(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 480 284 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
09.11.2016 Bulletin 2016/45

(21) Application number: **10818025.8**

(22) Date of filing: **21.09.2010**

(51) Int Cl.:
A61N 1/362 *(2006.01)* ***A61M 1/12*** *(2006.01)*
A61M 1/10 *(2006.01)* ***A61B 5/00*** *(2006.01)*

(86) International application number:
PCT/US2010/049666

(87) International publication number:
WO 2011/035308 (24.03.2011 Gazette 2011/12)

(54) **HARD-WIRED IMPLANTED CONTROLLER SYSTEM**

IMPLANTIERTES FESTVERDRAHTETES STEUERSYSTEM

SYSTÈME DE DISPOSITIF DE COMMANDE IMPLANTÉ CÂBLÉ

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR

(30) Priority: **21.09.2009 US 277135 P**
09.07.2010 US 399315 P

(43) Date of publication of application:
01.08.2012 Bulletin 2012/31

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Description

[0001] This application claims priority of U.S. Provisional Applications Nos. 61/399,315, filed July 9, 2010 and 61/277,135, filed September 21, 2009.

FIELD OF THE INVENTION

[0002] This invention relates to implantable medical devices. Specifically, the invention relates to a system for controlling implantable medical devices.

BACKGROUND OF THE INVENTION

[0003] Implantable medical devices such as ventricular assist devices are being developed for long term treatment of chronic heart failure. Such devices require a pumping mechanism to move blood. Due to the nature of the application, the pumping mechanism must be highly reliable. Patient comfort is also a significant consideration.

[0004] Transcutaneous energy transfer ("TET") systems are used to supply power to devices such as heart pumps implanted internally within a human body. An electromagnetic field generated by a transmitting coil outside the body can transmit power across a cutaneous (skin) barrier to a magnetic receiving coil implanted within the body. The receiving coil can then transfer the received power to the implanted heart pump or other internal device and to one or more batteries implanted within the body to charge the battery.

[0005] One of the challenges of such systems is insufficient battery lifetime. The implanted battery may be required to supply the implanted device's entire power demand for one to several hours at a time, such as when the patient does activities that preclude wearing the external TET power unit, such as showering or swimming. When the implanted battery is first implanted into the patient, the battery capacity is large and can meet the power demand for the required amount of time. However, when subjected to frequent charging and discharging, the implanted battery's capacity decreases. With decreased battery capacity, the patient cannot spend as much time without the external TET power unit. Eventually, the battery may need to be replaced so that the patient can go without the external TET power unit for long enough periods of time again.

[0006] In addition to the foregoing problems, the use of inductive coils by TET systems to wirelessly transfer power to an implanted battery results in slow recharging times, as inductive charging has lower efficiency and increased heating in comparison to direct contact. Thus, there is a need in the art for ventricular assist device ("VAD") technology that improves patient lifestyle during internal battery operation ("tether free") and reduces bulkiness of the external hardware during normal operation. Therefore, there is a need in the art for an implantable component design that solves the problems described above.

[0007] Document US 2007/142696 A1 discloses an example of an implantable circulatory assist system.

SUMMARY OF THE INVENTION

[0008] The present invention is defined in the appended claims.

[0009] The following presents a simplified summary of the invention in order to provide a basic understanding of some aspects of the invention. This summary is not an extensive overview of the invention. It is intended to neither identify key or critical elements of the invention nor delineate the scope of the invention. Its sole purpose is to present some concepts of the invention in a simplified form
as a prelude to the more detailed description that is presented later.

[0010] In accordance with one embodiment of the invention, an implantable controller and implantable power source attach to an implantable electrical device, such as a VAD, for powering the implantable electrical device when tether-free operation is desired, for example. In another embodiment of the present invention, a second power source, which may be referred to herein as an external power source in embodiments where implantable elements are actually implanted, supplies power to the implanted system and recharges the implantable power source by direct contact through a percutaneous connector.

[0011] In one embodiment, a backup controller is provided and it may have a hard wire communication link, through a percutaneous connector, to directly communicate with the implanted controller and serve as a programming/monitoring/diagnostic device). A back-up controller, which may be referred to herein as an external backup controller in embodiments where implantable elements are actually implanted, may also be plugged into the percutaneous connector to control the implantable electrical device. In one embodiment, a monitoring circuit of the implantable power unit can be used to monitor a condition of the implantable power source. The monitoring circuit can transmit a transcutaneous telemetry signal which represents the monitored condition to transfer control of the implantable electrical device to the backup controller or to trigger an alarm to alert a patient that an external power source should be connected to the percutaneous connector. In another embodiment the transcutaneous telemetry signal represents the monitored condition of the implantable controller for use by a control circuit to activate the backup controller. In one embodiment the backup controller transmits signals to the implantable controller through the percutaneous connector to disable the implantable controller and override the pump drive signals that are normally outputted by the implantable controller. In one embodiment, a logic signal used to switch between implantable controller and backup controller may be CMOS compatible (3.3 or 5 Volts,

for example), depending on the internal logic design.

[0012] One object of the invention is to provide VAD technology that improves a patient's lifestyle during tether free operation. Another object of the invention is to reduce the external hardware required during normal operation.

[0013] The following description and the annexed drawings set forth in detail certain illustrative aspects of the invention. These aspects are indicative, however, of but a few of the various ways in which the principles of the invention may be employed and the present invention is intended to include all such aspects and their equivalents. Other advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

FIG. 1 illustrates components and operation of an implantable therapeutic electrical system in accordance with one embodiment of the invention;

FIG. 2 illustrates a backup controller and a power source connected to an implantable therapeutic electrical system in accordance with one embodiment of the invention;

FIG. 3 illustrates a power source connected to an implantable therapeutic electrical system in accordance with one embodiment of the invention;

FIG. 4 illustrates an implantable therapeutic electrical system in accordance with one embodiment of the invention; and

FIG. 5 illustrates a backup controller and a power source connected to an implanted therapeutic electrical system in accordance with one embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] The embodiments described below provide an alternate configuration to the prior art implantable systems. In some of these embodiments power is provided by an external power source, including a battery, cigarette lighter adapter, AC adaptor or DC power source, through a percutaneous connector. This configuration may be used as an alternative to the TET power transfer disclosed in U.S. Provisional Application No. 61/191,595, assigned to the same assignee of the present application. In some embodiments the percutaneous connector includes extra pin connections to allow a backup controller to be connected in case the implantable controller were to fail.

[0016] In some embodiments, signals are transmitted by the backup controller to inhibit or block the implantable controller's drive circuits so that the backup controller's drive circuits tap into pump drive connections. When the implantable controller's drive MOSFETS are not disabled, the internal circuitry may sink the signal from the external motor drive and not properly drive the pump.

[0017] Fig. 1 illustrates an embodiment of the present invention, including an implantable therapeutic electrical device 101, such as a VAD device, implantable power sources including a rechargeable power source 103, a controller 105, and a skin button 107. In the illustrated embodiment, the power source 103 supplies power to the controller 105. In turn, the controller 105 sends driving signals to a motor in the electrical device 101. The skin button 107 may be implemented as a percutaneous connector that allows external modules to connect to the implantable controller 105, as well as to the implantable power source 103 and implantable device 101 (through wire lines inside the controller). In one embodiment of the present invention, controller 105, power source 103 and device 101 are all implanted inside a patient's body.

[0018] In one embodiment DC power may be supplied through the skin button 107 to the controller 105, the power source 103 and the device 101. If the implantable device 101 is a VAD, its power demands may not be supplied by the implantable power source 103 for long periods of time. In such case, the implantable power source 103 may act as a supplemental power source, the primary power being supplied externally through skin button 107, but the implanted power source 103 may still be used to supply power for short periods of time.

[0019] Fig. 2 illustrates another embodiment of the present invention. The figure illustrates implantable therapeutic electrical device 201, implantable power source 203, implantable controller 205, and wires 233, 255, 265 and 223. Also illustrated are external power source 213, external backup controller 235, external telemetry transceiver 227, as well as external wired connections 245 and 243 and wireless connection 217.

[0020] The controller 205 may include Drive MOSFETs 225 connected to a motor controller 215. The motor controller 215 may produce control signals for controlling a pump in the illustrated VAD 201. These control signals may be relayed to the VAD 201 by the Drive MOSFETs 225. The signals may also be conditioned by the Drive MOSFETs 225.

[0021] In one mode of operation, the Drive MOSFETs 225 operate as switches that interrupt the signal from the motor controller 215. In this mode of operation, the backup controller 235 sends the signal through wired connection 265 to command the interruption of the control signal from motor control 215. Also, the backup controller may supply a backup motor control signal 255 to drive the VAD 201. In one embodiment, this mode of operation is triggered after the remote telemetry transceiver 225 detects a signal sent over the wireless connection 217 indicative of a malfunction of motor controller 215. In another embodiment, the backup controller may receive the signal indicative of a malfunction through a wired connection.

[0022] In one embodiment of the present invention, the VAD's motor may be a permanent magnet brushless, sensorless DC motor. The motor is desirably highly reliable and maintenance free. The drive signals that are input to the stators(s) may be multiphase and biphasic to create a requisite rotating magnetic field excitation for normal operation of the motor. The stator drive signals may range from nearly zero volts to 16 volts, and from zero to three (3) amps. Typical power dissipation may be between 1 to 45 Watts, depending upon selected RPM and resultant flow rate.

[0023] Also, the backup controller may have a hard wire communication link to directly communicate with the implanted controller and serve as a programming/monitoring/diagnostic device. The transceiver 225 may also detect other signals representative of measurements of operational parameters of the implanted module. These can be routed to the external controller 235 for remedial or corrective action. Examples of these parameters include low battery, excessive voltage applied to implanted electrical device (e.g., VAD), high temperature of implanted module, etc. When a signal indicative of low power is received, power may be supplied externally by power source 3131, the power signal being routed through backup controller.

[0024] Also, with reference to FIG. 2, in another mode of operation of the illustrated embodiment, the external rechargeable battery 213 is connected to the skin button 207 (instead of backup controller) and may supply power to the controller 205 through wired connections 223 and 243. The cable 223 may be of a lesser width and composition from the cable 243, as cable 223 is implantable. The skin button 207 serves not only as the percutaneous physical interface between external and internal modules, it also serves as the electrical interface.

[0025] The mode of operation where the external power source 213 supplies power to the controller 205 may be triggered by receipt by the transceiver 227 of a signal over wireless connection 217 which is indicative of implanted battery 203 having low power. The "low power" signal may be generated by monitoring the signal fed to the controller 205 over cable 233. The signal indicative of a malfunction (e.g., low power) may trigger a visual or audible alarm to alert the patient to connect external power source to the skin button.

[0026] FIG. 3 illustrates another configuration of the system of the present invention. In the illustrated embodiment the backup controller 213 is not connected to the skin button 207. When the backup controller is not plugged into the skin button, the skin button may mechanically ground the input MOSFET disable signal 265 to avoid accidental disabling of controller 205

[0027] In the embodiment illustrated in FIG. 3, the telemetry transceiver 227 may still detect whether the controller 205 functions properly and may activate a visual and/or audible alarm to alert the patient of any malfunctioning of the implanted controller 205. In one embodiment, the alarm may be inserted in a wristwatch for use by the patient.

[0028] FIG. 4 illustrates the system components that may be used in one mode of operation. In this embodiment, neither the external battery (or power sources) 213 nor the backup controller is connected to the skin button 207, allowing the patient to move freely without any external physical connections.

[0029] In the embodiment illustrated in FIG. 4, the external transceiver 227 is still able to detect anomalies in the operation of the implanted controller 205 or in the supply of power through cable 233 and alert the patient of these. In the event that there are any anomalies, the patient may plug in either the battery 213 or the backup controller 235 as illustrated in FIG. 3. Alternatively, the power source 213 and the controller 235 may be connected in series as illustrated in FIG. 5, with the signal for providing power being routed through the controller 235.

[0030] The foregoing description of possible implementations consistent with the present invention does not represent a comprehensive list of all such implementations or all variations of the implementations described. The description of only some implementation should not be construed as an intent to exclude other implementations. For example, an embodiment described as including implantable components should not be construed as an intent to exclude an implementation whereby those components are actually implanted in a patient's body. Artisans will understand how to implement the invention in many other ways, using equivalents and alternatives that do not depart from the scope of the following claims. Moreover, unless indicated to the contrary in the preceding description, none of the components described in the implementations are essential to the invention.

Claims

1. A circulatory assist system comprising:

an implantable electrical device (101, 201) having an electric motor;
an implantable controller (105, 205) electrically connected to said implantable electrical device (101, 201);
an implantable power source (103, 203) electrically connected to said implantable controller (105, 205) for supplying power to the implantable controller (105, 205) or to the implantable electrical device (101, 201); and
a percutaneous connector (107, 207) having a first side and a second side opposite to said first side;

wherein said implantable controller (105, 205) is attachable to said first side of the percutaneous connector (107, 207),
the second side of said percutaneous connector

(107, 207) allows connectivity to said implantable controller (105, 205), and
characterized in that the implantable controller (105, 205) includes a drive MOSFET circuit (225) for disabling drive signals from the implantable controller (105, 205) or disabling routing of power from the implantable power source (103, 203) through the implantable controller (105, 205) to the implantable electrical device (101, 201), and that the percutaneous connector (107, 207) is a skin button, wherein the skin button is configured to selectively ground an input MOSFET disable signal.

2. The system of claim 1, further comprising:

a monitoring circuit operable to monitor a condition of power supplied by said implantable power source (103, 203) to said implantable controller (105, 205) or to said implantable electrical device (101, 201), or
operation of the implantable controller (105, 205), and
a telemetry transmitter, electrically connected to said monitoring circuit, for transmitting a transcutaneous telemetry signal representing the monitored condition.

3. The system of claim 2, further comprising:

a backup controller (235) electrically connected to said second side of the percutaneous connector (107, 207);
a telemetry transceiver (227), for wirelessly receiving said transcutaneous telemetry signal and retransmitting the signal to a receiver associated with the backup controller (235);

wherein said backup controller (235) is capable of transmitting through the percutaneous connector (107, 207) to said implantable controller (105, 205) a signal to disable said implantable controller (105, 205) or to override drive signals from said implantable controller (105, 205) to said implantable device (101, 201) when said retransmitted transcutaneous telemetry signal received by said backup controller (235) from said telemetry transceiver (227) is indicative of a faulty condition of said implantable controller (105, 205) or said implantable electrical device (101, 201).

4. The system of claim 2, further comprising:

a power source module (213, 313) electrically connected to said second side of the percutaneous connector (107, 207);

wherein said power source module (213, 313) is operable to supply power to the implantable controller (105, 205) or to the implantable electrical device (101, 201) through the percutaneous connector (107, 207).

5. The system of claim 3, further comprising:

a monitoring circuit operable to monitor a condition of: power supplied by said implantable power source (103, 203) to said implantable controller (105, 205) or to said implantable electrical device (101, 201), or operation of the implantable controller (105, 205), and
a telemetry transmitter, electrically connected to said monitoring circuit, for transmitting a telemetry signal representing through the percutaneous connector (107, 207) the monitored condition to a backup controller (235) electrically connected to said second side of the percutaneous connector (107, 207);

wherein said backup controller (235) is capable of transmitting through the percutaneous connector (107, 207) to said implantable controller (105, 205) a signal to disable said implantable controller (105, 205) or to override drive signals from said implantable controller (105, 205) to said implantable device (101, 201) when said retransmitted transcutaneous telemetry signal received by said backup controller (235) from said telemetry transceiver (227) is indicative of a faulty condition of said implantable controller (105, 205) or said implantable electrical device (101, 201).

6. The system of claim 1, wherein the implantable power source (103, 203) includes a rechargeable battery.

7. The system of claim 1, wherein the implantable electrical device (101, 201) includes a motor and the implantable controller (105, 205) includes a DC motor control circuit for controlling said motor.

8. The system of claim 2, further comprising an alarm device capable of:

receiving said transmitted transcutaneous telemetry signal, and
producing a sound alert when said received signal is indicative of a faulty condition of said implantable controller or said implantable electrical device.

9. The system of claim 8, wherein said alarm device is embodied in a wrist watch.

10. The system of claim 3, further comprising a power source (313) connected to the backup controller (235).

Patentansprüche

1. Kreislaufunterstützungssystem, Folgendes umfassend:

eine implantierbare elektrische Vorrichtung (101, 201) mit einem Elektromotor; eine implantierbare Steuerung (105, 205), die mit der implantierbaren elektrischen Vorrichtung (101, 201) elektrisch verbunden ist;
eine implantierbare Energiequelle (103, 203), die mit der implantierbaren Steuerung (105, 205) elektrisch verbunden ist, zur Versorgung der implantierbaren Steuerung (105, 205) oder der implantierbaren elektrischen Vorrichtung (101, 201) mit Energie; und
einen perkutanen Verbinder (107, 207) mit einer ersten Seite und einer zweiten Seite, die der ersten Seite gegenüberliegt;

wobei die implantierbare Steuerung (105, 205) an die erste Seite des perkutanen Verbinders (107, 207) angefügt werden kann,
wobei die zweite Seite des perkutanen Verbinders (107, 207) die Verbindung mit der implantierbaren Steuerung (105, 205) ermöglicht, und
dadurch gekennzeichnet, dass die implantierbare Steuerung (105, 205) einen Antriebs-MOSFET-Kreislauf (225) zur Deaktivierung von Antriebssignalen von der implantierbaren Steuerung (105, 205) oder zur Deaktivierung des Leitens von Energie von der implantierbaren Energiequelle (103, 203) durch die implantierbare Steuerung (105, 205) zur implantierbaren elektrischen Vorrichtung (101, 201) umfasst, und dass der perkutane Verbinder (107, 207) ein Hautknopf ist, wobei der Hautknopf so konfiguriert ist, dass er ein eingehendes MOSFET-Deaktivierungssignal selektiv erden kann.

2. System nach Anspruch 1, ferner Folgendes umfassend:

einen Überwachungskreislauf, der steuerbar ist, um einen Zustand der Energie zu überwachen, die von der implantierbaren Energiequelle (103, 203) zur implantierbaren Steuerung (105, 205) oder zur implantierbaren elektrischen Vorrichtung (101, 201) geführt wird, oder des Betriebs der implantierbaren Steuerung (105, 205), und einen Telemetriesender, der mit dem Überwachungskreislauf elektrisch verbunden ist, um ein transkutanes Telemetriesignal zu senden, das den überwachten Zustand darstellt.

3. System nach Anspruch 2, ferner Folgendes umfassend:

eine Backup-Steuerung (235), die mit der zweiten Seite des perkutanen Verbinders (107, 207) elektrisch verbunden ist;
ein Telemetriesignal (227) zum drahtlosen Empfangen des transkutanen Telemetriesignals und zum Weitersenden des Signals zu einem Empfänger, der mit der Backup-Steuerung (235) verbunden ist;

wobei die Backup-Steuerung (235) ein Signal durch den perkutanen Verbinder (107, 207) zur implantierbaren Steuerung (105, 205) senden kann, um die implantierbare Steuerung (105, 205) zu deaktivieren oder um Antriebssignale von der implantierbaren Steuerung (105, 205) zur implantierbaren Vorrichtung (101, 201) zu überbrücken, wenn das weitergesendete transkutane Telemetriesignal, das von der Backup-Steuerung (235) von dem Telemetrie-Transceiver (227) empfangen wurde, auf einen fehlerhaften Zustand der implantierbaren Steuerung (105, 205) oder der implantierbaren elektrischen Vorrichtung (101, 201) hinweist.

4. System nach Anspruch 2, ferner Folgendes umfassend:

eine Energieversorgungsquelle (213, 313), die mit der zweiten Seite des perkutanen Verbinders (107, 207) elektrisch verbunden ist;

wobei die Energieversorgungsquelle (213, 313) steuerbar ist, um Energie durch den perkutanen Verbinder (107, 207) zur implantierbaren Steuerung (105, 205) oder zur implantierbaren elektrischen Vorrichtung (101, 201) zu führen.

5. System nach Anspruch 3, ferner Folgendes umfassend:

einen Überwachungskreislauf, der steuerbar ist, um einen Zustand der Energie zu überwachen, die von der implantierbaren Energiequelle (103, 203) zur implantierbaren Steuerung (105, 205) oder zur implantierbaren elektrischen Vorrichtung (101, 201) geführt wird, oder des Betriebs der implantierbaren Steuerung (105, 205), und einen Telemetriesender, der mit dem Überwachungskreislauf verbunden ist, um ein Telemetriesignal zu senden, das durch den perkutanen Verbinder (107, 207) den überwachten Zustand zu einer Backup-Steuerung (235) darstellt, die mit der zweiten Seite des perkutanen Verbinders (107, 207) elektrisch verbunden ist;

wobei die Backup-Steuerung (235) ein Signal durch den perkutanen Verbinder (107, 207) zur implantierbaren Steuerung (105, 205) senden kann, um die implantierbare Steuerung (105, 205) zu deaktivieren oder um Antriebssignale von der implantierbaren

Steuerung (105, 205) zur implantierbaren Vorrichtung (101, 201) zu überbrücken, wenn das weitergesendete transkutane Telemetriesignal, das von der Backup-Steuerung (235) von dem Telemetrie-Transceiver (227) empfangen wurde, auf einen fehlerhaften Zustand der implantierbaren Steuerung (105, 205) oder der implantierbaren elektrischen Vorrichtung (101, 201) hinweist.

6. System nach Anspruch 1, wobei die implantierbare Energiequelle (103, 203) eine wiederaufladbare Batterie umfasst.

7. System nach Anspruch 1, wobei die implantierbare elektrische Vorrichtung (101, 201) einen Motor umfasst und die implantierbare Steuerung (105, 205) einen Gleichstrommotor-Steuerkreis für die Steuerung des Motors umfasst.

8. System nach Anspruch 2, ferner umfassend eine Alarmvorrichtung, die zu Folgendem fähig ist: Empfangen des gesendeten transkutanen Telemetriesignals, und
Erzeugen eines Alarmtons, wenn das empfangene Signal auf einen fehlerhaften Zustand der implantierbaren Steuerung und der implantierbaren elektrischen Vorrichtung hinweist.

9. System nach Anspruch 8, wobei die Alarmvorrichtung in eine Armbanduhr integriert ist.

10. System nach Anspruch 3, ferner umfassend eine Energiequelle (313), die mit der Backup-Steuerung (235) verbunden ist.

Revendications

1. Système d'assistance circulatoire comprenant :

un dispositif électrique implantable (101, 201) possédant un moteur électrique ; une unité de commande implantable (105, 205) connectée électriquement audit dispositif électrique implantable (101, 201) ;
une source d'alimentation implantable (103, 203) connectée électriquement à ladite unité de commande implantable (105, 205) destinée à délivrer l'alimentation à l'unité de commande implantable (105, 205) ou au dispositif électrique implantable (101, 201) ; et
un connecteur percutané (107, 207) possédant une première face et une deuxième face opposée à ladite première face ;

dans lequel ladite unité de commande implantable (105, 205) est attachable à ladite première face du connecteur percutané (107, 207),
la deuxième face dudit connecteur percutané (107, 207) permet une connectivité à ladite unité de commande implantable (105, 205), et
caractérisé en ce que l'unité de commande implantable (105, 205) inclut un circuit MOSFET d'entraînement (225) destiné à désactiver les signaux d'entraînement en provenance de l'unité de commande implantable (105, 205) ou à désactiver l'acheminement d'alimentation en provenance de la source d'alimentation implantable (103, 203) via l'unité de commande implantable (105, 205) au dispositif électrique implantable (101, 201), et **en ce que** le connecteur percutané (107, 207) est une touche sur la peau, dans lequel la touche sur la peau est configurée pour mettre à la masse sélectivement un signal de désactivation MOSFET en entrée.

2. Système selon la revendication 1, comprenant en outre :

un circuit de surveillance opérable pour surveiller une condition d'alimentation délivrée par ladite source d'alimentation implantable (103, 203) à ladite unité de commande implantable (105, 205) ou audit dispositif électrique implantable (101, 201), ou l'utilisation de l'unité de commande implantable (105, 205), et
un émetteur de télémesure, connecté électriquement audit circuit de surveillance, destiné à émettre un signal de télémesure transcutané représentant la condition surveillée.

3. Système selon la revendication 2, comprenant en outre :

une unité de commande de secours (235) connectée électriquement à ladite deuxième face du connecteur percutané (107, 207),
un émetteur-récepteur de télémesure (227), destiné à recevoir sans fil ledit signal de télémesure transcutané et à retransmettre le signal à un récepteur associé à l'unité de commande de secours (235) ;

dans lequel ladite unité de commande de secours (235) est en mesure de transmettre via le connecteur percutané (107, 207) à ladite unité de commande implantable (105, 205) un signal pour désactiver ladite unité de commande implantable (105, 205) ou pour annuler les signaux d'entraînement en provenance de ladite unité de commande implantable (105, 205) audit dispositif implantable (101, 201) quand ledit signal de télémesure transcutané retransmis reçu par ladite unité de commande de secours (235) en provenance dudit émetteur-récepteur de télémesure (227) indique une condition d'erreur de ladite unité de commande implantable (105, 205) ou dudit dispositif électrique implantable (101, 201).

4. Système selon la revendication 2, comprenant en outre :

un module de source d'alimentation (213, 313) connecté électriquement à ladite deuxième face du connecteur percutané (107, 207) ;

dans lequel ledit module de source d'alimentation (213, 313) est opérable pour délivrer l'alimentation à l'unité de commande implantable (105, 205) ou au dispositif électrique implantable (101, 201) via le connecteur percutané (107, 207).

5. Système selon la revendication 3, comprenant en outre :

un circuit de surveillance opérable pour surveiller une condition d'alimentation délivrée par ladite source d'alimentation implantable (103, 203) à ladite unité de commande implantable (105, 205) ou audit dispositif électrique implantable (101, 201), ou l'utilisation de l'unité de commande implantable (105, 205), et
un émetteur-récepteur de télémesure, connecté électriquement audit circuit de surveillance, pour transmettre un signal de télémesure représentant via le connecteur percutané (107, 207) la condition surveillée à une unité de commande de secours (235) connectée électriquement à ladite deuxième face du connecteur percutané (107, 207) ;

dans lequel ladite unité de commande de secours (235) est en mesure de transmettre via le connecteur percutané (107, 207) à ladite unité de commande implantable (105, 205) un signal pour désactiver ladite unité de commande implantable (105, 205) ou pour annuler les signaux d'entraînement en provenance de ladite unité de commande implantable (105, 205) audit dispositif implantable (101, 201) quand ledit signal de télémesure transcutané retransmis reçu par ladite unité de commande de secours (235) en provenance dudit émetteur-récepteur de télémesure (227) indique une condition d'erreur de ladite unité de commande implantable (105, 205) ou dudit dispositif électrique implantable (101, 201).

6. Système selon la revendication 1, dans lequel la source d'alimentation implantable (103, 203) inclut une batterie rechargeable.

7. Système selon la revendication 1, dans lequel le dispositif électrique implantable (101, 201) inclut un moteur et l'unité de commande implantable (105, 205) inclut un circuit de commande de moteur CC destiné à commander ledit moteur.

8. Système selon la revendication 2, comprenant en outre un dispositif d'alarme en mesure de recevoir ledit signal de télémesure transcutané transmis, et produire une alarme sonore quand ledit signal reçu indique une condition d'erreur de ladite unité de commande implantable ou dudit dispositif électrique implantable.

9. Système selon la revendication 8, dans lequel ledit dispositif d'alarme est mis en oeuvre dans une montre-bracelet.

10. Système selon la revendication 3, comprenant en outre une source d'alimentation (313) connectée à l'unité de commande de secours (235).

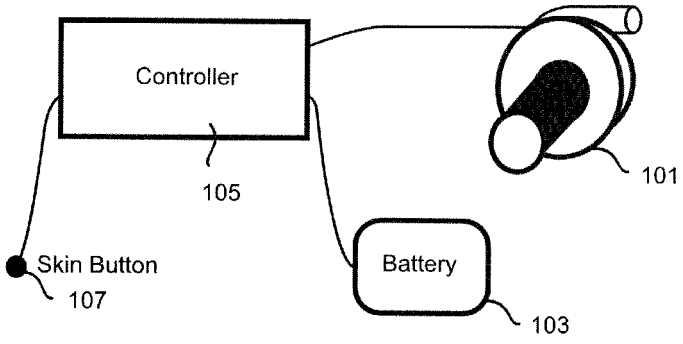


Fig. 1

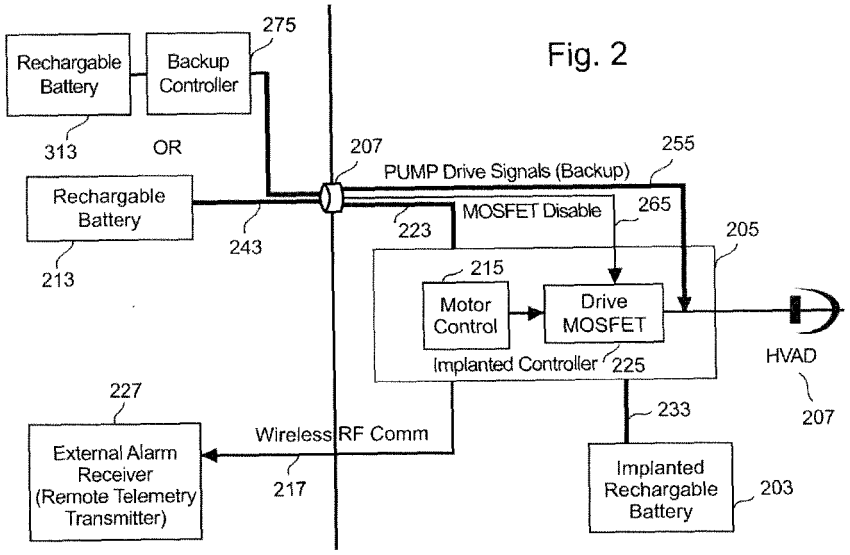

Rechargable Battery
Backup Controller
275
313
OR
207
255
PUMP Drive Signals (Backup)
Rechargable Battery
243
223
MOSFET Disable
265
205
213
215
Motor Control
Drive MOSFET
HVAD
Implanted Controller 225
207
227
233
External Alarm Receiver (Remote Telemetry Transmitter)
Wireless RF Comm
217
Implanted Rechargable Battery
203

Fig. 2

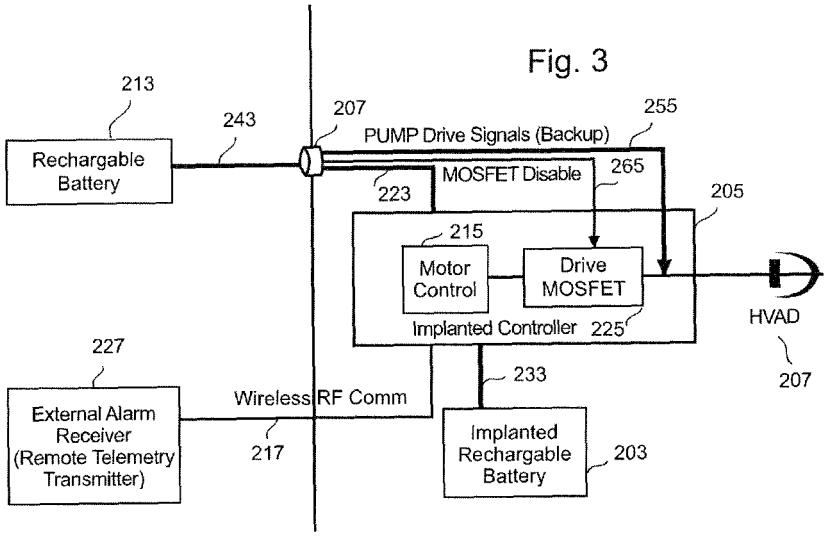

213
243
207
255
PUMP Drive Signals (Backup)
Rechargable Battery
223
MOSFET Disable
265
205
215
Motor Control
Drive MOSFET
HVAD
Implanted Controller 225
207
227
233
External Alarm Receiver (Remote Telemetry Transmitter)
Wireless RF Comm
217
Implanted Rechargable Battery
203

Fig. 3

Fig. 4

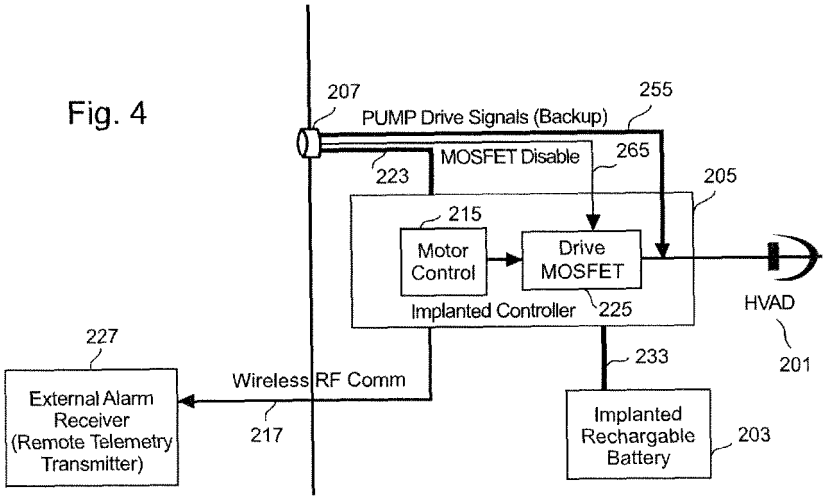
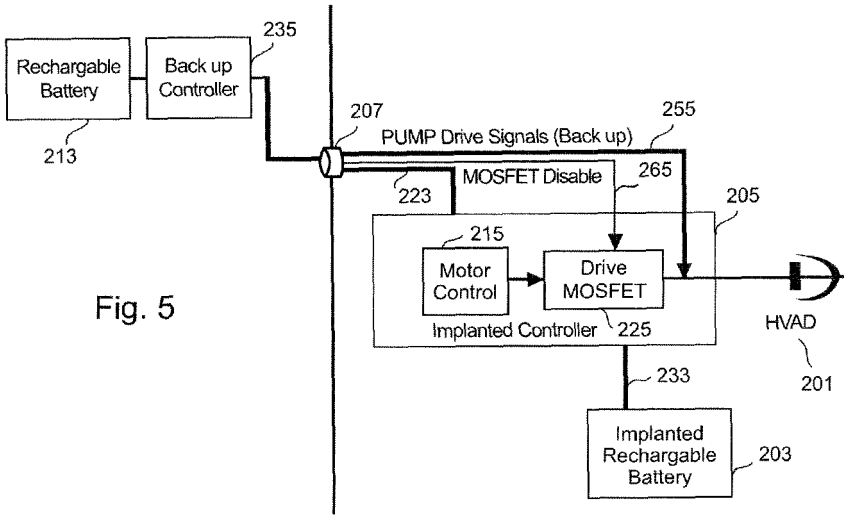

207
255
PUMP Drive Signals (Backup)
MOSFET Disable
265
223
205
215
Motor Control
Drive MOSFET
Implanted Controller
225
HVAD
201
227
External Alarm Receiver (Remote Telemetry Transmitter)
Wireless RF Comm
217
233
Implanted Rechargable Battery
203

Fig. 5


Rechargable Battery
213
Back up Controller
235
207
255
PUMP Drive Signals (Back up)
MOSFET Disable
265
223
205
215
Motor Control
Drive MOSFET
Implanted Controller
225
HVAD
201
233
Implanted Rechargable Battery
203

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 61399315 A **[0001]**
- US 61277135 B **[0001]**
- US 2007142696 A1 **[0007]**
- US 61191595 A **[0015]**

专利名称(译)	硬接线植入控制器系统		
公开(公告)号	EP2480284A4	公开(公告)日	2014-07-09
申请号	EP2010818025	申请日	2010-09-21
[标]申请(专利权)人(译)	哈特威尔公司		
申请(专利权)人(译)	心件，INC.		
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IPC分类号	A61N1/362 A61B5/00 A61M1/10 A61M1/12		
CPC分类号	A61M1/127 A61B5/0015 A61M1/1086 A61M1/12 A61M2205/10 A61M2205/18 A61M2205/3523 A61M2205/3592		
优先权	61/277135 2009-09-21 US 61/399315 2010-07-09 US		
其他公开文献	EP2480284B1 EP2480284A1		
外部链接	Espacenet		

摘要(译)

公开了一种循环辅助系统，该系统包括具有电动马达的可植入电气设备，连接到可植入电气设备的可植入控制器，以及连接到控制器的可植入电源，用于向控制器供电。控制器可附接到经皮连接器的第一侧。经皮连接器的与第一侧相对的第二侧允许与所述控制器的外部连接。