted medical device.

8. The telemetry arrangement of claim 1, wherein the circuit module includes a telemetry circuit coupled to the ECG electrodes.

9. The telemetry arrangement of claim 3, wherein the article is a wearable vest having the antenna member disposed on a perimeter of the vest.

10. The telemetry arrangement of claim 1, wherein the implanted medical device is one of the group consisting of: pacemakers, drug pumps, neurological implants, nerve stimulators and cardiac implants.

11. The telemetry arrangement of claim 1, wherein the article is a vest having the antenna member disposed on a perimeter of the vest.

12. A telemetry arrangement for communicatively coupling an implanted medical device with a medical information communications system, the telemetry arrangement comprising:

an article configured and arranged to be physically coupled to and donned on a body;

an antenna member disposed on the article and configured and arranged to establish a communications link between the implanted device and the medical communications system; and

a telescoping antenna coupled to the antenna member.

13. A telemetry arrangement for communicatively coupling an implanted medical device with a medical information communications system, the telemetry arrangement comprising:

an article configured and arranged to be physically coupled to and donned on a body;

an antenna member disposed on the article and configured and arranged to establish a communications link between the implanted device and the medical communications system; and

wherein the article is a wrist attachment having the antenna member disposed on a perimeter of the wrist attachment.

14. The telemetry arrangement of claim 13, wherein the wrist attachment further includes a telescoping antenna coupled to the antenna member.

15. A telemetry arrangement for communicatively coupling an implanted medical device with a medical information communications system, the telemetry arrangement comprising:

11

an article configured and arranged to be physically coupled to and donned on a body;

an antenna member disposed on the article and configured and arranged to establish a communications link between the implanted device and the medical communications system; and

a circuit module disposed on the article and coupled to the antenna member configured and arranged to communicate with the medical information communications system; the circuit module including:

(i) a transmitter module coupled to the antenna member configured and arranged to provide a downlink data transmission link between the implanted device and the medical communications system;

(ii) a receiver module coupled to the antenna member configured and arranged to provide an uplink data transmission link between the implanted device and the medical communications system; and

wherein the circuit module is configured and arranged to establish two way communication of data between the implanted medical device and the medical communications system via a communications network selected from the group consisting of: wireless, microwave and global satellite communications.

**16.** A telemetry arrangement for communicatively coupling an implanted medical device with a medical information communications system, the telemetry arrangement comprising:

an article configured and arranged to be physically coupled to and donned on a body;

an antenna member disposed on the article and configured and arranged to establish a communications link between the implanted device and the medical communications system; and

a circuit module disposed on the article and coupled to the antenna member configured and arranged to communicate with the medical information communications system; the circuit module including:

(i) a transmitter module coupled to the antenna member configured and arranged to provide a downlink data transmission link between the implanted device and the medical communications system;

(ii) a receiver module coupled to the antenna member configured and arranged to provide an uplink data transmission link between the implanted device and the medical communications system; and

wherein the circuit module is configured and arranged to establish two way communication of data between the implanted medical device and the medical communications system via the Internet, a LAN, a WAN, a local network and a public service telephone network.

**17.** A telemetry arrangement for communicatively coupling an implanted medical device with a medical information communications system, the telemetry arrangement comprising:

an article configured and arranged to be physically coupled to and donned on a body;

an antenna member disposed on the article and configured and arranged to establish a communications link between the implanted device and the medical communications system; and

a circuit module disposed on the article and coupled to the antenna member configured and arranged to communicate with the medical information communications system; and

12

wherein the circuit module is arranged and configured to provide a data link to a plurality of implanted medical devices.

**18.** A telemetry arrangement for communicatively coupling an implanted medical device with a medical information communications system, the telemetry arrangement comprising:

an article configured and arranged to be physically coupled to and donned on a body;

an antenna member disposed on the article and configured and arranged to establish a communications link between the implanted device and the medical communications system; and

a circuit module disposed on the article and coupled to the antenna member configured and arranged to communicate with the medical information communications system; and

wherein the article further includes a plurality of circuit modules located therein for providing communication links to a plurality of implanted devices.

**19.** A method for establishing a telemetric communications link between an implanted medical device in a body and a medical information communications system, the method comprising:

donning an article of apparel with an antenna member located thereon; and

establishing a data communications link between the implanted medical device and the medical communications system via the antenna member and the body;

wherein the step of donning the article includes the step of donning one of the articles from the group consisting of: a shirt, a vest, a belt, an article of jewelry, and an accessory; and

wherein the step of selecting the article includes providing a telescoping antenna coupled to the antenna member.

**20.** The method of claim **19**, wherein the step of establishing the communications link further includes the steps of:

determining the type of implanted medical device with which the telemetric communications link is being sought; and

selecting the article that places the antenna member thereon in close proximity to implanted device.

**21.** A method for establishing a telemetric communications link between an implanted medical device in a body and a medical information communications system, the method comprising:

donning an article of apparel with an antenna member located thereon; and

establishing a data communications link between the implanted medical device and the medical communications system via the antenna member and the body; and

wherein the step of establishing a data communications link further includes the step of providing a plurality of articles and antenna members located thereon for establishing data links to a plurality of implanted medical devices.

**22.** The method of claim **21**, wherein the step of donning the article includes draping the article on the body.

**23.** A system for establishing a telemetric communications link between an implanted medical device and a medical information communications system, the system comprising:

an article to be donned on a patient's body;

means for establishing a data communications link between the implanted medical device and the medical communications system;

a pair of ECG electrodes disposed on the article in an arrangement to sense cardiac signals from a patient's heart; and

means for coupling the ECG electrodes to the medical communications system.

**24.** The system of claim **23**, wherein the article further includes a circuit module located thereon and coupled to the antenna member configured and arranged to communicate with the medical information communications system.

**25.** The system of claim **24**, wherein the circuit module includes a telemetry circuit coupled to the ECG electrodes.

**26.** The system of claim **24**, wherein the circuit module includes a receiver module coupled to the antenna member configured and arranged to provide an uplink data transmission link between the implanted device and the medical communications system.

**27.** The system of claim **24**, wherein the circuit module includes a transmitter module coupled to the antenna member for providing a downlink data transmission link between the implanted device and the medical communications system.

**28.** The system of claim **24**, wherein the circuit module includes a receiver module coupled to the antenna member configured and arranged to provide an uplink data transmission link between the implanted device and the medical communications system.

**29.** The system of claim **24**, wherein the circuit module further includes means for providing an alert advising of a problem with the implanted medical device.

**30.** The system of claim **28**, wherein the article is a vest having the antenna member disposed on a perimeter of the vest.

**31.** The system of claim **23**, wherein the implanted medical device is one of the group consisting of: pacemakers, drug pumps, neurological implants, nerve stimulators and cardiac implants.

**32.** A system for establishing a telemetric communications link between an implanted medical device and a medical information communications system, the system comprising:

an article with an antenna member;

means for establishing a data communications link between the implanted medical device and the medical communications system via the antenna member; and wherein the article is a wrist attachment having the antenna member disposed on a perimeter of the wrist attachment.

**33.** The system of claim **32** wherein the wrist attachment further includes a telescoping antenna coupled to the antenna member.

**34.** A system for establishing a telemetric communications link between an implanted medical device and a medical information communications system, the system comprising:

an article with an antenna member;

means for establishing a data communications link between the implanted medical device and the medical communications system via the antenna member and the body;

wherein the article further includes a circuit module located thereon and coupled to the antenna member configured and arranged to communicate with the medical information communications system; and

wherein the circuit module is configured and arranged to establish two way wireless communication of data between the implanted medical device and the medical communications system.

**35.** The system of claim **34**, wherein the circuit module is configured and arranged to establish two way communication of data between the implanted medical device and the medical communications system via a communications network selected from the group consisting of: wireless, microwave and global satellite communications.

**36.** A system for establishing a telemetric communications link between one or more implanted medical device and a medical information communications system, the system comprising:

an article with an antenna member;

means for establishing a data communications link between the implanted medical device and the medical communications system via the antenna member and the body;

wherein the article further includes a circuit module located thereon and coupled to the antenna member configured and arranged to communicate with the medical information communications system; and

wherein the circuit module is arranged and configured to provide a data link to a plurality of implanted medical devices.

**37.** A system for establishing a telemetric communications link between an implanted medical device and a medical information communications system, the system comprising:

an article with an antenna member;

means for establishing a data communications link between the implanted medical device and the medical communications system via the antenna member and the body; and

wherein the article further includes a plurality of circuit modules located thereon configured and arranged to provide communication links to a plurality of implanted devices.

**38.** An arrangement for monitoring cardiac signals, the monitoring arrangement comprising:

an article configured and arranged to be physically coupled to and donned on a body; and

at least one pair of ECG electrodes located on the article and configured and arranged to sense cardiac signals.

**39.** The arrangement of claim **38**, wherein the article is a vest having the ECG electrodes integrated therein in a position that is proximate a patient's heart when the vest is donned.

**40.** The arrangement of claim **39**, further including a circuit module coupled to the ECG electrodes, wherein the circuit module is configured and arranged to communicate with a medical information communications system.

**41.** The arrangement of claim **40**, further including an antenna member located on the vest and communicatively coupled to the medical communications system.

**15**

42. The arrangement of claim 40, wherein the circuit module includes a telemetry circuit configured and arranged to provide wireless communication with the medical information communications system.

43. An arrangement for establishing a communication link with an implanted medical device, the arrangement comprising:

an article of apparel configured and arranged to be physically coupled to and donned on a body;

an antenna member disposed on the article and configured and arranged to establish the communications link with the implanted device; and

**16**

a circuit module disposed on the article and coupled to the antenna member configured and arranged to communicate with a medical information communications system; and

wherein the article is a wristband attachment having the antenna member disposed thereon.

44. The arrangement of claim 43, wherein the circuit module includes a telemetry circuit configured and arranged to provide wireless communication with the medical information communications system.

\* \* \* \* \*

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摘要(译)

可穿戴遥测装置与遥测系统中的医疗信息通信设备一起使用, 用于与可植入医疗设备通信。在示例性实施例中, 遥测装置包括物品, 该物品被配置和布置成物理地耦合到身体上并穿戴在身体上。另外, 天线构件位于物品上, 该物品被配置和布置成在植入装置和医疗通信系统之间建立通信链路。本发明的遥测装置提供了一种可靠且非侵入性的系统, 该系统方便地和长期地收集心脏和其他植入的医疗装置数据。此外, 该系统适用于患者管理模块和门户, 以提供到基于web的平台和数据管理系统的远程连接。

