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(54) MEDICAL MONITORING DEVICE, AND METHOD AND SYSTEM FOR DISPLAYING PATIENT MONITORING INFORMATION

(57) A medical monitoring device (100), comprising a signal collection module (120), a data processing module (110) and a display module (130). The data processing module (110) processes a vital sign signal collected by the signal collection module (120), generates physiological parameters, and generates visualization information about interested parameters corresponding to a designated anesthetic phase based on request information, the designated anesthetic phase is an anesthetic induction phase, an anesthetic maintenance phase or a postoperative recovery phase, and the interested parameters comprise parameters selected from the physiological parameters and/or anesthetic parameters derived from the physiological parameters. The display module (130) at least displays the visualization information about the interested parameters corresponding to the designated anesthetic phase in an anesthetic state display area. The medical monitoring device (100) intuitively presents parameters needing to be viewed by a doctor to the doctor, so that it is clear for the doctor to quickly determine whether a patient is acting abnormally during the anesthetic phase, whether the anesthesia is appropriate, etc. Further provided are a method and system for displaying patient monitoring information.

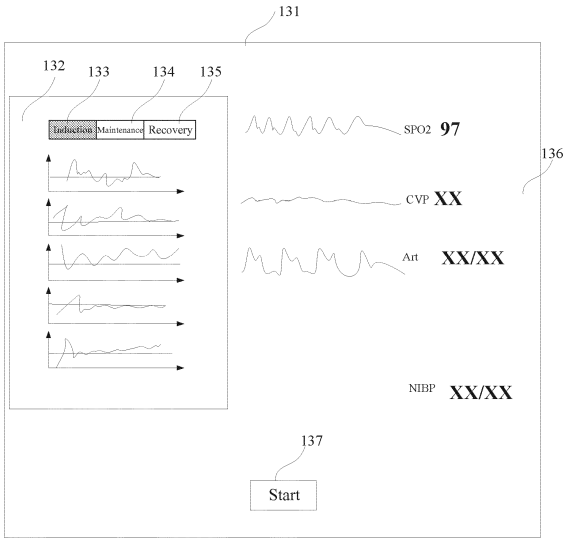

Fig. 3b

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Description

Technical Field

[0001] The present invention relates to the field of medical monitoring technology, and in particular to a medical monitoring device, a method and a system for displaying patient monitoring information.

Background Art

[0002] In order to control and reduce the risk of clinical anesthesia, individual anesthesia monitoring standards or monitoring guidelines have been developed both internationally and domestically, requiring strict monitoring of vital sign indexes of a patient. Studies have shown that failure to timely and comprehensively monitor the patient during anesthesia is one of the primary causes of perioperative anesthesia complications. By strengthening the monitoring, measures can be timely taken in accordance with the monitoring results, to reduce the incidence of adverse reactions or anesthesia accidents in order to reduce the mortality of anesthesia and ensure the safety of the patient.

[0003] The current monitoring parameters for the patient undergoing general anesthesia in surgery selectively comprise, depending on the situation, numerous parameters such as a non-invasive blood pressure, a respiratory rate, a heart rate, a blood oxygen saturation, a urine volume, a central venous pressure, an invasive arterial pressure, a partial pressure of end-tidal carbon dioxide, a body temperature, a brain function, respiratory mechanics parameters, muscle relaxation parameters, blood biochemical parameters, a cardiac output, and an anesthetic gas concentration. The patient's conventional physiological parameters, such as the blood pressure, the heart rate, and the blood oxygen saturation, are typically monitored in real time using a multi-parameter monitor, and waveforms, values, trends and other information associated with the monitored physiological parameters are displayed on a display screen of the multi-parameter monitor. In some cases, there is a need for a BIS (bispectral index) single-parameter monitor and an NMT (neuromuscular transmission) single-parameter monitor to monitor and display states of the consciousness and muscle relaxation of the patient. Whether in a pre-operative induction phase, in an intraoperative anesthesia maintenance phase, or in a postoperative recovery phase, a physician needs to view these parameters and make judgments about the patient's condition based on the monitored parameters. In the process of continuous development and improvement of monitoring devices, the inventors found that since the parameters monitored for anesthetized patients are numerous and may be allocated to different monitors, the physician often views these numerous parameters one by one, selects and combines required parameter information from the numerous parameters according to experience, and then makes a comprehensive judgment on the patient's anesthesia state, which makes the physician have to take a long time to judge the patient's anesthesia state, thereby affecting the physician's rapid reaction and response to the patient's abnormal condition.

Summary of the Invention

[0004] The technical problem to be solved by the present invention is to provide a medical monitoring device, and a method and a system for displaying patient monitoring information for assisting a physician in accelerating the judgment of an anesthesia state of a patient.

[0005] According to a first aspect, provided in an embodiment is a medical monitoring device, comprising:

a signal collection module configured to collect patient's vital sign signals from the body of a patient;

a data processing module connected to the signal collection module and configured to receive the vital sign signals and process the vital sign signals to generate physiological parameters for reflecting the condition of the patient, the data processing module being further configured to receive request information for requesting display of a designated anesthetic phase and generate, based on the request information, visualized information about interested parameters corresponding to the designated anesthetic phase, the designated anesthetic phase being an anesthetic induction phase before surgery, an anesthetic maintenance phase during surgery, or a postoperative recovery after surgery, and the interested parameters comprising parameters selected from the physiological parameters and/or anesthetic parameters derived from the physiological parameters; and

a display module comprising a display interface, the display module being connected to the data processing module and configured to receive the visualized information outputted by the data processing module, and display in an anesthetic state display area at least the visualized information about the interested parameters corresponding to the designated anesthetic phase, and the anesthetic state display area being at least a partial area of the display interface of the monitoring device.

[0006] According to a second aspect, provided in an embodiment is a method for displaying patient monitoring information, comprising:

acquiring vital sign signals collected from the body of a patient;

processing the vital sign signals to generate physiological parameters for reflecting condition of the patient;

receiving request information for requesting display of a designated anesthetic phase, the designated

anesthetic phase being an anesthetic induction phase before surgery, an anesthetic maintenance phase during surgery, or a postoperative recovery phase after surgery;

generating, based on the request information, visualized information about interested parameters corresponding to the designated anesthetic phase, the interested parameters comprising parameters selected from the physiological parameters and/or anesthetic parameters derived from the physiological parameters; and

displaying in an anesthetic state display area the visualized information about the interested parameters corresponding to the designated anesthetic phase, the anesthetic state display area being at least a partial area of a display interface of a monitoring device.

[0007] According to a third aspect, provided in an embodiment is a system for displaying patient monitoring information, comprising:

an information acquisition unit, configured to acquire vital sign signals collected from the body of a patient;

a first information processing unit, configured to process the vital sign signals to generate physiological parameters for reflecting the condition of the patient;

a request unit, configured to receive request information for requesting display of a designated anesthetic phase, the designated anesthetic phase being an anesthetic induction phase before surgery, an anesthetic maintenance phase during surgery, or a postoperative recovery phase after surgery;

a second information processing unit, configured to generate, based on the request information, visualized information about interested parameters corresponding to the designated anesthetic phase, the interested parameters comprising parameters selected from the physiological parameters and/or anesthetic parameters derived from the physiological parameters; and

a display unit, configured to display in an anesthetic state display area the visualized information about the interested parameters corresponding to the designated anesthetic phase, the anesthetic state display area being at least a partial area of a display interface of a monitoring device.

[0008] In the embodiments of the present invention, since the respective interested parameters are set for each anesthetic phase, and the current anesthesia state of the patient can be reflected by these interested parameters, when a certain anesthetic phase needs to be displayed, the interested parameters related to this anesthetic phase can be displayed on the same screen and intuitively presented to the physician, so that the physician is clear at a glance, and can quickly determine whether the patient is acting abnormally during the anesthetic phase, whether the anesthesia is appropriate, etc.

Brief Description of the Drawings

[0009]

Fig. 1 is a schematic structural diagram of a medical monitoring device in an embodiment;

Fig. 2 is a flow chart showing the display of patient anesthesia monitoring information in an embodiment;

Fig. 3a is a schematic diagram of an anesthetic state display area in an embodiment;

Fig. 3b is a schematic diagram of an anesthetic state display area in another embodiment;

Fig. 4 is a schematic diagram showing the display of interested parameters for an anesthetic induction phase in an embodiment;

Fig. 5 is a schematic diagram showing the display of interested parameters for an anesthetic maintenance phase in an embodiment;

Fig. 6 is a schematic diagram showing the display of interested parameters for an anesthetic maintenance phase in another embodiment;

Fig. 7 is a schematic diagram showing the display of interested parameters for a postoperative recovery phase in an embodiment;

Figs. 8, 9 and 10 are parameter trend graphs with baselines for the anesthetic induction phase, the anesthetic maintenance phase, and the postoperative recovery phase, respectively; and

Fig. 11 is a schematic structural diagram of a patient monitoring information display system in an embodiment.

Detailed Description of Embodiments

[0010] The present application is further described in detail below with specific embodiments and in conjunction with the accompanying drawings. Similar elements in various embodiments use associated similar component element reference signs. In the following embodiments, many details are described so that the present application can be better understood. However, it would be effortlessly appreciated by those skilled in the art that some features may be omitted in different cases, or may be substituted by other elements, materials and methods. In certain cases, some operations relevant to the present application are not shown or described in the description, and this is to prevent the core part of the application from being inundated by too much description. However, for those skilled in the art, the detailed description of these relevant operations is not necessary, and they may completely understand relevant operations according to the description and general technical knowledge in the art.

[0011] In addition, characteristics, operations or features described in the description may be combined in

any appropriate manner to form various embodiments. Moreover, the steps or actions in the method description may also be exchanged or adjusted in order in a way that would be obvious to those skilled in the art. Therefore, various orders in the description and accompanying drawings are merely to clearly describe a certain embodiment and are not meant to be necessary orders, unless specified otherwise that a certain order must be followed.

[0012] For a patient undergoing general anesthesia (e.g., a sufferer), there are usually three phases, namely an anesthetic induction phase before surgery, an anesthetic maintenance phase during surgery, or a postoperative recovery phase after surgery.

[0013] In the anesthetic induction phase, a physician will do the following operations:

1. Preoxygenation and denitrogenation: breathing oxygen is supplied via a mask to ensure oxygen supply throughout the induction process.
2. Anesthetic administration: an anesthetist administrates an intravenous anesthetic or inhalational anesthetic, an analgesic, and a muscle relaxant to the patient, the patient's consciousness gradually disappears, the sense of pain is passivated until it disappears, and the muscle tension is gradually weakened.
3. Endotracheal intubation: upon the patient's consciousness reaches the appropriate depth, and analgesia and muscle relaxation are both completed, the anesthetist administrates an endotracheal intubation to the patient to complete the induction process.

[0014] The requirements for the anesthetic induction phase are that the entire induction process is coherent and the patient's vital signs are stable. The requirements for the anesthetic maintenance phase are: to maintain the appropriate depth of consciousness, and the complete analgesia and muscle relaxation of the patient during surgery to meet the surgical requirements; and to maintain the stability of the vital signs of the patient during surgery to ensure the life safety of the patient. The requirements for the postoperative recovery phase are that after the surgery is completed, the anesthetist gradually reduces the anesthetic to the patient until the administration of the anesthetic is stopped. By monitoring the patient's vital signs, BIS, NNT, respiratory parameters, etc., when it is determined that the patient's vital signs are stable, the consciousness is restored, spontaneous breathing is established, and the muscle tension is restored, an extubation is administrated; and after the extubation, the monitoring of the important vital signs is continued. During the development of the present invention, the inventors have, based on clinical experience, realized that due to the different requirements and operations performed at each phase, the physician is concerned with different information when evaluating the condition of the patient at each phase. Therefore, the concept of the present invention is to exhibit information about the interested parameters related to the anesthetic phase on the display interface when there is a need to evaluate the condition of the patient in a certain anesthetic phase or when there is a need to perform the anesthesia monitoring for a certain phase. That is to say, each anesthetic phase has its own corresponding interested parameters. When the physician needs to understand the anesthesia state of the patient, he/she no longer has to view the numerous parameters one by one. Instead, the interested parameters corresponding to each anesthetic phase are processed to generate visualized information, displayed in the anesthetic state display area on the same screen and intuitively presented to the physician, so that the physician is clear at a glance, and can quickly determine whether the patient is acting abnormally during the anesthetic phase, whether the anesthesia is appropriate, etc.

[0015] These interested parameters may be the existing physiological parameters, for example, comprising the existing physiological parameters monitored by the monitoring device in real time, or parameters obtained by integrating parameters monitored by an external device into this monitoring device. The interested parameters may also be parameters calculated or statistically derived according to the existing physiological parameters, or may be parameters obtained by integrating the parameters monitored by the external device into the monitoring device. The parameters calculated or statistically derived according to the existing physiological parameters will be collectively referred to as anesthetic parameters herein. The interested parameters for each phase are set up in advance in the system based on clinical experience, and in some embodiments, the physician may also be allowed to modify the interested parameters. That is to say, when in use, the physician can use the default interested parameters corresponding to each anesthetic phase, or alter the interested parameters corresponding to a certain phase according to his/her own needs.

[0016] In the monitoring of the patient undergoing general anesthesia, the monitoring of the anesthetic state may be performed for all the three phases by implementing the present invention, or the monitoring of the anesthetic state may be performed only for any two of the phases by implementing the present invention, for example, the monitoring of the anesthetic state is performed for the anesthetic induction phase and the anesthetic maintenance phase, or the monitoring of the anesthetic state is performed for the anesthetic maintenance phase and the postoperative recovery phase. By way of example, the monitoring of the anesthetic state being performed for all the three phases will be described below.

First Embodiment:

[0017] Referring to Fig. 1, the present embodiment provides a medical monitoring device 100 for monitoring a

patient 150. The medical monitoring device 100 comprises a data processing module 110, a signal collection module 120 and a display module 130.

[0018] One end of the signal collection module 120 is used to make contact with the body of the patient to collect, from the body of the patient, patient's vital sign signals such as a pulse signal caused by the heartbeat, a body temperature signal, a blood absorption signal for a specific band of light, an electrocardiogram signal, and an electroencephalogram signal. The other end of the signal collection module 120 is connected to the data processing module 110, for example, to the data processing module 110 via an interface, and the vital sign signals are input to the data processing module 110.

[0019] The data processing module 110 is connected to the signal collection module 120 and the display module 130, respectively, receives the vital sign signals, processes the vital sign signals, generates physiological parameters for reflecting the condition of the patient, and processes the physiological parameters into visualized data, and the visualized data is then sent to the display module 130, such that the display module 130 displays the visualized data on a display interface. The conventional physiological parameters comprise, for example, a blood pressure, a blood oxygen saturation, a heart rate, a body temperature, an electrocardiogram, etc.

[0020] The display module 130 comprises a display screen that provides the display interface, the display screen may be of a touch or non-touch type.

[0021] In this embodiment, the data processing module 110 further receives request information for requesting display of a designated anesthetic phase and generates, based on the request information, visualized information about interested parameters corresponding to the designated anesthetic phase, the designated anesthetic phase being an anesthetic induction phase before surgery, an anesthetic maintenance phase during surgery, or a postoperative recovery after surgery, and the interested parameters comprising parameters selected from the physiological parameters and/or anesthetic parameters derived from the physiological parameters. The physiological parameters may be the existing physiological parameters monitored by the monitoring device in real time, or may be physiological parameters obtained by integrating parameters monitored by an external device into the monitoring device. The data processing module 110 sends the visualized information about the interested parameters to the display module 130. The display module 130 allocates at least a partial area as an anesthetic state display area on the display interface thereof, and displays the visualized information about the interested parameters in the anesthetic state display area.

[0022] In an embodiment, the display of the patient anesthesia monitoring information is implemented by running computer software, and a method for displaying the monitoring information is as shown in Fig. 2, and comprises the following steps:

Step 200, in which anesthesia monitoring is initiated. A start icon 137 for initiating the anesthesia monitoring is provided in the display interface, as shown in Fig. 3, and a request for initiating the anesthesia monitoring is triggered by the operator selecting the start icon. The display module 130 detects that the start icon is triggered by the operator, generates the request for initiating the anesthesia monitoring, and sends the request to the data processing module 110.

Step 201, in which at least one anesthetic state display area 132 is allocated on the display interface 131 of the monitoring device when it is detected that the start icon is selected. After receiving the request, the data processing module 110 outputs display data to the display module, such that the display module divides the display interface into the at least one anesthetic state display area 132. The anesthetic state display area may be the entire area of the display interface, as shown in Fig. 3a. The anesthetic state display area may also be only a partial area of the display interface, for example, the display interface 131 comprises at least one anesthetic state display area 132 and a conventional display area 136, as shown in Fig. 3b, interested parameters for a selection phase are displayed in the anesthetic state display area 132, the conventional display area 136 may be used to display the physiological parameters monitored by the monitoring device in real time, such as a beat of each heartbeat, such as a waveform or a real-time value of a blood pressure, a blood oxygen saturation, a heart rate, a body temperature, etc.

Step 202, in which three phase indication icons are displayed in the anesthetic state display area 132, as shown in Fig. 3, an "induction" icon 133 represents the anesthetic induction phase, a "maintenance" icon 134 represents the anesthetic maintenance phase, and a "recovery" icon 135 represents the postoperative recovery phase. Certainly, those skilled in the art should understand that in other embodiments, when the anesthesia monitoring is performed only in two phases, only two phase indication icons may be displayed in the anesthetic state display area 132, for example, only the "induction" icon 133 and the "maintenance" icon 134 are displayed, or only the "maintenance" icon 134 and the "recovery" icon 135 are displayed.

Step 203, in which it is detected whether a phase indication icon is selected. The operator can select the phase indication icon by manipulating a cursor. When the display module comprises a touch screen, the operator can also select the phase indication icon by touching. When a phase indication icon is selected, the selected phase indication icon is highlighted using an interface element different from the other phase indication icons, for example, it is highlighted using a different color, or a different fill pattern, a different gray level, or the like.

Step 204, in which when a phase indication icon is selected, request information for requesting display of the designated anesthetic phase is generated. The display module 130 detects an operator's trigger on the phase indication icon. When a phase indication icon is selected, the display module generates corresponding request information and sends the request information to the data processing module 110. When the "induction" icon 133 is selected, request information for requesting display of the anesthetic induction phase is generated. When the "maintenance" icon 134 is selected, request information for requesting display of the anesthetic maintenance phase is generated. When the "recovery" icon 135 is selected, request information for requesting display of the postoperative recovery phase is generated.

Step 205, in which visualized information about the interested parameters corresponding to the designated anesthetic phase is generated based on the request information. After receiving the request information, the data processing module 110 parses the request information, determines the anesthetic phase needing to be displayed, and then determines the interested parameters corresponding to the anesthetic phase in accordance with a pre-set correspondence table. The interested parameters can be directly acquired from the conventional physiological parameters if they already exist in the conventional physiological parameters, or obtained by mathematical means such as calculation or statistics according to the conventional physiological parameters if they are yet not in the conventional physiological parameters. Each interested parameter comprises a parameter name, a detection time point, and a parameter value corresponding to the time point. After obtaining the interested parameters, the data processing module 110 processes the interested parameters into corresponding visualized information according to the manner required to be presented, and outputs the visualized information to the display module.

Step 206, in which the visualized information about the interested parameters corresponding to the designated anesthetic phase is displayed in the anesthetic state display area. After receiving the visualized information, the display module 130 processes the visualized information into frame data and displays same on the display interface.

[0023] When the "induction" icon 133 is selected, the visualized information about the interested parameters for the anesthetic induction phase is displayed in the anesthetic state display area. In this embodiment, the interested parameters for the anesthetic induction phase comprise a heart rate (HR), a blood oxygen saturation (SPO_2), a blood pressure (NIBP), a body temperature (TEMP), a bispectral index (BIS), and a patient suffocation time, the heart rate, the blood oxygen saturation, the blood pressure, the body temperature and the bispectral index are parameters selected from the conventional physiological parameters, which can be directly obtained from the detected conventional physiological parameters, and the patient suffocation time is an anesthetic parameter obtained according to the detected respiratory signal. The heart rate, the blood oxygen saturation, the blood pressure, the body temperature and the bispectral index are used to assess whether the patient's vital signs are stable. The patient suffocation time is used to evaluate whether the patient has suffocated. In the anesthetic induction phase, one of the operations that the physician needs to do is endotracheal intubation, that is, upon the patient's consciousness reaches the appropriate depth, and analgesia and muscle relaxation are both completed, the anesthetist administrates the endotracheal intubation to the patient. During endotracheal intubation, the patient stops breathing, but the patient does not stop breathing for too long, otherwise the patient is at risk of life, so the patient suffocation time needs to be monitored, and once the suffocation time exceeds a certain length of time, the intubation is stopped immediately, and oxygen is supplied to the patient via a mask.

[0024] In this embodiment, as shown in Fig. 4, the heart rate 301, the blood oxygen saturation 302, the blood pressure 303, the body temperature 304 and the bispectral index 305 are respectively displayed in the form of trend graphs in the anesthetic state display area 132, for example, the horizontal axis represents time and the vertical axis represents the value of the interested parameter, and the point on the curve represents the parameter value of the interested parameter at that time. The display time of the trend graph may be the time of the entire anesthetic induction phase, or may be a determined period of time before or after the current time. The patient suffocation time 306 is displayed in the form of a time progress bar in the anesthetic state display area, and a normal zone 306a, a warning zone 306b and a danger zone 306c are marked on the time bar in the time progress direction. The warning zone represents a period of time for which the patient is allowed to suffocate, and the length of time of the warning zone is set according to the type of the patient, for example, 120 seconds for adults, 30 seconds for children, and 20 seconds for newborns. The danger zone represents a period of suffocation time for which the patient may be in danger. When the progress pointer enters the danger zone, it indicates that the patient has a long suffocation time and is in danger. The normal zone 306a, the warning zone 306b and the danger zone 306c may be clearly distinguished by different colors or patterns, for example, the normal zone 306a is represented by green, the warning zone 306b is represented by yellow, and the danger zone 306c is represented by red. In applications, when the signal collection module 120 detects a respiratory signal, the data processing module 110 starts timing, and outputs a display signal such that the display module 130 moves the progress pointer along the time bar according to the tim-

ing time from the 0 coordinate of the time bar. When the signal collection module 120 detects a next respiratory signal, the data processing module 110 outputs a display signal such that the display module 130 resets the progress pointer to the 0 coordinate. In a modified embodiment, when the progress pointer enters the danger zone, the monitoring device may issue an alarm alerting the on-site physician.

[0025] In this embodiment, the patient suffocation time is displayed in the form of a time progress bar, which enables the physician to intuitively observe the current suffocation time of the patient, so as to quickly determine whether the operation of the endotracheal intubation needs to be stopped. Therefore, the time progress bar of the suffocation time is also called a suffocation indicator.

[0026] In other embodiments, the patient suffocation time may also be displayed in the form of values in the anesthetic state display area.

[0027] In some embodiments, if there is a calculated breathing time in the conventionally detected physiological parameters, it is generally provided with a breathing alarm, that is, a threshold is set in advance, and an alarm is issued when the breathing time exceeds the threshold. Since this threshold is set for normal breathing, it is not suitable for respiratory monitoring in the endotracheal intubation. Since the physician usually provides a large amount of oxygen to the patient by artificially assisted breathing before the endotracheal intubation, the patient can extend the suffocation time with the support of this large amount of oxygen to provide a longer intubation time for the physician. Based on this, in a modified embodiment, when the monitoring of the anesthetic induction phase is performed, the patient suffocation time is detected, and the breathing alarm is also masked, or the breathing alarm threshold is altered such that the breathing alarm threshold is greater than or equal to the maximum time value of the warning zone, thereby allowing the suffocation-related physiological alarm to be masked within a rational time range to avoid alarm interference caused by suffocation during intubation.

[0028] Certainly, in some embodiments, the interested parameters for the anesthetic induction phase may also not comprise the patient suffocation time, that is, the patient suffocation time is not displayed in the anesthetic state display area, and whether the patient suffocation time is too long determined only based on a monitoring alarm for the breathing. In this case, however, the physician can't intuitively see how much the patient suffocation time is.

[0029] In some embodiments, the interested parameters for the anesthetic induction phase may also comprise a timer that supports the timing of a user to start, pause and stop, and assists the physician to determine the drug onset time, intubation time, etc.

[0030] In some embodiments, the interested parameters for the anesthetic induction phase may also not comprise the body temperature (TEMP) and the bispectral index (BIS), that is, the trend graphs of the body temperature (TEMP) and the bispectral index (BIS) are not displayed in the anesthetic state display area.

[0031] When the "maintenance" icon 134 is selected, the visualized information about the interested parameters for the anesthetic maintenance phase is displayed in the anesthetic state display area. In this embodiment, three dimensions of information are used to evaluate the condition of the patient in the anesthetic maintenance phase. The three dimensions are a consciousness dimension, a pain dimension and a muscle relaxation dimension, respectively. The interested parameters for the anesthetic maintenance phase also correspondingly comprise a consciousness parameter characterizing the consciousness condition of the patient under anesthesia, a pain parameter characterizing the pain condition of the patient under anesthesia, and a muscle relaxation parameter characterizing the neuromuscular transmission condition of the patient under anesthesia, the consciousness parameter comprises the bispectral index (BIS) and/or a minimum alveolar concentration (MAC), the pain parameter comprises at least one of a blood pressure change (ΔNIBP) and a heart rate change (ΔHR), the pain parameter may also be obtained by a dedicated pain monitoring module, and the muscle relaxation parameter comprises neuromuscular transmission (NMT), the biospectral index and the neuromuscular transmission may be obtained directly from the conventional physiological parameters, and the blood pressure change and the heart rate change are anesthetic parameters calculated from the blood pressure and the heart rate in the conventional physiological parameters. The blood pressure change refers to the change in blood pressure relative to a blood pressure reference value, the heart rate change is the change in heart rate relative to a heart rate reference value, and the reference values may be parameter values of the patient measured before anesthesia, or may be values set according to clinical experience. As shown in Fig. 5, the anesthetic state display area 132 is divided into three areas for respectively displaying the information about the three dimensions. In this embodiment, current parameter values of the consciousness parameter, the pain parameter and the muscle relaxation parameter are respectively displayed in the form of a graph in the respective area, the bispectral index (BIS) and/or the minimum alveolar concentration (MAC) are/is shown in the area 401, the blood pressure change (ΔNIBP) and the heart rate change (ΔHR) are shown in the area 402, and the neuromuscular transmission (NMT) is shown in the area 403. The graph form uses a histogram, and parameters of the three dimensions form three sets of histograms. In Fig. 5, the three sets of histograms are arranged in a star shape. In other embodiments, the three sets of histograms may also be arranged in parallel or may be enclosed in a triangle. In the histogram, the histogram and its varying height or length or width are used to reflect the changes of the corresponding parameter, or the histogram is combined with different colors

to reflect whether the corresponding parameter is normal, etc. In the histogram, various markers can also be used to represent the thresholds of the corresponding parameters, such as a horizontal cut line in the histogram is used as the threshold 404 of the parameter, and the parameter value 405 of the corresponding parameter is represented by a color, a pattern or a graphic mark, and whether the corresponding parameter exceeds the threshold and how much is exceeded are represented by the spacing between the color, the pattern or the graphic marker and the horizontal cut line. To clearly display the parameters represented by each histogram, the parameter name 406 is indicated by a text or abbreviated abbreviation next to each histogram. To enable the physician to quickly know the value of each parameter, the parameter value 407 of each parameter may also be indicated next to each histogram.

[0032] In a further embodiment, the current parameter valuesof the consciousness parameter, the pain parameter and the muscle relaxation parameter may also be displayed in their respective regions using other graphical means such as a gage or a sector, and the current parameter values of the consciousness parameter, the pain parameter and the muscle relaxation parameter may also be displayed in the respective areas directly using a text plus a value.

[0033] In a further embodiment, the interested parameters for the anesthetic maintenance phase may also comprise the blood pressure and the heart rate, as shown in Fig. 6, in the anesthetic state display area 132, in addition to displaying the information about the three dimensions, the trend graphs of the bispectral index, the neuromuscular transmission, the blood pressure and the heart rate are also displayed. The display time of the trend graph may be the time of the entire anesthetic maintenance phase, or may be a determined period of time before or after the current time.

[0034] When the "recovery" icon 135 is selected, the visualized information about the interested parameters for the postoperative recovery phase is displayed in the anesthetic state display area. In this embodiment, the interested parameters for the postoperative recovery phase comprise the heart rate (HR), the blood oxygen saturation (SPO_2), the blood pressure (BP), the respiratory rate (RR), the bispectral index (BIS), the body temperature (TEMP) and a postoperative score result, the heart rate (HR), the blood oxygen saturation (SPO_2), the blood pressure (BP), the RR, the bispectral index (BIS), and the body temperature (TEMP) can be obtained directly from the conventional physiological parameters, and the postoperative score result is an anesthetic parameter obtained from the statistics and comparison of the conventional physiological parameters. As shown in Fig. 7, the heart rate 501, the blood oxygen saturation 502, the blood pressure 503, the body temperature 504, the bispectral index 505 and the RR 506 are respectively displayed in the form of trend graphs in the anesthetic state display area 132, and the display time of the trend graph may be the time of the entire anesthetic induction phase, or may also be a determined period of time before or after the current time. The postoperative score result 507 is displayed in the form of an icon in the anesthetic state display area, and a score sheet is popped up when it is detected that the icon is selected, the score sheet comprising a score for each item and a total score. When some sub-items are being scored, automatic scoring can be used. For example, when the blood oxygen saturation is being scored, the data processing module acquires the current parameter value of the blood oxygen saturation of the patient, and compares the current parameter value of the blood oxygen saturation with predetermined scoring criteria. The scoring criteria specifies the scores of various intervals of the parameter value of the blood oxygen saturation, and the data processing module can obtain the score of the current blood oxygen saturation item of the patient according to the scoring criteria. When scores of items are obtained, the data processing module accumulates the scores of the items to obtain the total score of the patient in the current condition.

[0035] In a further embodiment, the interested parameters for the postoperative recovery phase may not comprise at least one of the respiratory rate (RR), the bispectral index (BIS), the body temperature (TEMP), and the postoperative score result.

[0036] In this embodiment, the corresponding interested parameters are set for each anesthetic phase, and the interested parameters are displayed in a graphical manner on the same screen to indicate the current anesthetic state of the patient, and provide intuitive and comprehensive information for the physician, so that the physician can see the required information at a glance, without having to look through the screen to find out relevant information to understand the current anesthetic state of the patient. Consequently, on the one hand, the physician can quickly understand the current anesthetic state of the patient; and on the other hand, the ease of use and operability of the monitoring device is improved to some extent.

[0037] When the interested parameters for each anesthetic phase are displayed by means of trend graphs, according to this embodiment, for each anesthetic phase, basic physiological parameters such as the heart rate (HR) and the blood pressure (BP) are basically comprised.

[0038] In this embodiment, the phase indication icon of the anesthetic state display area is triggered to generate the request information for requesting display of the designated anesthetic phase. In a further embodiment, it is also possible to arrange a corresponding button or a knob or slide switch with different settings on the monitoring device to generate the corresponding request information. As an example, different buttons correspond to different anesthetic phases, and the corresponding request information is generated by selecting the button. As another example, for the knob or slide switch with different settings, the different settings represent differ-

ent anesthetic phases. When the knob or slide switch is switched to a certain setting, the request information for the anesthetic phase corresponding to the setting is generated.

Second Embodiment:

[0039] In the first embodiment, the request information for requesting display of the designated anesthetic phase needs to be manually triggered by the operator. Unlike the first embodiment, in this embodiment, the request information for requesting display of the designated anesthetic phase is automatically generated by the monitoring device, for example, generated in such a way that the signal collection module detects a distinctive operation or state for each phase. Each phase has an operation or state that is different from the other phases. When these operations or states occur, it means that the operations or states can be used as the distinctive operations or states of the phases at the end of the previous phase and the beginning of the subsequent phase. As an example, the detection of a patient breathing support mode from a manual mode (gripping a ball by a hand) into a machine control mode means that the endotracheal intubation is completed and the surgery is about to begin, so the breathing of the patient into the machine control mode can be used as the distinctive operation or state for the anesthetic maintenance phase. As another example, the detection of the monitored value of neuromuscular transmission (NMT) of the patient being 0 for a certain period of time is used as a distinctive operation or state for the anesthetic maintenance phase. As an example, the detection of the monitored value of concentration of an inhaled anesthetic drug being 0 or (and) an infusion pump being stopped to provide an anesthetic is used as a distinctive operation or status for the postoperative recovery phase. It is suitable for a single anesthesia mode or for a combined anesthesia mode. As another example, the detection of the monitored value of the bispectral index (BIS) of the patient being 80 or more is used as the distinctive operation or state for the postoperative recovery phase.

[0040] In this embodiment, the signal collection module further comprises a first detection component for detecting the state of a respirator and a second detection component for detecting the state of the infusion pump, the first detection component and the second detection component are connected to the data processing module, and the data processing module generates, according to detection results of the first detection component and the second detection component, request information for requesting display of the anesthetic maintenance phase and request information for requesting display of the postoperative recovery phase.

[0041] As an example, when the first detection component detects that the breathing of the patient enters the machine control mode, the level state of the first detection component is reversed and a pulse is output to the data processing module, and the data processing module switches, based on the pulse, the display content of the anesthetic state display area from the anesthetic induction phase to the anesthetic maintenance phase, and displays the visualized information about the interested parameters for the anesthetic maintenance phase. When the second detection component detects that the infusion pump stops administrating the anesthetic, the level state of the second detection component is reversed and a pulse is output to the data processing module, and the data processing module switches, based on the pulse, the display content of the anesthetic state display area from the anesthetic induction phase or the anesthetic maintenance phase to the postoperative recovery phase, and displays the visualized information about the interested parameters for the postoperative recovery phase.

Third Embodiment:

[0042] As shown in Figs. 8, 9 and 10, this embodiment differs from the above embodiments in that a baseline parallel to a time axis is displayed on the trend graph, trend graphs of the parameters for the anesthetic induction phase are shown in Fig. 8, trend graphs of the parameters for the anesthetic maintenance phase are shown in Fig. 9, and trend graphs of the parameters for the postoperative recovery phase are shown in Fig. 10. The value of the baseline may be the average value of a respective interested parameter for a determined period of time before the beginning of the anesthetic induction phase, a value of the respective interested parameter at a set time point or a pre-set value of the respective interested parameter, the set time point may be, for example, the anesthetic induction phase start time.

[0043] In this embodiment, when it is detected that the start icon for initiating the anesthesia monitoring is triggered, the data processing module obtains the interested parameters for all the anesthetic phases according to the currently detected physiological parameters, and takes the interested parameters at this moment as the reference values. Alternatively, when it is detected that the start icon for initiating the anesthesia monitoring is triggered, the data processing module obtains the interested parameters for all the anesthetic phases according to the average values of the various physiological parameters previously measured within a period of time, and then takes the interested parameters at this moment as the reference values.

[0044] When the data processing module receives the request information for requesting display of the designated anesthetic phase, on the one hand, the interested parameters corresponding to the designated anesthetic phase are obtained based on the request information, and on the other hand, the reference value of each interested parameter corresponding to the designated anesthetic phase is obtained based on the request information, the reference values and the interested parameters

are then processed into visualized information and output to the display module, and the display module displays the interested parameters in the form of trend graphs, and displays, on the trend graphs, the reference values in the form of baselines parallel to the time axis.

[0045] In addition, when it is detected that the start icon for initiating the anesthesia monitoring is triggered, the data processing module further acquires the current time, and takes the current time as the start time of the anesthetic induction phase. When the data processing module receives the request information for requesting display of the anesthetic induction phase, an event line perpendicular to the time axis is also displayed on the trend graph, indicating that the anesthetic induction phase starts from this moment, as shown in Fig. 8.

[0046] Displaying the baseline on the trend graph can facilitate the physician in comparing the various parameters of the patient with the baselines corresponding to the parameters to understand the patient's changes in vital signs after anesthesia relative to those before anesthesia, which facilitates the physician in determining whether the condition of the patient is appropriate.

Fourth Embodiment:

[0047] In this embodiment, a system for displaying patient anesthesia monitoring information is provided. Referring to Fig. 11, the system for displaying patient monitoring information 600 comprises an information acquisition unit 601, a first information processing unit 602, a request unit 603, and a second information processing unit 604 and a display unit 605.

[0048] In one embodiment, the information acquisition unit 601 may be connected to an output end of the signal collection module 120 and is configured to obtain vital sign signals collected by the signal collection module 120 from the body of the patient. The conventional vital sign signals comprise a pulse signal, a body temperature signal, a blood absorption signal for a specific band of light, an electrocardiogram signal, an electroencephalogram signal, etc.

[0049] The first information processing unit 602 is connected to the information acquisition unit 601, and is configured to process the vital sign signals to generate physiological parameters for reflecting the condition of the patient. The conventional physiological parameters comprise, for example, a blood pressure, a blood oxygen saturation, a heart rate, a body temperature, electrocardiogram, respiratory rate, etc.

[0050] The request unit 603 is configured to receive request information for requesting display of a designated anesthetic phase, the designated anesthetic phase being an anesthetic induction phase before surgery, an anesthetic maintenance phase during surgery, or a postoperative recovery phase after surgery. In a specific embodiment, the request information is generated based on a selection operation performed by the operator on the display interface, and thus the request unit 603 is connected to the display module 130, as shown by the solid line in Fig. 11. In another specific embodiment, the request information is generated based on the operator switching the state of an input unit provided on the monitoring device, and thus the request unit 603 is connected to the input unit, and the input unit may be a button, a knob or slide switch having different settings, etc., as shown by the dotted line in Fig. 11. In yet another specific embodiment, the request information is generated based on the signal collection module detecting a distinctive operation or state for each stage, and thus the request unit 603 is connected to the signal collection module 120, as shown by the bold line in Fig. 11.

[0051] The second information processing unit 604 is connected to the request unit 603 and the first information processing unit 602, and is configured to generate, based on the request information, visualized information about interested parameters corresponding to the designated anesthetic phase, the interested parameters comprising parameters selected from the physiological parameters and/or anesthetic parameters derived from the physiological parameters. Each anesthetic phase has its own corresponding interested parameters. The interested parameters for the anesthetic induction phase comprise at least a heart rate, a blood oxygen saturation and a blood pressure, and may further comprise at least one of a body temperature, a bispectral index and a patient suffocation time. The interested parameters for the anesthetic maintenance phase comprise at least a consciousness parameter characterizing the consciousness condition of the patient under anesthesia, a pain parameter characterizing the pain condition of the patient under anesthesia, and a muscle relaxation parameter characterizing the neuromuscular transmission condition of the patient under anesthesia, the consciousness parameter comprises the bispectral index and/or a minimum alveolar concentration value, the pain parameter comprises a blood pressure change and/or a heart rate change, and the muscle relaxation parameter comprises neuromuscular transmission. The interested parameters for the anesthetic maintenance phase may further comprise the blood pressure and the heart rate. The interested parameters for the postoperative recovery phase comprise at least the heart rate, the blood oxygen saturation and the blood pressure. The interested parameters for the postoperative recovery phase may further comprise a postoperative score result.

[0052] The display unit 605 is at least a part of the display module for displaying display data in a suitable manner on the display screen. The second information processing unit 604 is further connected to the display unit 605, and outputs the visualized information about the interested parameters corresponding to the designated anesthetic phase to the display unit 605, such that the visualized information is displayed in an anesthetic state display area, the anesthetic state display area being at least a partial area of a display interface of a monitoring device. As an example, in order to facilitate the physician

in observing real-time data and historical data of the parameters such as the heart rate, the blood oxygen saturation, the blood pressure and the bispectral index of the patient, the second information processing unit 604 outputs data to the display unit 605 when the interested parameters are displayed, so that the display unit 605 displays two-dimensional trend graphs of the interested parameters in the anesthetic state display area. To facilitate the physician in understanding the patient's perception of pain during surgery (i.e., the anesthetic maintenance phase), the second information processing unit 604 outputs data to the display unit 605, such that current parameter values of the consciousness parameter, the pain parameter and the muscle relaxation parameter are respectively displayed in the form of a graph and/or a text in the anesthetic state display area by the display unit 605. To facilitate the physician in intuitively understanding the patient suffocation time during the endotracheal intubation, the second information processing unit 604 outputs data to the display unit 605, such that the patient suffocation time is displayed in the form of a time progress bar in the anesthetic state display area by the display unit 605. To facilitate the physician in understanding the postoperative recovery condition of the patient, the second information processing unit 604 outputs data to the display unit 605, such that the postoperative score result is displayed in the form of a selectable icon in the anesthetic state display area by the display unit 605. When the display module detects that the icon is selected, the selected information is sent to the second information processing unit 604, and the second information processing unit 604 outputs the data to the display unit 605, such that the display unit 605 pops up a score sheet, the score sheet comprising a score for each item and a total score.

[0053] In another embodiment, the display interface is divided into at least two parts, one of which is an anesthetic state display area and the other is a conventional physiological parameter display area. The first information processing unit 602 is further connected to the display unit 605, and processes the conventional physiological parameters into visualized data and outputs same to the display unit, which displays the display data of the conventional physiological parameters in a suitable manner in the conventional physiological parameter display area.

[0054] The patient monitoring information display system can either be implemented by means of the programs described in the above embodiments, or by hardware, for example, by using gate circuits to build an application-specific integrated circuit. Those skilled in the art will appreciate that various programs in the foregoing embodiments may be stored in a computer readable storage medium, the storage medium may comprise: a read only memory, a random access memory, a magnetic disk or an optical disk, etc., and the data processing module may implement the above functions by executing the programs.

[0055] The present invention has been described in detail with reference to specific examples, which are merely for the purpose of facilitating understanding of the present invention and are not intended to limit the present invention. It will be apparent to those skilled in the art that changes may be made to the specific embodiments described above in accordance with the teachings of the present invention.

Claims

1. A medical monitoring device, comprising:

   a signal collection module configured to collect patient's vital sign signals from the body of a patient;
   a data processing module connected to the signal collection module and configured to receive the vital sign signals and process the vital sign signals to generate physiological parameters for reflecting condition of the patient, the data processing module being further configured to receive request information for requesting display of a designated anesthetic phase and generate, based on the request information, visualized information about interested parameters corresponding to the designated anesthetic phase, the designated anesthetic phase being an anesthetic induction phase before surgery, an anesthetic maintenance phase during surgery, or a postoperative recovery after surgery, and the interested parameters comprising parameters selected from the physiological parameters and/or anesthetic parameters derived from the physiological parameters; and
   a display module comprising a display interface, the display module being connected to the data processing module and configured to receive the visualized information outputted by the data processing module, and display in an anesthetic state display area at least the visualized information about the interested parameters corresponding to the designated anesthetic phase, and the anesthetic state display area being at least a partial area of the display interface of the monitoring device.

2. The medical monitoring device of claim 1, **characterized in that** at least one of the interested parameters corresponding to the designated anesthetic phase is displayed at least in the form of a trend graph in the anesthetic state display area, the trend graph representing a trend of values of the at least one of the interested parameters over time in the designated anesthetic phase.

3. The medical monitoring device of claim 2, **characterized in that** a baseline parallel to a time axis is

displayed on the trend graph, a value of the baseline is capable of being an average value of a respective interested parameter for a determined period of time before the beginning of the anesthetic induction phase, a value of the respective interested parameter at a set time point or a pre-set value of the respective interested parameter.

4. The medical monitoring device of claim 3, **characterized in that** an event line representing an anesthetic induction phase start time is further displayed on the trend graph, the event line being perpendicular to the time axis.

5. The medical monitoring device of any one of claims 2-4, **characterized in that** the designated anesthetic phase is the anesthetic induction phase, and the interested parameters for the anesthetic induction phase comprise at least a heart rate, a blood oxygen saturation and a blood pressure.

6. The medical monitoring device of claim 5, **characterized in that** the interested parameters for the anesthetic induction phase further comprise a body temperature and a bispectral index, and the heart rate, the blood oxygen saturation, the blood pressure, the body temperature and the bispectral index are respectively displayed in the form of trend graphs in the anesthetic state display area.

7. The medical monitoring device of claim 5, **characterized in that** the interested parameters for the anesthetic induction phase further comprise a patient suffocation time, the patient suffocation time is displayed in the form of a time progress bar in the anesthetic state display area, at least a warning zone and a danger zone are marked on a time bar in a time progress direction, the warning zone represents a period of time for which the patient is allowed to suffocate, the length of time of the warning zone is set according to a type of the patient, and the danger zone represents a period of suffocation time for which the patient may be in danger; when the signal collection module detects a respiratory signal, the data processing module starts timing and outputs a display signal such that the display module moves a progress pointer along the time bar according to the timing time from the 0 coordinate of the time bar; and when a next respiratory signal is detected, the data processing module outputs a display signal such that the display module resets the progress pointer to the 0 coordinate.

8. The medical monitoring device of any one of claims 2-4, **characterized in that** the designated anesthetic phase is the anesthetic maintenance phase, and the interested parameters for the anesthetic maintenance phase comprise at least a consciousness parameter characterizing consciousness condition of the patient under anesthesia, a pain parameter characterizing pain condition of the patient under anesthesia, and a muscle relaxation parameter characterizing neuromuscular transmission condition of the patient under anesthesia, current parameter values of the consciousness parameter, the pain parameter, and the muscle relaxation parameter being respectively displayed in the form of a graph and/or a text in the anesthetic state display area.

9. The medical monitoring device of claim 8, **characterized in that** the consciousness parameter comprises a bispectral index and/or a minimum alveolar concentration, the pain parameter comprises a blood pressure change and/or a heart rate change, and the muscle relaxation parameter comprises neuromuscular transmission, the blood pressure change being a change in a blood pressure relative to a blood pressure reference value, and the heart rate change being a change in a heart rate relative to a heart rate reference value.

10. The medical monitoring device of claim 9, **characterized in that** the interested parameters for the anesthetic maintenance phase further comprise the blood pressure and the heart rate, and the bispectral index, the minimum alveolar concentration, the neuromuscular transmission, the blood pressure and the heart rate which are respectively displayed in the form of trend graphs in the anesthetic state display area.

11. The medical monitoring device of any one of claims 2-4, **characterized in that** the designated anesthetic phase is the postoperative recovery phase, and the interested parameters for the postoperative recovery phase comprise at least a heart rate, a blood oxygen saturation and a blood pressure, a heart rate, a blood oxygen saturation and a blood pressure being respectively displayed in the form of trend graphs in the anesthetic state display area.

12. The medical monitoring device of claim 11, **characterized in that** the interested parameters for the postoperative recovery phase also comprise a postoperative score result, which is displayed in the form of an icon in the anesthetic state display area, and a score sheet is popped up on the display interface when the data processing module detects that the icon is selected, the score sheet comprising a score for each item and a total score.

13. The medical monitoring device of claim 1, **characterized in that** the display module displays phase indication icons in the anesthetic state display area for respectively representing at least two of the anesthetic induction phase, the anesthetic mainte-

nance phase and the postoperative recovery phase, and the request information for requesting display of the designated anesthetic phase is generated in such a way that a phase indication icon is manually triggered.

14. The medical monitoring device of claim 1, **characterized in that** the request information for requesting display of the designated anesthetic phase is generated in such a way that the signal collection module detects a distinctive operation or state for each phase.

15. The medical monitoring device of claim 14, **characterized in that** request information for requesting display of the anesthetic maintenance phase is generated when it is detected that breathing of the patient enters a machine control mode, and request information for requesting display of the postoperative recovery phase is generated when an operation is detected.

16. A method for displaying patient monitoring information, comprising:

acquiring vital sign signals collected from the body of a patient;
processing the vital sign signals to generate physiological parameters for reflecting condition of the patient;
receiving request information for requesting display of a designated anesthetic phase, the designated anesthetic phase being an anesthetic induction phase before surgery, an anesthetic maintenance phase during surgery, or a postoperative recovery phase after surgery;
generating, based on the request information, visualized information about interested parameters corresponding to the designated anesthetic phase, the interested parameters comprising parameters selected from the physiological parameters and/or anesthetic parameters derived from the physiological parameters; and
displaying in an anesthetic state display area the visualized information about the interested parameters corresponding to the designated anesthetic phase, the anesthetic state display area being at least a partial area of a display interface of a monitoring device.

17. The method of claim 16, **characterized in that** at least one of the interested parameters corresponding to the designated anesthetic phases is displayed at least in the form of a trend graph in the anesthetic state display area, the trend graph representing a trend of values of the at least one of the interested parameters over time in the designated anesthetic phase.

18. The method of claim 17, further comprising:

acquiring a reference value of each interested parameter for the designated anesthetic phase, a value of a baseline is an average value of a respective interested parameter for a determined period of time before the beginning of the anesthetic induction phase, a value of the respective interested parameter at a set time point or a pre-set value of the respective interested parameter; and
displaying, on the trend graph, the reference value in the form of the baseline parallel to a time axis.

19. The method of claim 17, further comprising:

displaying a start icon for initiating anesthesia monitoring on the display interface of the monitoring device;
allocating at least one anesthetic state display area on the display interface of the monitoring device when it is detected that the start icon is selected;
acquiring a reference value of each interested parameter for the designated anesthetic phase, the reference value of the interested parameter referring to an average value of a respective interested parameter for a determined period of time in the anesthetic induction phase, the value of the respective interested parameter at a set time point or a pre-set value of the respective interested parameter;
displaying, on the trend graph, the reference value in the form of a baseline parallel to a time axis; and
acquiring a start time of the anesthetic induction phase, and displaying, on the trend graph, the start time in the form of an event line perpendicular to the time axis.

20. The method of any one of claims 17-19, **characterized in that** the designated anesthetic phase is the anesthetic induction phase, and the interested parameters for the anesthetic induction phase comprise at least a heart rate, a blood oxygen saturation and a blood pressure.

21. The method of claim 20, **characterized in that** the interested parameters for the anesthetic induction phase further comprise a body temperature and a bispectral index, and the heart rate, the blood oxygen saturation, the blood pressure, the body temperature and the bispectral index are respectively displayed in the form of trend graphs in the anesthetic state display area.

22. The method of claim 20, **characterized in that** the

interested parameters for the anesthetic induction phase further comprise a patient suffocation time, the patient suffocation time being displayed in the form of a time progress bar or values in the anesthetic state display area.

23. The method of claim 22, **characterized in that** the patient suffocation time being displayed in the form of the time progress bar in the anesthetic state display area comprises:

marking at least a warning zone and a danger zone on the time bar in a time progress direction, the warning zone representing a period of time for which the patient is allowed to suffocate, the length of time of the warning zone being set according to a type of the patient, and the danger zone representing a period of suffocation time for which the patient may be in danger; and
acquiring a respiratory signal of the patient, starting timing when the respiratory signal is detected, moving a progress pointer along the time bar according to the timing time from the 0 coordinate of the time bar, and resetting the progress pointer to the 0 coordinate when a next respiratory signal is detected.

24. The method of claim 23, **characterized in that** a breathing alarm is masked or a breathing alarm threshold is altered such that the breathing alarm threshold is greater than or equal to a maximum time value of the warning zone, when the patient suffocation time is detected.

25. The method of any one of claims 17-19, **characterized in that** the designated anesthetic phase is the anesthetic maintenance phase, and the interested parameters for the anesthetic maintenance phase comprise at least a consciousness parameter characterizing consciousness condition of the patient under anesthesia, a pain parameter characterizing pain condition of the patient under anesthesia, and a muscle relaxation parameter characterizing neuromuscular transmission condition of the patient under anesthesia, current parameter values of the consciousness parameter, the pain parameter, and the muscle relaxation parameter being respectively displayed in the form of a graph and/or a text in the anesthetic state display area.

26. The method of claim 25, **characterized in that** the consciousness parameter comprises a bispectral index and/or a minimum alveolar concentration, the pain parameter comprises a blood pressure change and/or a heart rate change, and the muscle relaxation parameter comprises neuromuscular transmission, the blood pressure change being a change in a blood pressure relative to a blood pressure reference value, and the heart rate change being a change in a heart rate relative to a heart rate reference value.

27. The method of claim 26, **characterized in that** the interested parameters for the anesthetic maintenance phase further comprise the blood pressure and the heart rate, and the bispectral index, the minimum alveolar concentration, the neuromuscular transmission, the blood pressure and the heart rate which are respectively displayed in the form of trend graphs in the anesthetic state display area.

28. The method of any one of claims 17-19, **characterized in that** the designated anesthetic phase is the postoperative recovery phase, and the interested parameters for the postoperative recovery phase comprise at least a heart rate, a blood oxygen saturation and a blood pressure, a heart rate, a blood oxygen saturation and a blood pressure being respectively displayed in the form of trend graphs in the anesthetic state display area.

29. The method of claim 28, **characterized in that** the interested parameters for the postoperative recovery phase also comprise a postoperative score result, which is displayed in the form of an icon in the anesthetic state display area, and a score sheet is popped up when it is detected that the icon is selected, the score sheet comprising a score for each item and a total score.

30. The method of claim 16, **characterized in that** the request information for requesting display of the designated anesthetic phase is generated by means of manual triggering.

31. The method of claim 30, **characterized in that** the way in which the request information for requesting display of the designated anesthetic phase is generated comprises the following steps:

displaying phase indication icons respectively in the anesthetic state display area for representing at least two of the anesthetic induction phase, the anesthetic maintenance phase and the postoperative recovery phase; and
generating the request information for requesting display of the designated anesthetic phase in such a way that the phase indication icon is selected.

32. The method of claim 16, **characterized in that** the request information for requesting display of the designated anesthetic phase is generated in such a way that a distinctive operation or state for each phase is detected.

33. The method of claim 32, **characterized in that** request information for requesting display of the anesthetic maintenance phase is generated when it is detected that breathing of the patient enters a machine control mode, and request information for requesting display of the postoperative recovery phase is generated when an operation is detected.

34. A system for displaying patient monitoring information, comprising:

an information acquisition unit, configured to acquire vital sign signals collected from the body of a patient;
a first information processing unit, configured to process the vital sign signals to generate physiological parameters for reflecting condition of the patient;
a request unit, configured to receive request information for requesting display of a designated anesthetic phase, the designated anesthetic phase being an anesthetic induction phase before surgery, an anesthetic maintenance phase during surgery, or a postoperative recovery phase after surgery;
a second information processing unit, configured to generate, based on the request information, visualized information about interested parameters corresponding to the designated anesthetic phase, the interested parameters comprising parameters selected from the physiological parameters and/or anesthetic parameters derived from the physiological parameters; and
a display unit, configured to display in an anesthetic state display area the visualized information about the interested parameters corresponding to the designated anesthetic phase, the anesthetic state display area being at least a partial area of a display interface of a monitoring device.

35. The system of claim 34, **characterized in that** at least one of the interested parameters corresponding to the designated anesthetic phases is displayed at least in the form of a trend graph in the anesthetic state display area, the trend graphs representing a trend of values of the at least one of the interested parameters over time in the designated anesthetic phase.

36. The system of claim 35, **characterized in that**
the second information processing unit is further configured to acquire a reference value of each interested parameter for the designated anesthetic phase, a value of a baseline is an average value of a respective interested parameter for a determined period of time before the beginning of the anesthetic induction phase, a value of the respective interested parameter at a set time point or a pre-set value of the respective interested parameter; and
the display unit is further configured to display, on the trend graph, the reference value in the form of the baseline parallel to a time axis.

37. The system of claim 35, **characterized in that**
the second information processing unit is further configured to acquire a reference value of each interested parameter for the designated anesthetic phase and a start time of the anesthetic induction phase, the reference value of the interested parameter referring to an average value of a respective interested parameter for a determined period of time in the anesthetic induction phase, the value of the respective interested parameter at a set time point or a pre-set value of the respective interested parameter; and
the display unit is further configured to display a start icon for initiating anesthesia monitoring on the display interface of the monitoring device, to allocate at least one anesthetic state display area on the display interface of the monitoring device when it is detected that the start icon is selected, to display, on the trend graph, the reference value in the form of a baseline parallel to a time axis, and to display, on the trend graph, the start time of the anesthetic induction phase in the form of an event line perpendicular to the time axis.

38. The system of any one of claims 35-37, **characterized in that** the designated anesthetic phase is the anesthetic induction phase, and the interested parameters for the anesthetic induction phase comprise at least a heart rate, a blood oxygen saturation and a blood pressure.

39. The system of claim 38, **characterized in that** the interested parameters for the anesthetic induction phase further comprise a body temperature and a bispectral index, and the heart rate, the blood oxygen saturation, the blood pressure, the body temperature and the bispectral index are respectively displayed in the form of trend graphs in the anesthetic state display area.

40. The system of claim 38, **characterized in that** the interested parameters for the anesthetic induction phase further comprise a patient suffocation time, the patient suffocation time being displayed in the form of a time progress bar or values in the anesthetic state display area.

41. The system of any one of claims 35-37, **characterized in that** the designated anesthetic phase is the anesthetic maintenance phase, and the interested parameters for the anesthetic maintenance phase comprise at least a consciousness parameter characterizing consciousness condition of the patient un-

der anesthesia, a pain parameter characterizing pain condition of the patient under anesthesia, and a muscle relaxation parameter characterizing neuromuscular transmission condition of the patient under anesthesia; the consciousness parameter comprises a bispectral index and/or a minimum alveolar concentration, the pain parameter comprises a blood pressure change and/or a heart rate change, and the muscle relaxation parameter comprises neuromuscular transmission, the blood pressure change being a change in a blood pressure relative to a blood pressure reference value, and the heart rate change being a change in a heart rate relative to a heart rate reference value; and current parameter values of the consciousness parameter, the pain parameter, and the muscle relaxation parameter are respectively displayed in the form of a graph and/or a text in the anesthetic state display area, the graph comprises at least one of a line, a column, a sector and a gage-like chart, and the text comprises a character representing a parameter name and a number representing a parameter value.

42. The system of claim 41, **characterized in that** the interested parameters for the anesthetic maintenance phase further comprise the blood pressure and the heart rate, and the bispectral index, the minimum alveolar concentration, the neuromuscular transmission, the blood pressure and the heart rate which are respectively displayed in the form of trend graphs in the anesthetic state display area.

43. The system of any one of claims 35-37, **characterized in that** the designated anesthetic phase is the postoperative recovery phase, and the interested parameters for the postoperative recovery phase comprise at least a heart rate, a blood oxygen saturation and a blood pressure, a heart rate, a blood oxygen saturation and a blood pressure being respectively displayed in the form of trend graphs in the anesthetic state display area.

44. The system of claim 43, **characterized in that** the interested parameters for the postoperative recovery phase also comprise a postoperative score result, which is displayed in the form of an icon in the anesthetic state display area, and a score sheet is popped up when it is detected that the icon is selected, the score sheet comprising a score for each item and a total score.

45. The system of claim 34, **characterized in that** the request information for requesting display of the designated anesthetic phase is generated by means of manual triggering.

46. The system of claim 34, **characterized in that** the request information for requesting display of the designated anesthetic phase is generated in such a way that a distinctive operation or state for each phase is detected.

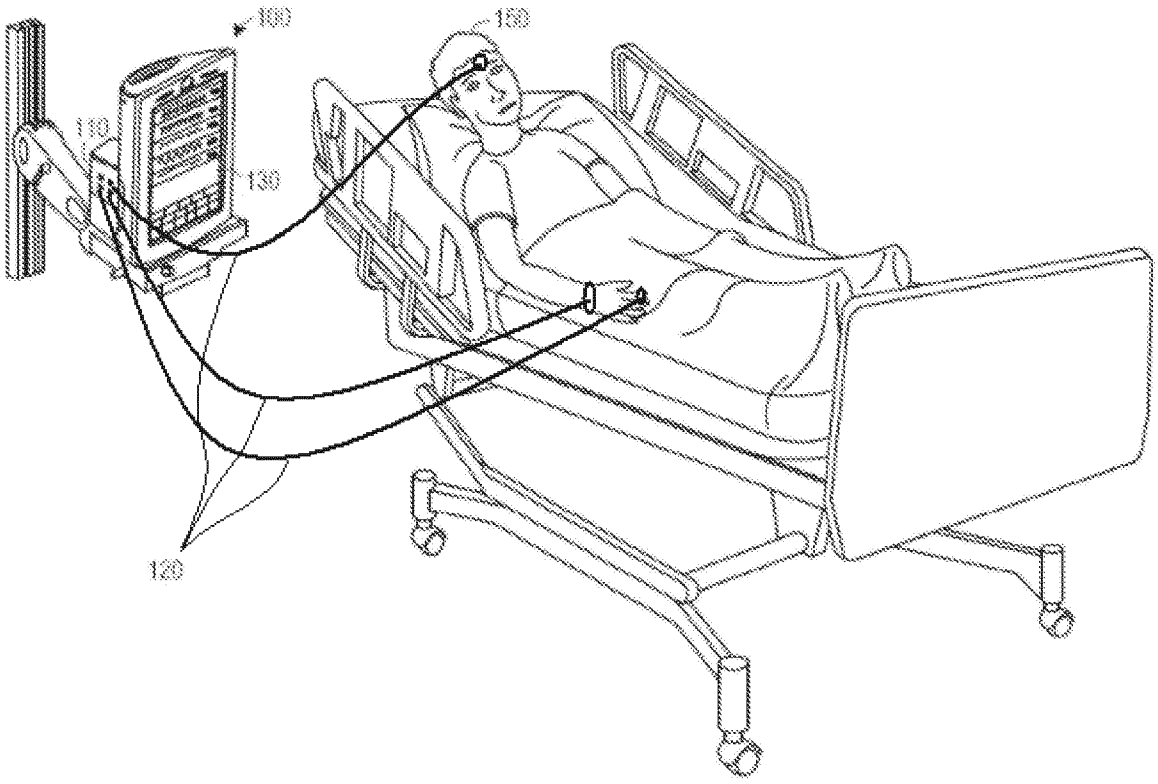


Fig. 1

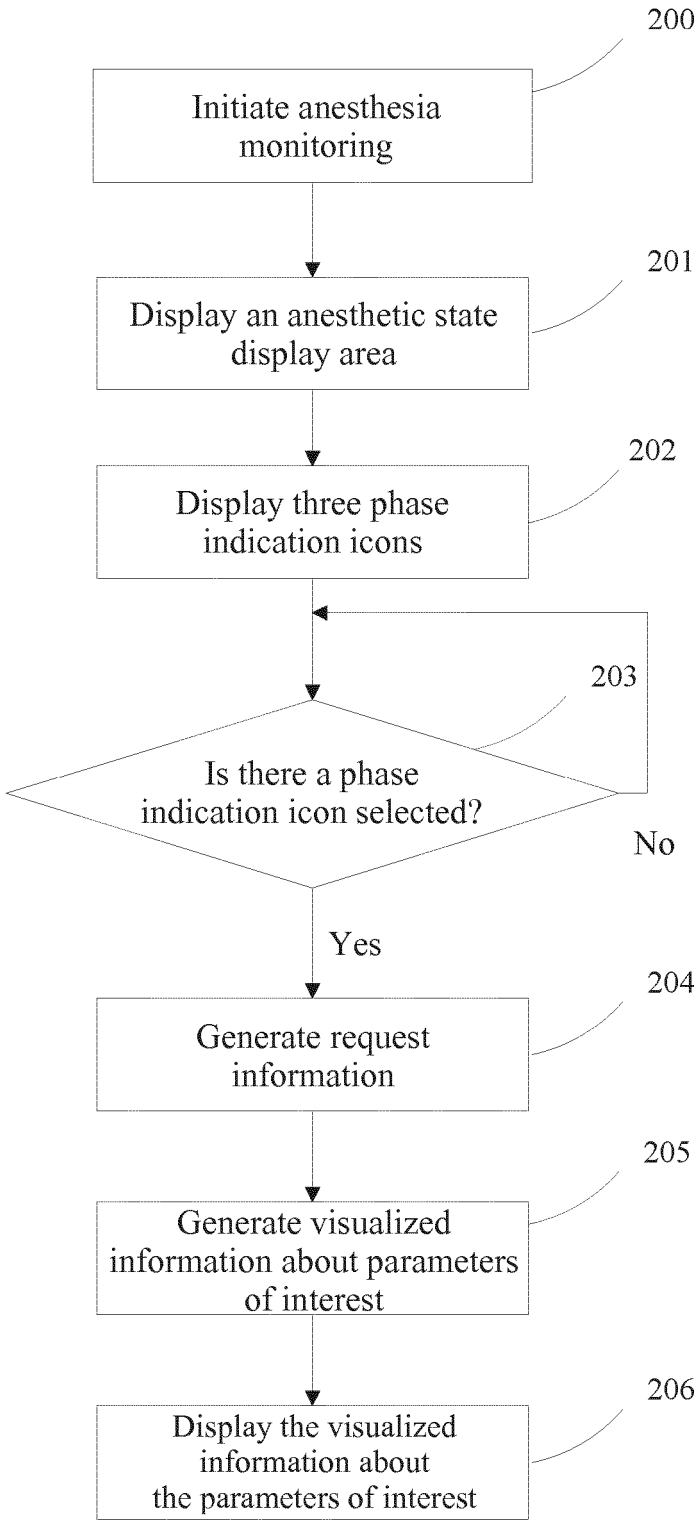

200
Initiate anesthesia monitoring
201
Display an anesthetic state display area
202
Display three phase indication icons
203
Is there a phase indication icon selected?
No
Yes
204
Generate request information
205
Generate visualized information about parameters of interest
206
Display the visualized information about the parameters of interest

Fig. 2

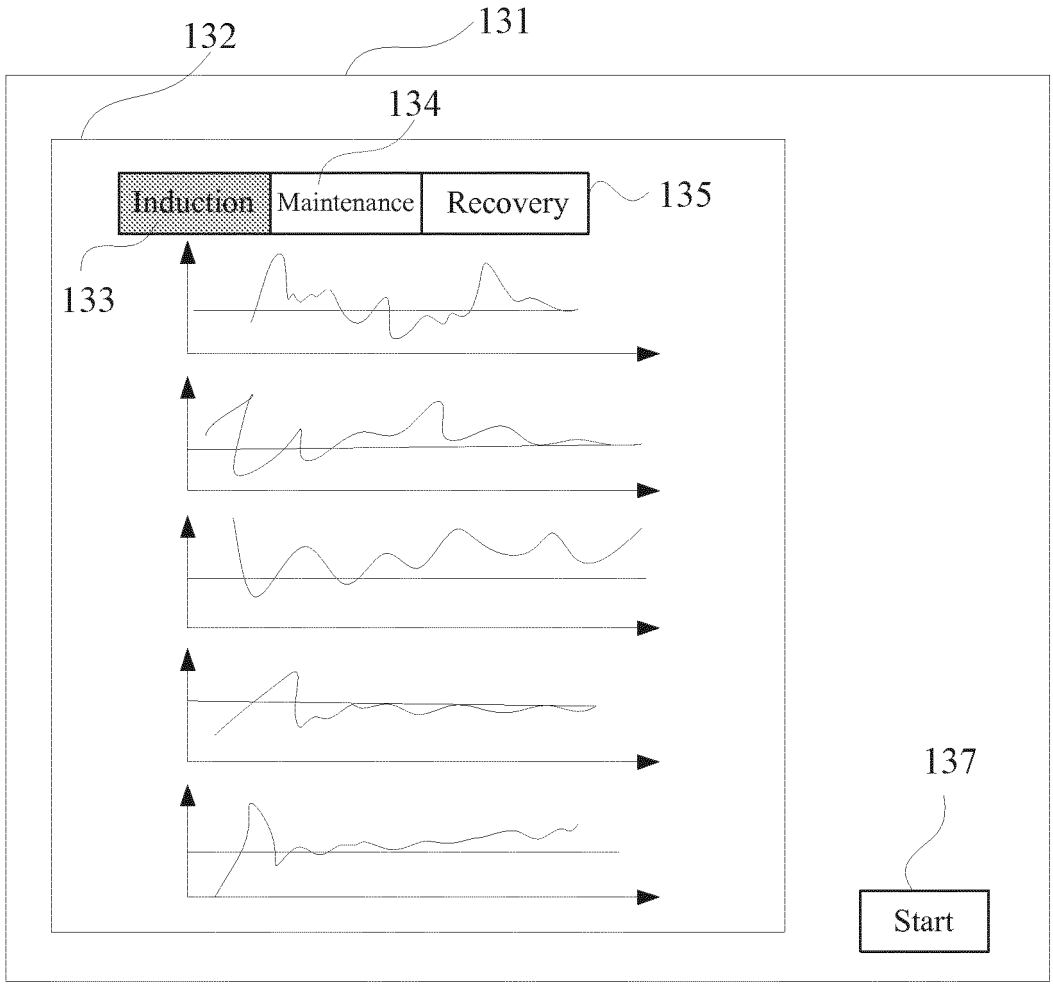

132
131
134
Induction
Maintenance
Recovery
135
133
137
Start

Fig. 3a

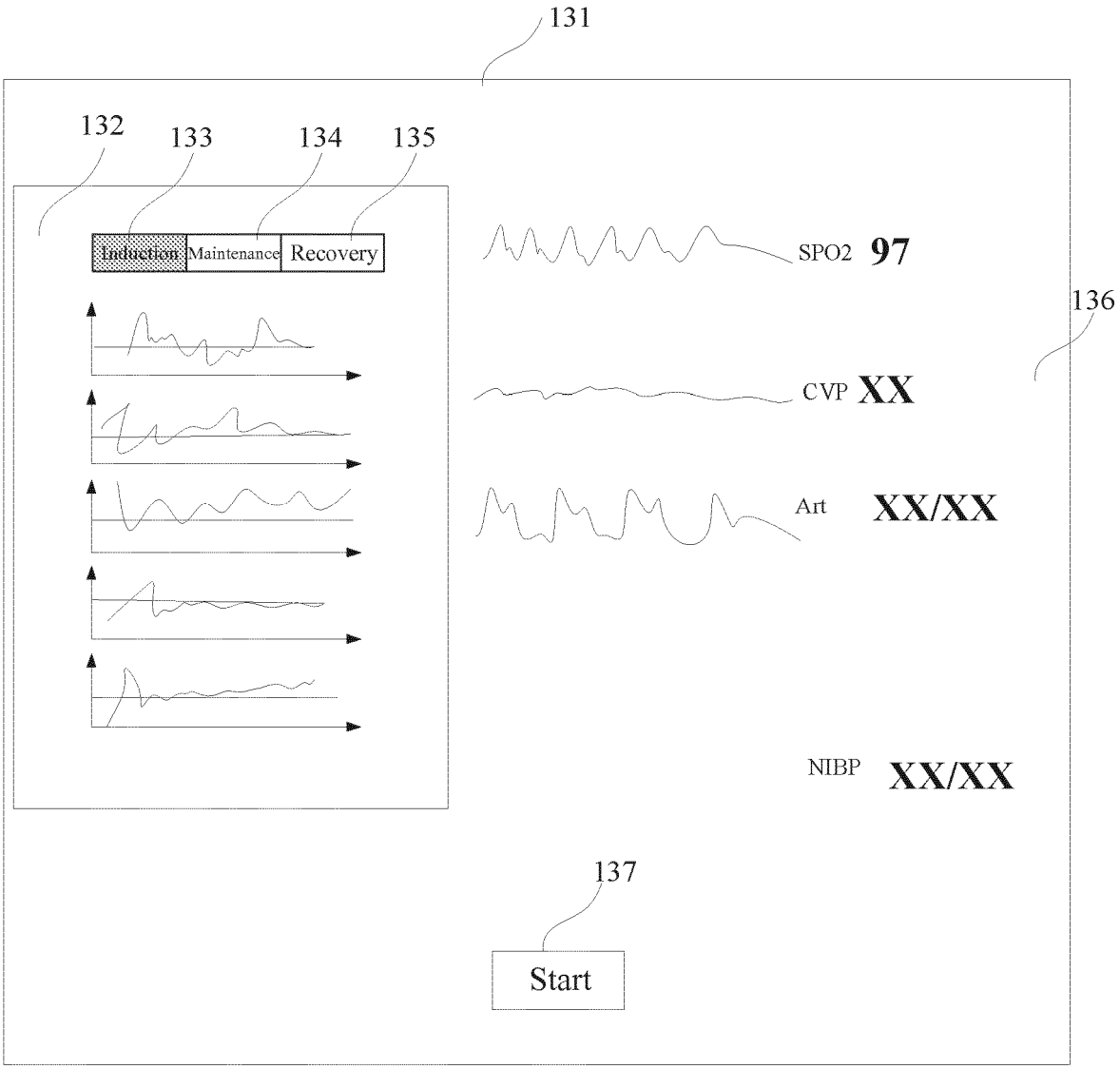

131
132
133
134
135
Induction
Maintenance
Recovery
SPO2 97
136
CVP XX
Art XX/XX
NIBP XX/XX
137
Start

Fig. 3b

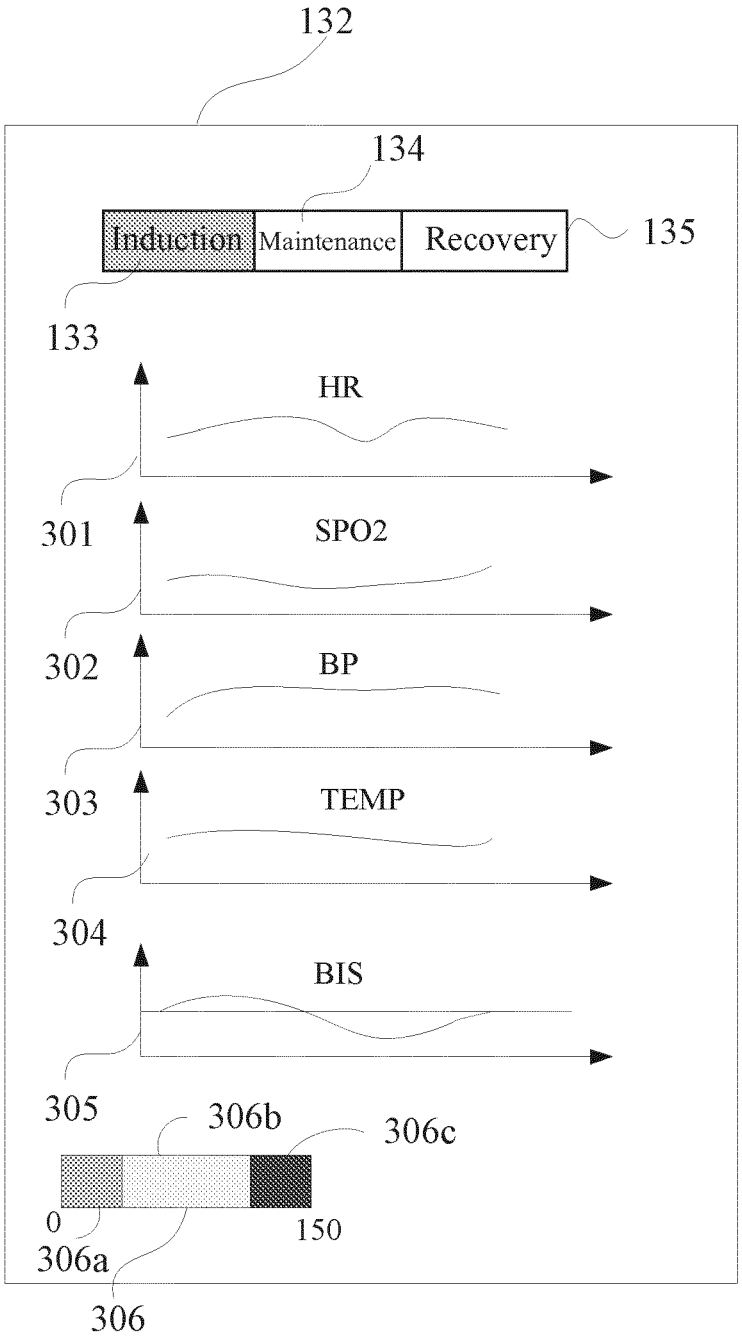

132
134
Induction
Maintenance
Recovery
135
133
HR
301
SPO2
302
BP
303
TEMP
304
BIS
305
306b
306c
0
150
306a
306

Fig. 4

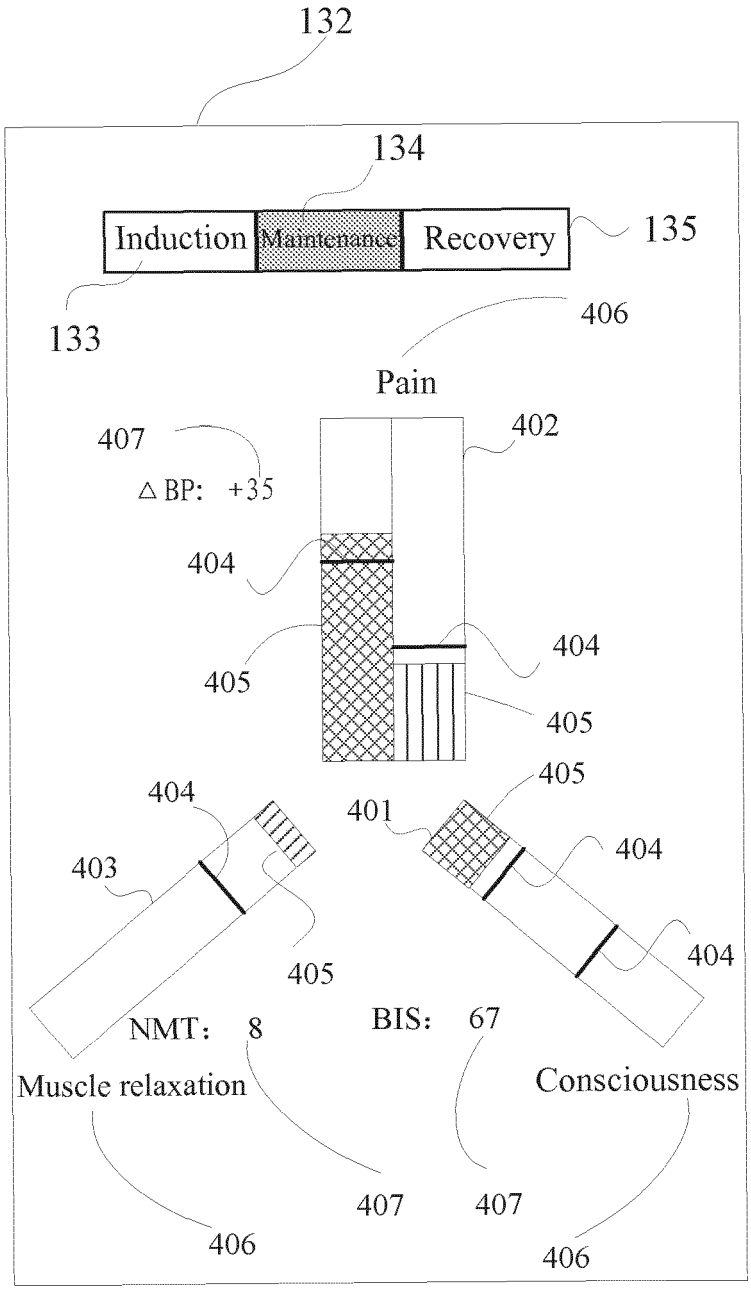
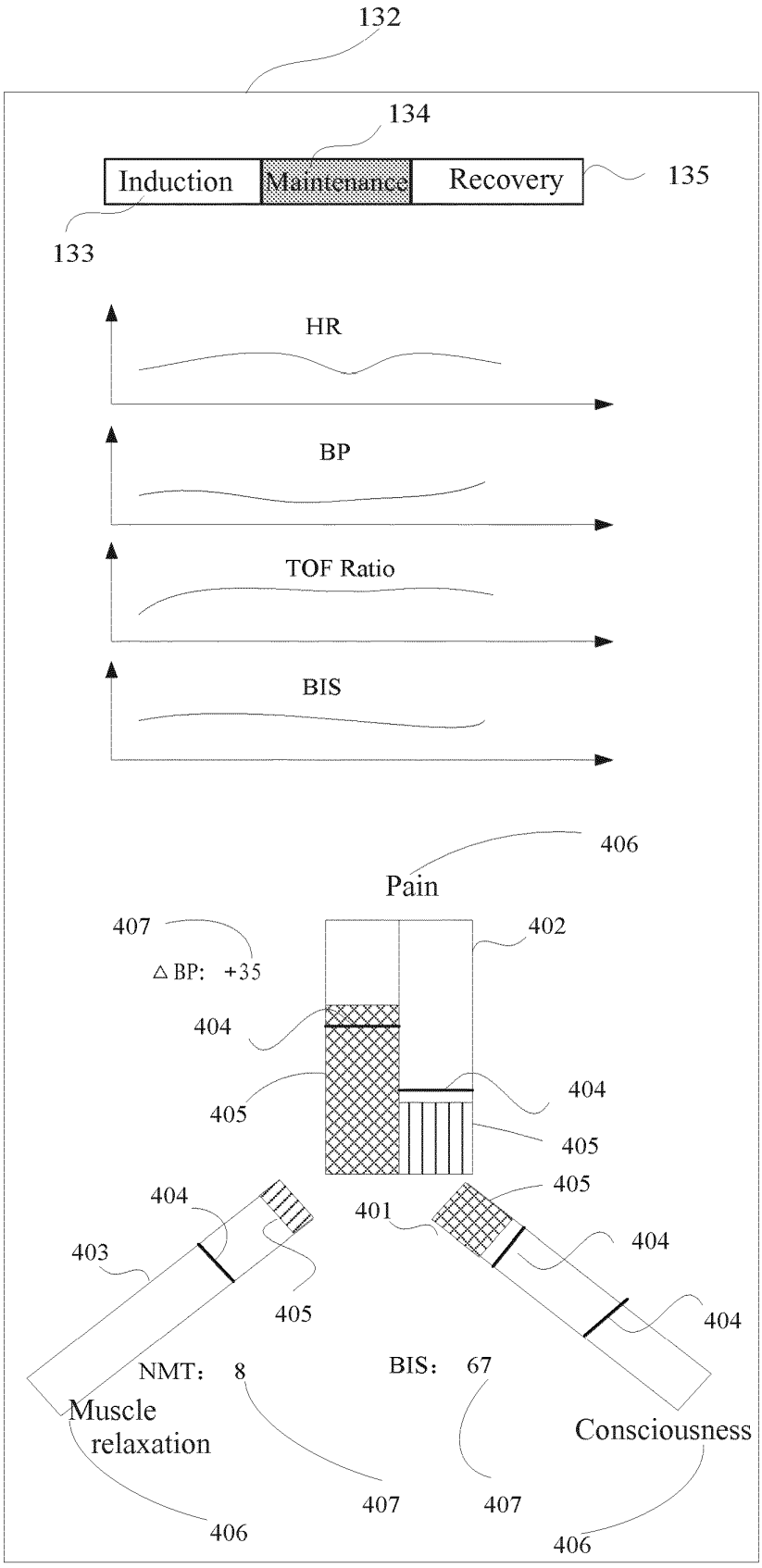

132
134
Induction
Maintenance
Recovery
135
133
406
Pain
407
△BP: +35
402
404
405
404
405
405
404
401
403
404
405
404
NMT: 8
BIS: 67
Muscle relaxation
Consciousness
407
407
406
406

Fig. 5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134
Induction
Maintenance
Recovery
135
133
HR
BP
TOF Ratio
BIS
406
Pain
407
△BP: +35
402
404
405
404
405
404
405
401
403
404
405
404
NMT: 8
BIS: 67
Muscle relaxation
Consciousness
407
407
406
406

Fig. 6

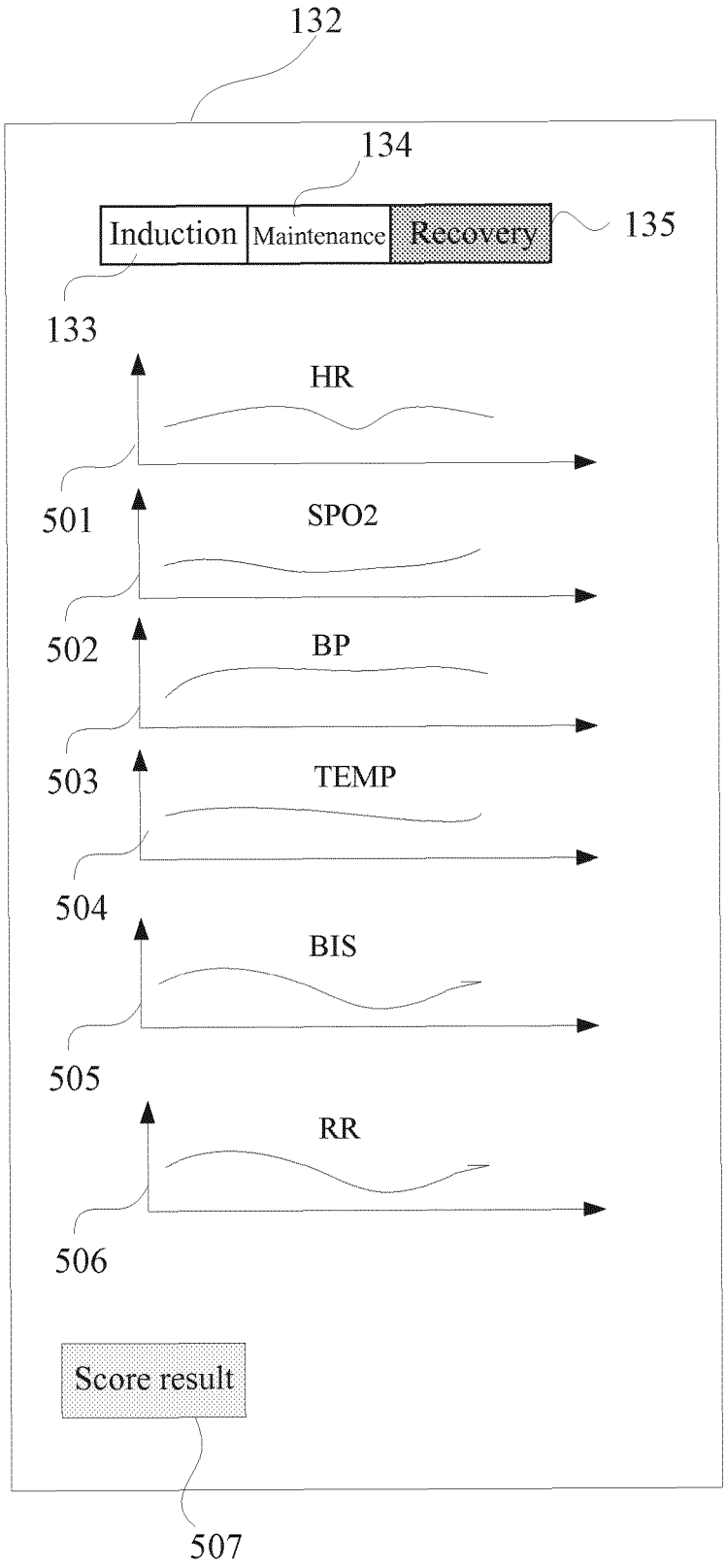
132
134
Induction
Maintenance
Recovery
135
133
HR
501
SPO2
502
BP
503
TEMP
504
BIS
505
RR
506
Score result
507

Fig. 7

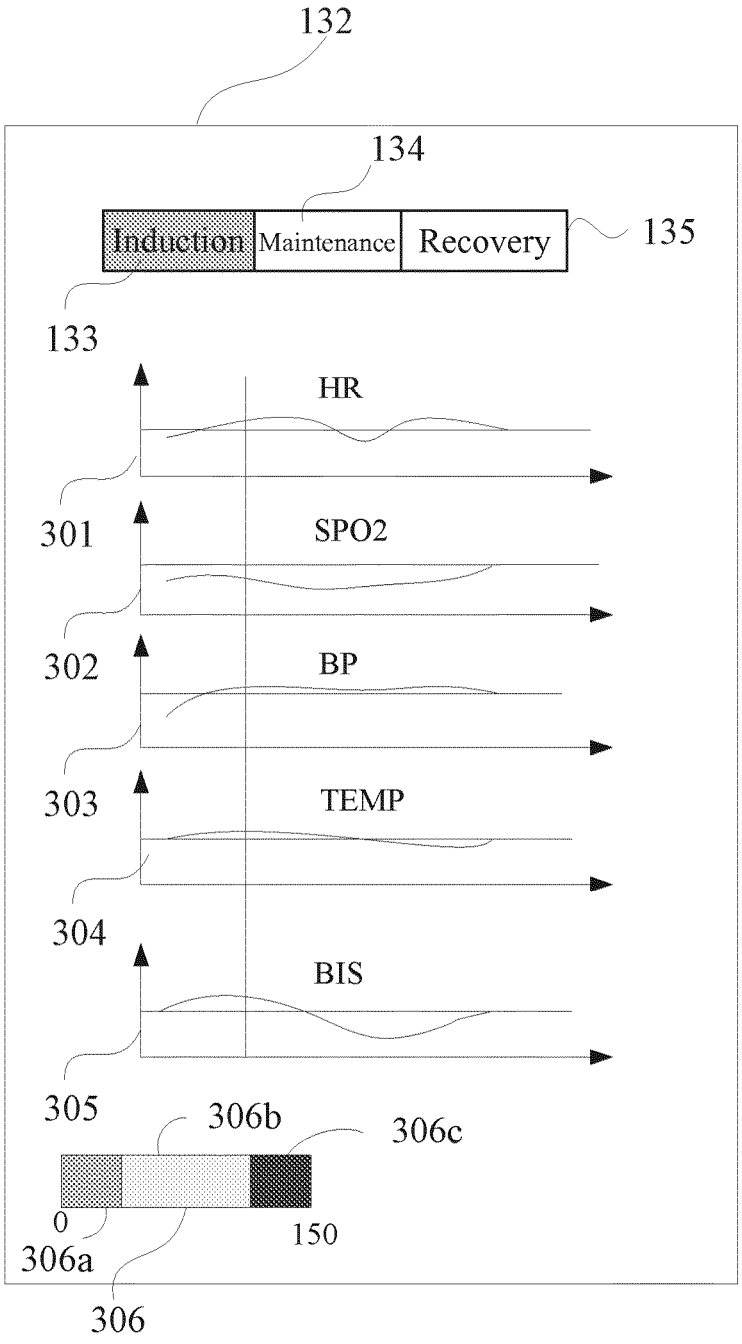
132
134
Induction
Maintenance
Recovery
135
133
HR
301
SPO2
302
BP
303
TEMP
304
BIS
305
306b
306c
0
150
306a
306

Fig. 8

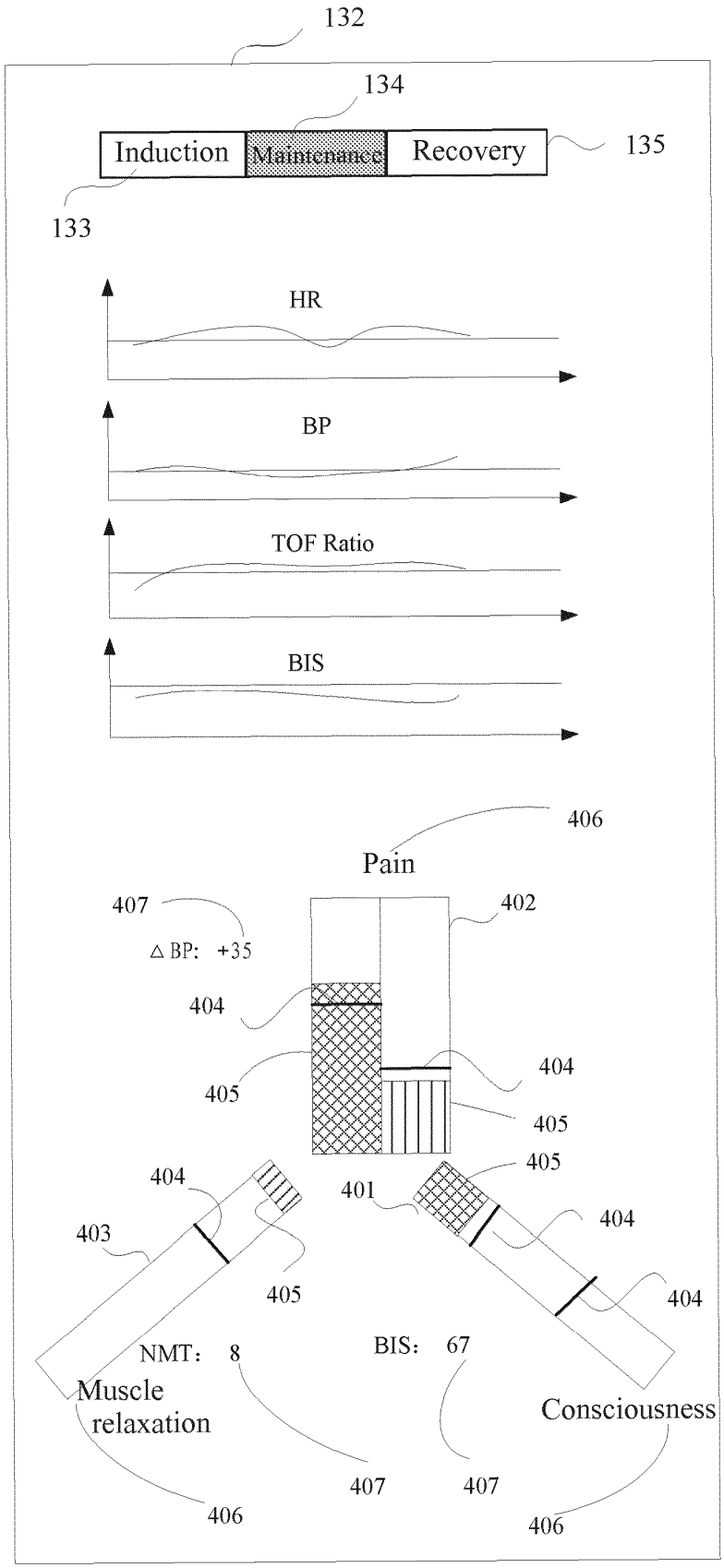
132
134
Induction
Maintenance
Recovery
135
133
HR
BP
TOF Ratio
BIS
406
Pain
407
△BP: +35
402
404
405
404
405
405
404
401
403
404
405
404
NMT: 8
BIS: 67
Muscle relaxation
Consciousness
407
407
406
406

Fig. 9

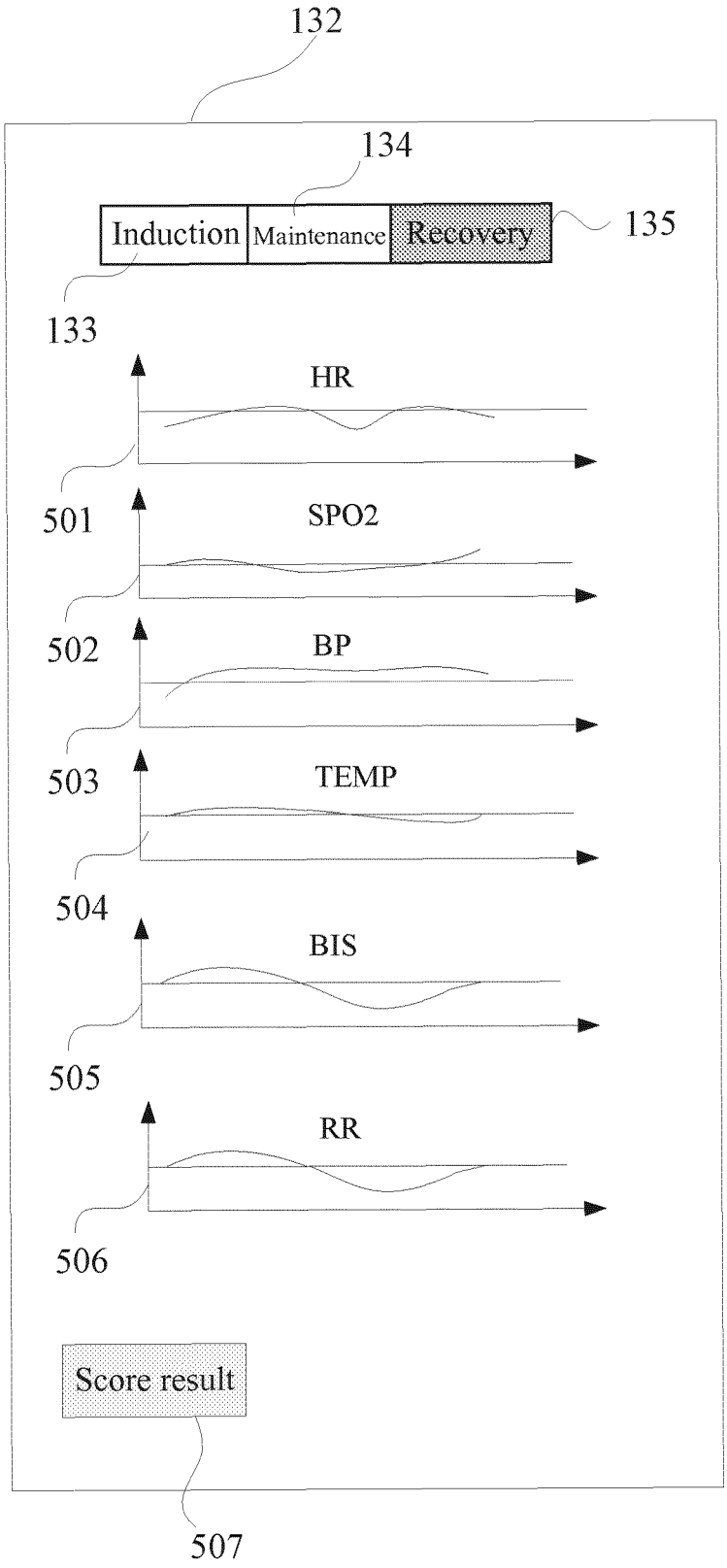
132
134
Induction
Maintenance
Recovery
135
133
HR
501
SPO2
502
BP
503
TEMP
504
BIS
505
RR
506
Score result
507

Fig. 10

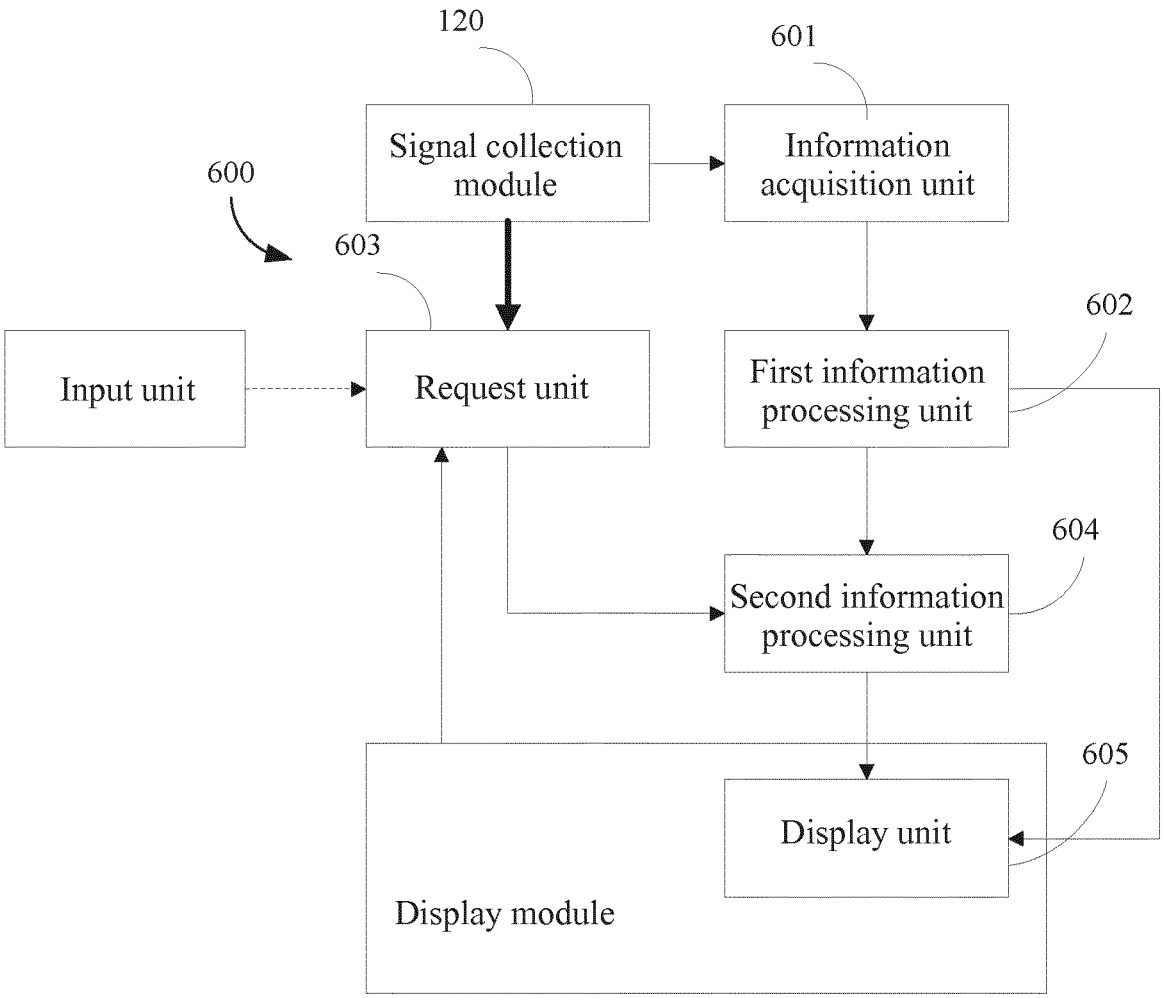
120
601
Signal collection module
Information acquisition unit
600
603
602
Input unit
Request unit
First information processing unit
604
Second information processing unit
605
Display unit
Display module

Fig. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2016/098135

A. CLASSIFICATION OF SUBJECT MATTER

A61B 5/02 (2006.01) i; A61B 5/00 (2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61B 5/-

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

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

CNPAT, CNKI, WPI, EPODOC: 监护, 麻醉, 手术, 显示, 界面, 术前, 术中, 术后, 生理参数, 心电, 血压, 迈瑞; monitor, anesthesia, surgery, display+, interface, parameter?, electrocardiogram, ECG, blood w pressure, MINDRAY

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 103040460 A (SHENZHEN MINDRAY BIO-MEDICAL ELECTRONICS CO., LTD.) 17 April 2013 (17.04.2013), description, paragraphs [0042]-[0076], and figures 1-6	1-46
X	CN 202288276 U (SHENZHEN MINDRAY BIO-MEDICAL ELECTRONICS CO., LTD.) 04 July 2012 (04.07.2012), description, paragraphs [0035]-[0065], and figures 1-6	1-46
X	CN 105413030 A (SHENZHEN MINDRAY BIO-MEDICAL ELECTRONICS CO., LTD.) 23 March 2016 (23.03.2016), description, paragraphs [0035]-[0059], and figures 1-7	1-46
A	CN 104116502 A (SHENZHEN CAREWELL ELECTRONICS CO., LTD.) 29 October 2014 (29.10.2014), entire document	1-46
A	CN 103893873 A (BEIJING AEONMED CO., LTD.) 02 July 2014 (02.07.2014), entire document	1-46

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 May 2017	12 June 2017
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer WU, Xinzhong Telephone No. (86-10) 53318969

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2016/098135

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 204654929 U (TIANJIN WELDING SCIENCE AND TECHNOLOGY CO., LTD.) 23 September 2015 (23.09.2015), entire document	1-46
A	WO 2013119978 A1 (DRAEGER MEDICAL SYSTEMS, INC.) 15 August 2013 (15.08.2013), entire document	1-46

Form PCT/ISA /210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2016/098135

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 103040460 A	17 April 2013	CN 103040460 B	10 June 2015
CN 202288276 U	04 July 2012	None	
CN 105413030 A	23 March 2016	None	
CN 104116502 A	29 October 2014	None	
CN 103893873 A	02 July 2014	CN 103893873 B	02 March 2016
CN 204654929 U	23 September 2015	None	
WO 2013119978 A1	15 August 2013	None	

Form PCT/ISA /210 (patent family annex) (July 2009)

专利名称(译)	医疗监控设备，以及用于显示患者监控信息的方法和系统		
公开(公告)号	EP3508114A1	公开(公告)日	2019-07-10
申请号	EP2016914675	申请日	2016-09-05
[标]申请(专利权)人(译)	深圳迈瑞生物医疗电子股份有限公司		
申请(专利权)人(译)	深圳迈瑞生物医疗电子股份有限公司.		
当前申请(专利权)人(译)	深圳迈瑞生物医疗电子股份有限公司.		
[标]发明人	TANG XIAOCHENG CHEN MINGYU WU WEIJUN ZHANG JIANHUI TAO QINGLIN		
发明人	TANG, XIAOCHENG CHEN, MINGYU WU, WEIJUN ZHANG, JIANHUI TAO, QINGLIN		
IPC分类号	A61B5/02 A61B5/00		
CPC分类号	A61B5/00 A61B5/02 G16H40/63 A61B5/02055 A61B5/021 A61B5/024 A61B5/02405 A61B5/14551 A61B5/4821 A61B5/4824 A61B5/743 A61B5/7435		
代理机构(译)	KIPA AB		
其他公开文献	EP3508114A4		
外部链接	Espacenet		

摘要(译)

一种医学监测设备（100），包括信号采集模块（120），数据处理模块（110）和显示模块（130）。数据处理模块（110）处理由信号采集模块（120）采集的生命体征信号，生成生理参数，并基于请求信息生成与指定的麻醉阶段对应的感兴趣参数的可视化信息，指定的麻醉阶段为麻醉诱导阶段，麻醉维持阶段或术后恢复阶段，并且感兴趣的参数包括选自生理参数和/或源自生理参数的麻醉参数的参数。显示模块（130）至少在麻醉状态显示区域中显示关于对应于指定麻醉阶段的感兴趣参数的可视化信息。医疗监测装置（100）直观地呈现医生需要向医生查看的参数，因此医生可以快速确定患者在麻醉阶段是否异常，麻醉是否合适等。还提供了一种用于显示患者监测信息的方法和系统。

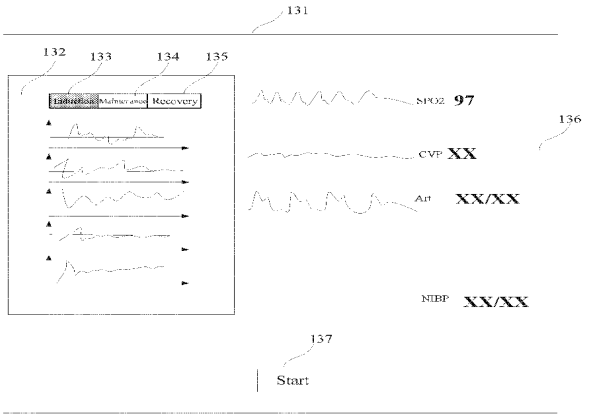

Fig. 3b