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(54) **Cable monitoring apparatus**

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(73) Proprietor: **KPR U.S., LLC**
Mansfield, MA 02048 (US)

(72) Inventors:
• **Meyer, Peter**
Shrewsbury, MA Massachusetts 01545 (US)
• **Zaiken, Eliot**
Sparta, NJ New Jersey 07871 (US)

(74) Representative: **Prock, Thomas**
Marks & Clerk LLP
15 Fetter Lane
London EC4A 1BW (GB)

(56) References cited:
EP-A1- 0 484 107 US-A- 5 566 680
US-A1- 2005 182 466

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Description

(a) BACKGROUND

(b) Technical Field

[0001] The present disclosure relates to medical equipment. In particular, the present disclosure relates to a method of cable monitoring which checks the functionality of an electrical cable adapted to connect to a medical apparatus, such as a fetal monitor.

(c) Description of Related Art

[0002] Fetal monitors have been widely used and are capable of measuring a wide variety of uterine, fetal and maternal parameters, such as for example, uterine temperature, intrauterine pressure, fetal electrocardiogram, etc. This information may be gathered via a variety of sensors (e.g., electrode arrays, pressure transducers, catheters, etc.) applied to the maternal patient. Monitoring signals, from the fetus and maternal patient, are received by the sensors, transmitted via electrical cables to a fetal monitor and displayed on the fetal monitor.

[0003] Typically, during labor and delivery, a multitude of sensors are required to receive monitoring signals containing maternal and fetal information. Application of maternal and fetal sensors is time consuming and at times unpleasant to the woman, particularly the application of invasive devices such as an intrauterine pressure transducer or a fetal scalp electrode. The proper operation of sensors is essential and clinicians continually monitor the various sensors and the associated systems to check functionality and to insure the sensors are providing accurate information.

[0004] When a sensor is not functioning properly or not providing accurate information, it becomes necessary to troubleshoot the entire fetal monitoring system to determine the origin of the malfunction. One troubleshooting step includes determining if the origin of the malfunction is hardware related, in particular a faulty sensor and/or electrical cable. Typically, electrical cables are easier to diagnose and replace since electrical cable replacement usually does not require the removal and reapplication of the sensor. Reusable cables may cost much more than disposable sensors, making the potentially unnecessary replacement of cables wasteful. Therefore, there is a need for a cable monitoring apparatus for determining whether the fetal monitoring cables are functioning properly.

[0005] EP0484107 and US5566680 refer respectively to an electrical connection device for use in monitoring fetal heart rate and a transducer tipped intrauterine pressure catheter system.

SUMMARY

[0006] The present disclosure relates to medical

equipment. In particular, the present disclosure relates to a method of cable monitoring which checks the functionality of an electrical cable adapted to connect to a medical apparatus, such as a fetal monitor, as well as allows for zeroing and/or re-zeroing of monitoring functions of the medical apparatus, wherein monitoring signals are supplied from fetal and maternal monitoring sensors.

[0007] According to the present invention, that is defined in claim 1, there is provided a method for fetal or maternal monitoring, comprising the steps of:

electrically connecting a medical cable monitor with a monitoring apparatus;

electrically connecting one end of a medical cable to an input interface of the medical cable monitor and the other end of the medical cable to a cable diagnostic interface of the medical cable monitor;

activating the medical cable monitor in one mode of operation whereby signal processing circuitry of the medical cable monitor tests functionality of the medical cable connected between the input interface and the cable diagnostic interface;

electrically connecting the other end of the medical cable to a sensor after removing the other end of the medical cable from the cable diagnostic interface of the medical cable monitor;

sensing a parameter with the sensor and sending a monitoring signal associated with the parameter to the input interface of the medical cable monitor; and activating the medical cable monitor in another mode of operation whereby the signal processing circuitry passes the monitoring signal to the monitoring apparatus.

[0008] In the step of connecting one end of the medical cable to a sensor, a sensor is selected from a group consisting of a medical electrode, a medical electrode sensor array, an abdominal strain gauge, a tocodynamometer, an intrauterine pressure catheter, a vacuum pressure sensor, a pulse oximeter, a pH sensor, a cervical dilation sensor, a cervical effacement sensor, a cervical length sensor, a fetal station sensor, and an ultrasound transducer.

FIG. 1 is a view of a fetal monitoring system incorporating a cable monitoring apparatus in accordance with the present disclosure;

FIG. 2 is a view of the cable monitoring apparatus of **FIG. 1**;

FIG. 3 is an electrical schematic illustrating the components of the cable monitoring apparatus; and

FIG. 4 is a programming flowchart illustrating functionality of the cable monitoring apparatus.

DETAILED DESCRIPTION

[0009] Particular embodiments of the present disclo-

sure are described hereinbelow with reference to the accompanying drawings. In the following description, well-known functions or constructions are not described in detail to avoid obscuring the present disclosure in unnecessary detail.

[0010] FIG. 1 shows a fetal monitoring system 10 incorporating a cable monitoring apparatus according to the present disclosure. The fetal monitoring system 10 includes one or more sensor, devices or probes, such as fetal electrocardiogram (FECG) sensor 20 and an intra-uterine pressure (IUP) catheter 30. The FECG sensor 20 may include at least one electrode adapted to adhere to skin on the abdomen of the patient P. The IUP catheter 30 may be a pressure catheter placed within the uterus of the patient P. The FECG sensor 20 and the IUP catheter 30 are operably and electrically coupled with the FECG sensor cable connector 26 and IUP catheter cable connector 36, respectively.

[0011] In the discussion which follows, the term cable may incorporate a single conductor or may comprise an assembly of conductors arranged in any mode of operation known in the art. Connector refers to a single plug, receptacle, or other device capable of electro-mechanically connecting to a cable, device or apparatus. A connector assembly refers to the connection between two connectors wherein the connectors facilitate connectivity between two cables, devices or apparatus, or any combination thereof. Connection between the two components may be solely electrical without any mechanical means of connection. Such electrical connection may be infrared or incorporate electromagnetic wave principles. Thus, the term "connection" or "electrical connection" is to be construed as any electrical, mechanical connection or combination thereof known in the art.

[0012] The FECG electrical cable 40 and the IUP electrical cable 42 first connectors 40A, 42A are connected to the respective device connectors 26, 36. In the prior art, second connectors 40B, 42B of the cables 40, 42 connect directly to the monitoring device 50. Signal loss at the monitoring device 50 typically resulted in the replacement of an electrical cable 40, 42 since cable replacement is easier than the removal and subsequent reapplication of a sensor 20,30.

[0013] The first embodiment of a cable monitoring apparatus 100 in accordance with the present disclosure will now be discussed. Cable monitoring apparatus 100 is coupled between one or more electrical cables 40, 42 and the monitoring device 50. The FECG electrical cable second connector 40B of the FECG sensor cable 40 electro-mechanically connects to the first input connector 102 and the sensed information from the FECG sensor 20 is selectively passed through the first output connector 104 to the monitoring device 50. The IUP sensor cable second connector 42B of the IUP sensor cable 42 electro-mechanically connects to the second input connector 106 and the sensed information from the IUP sensor 30 is selectively passed through the second output connector 108 to a monitoring device 50. Cable monitoring appa-

ratus 100 electro-mechanically connects to the monitoring device 50 with two interface cables 110. It is envisioned that the cable monitoring apparatus 100 electro-mechanically connects to the monitoring device in any number of ways known in the art.

[0014] FIG. 1 illustrates a fetal monitoring system 10 with a cable monitoring apparatus 100 interfacing with two sensor cables 40, 42 and one monitoring device 50. Monitoring device 50 may be a fetal monitoring device or any other device capable of receiving and displaying a monitoring signal. The present disclosure may interface with any number of cables or monitoring devices.

[0015] In a first mode of operation of cable monitoring apparatus 100, sensed information is passed from the sensors 20, 30 through the cables 40, 42 and the cable monitoring apparatus 100 and to the monitoring device 50. In a first mode of operation, cable monitoring apparatus 100 does not substantially alter or degrade the signal provided to the fetal monitoring system 10.

[0016] With reference to FIG. 2, cable monitoring apparatus 100 consists of a housing 120 which houses a plurality of connectors and user interface devices described hereinbelow. In this particular embodiment, cable monitoring apparatus 100 is configured to connect to two medical sensors although it is envisioned cable monitoring apparatus 100 described herein may connect to any number of medical sensors or devices. Housing 120 may be sufficiently small and manufactured from lightweight materials, such as plastic, such that the cable monitoring apparatus 100 is a light-weight inline device.

[0017] FIG. 2 illustrates the cable monitoring apparatus 100 in a second mode of operation wherein cable monitoring apparatus 100 is utilized in a diagnostic capacity. Clinicians start the process of troubleshooting after it is determined that the fetal monitoring system 10 is not operating correctly. The cable monitoring apparatus 100 may be used as a diagnostic tool to determine the functionality of electrical cables 140, 142. The cable monitoring apparatus 100 may perform a number of diagnostic tests known in the art.

[0018] Second connector 140B of an electrical cable 140 is electro-mechanically connected to the first input connector 102. The first connector 140A of the same electrical cable 140 is disconnected from a medical sensor and electro-mechanically connected to the first diagnostic connector 103. A second electrical cable 142 may connect in a similar fashion with the second connector 142B connected to a second input connector 106 and the first connector 142A connected to a second diagnostic connector 107. The various electrical cables 140, 142 attached to the cable monitoring apparatus 100 may operate independent of each other wherein an electrical cable may be arranged in the first mode of operation while a second electrical cable may be arranged in the second mode of operation.

[0019] With reference to FIGS. 1 and 2, switching from the first mode of operation, as shown in FIG. 1 wherein sensed information is selectively passed through the ca-

ble monitoring apparatus, to the second mode of operation, as shown in **FIG. 2** wherein the cable monitoring apparatus is used to diagnose an electrical cable, requires disconnecting the first connectors **140A, 142A** of the first and second electrical cables **40, 42** from the FECG sensor cable connector **26** and the IUP catheter cable connector **36** and reconnecting the first connectors **140A, 142A** to the first and second diagnostic connectors **103, 107**.

[0020] Alternatively, the clinician may diagnose the electrical cable with cable monitoring apparatus **100** prior to connecting the first connectors **140A, 142A** to the sensors connectors **26, 36**.

[0021] Returning to **FIG. 2**, first cable indicator **150** indicates the functionality of a cable connected between the first input connector **102** and the first diagnostic connector **103**. Second cable indicator **152** indicates the functionality of a cable connected between the second input connector **106** and the second diagnostic connector **107**. First and second cable indicators **150, 152** may be audio indicators, visual indicators, or any indicator known in the art, or combination thereof.

[0022] **FIG. 3** is a schematic of the cable monitoring apparatus **100** including signal processing circuitry **150** operably coupled to the various input connectors, output connectors, test connectors and indicator devices described hereinbelow. Signal processing circuitry **150** may include a Digital Signal Processor (DSP) **150A** having a memory storing a set of programmable instructions capable of being executed by the DSP **150A** for performing the functions described herein. Signal processing circuitry **150** may be an application-specific integrated circuit (ASIC) customized for this particular use or may be a general purpose device adapted for this use.

[0023] In the first mode of operation, signal processing circuitry **150** selectively passes monitoring information from the first and second input connectors **102, 106** to the respective first and second output connectors **104, 108**. First and second output connectors **104, 108** pass monitoring information to display monitor **50**. In this mode of operation, the monitoring information received at the display monitor **50** is essentially identical to the monitoring information received by the sensors **20, 30**.

[0024] In the second mode of operation, signal processing circuitry **150** performs a diagnostic check on an electrical cable attached between the first or second input connectors **102, 106** and the respective first or second diagnostic connectors **103, 107**. Signal processing circuitry **150** is connected to various indicators **152, 153** to indicate the results of the diagnostic check for each electrical cable. Diagnostic check may include testing the continuity and impedance of the various conductors, testing continuity and impedance between the various conductors, testing the capacitive properties of the cable, testing the insulation in the cable, measuring losses within the cable and conductors, measuring the frequency response and signal losses at various frequencies and any other test known in the art. Various indicators **152,**

153 are indicative of at least one operating feature of the electrical cable which include test performed, or measurements made, on the cable. Indicators **152, 153** may be audible indicators, visual indicators, or other indicators known in the art.

[0025] The first or second input connectors **102, 106** may interface with various medical sensors (not shown) including a medical electrode, a medical electrode sensor array, an abdominal

[0026] The first or second input connectors **102, 106** may interface with various medical sensors (not shown) including a medical electrode, a medical electrode sensor array, an abdominal strain gage, a tocodynamometer, an intrauterine pressure catheter, and an ultrasound transducer.

[0027] One such sensor, the pressure catheter, is a common apparatus for measuring the uterine contractions of a maternal abdomen. Various pressure catheter components and systems are described in U.S. Patent No. 5,566,680 to Urion et al. titled "Transducer-Tipped Intrauterine Pressure Catheter System". Referring to **FIG. 1**, the IUP catheter **30** is a type of pressure catheter that measures force applied to the pressure catheter by the patient **P**.

[0028] In monitoring fetal contractions with a pressure catheter it often becomes necessary or desirable to "zero" or "re-zero" the pressure catheter in situ. U.S. Application 10/952,942 to Zaiken et al. titled "Intrauterine Pressure Catheter Interface Cable System" describes a pressure catheter and a zero / re-zero apparatus and method.

[0029] Referring again to **FIG. 3**, an alternative embodiment of the present disclosure includes zero / re-zero hardware **154**. The signal processing circuitry **150** of the cable monitoring apparatus is operably connected to zero / re-zero selector **156** and zero / re-zero indicator **158**. Clinicians initiate a zero / re-zero of the monitoring device **50** and the pressure catheter by depressing the zero / re-zero selector **156**. The signal processing circuitry **150** short-circuits the output connector, corresponding to the pressure catheter, to ground thus creating a zero voltage signal to the monitoring device **50**. The zero voltage signal is held for a predetermined period of time and clinicians are alerted that the output connector is short-circuited by a zero / re-zero indicator **158**. The length of time the zero voltage signal is held must be sufficient for clinician to perform a zero / re-zero operation on the monitoring device **50**, typically between 5 and 30 seconds. connector **102, 106**, provides information about an operating feature of the medical signal. Indicators may identify the presence of uterine or fetal ECG activity.

[0030] Referring again to **FIG. 3**, indicators **162** may correspond to the number of electrodes on the electrode array **167** applied to the maternal abdomen **170**. Indicator circuit **160** is operably connected to the signal processing circuitry **150** and the signal processing circuitry **150** may drive the indicators **162** with a signal indicative of at least one operating feature of the electrical cable **140**. An operating feature of the electrical cable **140** may be asso-

ciated with the functionality of the cable, the quality of the signal transmitted by the electrical cable, or a feature of the electrical cable or medical signal.

[0031] In yet another embodiment of the present disclosure, indicators **162** include lights driven by signals from the signal processing circuitry **150** wherein the signals are indicative of the functionality of an electrical cable. Indicator circuit **160** includes an array of indicator lights **162** with at least one indicator light corresponding to a medical sensor. Each individual indicator light may be driven with a signal proportional to the medical signal from the sensor or device. Clinicians can troubleshoot problems with an electrical cable **140**, sensor or device containing sensors, such as an electrode array **167**, by observing the array of indicator lights **162** on the cable monitoring apparatus **100**.

[0032] Referring again to **FIG. 3**, in yet another embodiment, the cable monitoring apparatus includes a signal transmitter assembly **164** having a signal generator **166** and a signal applicator **168**. Signal generator **166** generates and supplies a signature signal to the signal processing circuitry **150** and the signal applicator **168**. The signature signal is a low energy signal with distinct and identifiable voltage and frequency characteristics. The signal applicator **168** is applied to patient skin **170** in close proximity to a medical device, such as an electrode **172** in an electrode array **167**. Electrode **172** receives the signature signal and supplies the sensed information, including the signature signal, to the cable monitoring apparatus **100** through the electrical cable **140**. The signal processing circuitry **150** receives the sensed information, including the signature signal, and processes the sensed information and signature signal. The DSP **150A** of the signal processing circuit **150** may compare the received signature signal to the generated signature signal to determine the functionality of the circuit between the signal applicator **168** and the cable monitoring apparatus **100**. Various factors which may affect the circuit include the conductivity of patient skin **170** adjacent the electrode, the connection between patient skin **170** and the electrode **172**, the electrical cable **140** and the electrical cable connections **140A**, **140B**.

[0033] In yet another embodiment, the signal applicator **168** is integrated into the electrode array **167**. In use, signature signal is transmitted on one conductor of electrical cable **140**, applied to patient skin **170** by the signal applicator integrated into the electrode array and received by the plurality of electrodes **172** on the electrode array **167**. The DSP **150A** of the signal processing circuit **150** may compare the received signal to the generated signal to determine the functionality of the electrode array **167** and electrical cable **140**. In the case where all electrodes are receiving a signature signal of poor quality DSP **150A** may compare the plurality of received signals to determine if the poor signal is due to the signal applicator.

[0034] Referring now to **FIG. 4**, programming flowchart **200** illustrates processes executed by the DSP **150A** for

performing the functions described herein in accordance with the present disclosure. Cable monitoring apparatus may be configured in a first or second mode of operation prior to executing the steps and the mode of operation and connections may be modified at any time. While the programming flowchart of **FIG. 4** includes multiple embodiments of the present disclosure, the steps executed by the DSP **150A** may be limited to one or more of the various embodiment described herein.

[0035] Step **202** determines if a monitoring signal or sensor is present on an input connector. Various methods of detecting the presence of an input connector may be used such as measuring the impedance of the input or by analyzing the input signal. Sensors may also exhibit a distinct impedance characteristic or may contain a specific identification feature, such as a fixed resistor. Step **204** is executed if the signal or device is not detected on the input.

[0036] Step **204** checks for a cable connected between an input connector and a corresponding diagnostic connector. The presence of a cable between an input connector and a diagnostic connector may be determined by checking continuity, by a sensor detecting the physical presence of a cable or by user input. Step **208**, which resets the diagnostic indicator, is executed if a cable is not detected between the input connectors. Step **216**, which is executed if a cable is detected, performs cable diagnostic and the results of the diagnostics are indicated in Step **212**.

[0037] Returning to Step **202**, if a signal is detected on the input, the diagnostics indicator is reset in Step **218**. The next step in sequence, Step **220**, determines if the user has initiated a zero / re-zero function.

[0038] Zero / re-zero function is executed by Steps **224**, **228**, **232** and **236**. Step **224** resets and starts the zero / re-zero timer. A zero voltage signal is held on the output in Step **228**. If the zero / re-zero timer, in Step **232**, has not exceeded the pre-determined time, the zero / re-zero indicator is turned on in Step **236**, and the zero voltage signal is maintained on the output in Step **228**. When the zero / re-zero timer exceeds the pre-determined time, the zero / re-zero indicator is turned off in Step **240**, and the zero voltage signal is removed from the output in Step **244**.

[0039] Returning to Step **220**, if a zero / re-zero function is not performed, the monitoring signal at the input is analyzed in Step **248**. The next step in the sequence, Step **252**, checks for the presence of a signature signal in the monitoring signal. The clinician applies the signature signal transmitter to the patient (not shown in flow chart), in close proximity to the sensor, or to the sensor itself, in order to either check the functionality of the electrical the presence of a signature signal in the monitoring signal. The clinician applies the signature signal transmitter to the patient (not shown in flow chart), in close proximity to the sensor, or to the sensor itself, in order to either check the functionality of the electrical cables and/or the electrical circuits. If the signature signal is

present, Step 256 determines various cable and circuit parameters by comparing the received signature signal to the generated signature signal. Step 260 indicates at least one parameters indicative of the functionality of the electrical cable or circuit. Step 264 selectively filters the medical signal and removes at least a portion of the signature signal from the medical signal.

[0040] Next, in Step 268, the medical signal is analyzed to determine one or more operating features of the medical signal. At least one operating feature is indicated in Step 272 and the medical signal is passed to the output in Step 276.

[0041] In yet another embodiment, the features, functions and methods of the present disclosure, are incorporated into another electronic device, such as a personal computer, oscilloscope or monitoring device.

[0042] While several embodiments of the disclosure have been shown in the drawings and/or discussed herein, it is not intended that the disclosure be limited thereto, as it is intended that the disclosure be as broad in scope as the art will allow and that the specification be read likewise. Therefore, the above description should not be construed as limiting, but merely as exemplifications of particular embodiments. Those skilled in the art will envision other modifications within the scope of the claims appended hereto.

Claims

1. A method for fetal or maternal monitoring, comprising the steps of electrically connecting a medical cable monitor (100) with a fetal monitoring apparatus (50); electrically connecting a first end of a medical cable (40,42,140,142) to an input interface (102,106) of the medical cable monitor (100) and a second end of the medical cable (40,42,140,142) to a cable diagnostic interface (103,107) of the medical cable monitor (100); activating the medical cable monitor (100) in one mode of operation whereby signal processing circuitry of the medical cable monitor (100) tests functionality of the medical cable (40,42,140,142) connected between the input interface (102,106) and the cable diagnostic interface (103,107); electrically connecting the second end of the medical cable (40,42,140,142) to a sensor (20,30,172) after removing the second end of the medical cable (40,42,140,142) from the cable diagnostic interface (103,107) of the medical cable monitor (100); sensing fetal parameter with the sensor (20,30,172) and sending a fetal monitoring signal associated with the fetal parameter to the input interface (102,106) of the medical cable monitor (100); and activating the medical cable monitor (100) in another mode of operation whereby the signal processing circuitry passes the fetal monitoring signal to the fetal monitoring apparatus (52).
2. The method according to Claim 1, where the step of electrically connecting the second end of the medical cable (40,42,140,142) to a sensor (20,30,172) includes connecting said medical cable (40,42,140,142) to a sensor (20,30,172) selected from the group consisting of at least one medical electrode, a medical electrode sensor array, an abdominal strain gauge, a tocodynamometer, an intrauterine pressure catheter, and an ultrasound transducer.
3. The method according to Claim 1, wherein the step of electrically connecting the second end of the medical cable (40,42,140,142) to a sensor (20,30,172) includes connecting said medical cable (40,42,140,142) to a vacuum pressure sensor.
4. The method according to Claim 1, wherein the step of electrically connecting the second end of the medical cable (40,42,140,142) to a sensor (20,30,172) includes connecting said medical cable (40,42,140,142) to a pulse oximeter.
5. The method according to Claim 1, wherein the step of electrically connecting the second end of the medical cable (40,42,140,142) to a sensor (20,30,172) includes connecting said medical cable (40,42,140,142) to a pH sensing device.
6. The method according to Claim 1, wherein the step of electrically connecting the second end of the medical cable (40,42,140,142) to a sensor (20,30,172) includes connecting said medical cable (40,42,140,142) to a sensor (20,30,172) selected from a group consisting of a cervical dilation sensor, a cervical effacement sensor and a cervical length sensor.
7. The method according to Claim 1, wherein the step of electrically connecting the second end of the medical cable (40,42,140,142) to a sensor (20,30,172) includes connecting said medical cable (40,42,140,142) to a fetal station sensor.
8. The method according to claim 1 further including the steps of electrically connecting a first end of a second medical cable (40,42,140,142) to a second input interface (102,106) of the medical cable monitor (100) and the second end of the second medical cable (40,42,140,142) to a second cable diagnostic interface (103,107) of the medical cable monitor (100); activating the medical cable monitor (100) in one mode of operation whereby signal processing circuitry of the medical cable monitor (100) tests functionality of the second medical cable

(40,42,140,142) connected between the second input interface (102,106) and the second cable diagnostic interface (103,107).

9. The method according to claim 1 including the step of performing a zero/rezero function to short circuit the monitoring signal and create a zero voltage signal.

Patentansprüche

1. Verfahren zur Fötus- oder Mutterüberwachung, das die folgenden Schritte umfasst: elektrisches Verbinden eines medizinischen Kabelmonitors (100) mit einer Fötus-Überwachungsvorrichtung (50), elektrisches Verbinden eines ersten Endes eines medizinischen Kabels (40, 42, 140, 142) mit einer Eingangsschnittstelle (102, 106) des medizinischen Kabelmonitors (100) und eines zweiten Endes des medizinischen Kabels (40, 42, 140, 142) mit einer Kabeldiagnose-Schnittstelle (103, 107) des medizinischen Kabelmonitors (100), Aktivieren des medizinischen Kabelmonitors (100) in einem Betriebsmodus, wodurch Signalverarbeitungsschaltungen des medizinischen Kabelmonitors (100) die Funktionsfähigkeit des medizinischen Kabels (40, 42, 140, 142) prüft, das zwischen der Eingangsschnittstelle (102, 106) und der Kabeldiagnose-Schnittstelle (103, 107) angeschlossen ist, elektrisches Verbinden des zweiten Endes des medizinischen Kabels (40, 42, 140, 142) mit einem Sensor (20, 30, 172) nach dem Entfernen des zweiten Endes des medizinischen Kabels (40, 42, 140, 142) von der Kabeldiagnose-Schnittstelle (103, 107) des medizinischen Kabelmonitors (100), Abfühlen eines Fötusparameters mit dem Sensor (20, 30, 172) und Senden eines Fötus-Überwachungssignals, das mit dem Fötusparameter verknüpft ist, an die Eingangsschnittstelle (102, 106) des medizinischen Kabelmonitors (100) und Aktivieren des medizinischen Kabelmonitors (100) in einem anderen Betriebsmodus, wodurch die Signalverarbeitungsschaltungen das Fötus-Überwachungssignal an die Fötus-Überwachungsvorrichtung (52) weiterleiten.
2. Verfahren nach Anspruch 1, wobei der Schritt des elektrischen Verbindens des zweiten Endes des medizinischen Kabels (40, 42, 140, 142) mit einem Sensor (20, 30, 172) das Verbinden des medizinischen Kabels (40, 42, 140, 142) mit einem Sensor (20, 30, 172) einschließt, der ausgewählt ist aus der Gruppe, die aus wenigstens einer medizinischen Elektrode, einer medizinischen Elektrodensensor-Anordnung, einem Bauchdehnungsmesser, einem Tokodynamometer, einem Intrauterindruckkatheter und einem Ultraschallwandler besteht.

3. Verfahren nach Anspruch 1, wobei der Schritt des elektrischen Verbindens des zweiten Endes des medizinischen Kabels (40, 42, 140, 142) mit einem Sensor (20, 30, 172) das Verbinden des medizinischen Kabels (40, 42, 140, 142) mit einem Vakuumdrucksensor einschließt.
4. Verfahren nach Anspruch 1, wobei der Schritt des elektrischen Verbindens des zweiten Endes des medizinischen Kabels (40, 42, 140, 142) mit einem Sensor (20, 30, 172) das Verbinden des medizinischen Kabels (40, 42, 140, 142) mit einem Pulsoximeter einschließt.
5. Verfahren nach Anspruch 1, wobei der Schritt des elektrischen Verbindens des zweiten Endes des medizinischen Kabels (40, 42, 140, 142) mit einem Sensor (20, 30, 172) das Verbinden des medizinischen Kabels (40, 42, 140, 142) mit einer pH-Abfühleinrichtung einschließt.
6. Verfahren nach Anspruch 1, wobei der Schritt des elektrischen Verbindens des zweiten Endes des medizinischen Kabels (40, 42, 140, 142) mit einem Sensor (20, 30, 172) das Verbinden des medizinischen Kabels (40, 42, 140, 142) mit einem Sensor (20, 30, 172) einschließt, der ausgewählt ist aus der Gruppe, die aus einem Portioweitensensor, einem Portioverkürzungssensor und einem Portiolängensensor besteht.
7. Verfahren nach Anspruch 1, wobei der Schritt des elektrischen Verbindens des zweiten Endes des medizinischen Kabels (40, 42, 140, 142) mit einem Sensor (20, 30, 172) das Verbinden des medizinischen Kabels (40, 42, 140, 142) mit einem Fötushöhenstandssensor einschließt.
8. Verfahren nach Anspruch 1, das ferner die folgenden Schritte umfasst:
- elektrisches Verbinden eines ersten Endes eines zweiten medizinischen Kabels (40, 42, 140, 142) mit einer zweiten Eingangsschnittstelle (102, 106) des medizinischen Kabelmonitors (100) und des zweiten Endes des zweiten medizinischen Kabels (40, 42, 140, 142) mit einer zweiten Kabeldiagnose-Schnittstelle (103, 107) des medizinischen Kabelmonitors (100), Aktivieren des medizinischen Kabelmonitors (100) in einem Betriebsmodus, wodurch Signalverarbeitungsschaltungen des medizinischen Kabelmonitors (100) die Funktionsfähigkeit des zweiten medizinischen Kabels (40, 42, 140, 142) prüft, das zwischen der zweiten Eingangsschnittstelle (102, 106) und der zweiten Kabeldiagnose-Schnittstelle (103, 107) angeschlossen ist.

9. Verfahren nach Anspruch 1, das den Schritt des Durchführens einer Funktion des Nullstellens/erneuten Nullstellens umfasst, um das Überwachungssignal kurzzuschließen und ein Nullspannungssignal zu erzeugen.

Revendications

1. Procédé de surveillance fœtal ou maternel, comprenant les étapes consistant à brancher électriquement un moniteur de câble médical (100) avec un appareil de surveillance fœtale (50) ; brancher électriquement une première extrémité d'un câble médical (40, 42, 140, 142) à une interface d'entrée (102, 106) du moniteur de câble médical (100) et une seconde extrémité du câble médical (40, 42, 140, 142) à une interface de diagnostic à câble (103, 107) du moniteur de câble médical (100) ; activer le moniteur de câble médical (100) dans un mode de fonctionnement, moyennant quoi les circuits de traitement de signal du moniteur de câble médical (100) testent la fonctionnalité du câble médical (40, 42, 140, 142) branché entre l'interface d'entrée (102, 106) et l'interface de diagnostic de câble (103, 107) ; brancher électriquement la seconde extrémité du câble médical (40, 42, 140, 142) à un capteur (20, 30, 172) après avoir enlevé la seconde extrémité du câble médical (40, 42, 140, 142) de l'interface de diagnostic de câble (103, 107) du moniteur de câble médical (100) ; détecter un paramètre fœtal avec le capteur (20, 30, 172) et envoyer un signal de surveillance fœtale associé au paramètre fœtal à l'interface d'entrée (102, 106) du moniteur de câble médical (100) ; et activer le moniteur de câble médical (100) dans un autre mode de fonctionnement, moyennant quoi les circuits de traitement de signal transmettent le signal de surveillance fœtal à l'appareil de surveillance fœtale (52).
2. Procédé selon la revendication 1, dans lequel l'étape consistant à brancher électriquement la seconde extrémité du câble médical (40, 42, 140, 142) à un capteur (20, 30, 172) inclut le branchement dudit câble médical (40, 42, 140, 142) à un capteur (20, 30, 172) sélectionné dans le groupe constitué d'au moins une électrode médicale, une rangée de capteurs d'électrodes médicales, une jauge de contrainte abdominale, un tocodynamomètre, un cathéter de pression intra-utérine, et un transducteur à ultrasons.
3. Procédé selon la revendication 1, dans lequel l'étape consistant à brancher électriquement la seconde extrémité du câble médical (40, 42, 140, 142) à un capteur (20, 30, 172) inclut le branchement dudit câble

médical (40, 42, 140, 142) à un capteur de pression sous vide.

4. Procédé selon la revendication 1, dans lequel l'étape consistant à brancher électriquement la seconde extrémité du câble médical (40, 42, 140, 142) à un capteur (20, 30, 172) inclut le branchement dudit câble médical (40, 42, 140, 142) à un oxymètre de pouls.
5. Procédé selon la revendication 1, dans lequel l'étape consistant à brancher électriquement la seconde extrémité du câble médical (40, 42, 140, 142) à un capteur (20, 30, 172) inclut le branchement dudit câble médical (40, 42, 140, 142) à un dispositif de détection de pH.
6. Procédé selon la revendication 1, dans lequel l'étape consistant à brancher électriquement la seconde extrémité du câble médical (40, 42, 140, 142) à un capteur (20, 30, 172) inclut le branchement dudit câble médical (40, 42, 140, 142) à un capteur (20, 30, 172) sélectionné dans un groupe constitué d'un capteur de dilatation du col de l'utérus, d'un capteur d'effacement du col de l'utérus et d'un capteur de longueur du col de l'utérus.
7. Procédé selon la revendication 1, dans lequel l'étape consistant à brancher électriquement la seconde extrémité du câble médical (40, 42, 140, 142) à un capteur (20, 30, 172) inclut le branchement dudit câble médical (40, 42, 140, 142) à un capteur de station fœtale.
8. Procédé selon la revendication 1, incluant en outre les étapes consistant à :
- brancher électriquement une première extrémité d'un second câble médical (40, 42, 140, 142) à une seconde interface d'entrée (102, 106) du moniteur de câble médical (100) et la seconde extrémité du second câble médical (40, 42, 140, 142) à une seconde interface de diagnostic de câble (103, 107) du moniteur de câble médical (100) ; activer le moniteur à câble médical (100) dans un mode de fonctionnement, moyennant quoi les circuits de traitement de signal du moniteur de câble médical (100) testent la fonctionnalité du second câble médical (40, 42, 140, 142) branché entre la seconde interface d'entrée (102, 106) et la seconde interface de diagnostic de câble (103, 107).
9. Procédé selon la revendication 1, incluant l'étape consistant à exécuter une fonction de mise à zéro/remise à zéro afin de court-circuiter le signal de surveillance et de créer un signal à tension zéro.

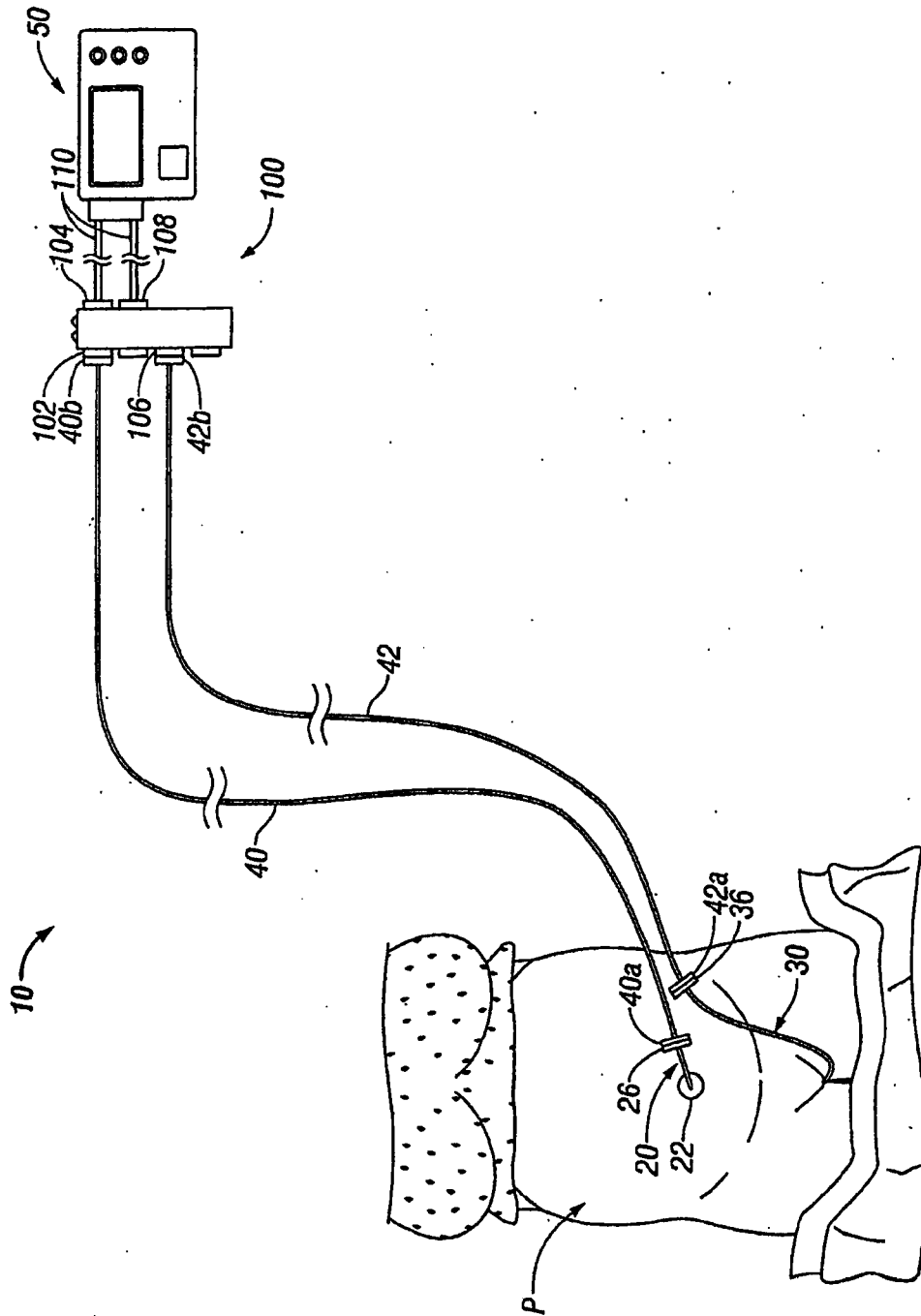


FIG. 1

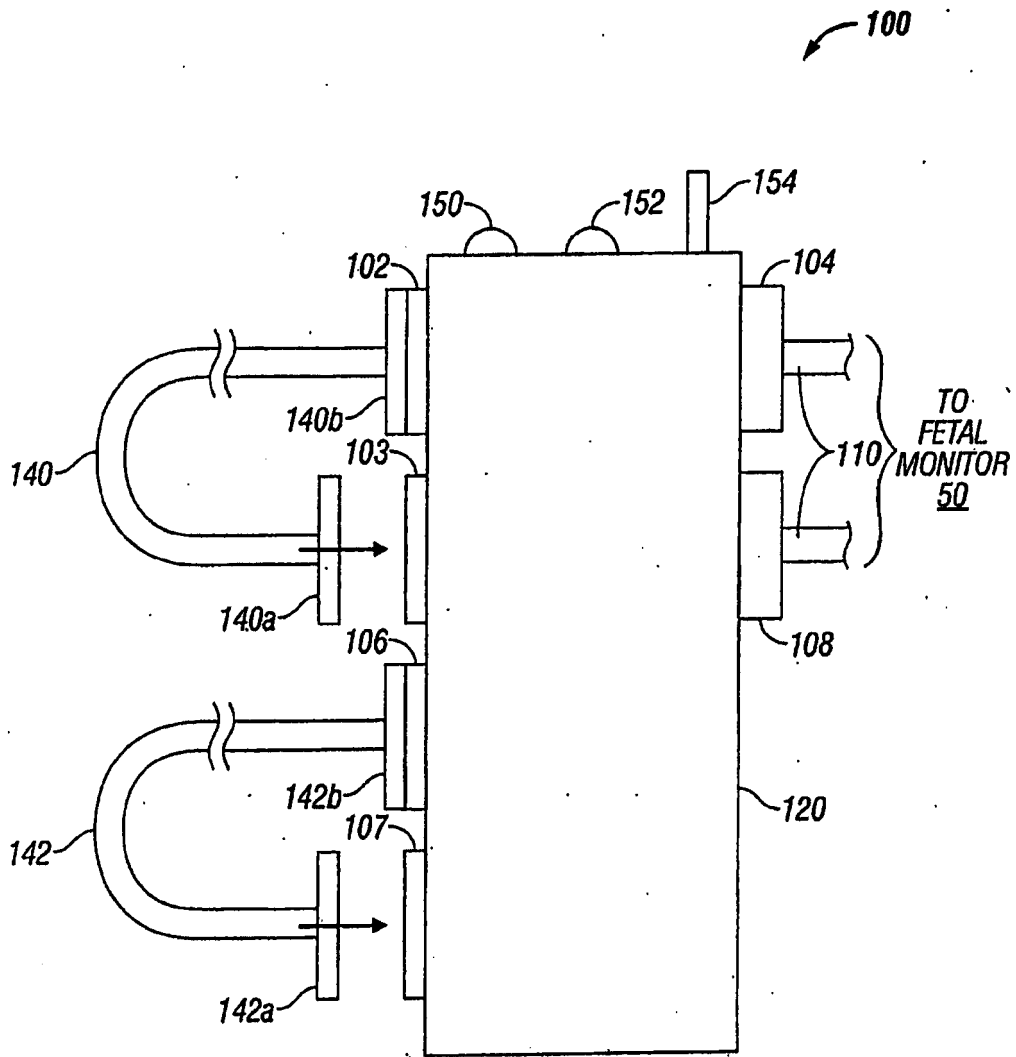


FIG. 2

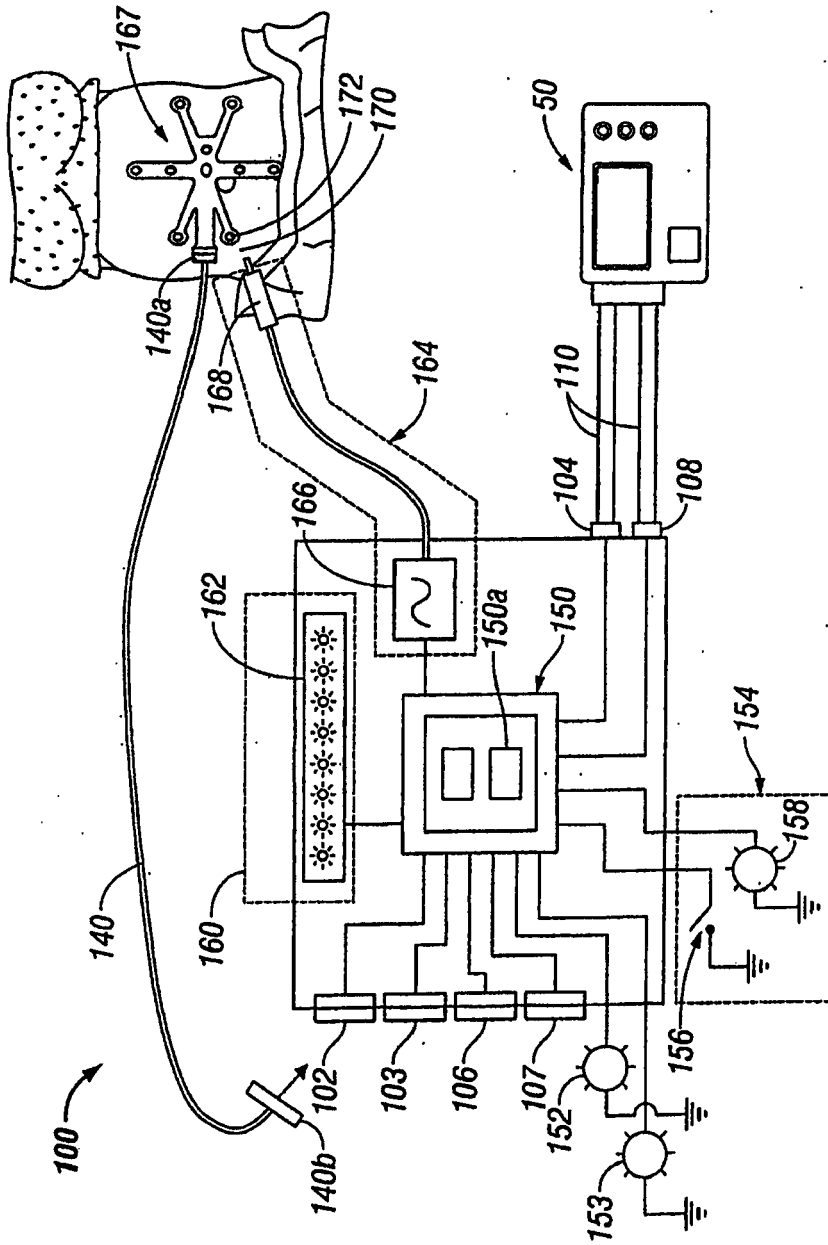


FIG. 3

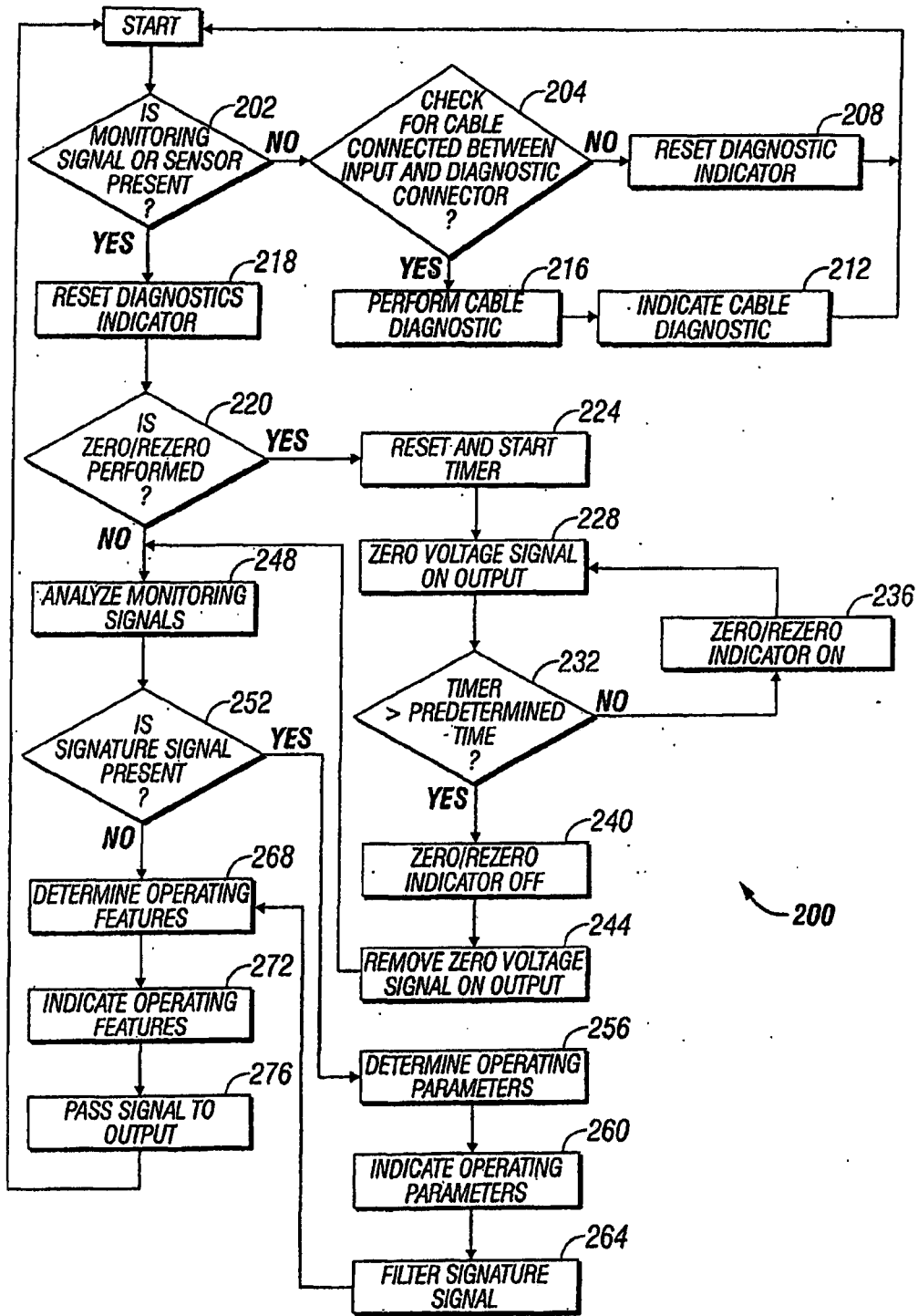


FIG. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0484107 A **[0005]**
- US 5566680 A **[0005] [0027]**
- US 952942, Zaiken **[0028]**

专利名称(译)	电缆监视装置		
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[标]发明人	MEYER PETER ZAIKEN ELIOT		
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IPC分类号	A61B5/00 G01R19/25 H01R13/66		
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外部链接	Espacenet		

摘要(译)

电缆监视装置包括：外壳，其具有适于电连接至医疗电缆的一端的输入接口；以及适于电连接至电气系统的输出接口。信号处理电路结合在外壳内，用于从医疗设备接收医疗信号。电缆通过输入接口在第一操作模式下用于将医学信号选择性地通过输出接口传递到电气系统，并具有应用软件，用于在第二操作模式下用于选择性地测试医学电缆的功能。该医学信号可以包括选自胎儿和母亲医学信号的至少一个监测信号。优选地，所述至少一个监测信号是从选自以下的医疗设备产生的：至少一个医疗电极，医疗电极阵列，腹部应变仪，测功机，子宫内压导管，超声换能器，真空压力传感器，脉搏血氧仪，pH传感器，子宫颈扩张传感器，子宫颈外观传感器，子宫颈长度传感器，胎位传感器和超声换能器。

