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(54) VENTILATION MANAGEMENT SYSTEM

BELÜFTUNGSVERWALTUNGSSYSTEM

SYSTÈME DE GESTION DE VENTILATION

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Description

BACKGROUND

Field

[0001] The present disclosure generally relates to medical devices, and more particularly to the configuration of a ventilator.

Description of the Related Art

[0002] Medical ventilation systems (or "ventilators," colloquially called "respirators") are machines that are typically used to mechanically provide breathable air or blended gas to lungs in order to assist a patient in breathing. Ventilation systems are chiefly used in intensive care medicine, home care, emergency medicine, and anesthesia. Common ventilation systems are limited to a single direction of communication, and as such are configured to provide information related to the ventilation system for display, but not receive information from a remote source for any purpose to control the ventilator. For example, common ventilation systems send outbound data to another entity, such as a display device, in order to display ventilator settings.

[0003] US Patent Publication 2009/326389 describes a system and a method for synchronizing operation between a patient monitoring device and a patient treatment device such as a ventilator. The patient monitoring device and the patient treatment device are operatively connected via a network, for example, a patient area network (PAN) or a local area network (LAN). In one embodiment, a central processor may be configured to change parameter values transmitted to the treatment modules based on physiological parameters derived from the patient monitoring module. However, such system does not provide for a clinician's approval of any modification of a configuration profile in either a plurality of hospital ventilation devices or home ventilation devices.

[0004] US Patent Publication 2010/108064 describes a system and/or method of guiding transitions between therapy modes in connection with the treatment and/or diagnosis of a patient for a respiratory disorder employing a a processor configured to receive ventilator data from a ventilation device and determine modifications of the operating parameters of the ventilation device.

SUMMARY

[0005] According to an embodiment of the present invention, a ventilator management system is provided as set out in claim 1.

[0006] According to another embodiment of the present invention, a method for managing a plurality of ventilators is provided as set out in claim 8.

[0007] According to a further embodiment of the present invention, a machine- readable storage medium includes machine-readable instructions for causing a processor to execute a method for managing a plurality of ventilators is provided as set out in claim 15.

[0008] It is understood that other configurations of the subject technology will become readily apparent to those skilled in the art from the following detailed description, wherein various configurations of the subject technology are shown and described by way of illustration. As will be realized, the subject technology is capable of other and different configurations and its several details are capable of modification in various other respects, all without departing from the scope of the subject technology. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The accompanying drawings, which are included to provide further understanding and are incorporated in and constitute a part of this specification, illustrate disclosed embodiments and together with the description serve to explain the principles of the disclosed embodiments. In the drawings:

FIG. 1 illustrates an example architecture for a ventilator management system

FIG. 2 is a block diagram illustrating an example ventilation system, ventilation management system, and home ventilation device from the architecture of FIG. 1 according to certain aspects of the invention.

FIG. 3 illustrates an example flow chart of exchanging data between a ventilation system and a ventilation management system.

FIG. 4 illustrates an example flow chart for a communication protocol used by the ventilation system of FIG. 3.

FIG. 5 illustrates example processes for contextualizing ventilator data for a ventilation system.

FIGS. 6A and 6B illustrate example flow charts for caching data on a ventilation system and a ventilation management system.

FIG. 7 illustrates an example process for managing a ventilation system.

FIG. 8 is a block diagram illustrating an example computer system with which the example ventilation system, ventilation management system, and home ventilation device of FIG. 2 can be implemented.

DETAILED DESCRIPTION

[0010] In the following detailed description, numerous specific details are set forth to provide a full understanding of the present invention. It will be apparent, however, to one ordinarily skilled in the art that the embodiments of the present invention may be practiced without some of these specific details. In other instances, well-known structures and techniques have not been shown in detail so as not to obscure the disclosure.

[0011] Certain aspects of the disclosed system provide ventilation systems with two-way communication. Specifically, in addition to permitting a ventilation system to output basic ventilation data such as physiological statistics, the disclosed ventilation systems permit output of additional information such as ventilator settings, notifications, patient information, ventilation waveforms, loops or trended data ("scalars"), and ventilation monitoring information. The disclosed ventilation systems also permit input of configuration profiles, rules and clinical protocols, user data, notifications, preprogramming, patient data, and lab results. The disclosed ventilation systems are configured to operate according to the received configuration profiles, rules, and protocols, and in view of the user data, notifications, preprogramming, patient data, and lab results. The data for the ventilation system can also be "contextualized" (e.g., associated with a patient and/or caregiver) using various wired and wireless techniques. The disclosed ventilation systems are configured to provide the output of additional information to, for example, a ventilation management system.

[0012] The disclosed ventilation management system is configured to receive the information from one or many ventilation systems, analyze the information, and determine new or modified configuration profiles, rules, and clinical protocols from the received information. The information may be received wired or wirelessly over a network. The disclosed ventilation management system is also configured to provide the new or modified configuration profiles, rules, and clinical protocols back to one or many of the ventilation systems. The ventilation systems managed by the ventilation management system can be located either in a healthcare institution (e.g., a hospital) or outside of a healthcare institution (e.g., a home or other care site). Both the ventilation systems and the ventilation management systems are configured to cache data, for example, when the network is not available, so that data may be saved for later transmission.

[0013] FIG. 1 illustrates an example architecture 10 for a ventilator management system. The architecture 10 includes a ventilation system 102 and a hospital ventilation management system 14 connected over a local area network (LAN) 119 in a hospital 101, and a home ventilation device 130 in a home 140 connected to a wide area ventilation management system 16 over a wide area network (WAN) 120. The hospital ventilation management system 14, which can be configured, for example, by a clinician 12, other healthcare provider, or administrator, is connected to the wide area ventilation management system 16 through the WAN 120. Furthermore, the home ventilation device 130 may operate substantially similar to, and be configured substantially the same as, the ventilation system 102 of the hospital 101, except that the home ventilation device 130 operates in the home 140.

[0014] Each of the ventilation systems 102 is configured to mechanically move breathable air into and out of lungs in order to assist a patient in breathing. The ventilation systems 102 can provide ventilator data, such as notifications, settings, monitor information (e.g., physiological statistics), and scalars to the hospital ventilation management system 14. The ventilation system 102 includes a device having appropriate processor, memory, and communications capabilities for processing and providing ventilator data to the hospital ventilation management system 14. Similarly, the hospital ventilation management system 14 is configured to provide user data, notifications, preprogrammed instructions, lab results, patient data, configuration information, and rules and clinical protocols to each ventilation system 102 in the hospital 101 in order to configure each ventilation system 102 (e.g., remotely over a wired or wireless network, such as LAN 119). The information provided by the hospital ventilation management system 14 to each ventilation system 102 can be based on the information provided to the hospital ventilation management system 14 by each ventilation system 102.

[0015] For example, a ventilation system 102 can provide the hospital ventilation management system 14 with a current configuration profile and current monitor information for a patient associated with the ventilation system 102. The hospital ventilation management system 14 can analyze the information provided by the ventilation system 102 in order to determine which modifications, if any, to make to the configuration profile in view of the patient's monitor information. The hospital ventilation management system 14 may then provide a modified configuration profile to the ventilation system 102 so that the ventilation system 102 may treat the patient in accordance with the modified configuration profile.

[0016] The hospital ventilation management system 14 is connected to a wide area ventilation management system 16 configured to manage one or many home ventilation devices 130. Although the hospital ventilation management system 14 and the wide area ventilation management system 16 are illustrated as being separate systems, both the hospital ventilation management system 14 and the wide area ventilation management system 16 can be hosted or otherwise executed from a single server. In certain aspects, many servers may share the hosting responsibilities of the hospital ventilation management system 14 and the wide area ventilation management system 16. The server can be any device having an appropriate processor, memory, and communications capability for hosting the hospital ventilation management system 14 and the wide area ventilation management system 16, and can be in a hospital data center or

remotely hosted over a network.

[0017] The WAN 120 can include, for example, any one or more of a metropolitan area network (MAN), a wide area network (WAN), a broadband network (BBN), the Internet, and the like. The LAN 119 can include, for example, a personal area network (PAN) or campus area network (CAN). Further, each of the WAN 120 and LAN 119 can include, but is not limited to, any one or more of the following network topologies, including a bus network, a star network, a ring network, a mesh network, a star-bus network, tree or hierarchical network, and the like.

[0018] An example use of the ventilator management system will now be provided. A patient associated with the ventilation system 102 is discharged by a clinician 12 from the hospital 101 but still requires ventilation using home ventilation device 130 in the patient's home 140. The hospital ventilation management system 14 registers with the wide area ventilation management system 16, and then sends the patient's information and ventilator information from the ventilation system 102 for the patient to the wide area ventilation management system 16. The home ventilation device 130 is configured using the patient's information and ventilator information and the patient begins treatment using the home ventilation device 130. The clinician monitors the patient's progress with the home ventilation device 130 by reviewing logs from the home ventilation device 130 that are sent to the hospital ventilation management system 14 through the wide area ventilation management system 16. As needed, the clinician may modify the configuration parameters of the home ventilation device 130 remotely by sending new configuration parameters from the hospital ventilation management system 14 to the wide area ventilation management system 16, which then sends the new configuration parameters to the home ventilation device 130 for review by the patient or caregiver. The patient or caregiver accepts the new configuration parameters and the home ventilation device 130 begins to operate according to the new configuration parameters.

[0019] FIG. 2 is a block diagram illustrating an example ventilation system 102, ventilation management system 150, and home ventilation device 130 from the architecture 10 of FIG. 1 according to certain aspects of the invention. Although the ventilation management system 150 is illustrated as connected to a ventilation system 102 and a home ventilation device 130, the ventilation management system 150 is configured to also connect to infusion pumps, point of care vital signs monitors, and pulmonary diagnostics devices.

[0020] The ventilation system 102 is connected to the ventilation management system 150 over the LAN 119 via respective communications modules 110 and 160 of the ventilation system 102 and the ventilation management system 150. The ventilation management system 150 is connected over WAN 120 to the home ventilation device 130 via respective communications modules 160 and 146 of the ventilation management system 150 and the home ventilation device 130. The home ventilation device 130 is configured to operate substantially similar to the ventilation system 102 of the hospital 101, except that the home ventilation device 130 is configured for use in the home 140. The communications modules 110, 160, and 146 are configured to interface with the networks to send and receive information, such as data, requests, responses, and commands to other devices on the networks. The communications modules 110, 160, and 146 can be, for example, modems or Ethernet cards.

[0021] The ventilation management system 150 includes a processor 154, the communications module 160, and a memory 152 that includes hospital data 156 and a ventilation management application 158. Although one ventilation system 102 is shown in FIG. 2, the ventilation management system 150 is configured to connect with and manage many ventilation systems 102, both ventilation systems 102 for hospitals 101 and home ventilation devices 130 for use in the home 140.

[0022] In certain aspects, the ventilation management system 150 is configured to manage many ventilation systems 102 in the hospital 101 according to certain rules and procedures. For example, when powering on, a ventilation system 102 may send a handshake message to the ventilation management system 150 to establish a connection with the ventilation management system 150. Similarly, when powering down, the ventilation system 102 may send a power down message to the ventilation management system 150 so that the ventilation management system 150 ceases communication attempts with the ventilation system 102.

[0023] The ventilation management system 150 is configured to support a plurality of simultaneous connections to different ventilation systems 102 and home ventilation devices 130. The number of simultaneous connections can be configured by an administrator in order to accommodate network communication limitations (e.g., limited bandwidth availability). After the ventilation system 102 successfully handshakes with (e.g., connects to) the ventilation management system 150, the ventilation management system 150 may initiate communications to the ventilation system 102 when information becomes available, or at established intervals. The established intervals can be configured by a user so as to ensure that the ventilation system 102 does not exceed an established interval for communicating with the ventilation management system 150.

[0024] The ventilation management system 150 can provide the data to the ventilation system 102 in a first-in-first-out (FIFO) order. For instance, if a software upgrade is scheduled to be sent to a ventilation system 102, the software upgrade can be deployed at configurable timeframes in FIFO order for the specified ventilation systems 102. Upon receipt, a ventilation system 102 may initialize the software upgrade on a manual reboot. An admit-discharge-transfer communication can be sent to specified ventilation systems 102 within a certain care area of the hospital 101. A configuration profile commu-

nication can be sent to all ventilation systems 102 connected to the ventilation management system 150. On the other hand, orders specific to a patient are sent to the ventilation system 102 associated with the patient.

[0025] The ventilation system 102 may initiate a communication to the ventilation management system 150 if an alarm occurs on the ventilation system 102. The alarm may be sent to the beginning of the queue for communicating data to the ventilation management system 150. All other data of the ventilation system 102 may be sent together at once, or a subset of the data can be sent at certain intervals.

[0026] The hospital data 156 includes configuration profiles configured to designate operating parameters for the ventilation system 102, operating parameters of the ventilation system 102 and/or physiological statistics of a patient associated with the ventilation system 102. Hospital data 156 also includes patient data for patients at the hospital 101, order (e.g., medication orders, respiratory therapy orders) data for patients at the hospital 101, and/or user data (e.g., for caregivers associated with the hospital 101).

[0027] The physiological statistics of the ventilator data includes, for example, a statistic for compliance of the lung (Cdyn, Cstat), flow resistance of the patient airways (Raw), inverse ratio ventilation (I/E), spontaneous ventilation rate, exhaled tidal volume (Vte), total lung ventilation per minute (Ve), peak expiratory flow rate (PEFR), peak inspiratory flow rate (PIFR), mean airway pressure, peak airway pressure, an average end-tidal expired CO2 and total ventilation rate. The operating parameters include, for example, a ventilation mode, a set mandatory tidal volume, positive end respiratory pressure (PEEP), an apnea interval, a bias flow, a breathing circuit compressible volume, a patient airway type (for example endotracheal tube, tracheostomy tube, face mask) and size, a fraction of inspired oxygen (FiO2), a breath cycle threshold, and a breath trigger threshold.

[0028] The processor 154 of the ventilation management system 150 is configured to execute instructions, such as instructions physically coded into the processor 154, instructions received from software (e.g., ventilation management application 158) in memory 152, or a combination of both. For example, the processor 154 of the ventilation management system 150 executes instructions to receive ventilator data from the ventilation system 102 (e.g., including an initial configuration profile for the ventilation system 102).

[0029] FIG. 3 illustrates an example flow chart 300 of exchanging data between the ventilation system 102 and the ventilation management system 150. As illustrated in the flow chart 300, the ventilation system 102 is configured to send ventilator information, notifications (or "alarms"), scalars, operating parameters 106 (or "settings"), physiological statistics (or "monitors") of a patient associated with the ventilation system 102, and general information. The notifications include operational conditions of the ventilation system 102 that may require operator review and corrective action. The scalars include parameters that are typically updated periodically (e.g., every 500ms) and can be represented graphically on a two-dimensional scale. The physiological statistics represent information that the ventilation system 102 is monitoring, and can dynamic based on a specific parameter. The operating parameters 106 represent the operational control values that the caregiver has accepted for the ventilation system 102. The general information can be information that is unique to the ventilation system 102, or that may relate to the patient (e.g., a patient identifier). The general information can include an identifier of the version and model of the ventilation system 102.

[0030] In the example of FIG. 3, the data is sent via a serial connector. The data is sent to a wired adapter 304 having a serial connector and a TCP connector 308. The data is sent using any appropriate communication protocol 400 (e.g., VOXP protocol). FIG. 4 illustrates an example flow chart for a communication protocol, the VOXP protocol, used by the ventilation system 102 of FIG. 3.

[0031] The communication protocol 400 of FIG. 4 is configured, in certain aspects, to operate in an active mode and a passive mode. In active mode, the ventilation system 102 both responds to requests (e.g., from the ventilation management system 150), as well as automatically sends data as it becomes available to the ventilation system 102. In passive mode, the ventilation system 102 responds to requests but does not automatically send data as it becomes available. The protocol 400 begins by transition from a dormant (or "passive") mode 401 to starting the VOXP protocol 402 (e.g., to enter into active mode). When the communication input/output port is ready, a connection is established 403 with the destination (e.g., wired adapter 304). If the connection is established without a ventilation device 118 being connected to the ventilation system 102, then the protocol instructs to wait for docking 404 (e.g., of a ventilation device 118). If a connection is broken while waiting for docking, the link between the ventilation system 102 and the destination is reestablished 405. Otherwise, when a ventilation device 118 is docked, or a connection is established, the protocol waits for a profile or other data request 406 (e.g., from the ventilation management system 150). If the connection is broken while waiting for the profile request, the link between the ventilation system 102 and the destination is reestablished. When the profile request is received, ventilation system 102 sends a configuration profile 108 (specifying the capabilities of the ventilation system 102 and the set of operating parameters and other data that it can provide), and then the protocol waits for a configuration command 407 (e.g., from the ventilation management system 150). When the configuration command is received, a link is established with the destination and the link is configured 408. If while configuring the link there is a processing error, a mode changes, or the link is restarted, the link is again reestablished 405. Otherwise, upon configuring the link 408, the protocol for the ventilation system 102 may enter a passive mode

409 or active mode 410. In passive mode 409, the ventilation management system 150 sends requests, at intervals determined by the ventilation management application 158, for specified information. At each such request, the ventilation system 102 responds with the specified information 318, which may include notifications (or "alarms"), scalars, operating parameters 106 (or "settings"), and physiological statistics (or "monitors") of a patient associated with the ventilation system 102. In active mode 410, the ventilation system 102 sends specified information 318, which may include notifications (or "alarms"), scalars, operating parameters 106 (or "settings"), and physiological statistics (or "monitors") of a patient associated with the ventilation system 102, as each item becomes available. For example an operating parameter 106 is sent when a user of the ventilation system makes a change to a set value. When the ventilation system is turned off, the protocol signals a shutdown 411. Upon shutting down, the protocol can automatically enter a dormant mode 401 (e.g., after 5 seconds).

[0032] Returning to FIG. 3, the wired adapter 304 is configured to receive 312 the data according to the communication protocol 400 of FIG. 4, and convert the data from a serial connection format to a TCP connection format. The wired adapter 304 then provides 314 the data in the TCP connection format according to the communication protocol 400 of FIG. 4 to a communication system 302.

[0033] The data is received from the ventilation system 102 through the wired adapter 304 by the communication system 302. The data may be in a native message format of the ventilation system 102. The communication system 302 is configured to convert the data into an internal messaging format configured for use with a ventilation management system 150. The conversion can take place according to the system and method of converting messages being sent between data systems using different communication protocols and message structures described in U.S. Pat. App. No. 13/421,776, entitled "Scalable Communication System," and filed on March 15, 2012. The communication system 302 can include, for example, an interface module for communicating with the wired adapter 304.

[0034] The interface module can include information on the communication protocol 400 (e.g., VOXP protocol) and data structure used by the ventilation system 102 and is configured to both receive messages from and transmit messages between the ventilation system 102 and the ventilation management system 150. For example, the ventilation management system 150 is configured to provide, through the communication system 302 and the wired adapter 304, patient data, order data, configuration data, user data, preprogrammed information, vital sign information, rules, notifications, and clinical protocols to the ventilation system 102. The patient data includes, for example, admit-discharge-transfer data, allergy data, diagnosis data, medication history, procedure history, a patient's name, the patient's medical record number (MRN), lab results, or the patient's visit number. Medication history may include a list of the medications and doses that have been administered to the patient, for example sedative medications, muscle paralytic medications, neural block medications, anti-inflammatory medications. Procedure history may include a list of surgical or other interventional procedures that have been administered, for example cardiothoracic surgery; lung lavage; maxillofacial surgery; chest physiotherapy. The order data includes, for example medication order information, procedure order information for at least one of physical therapy or percussion therapy, sedation order information indicating sedation vacations or modes of ventilator therapy, therapy order information for invasive or non-invasive ventilator therapy, or trial order information for spontaneous breathing trials. The configuration data includes, for example, a patient profile, a user interface configuration, a limit configuration, a notification configuration, or a clinical protocol configuration. The notification configuration can indicate whether certain limits or alerts should be enabled or disabled, and the clinical protocol configuration can be used in a particular area of the hospital 101 (e.g., ICU) and indicate which clinical protocol library should be enabled. A clinical protocol library may include several clinical protocols that may be applicable to a specified group of patients, for example a spontaneous breathing trial clinical protocol. A clinical protocol may include a set of rules defining actions that the ventilation system 102 should effect in response to events such as a change in patient physiological data, for example a spontaneous breathing trial clinical protocol may include a rule that recommences mandatory ventilation in the event that the patient's rapid shallow breathing index (RSBI) exceeds a set threshold. As another example the spontaneous breathing trial clinical protocol may include a rule that a notification should be provided on display device 114 when the patient has been controlling their own respiration within specified limits for a period of one hour. In certain aspects, the notifications can be generated by the ventilation management system 150 and sent to the ventilation system 102 to alert a caregiver or patient near the ventilation system 102. The user data includes, for example, an identification of a caregiver or a healthcare institution.

[0035] After receiving the ventilator data from the ventilation system 102, the processor 154 of the ventilation management system 150 is configured to determine, based on the ventilator data, a modification to the initial configuration profile for the ventilation system 102. In certain aspects, the initial configuration profile is received by the ventilation management system 150 from the ventilation system 102. The processor 154 of the ventilation management system 150 is further configured to generate a modified configuration profile for the ventilation system 102 based on the determined modification. In certain aspects, the modification to the configuration profile is also determined based on the initial configuration profile of the ventilation system 102. For example, if the initial

configuration profile indicated an average end tidal CO2 level that was considered clinically too low for the patient, the configuration profile could be modified to increase the average end tidal CO2.

[0036] In certain aspects, the modification to the configuration profile is also determined based on comparing the physiological statistics of the patient with historical patient data (e.g., stored in the hospital data 156) to identify a modification to at least one operating parameter of the initial configuration profile, and modify the operating parameter based on the identification. For example, if an apnea interval that, based on historical patient data for many patients at the hospital 101, was not likely to improve the condition of the patient, then the apnea interval of the configuration profile could be modified by the ventilation management system 150. As another example, if a specified level of tidal ventilation normalized to patient weight, based on historical patient data for many patients at the hospital 101 with a specified diagnosis, has been associated with a reduced length of hospital stay, then the configuration profile could be modified to adjust pressure support to target this level of tidal ventilation.

[0037] The processor 154 of the ventilation management system 150 can be further configured to provide the modified configuration profile to the ventilation system 102 for modifying operating parameters 106 in the memory 104 of the ventilation system 102. The modified configuration profile 108 is stored in the memory 104 of the ventilation system, and used by the processor 112 of the ventilation system 102 to modify the operating parameters 106 in the memory 104 of the ventilation system. In certain aspects, details regarding the modified configuration profile (e.g., the modifications made to operating parameters, an identification of a clinician responsible for approving the modifications, etc.) are provided for display using the display device 114 of the ventilation system 102.

[0038] The ventilation system 102 includes a processor 112, the communications module 110, and a memory 104 that includes operating parameters 106 and a configuration profile 108. The ventilation system 102 also includes an input device 116, such as a keyboard, scanner, or mouse, an output device 214, such as a display, and a ventilation device 118 configured to mechanically move breathable air into and out of lungs in order to assist a patient in breathing according to instructions from the ventilation system 102. The configuration profile 108 includes one or many configuration profiles for operating the ventilation device 118 of the ventilation system 102. For example, the configuration profile 108 can include a profile for operating the ventilation device 118 in an intensive care unit, neonatal intensive care unit, or surgical room, or a profile for operating the ventilation device 118 for patients with a specified respiratory diagnosis, such as ARDS, neuromuscular disease, pneumonia, or post-surgical recovery.

[0039] The processor 112 of the ventilation system 102 is configured to execute instructions, such as instructions physically coded into the processor 112, instructions received from software (e.g., from configuration profile 108) in memory 104, or a combination of both. For example, the processor 112 of the ventilation system 102 executes instructions to configure the ventilation device 118. The processor 112 of the of the ventilation system 102 executes instructions from the configuration profile 108 causing the processor 112 to receive, over the LAN 119, at least one of patient data, order data, configuration data, or user data. The configuration data can include, for example, an indication (e.g., a set limit) for limiting use of the ventilation system 102 within the hospital 101. The processor 112 of the of the ventilation system 102 is also configured to provide a modification of operating parameters 106 of the ventilation device 118 based on the received patient data, order data, configuration data, or user data.

[0040] In certain aspects the patient data received by the ventilation system 102 includes a patient identifier, such as a MRN, that is obtained through various processes 510, 520, and 530 and used to contextualize data generated by the ventilation system 102 as illustrated in FIG. 5. The contextualization of data includes identifying data generated by a ventilation system 102 as being data associated with a specific patient (a "patient context"). The patient context and ventilation system 102 to patient association can be stored in the memory 103 of the ventilation system 102 or in the hospital data 156 in the memory 152 of the ventilation management system 150.

[0041] As provided in process 510 of FIG. 5, a ventilation system 102 can be associated with a patient manually when the ventilation system 102 first receives in step 511 an external admit-discharge-transfer alert (e.g., from the ventilation management system 150 or a hospital information system) for a patient. Next, in step 512, the ventilation system 102 is connected to the patient and in step 513 a caregiver, using input device 116 and display device 114, searches for the patient's name or identifier (from among a list of patient names/identifiers) on the display device 114 of the ventilation system 102. The patient's identifier can be found, for example, using a search by care area, patient type, alphabetically, or a list of patients associated with the caregiver. In step 514, the user validates the patient data (e.g., selects the patient to associate with the ventilation system 102) and in step 515 the patient is associated with the ventilation system 102. In certain aspects, a second identifier can be required, such as a medical record number, in order to validate the patient data.

[0042] As provided in process 520 of FIG. 5, a ventilation system 102 can be associated with a patient automatically when the ventilation system 102 again first receives in step 521 an external admit-discharge-transfer alert (e.g., from the ventilation management system 150 or a hospital information system) for a patient and the ventilation system 102 is connected to the patient in step 522. Next, in step 523, a clinician performs an electronic search for the patient by, for example, scanning a bar-

code on the patient's wrist with the input device 116 or having the ventilation system 102 identify the patient using a radio frequency identification (RFID). Next, in step 524, the user validates the patient data (e.g., confirms the automatically identified patient) and in step 525 the patient is associated with the ventilation system 102.

[0043] As provided in process 530 of FIG. 5, a ventilation system 102 can also be associated with a patient automatically when the ventilation system 102 is connected to a patient in step 531 and an external system (e.g., a network scanner connected to a server, such as the ventilation management system 150 or an admit-discharge-transfer system) performs a search for the patient (e.g., using RFID). The user in step 533 validates the patient data identified by the external system and the external system sends the patient identification to the ventilation system 102 in step 534. In step 535 the patient is associated with the ventilation system 102. As yet another example, a ventilator may first be connected to a patient, the ventilation system 102 or user then performs an electronic search by, for example, and RFID or scanned patient barcode, the external system validates patient data, the external system sends patient data to the ventilation system 102, and the patient is associated with the ventilation system 102.

[0044] In certain aspects, both the ventilation management system 150 and ventilation system 102 are configured to cache data, such as the patient data, order data, configuration data, user data, vital sign information (e.g., physiological statistics of a patient), rules, notifications, clinical protocols, and operating parameters. Cached (or "logged") data can be used to perform analytics that result in improved patient care. By caching the data even when the ventilation system 102 or the ventilation management system 150 are not connected, the data will have a greater chance of being used for analytics and result in improved patient care. The data may be cached, for example, when the LAN 119 connection is unavailable. The data may then be shared between the ventilation management system 150 and ventilation system 102 when the connection becomes available. Similarly, the data may then be shared between the ventilation management system 150 and ventilation system 102 at regularly scheduled intervals (e.g., every 30 minutes). The scheduled intervals are configurable by a caregiver or other user, and can be based on, for example, the data being transmitted, when a change is made to an operating parameter of the ventilation system 102, or when a measured value, alarm threshold, or monitored value reach a predefined level or rate of change. The home ventilation device 130 can also cache data similar to the ventilation system 102. The data may be cached by the home ventilation device 130, for example, when the WAN 120 connection is unavailable.

[0045] For example, any data that is generated by the ventilation system 102 for documentation, clinical decision support, biomedical engineering or maintenance support can be cached in the memory 104 of the ventilation system 102 to be sent out to the ventilation management system 150. Similarly, any data that needs to be sent to the ventilation system 102 from the ventilation management system 150 can be cached in memory 152 at the ventilation management system 150 until a scheduled time to send the data, or a next time the ventilation system 150 and ventilation are connected.

[0046] FIGS. 6A and 6B illustrate example flow charts for caching data on a ventilation system 102 and a ventilation management system 150. In FIG. 6A, data 318 for the ventilation system 102, including ventilation system information, alarms, scalars, settings, and monitors, when available, is sent to the ventilation management system 150 via a connector 316 for storage as hospital data 156 when a connection 602 between the ventilation system 102 and the ventilation management system 150 is available. Otherwise, when the connection 602 between the ventilation system 102 and the ventilation management system 150 is not available, the data is stored in a data cache 604 on the ventilation system 102.

[0047] In FIG. 6B, data 652 for the ventilation management system 150, including user data, alerts, preprogrammed information, lab results, patient data, and configuration information, when available, is sent to the ventilation system 102 via a connector 316 for storage as data 658 in memory 104 when a connection 654 between the ventilation system 102 and the ventilation management system 150 is available. Otherwise, when the connection 654 between the ventilation system 102 and the ventilation management system 150 is not available, the data is stored in a data cache 656 on the ventilation management system 150.

[0048] FIG. 7 illustrates an example process 700 for managing a ventilation system using the example ventilation system 102 and ventilation management system 150 of FIG. 2. While FIG. 7 is described with reference to FIG. 2, it should be noted that the process steps of FIG. 7 may be performed by other systems.

[0049] The process 700 begins by proceeding from beginning step 701 when a ventilation system 102 is initialized and establishes a communication with the ventilation management system 150, to step 702 when the ventilation system 102 provides ventilator data including at least one of operating parameters of the ventilation device 118 or physiological statistics of a patient associated with the ventilation device 118 to the ventilation management system 150. In step 703, the ventilation management system 150 receives the ventilator data from the ventilation system 102 and in step 704 determines, based on the ventilator data, a modification to the initial configuration profile 108 for the ventilation system 102. In step 705 a modified configuration profile is generated for the ventilation system 102 based on the determined modification of step 704, and in step 706 the ventilation management system 706 provides the modified configuration profile to the ventilation system 102 for modifying the operating parameters 106 of the ventilation system 102. The ventilation management system 706 may also optionally provide at

least one of patient data, order data, configuration data, or user data to the ventilation system 102 in step 706. In step 707, the ventilation system 102 receives the modified configuration profile and optional patient data, order data, configuration data, or user data. The process 700 then ends in step 708.

[0050] FIG. 7 sets forth an example process 700 for managing a ventilation system using the example ventilation system 102 and ventilation management system 150 of FIG. 2. An example will now be described using the example process 700 of FIG. 7.

[0051] The process 700 begins by proceeding from beginning step 701 when a ventilation system 102 in the hospital 101 is turned on and establishes a communication with the ventilation management system 150, to step 702 when the ventilation system 102 provides operating parameters of the ventilation device 118, physiological statistics of a patient associated with the ventilation device 118, and an initial configuration profile 108 of the ventilation system 102 to the ventilation management system 150. In step 703, the ventilation management system 150 receives the data from the ventilation system 102 and in step 704 determines that the patient's tidal volume has decreased over the last five minutes by 30%, which is an indication of a degradation in the patient's clinical status. The data also indicates the patient's heart rate has increased. The ventilation management system 150 further determines, based on the ventilator data, that the initial configuration profile 108 for the ventilation system 102 should be modified to increase the breath rate parameter. In an alternative example, in step 704 the ventilation management system 150 uses data from other devices such as lab results data 652 including a blood oxygen measurement and a blood carbon dioxide measurement which indicate that the patient is being overventilated. The ventilation management system 150 further determines, based on the lab results data, that the initial configuration profile 108 for the ventilation system 102 should be modified to decrease the breath rate parameter. In step 705 the modified configuration profile having the changed breath rate parameter is generated for the ventilation system 102 based on the determined modification of step 704, and in step 706 the ventilation management system 706 provides the modified configuration profile to the ventilation system 102 for modifying the operating parameters 106 of the ventilation system 102. The configuration profile 108 of the ventilation system 102 is modified with the modified configuration profile to increase the patient's breath rate, and the process 700 then ends in step 708.

[0052] FIG. 8 is a block diagram illustrating an example computer system 800 with which the ventilation system 102, ventilation management system 150, and home ventilation device 130 of FIG. 2 can be implemented. In certain aspects, the computer system 800 may be implemented using hardware or a combination of software and hardware, either in a dedicated server, or integrated into another entity, or distributed across multiple entities.

[0053] Computer system 800 (e.g., ventilation system 102, ventilation management system 150, and home ventilation device 130) includes a bus 808 or other communication mechanism for communicating information, and a processor 802 (e.g., processor 112, 154, and 136) coupled with bus 808 for processing information. By way of example, the computer system 800 may be implemented with one or more processors 802. Processor 802 may be a general-purpose microprocessor, a microcontroller, a Digital Signal Processor (DSP), an Application Specific Integrated Circuit (ASIC), a Field Programmable Gate Array (FPGA), a Programmable Logic Device (PLD), a controller, a state machine, gated logic, discrete hardware components, or any other suitable entity that can perform calculations or other manipulations of information.

[0054] Computer system 800 can include, in addition to hardware, code that creates an execution environment for the computer program in question, e.g., code that constitutes processor firmware, a protocol stack, a database management system, an operating system, or a combination of one or more of them stored in an included memory 804 (e.g., memory 104, 152, and 132), such as a Random Access Memory (RAM), a flash memory, a Read Only Memory (ROM), a Programmable Read-Only Memory (PROM), an Erasable PROM (EPROM), registers, a hard disk, a removable disk, a CD-ROM, a DVD, or any other suitable storage device, coupled to bus 808 for storing information and instructions to be executed by processor 802. The processor 802 and the memory 804 can be supplemented by, or incorporated in, special purpose logic circuitry.

[0055] The instructions may be stored in the memory 804 and implemented in one or more computer program products, i.e., one or more modules of computer program instructions encoded on a computer readable medium for execution by, or to control the operation of, the computer system 800, and according to any method well known to those of skill in the art, including, but not limited to, computer languages such as data-oriented languages (e.g., SQL, dBase), system languages (e.g., C, Objective-C, C++, Assembly), architectural languages (e.g., Java, .NET), and application languages (e.g., PHP, Ruby, Perl, Python). Instructions may also be implemented in computer languages such as array languages, aspect-oriented languages, assembly languages, authoring languages, command line interface languages, compiled languages, concurrent languages, curly-bracket languages, dataflow languages, data-structured languages, declarative languages, esoteric languages, extension languages, fourth-generation languages, functional languages, interactive mode languages, interpreted languages, iterative languages, list-based languages, little languages, logic-based languages, machine languages, macro languages, metaprogramming languages, multiparadigm languages, numerical analysis, non-English-based languages, object-oriented class-based languages, object-oriented prototype-based languages, off-side

rule languages, procedural languages, reflective languages, rule-based languages, scripting languages, stack-based languages, synchronous languages, syntax handling languages, visual languages, wirth languages, embeddable languages, and xml-based languages. Memory 804 may also be used for storing temporary variable or other intermediate information during execution of instructions to be executed by processor 802.

[0056] A computer program as discussed herein does not necessarily correspond to a file in a file system. A program can be stored in a portion of a file that holds other programs or data (e.g., one or more scripts stored in a markup language document), in a single file dedicated to the program in question, or in multiple coordinated files (e.g., files that store one or more modules, subprograms, or portions of code). A computer program can be deployed to be executed on one computer or on multiple computers that are located at one site or distributed across multiple sites and interconnected by a communication network. The processes and logic flows described in this specification can be performed by one or more programmable processors executing one or more computer programs to perform functions by operating on input data and generating output.

[0057] Computer system 800 further includes a data storage device 806 such as a magnetic disk or optical disk, coupled to bus 808 for storing information and instructions. Computer system 800 may be coupled via input/output module 810 to various devices (e.g., ventilation device 118). The input/output module 810 can be any input/output module. Example input/output modules 810 include data ports such as USB ports. The input/output module 810 is configured to connect to a communications module 812. Example communications modules 812 (e.g., communications modules 110, 160, and 146) include networking interface cards, such as Ethernet cards and modems. In certain aspects, the input/output module 810 is configured to connect to a plurality of devices, such as an input device 814 (e.g., input device 116) and/or an output device 816 (e.g., display device 114). Example input devices 814 include a keyboard and a pointing device, e.g., a mouse or a trackball, by which a user can provide input to the computer system 800. Other kinds of input devices 814 can be used to provide for interaction with a user as well, such as a tactile input device, visual input device, audio input device, or brain-computer interface device. For example, feedback provided to the user can be any form of sensory feedback, e.g., visual feedback, auditory feedback, or tactile feedback; and input from the user can be received in any form, including acoustic, speech, tactile, or brain wave input. Example output devices 816 include display devices, such as a LED (light emitting diode), CRT (cathode ray tube), or LCD (liquid crystal display) screen, for displaying information to the user.

[0058] According to one aspect of the present invention, the ventilation system 102, ventilation management system 150, and home ventilation device 130 can be implemented using a computer system 800 in response to processor 802 executing one or more sequences of one or more instructions contained in memory 804. Such instructions may be read into memory 804 from another machine-readable medium, such as data storage device 806. Execution of the sequences of instructions contained in main memory 804 causes processor 802 to perform the process steps described herein. One or more processors in a multi-processing arrangement may also be employed to execute the sequences of instructions contained in memory 804. In alternative aspects, hard-wired circuitry may be used in place of or in combination with software instructions to implement various aspects of the present disclosure. Thus, aspects of the present disclosure are not limited to any specific combination of hardware circuitry and software.

[0059] Various aspects of the subject matter described in this specification can be implemented in a computing system that includes a back end component, e.g., as a data server, or that includes a middleware component, e.g., an application server, or that includes a front end component, e.g., a client computer having a graphical user interface or a Web browser through which a user can interact with an implementation of the subject matter described in this specification, or any combination of one or more such back end, middleware, or front end components. The components of the system can be interconnected by any form or medium of digital data communication, e.g., a communication network. The communication network (e.g., local area network 119 and wide area network 120) can include, for example, any one or more of a personal area network (PAN), a local area network (LAN), a campus area network (CAN), a metropolitan area network (MAN), a wide area network (WAN), a broadband network (BBN), the Internet, and the like. Further, the communication network can include, but is not limited to, for example, any one or more of the following network topologies, including a bus network, a star network, a ring network, a mesh network, a star-bus network, tree or hierarchical network, or the like. The communications modules can be, for example, modems or Ethernet cards.

[0060] Computing system 800 can include clients and servers. A client and server are generally remote from each other and typically interact through a communication network. The relationship of client and server arises by virtue of computer programs running on the respective computers and having a client-server relationship to each other. Computer system 800 can be, for example, and without limitation, a desktop computer, laptop computer, or tablet computer. Computer system 800 can also be embedded in another device, for example, and without limitation, a mobile telephone, a personal digital assistant (PDA), a mobile audio player, a Global Positioning System (GPS) receiver, a video game console, and/or a television set top box.

[0061] The term "machine-readable storage medium" or "computer readable medium" as used herein refers to

any medium or media that participates in providing instructions or data to processor 802 for execution. Such a medium may take many forms, including, but not limited to, non-volatile media, volatile media, and transmission media. Non-volatile media include, for example, optical disks, magnetic disks, or flash memory, such as data storage device 806. Volatile media include dynamic memory, such as memory 804. Transmission media include coaxial cables, copper wire, and fiber optics, including the wires that comprise bus 808. Common forms of machine-readable media include, for example, floppy disk, a flexible disk, hard disk, magnetic tape, any other magnetic medium, a CD-ROM, DVD, any other optical medium, punch cards, paper tape, any other physical medium with patterns of holes, a RAM, a PROM, an EPROM, a FLASH EPROM, any other memory chip or cartridge, or any other medium from which a computer can read. The machine-readable storage medium can be a machine-readable storage device, a machine-readable storage substrate, a memory device, a composition of matter effecting a machine-readable propagated signal, or a combination of one or more of them.

[0062] As used herein, the phrase "at least one of' preceding a series of items, with the terms "and" or "or" to separate any of the items, modifies the list as a whole, rather than each member of the list (i.e., each item). The phrase "at least one of' does not require selection of at least one item; rather, the phrase allows a meaning that includes at least one of any one of the items, and/or at least one of any combination of the items, and/or at least one of each of the items. By way of example, the phrases "at least one of A, B, and C" or "at least one of A, B, or C" each refer to only A, only B, or only C; any combination of A, B, and C; and/or at least one of each of A, B, and C.

[0063] Furthermore, to the extent that the term "include," "have," or the like is used in the description or the claims, such term is intended to be inclusive in a manner similar to the term "comprise" as "comprise" is interpreted when employed as a transitional word in a claim.

[0064] A reference to an element in the singular is not intended to mean "one and only one" unless specifically stated, but rather "one or more." All structural and functional equivalents to the elements of the various configurations described throughout this disclosure that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and intended to be encompassed by the subject technology. Moreover, nothing disclosed herein is intended to be dedicated to the public regardless of whether such disclosure is explicitly recited in the above description.

[0065] While this specification contains many specifics, these should not be construed as limitations on the scope of what is claimed, but rather as descriptions of particular implementations of the subject matter.

[0066] Similarly, while operations are depicted in the drawings in a particular order, this should not be understood as requiring that such operations be performed in the particular order shown or in sequential order, or that all illustrated operations be performed, to achieve desirable results. In certain circumstances, multitasking and parallel processing may be advantageous. Moreover, the separation of various system components in the aspects described above should not be understood as requiring such separation in all aspects, and it should be understood that the described program components and systems can generally be integrated together in a single software product or packaged into multiple software products.

[0067] The subject matter of this specification has been described in terms of particular aspects, but other aspects can be implemented if these are within the scope of the invention which is solely defined in the following claims.

Claims

1. A ventilator management system (150) comprising:

a memory (152) comprising an initial configuration profile configured to designate operating parameters for a ventilation device (118, 130); and
a processor (154) configured to:

- receive ventilator data over a local area network (119) from a plurality of hospital ventilation devices (118) and over a wide area network (120) from a plurality of home ventilation devices (130), the ventilator data comprising at least one of operating parameters for each of the hospital ventilation devices (118) and the plurality of home ventilation devices (130), or physiological statistics of a patient associated with each of the hospital ventilation devices (118) and each of the plurality of home ventilation devices (130);
- determine, for each of the plurality of hospital ventilation devices(118) and each of the plurality of home ventilation devices (130) and based on the ventilator data, a modification to the initial configuration profile for each of the plurality of hospital ventilation devices (118) and the plurality of home ventilation devices (130); and
- generate a modified configuration profile for each of the plurality of hospital ventilation devices (118) and each of the plurality of home ventilation devices (130) based on the determined modification to the initial configuration profile for each of the plurality of hospital ventilation devices and each of the plurality of home ventilation devices,

wherein the physiological statistics comprise at

least one of a statistic for compliance of the lung (Cdyn, Cstat), resistance of the patient airways (Raw), inverse ratio ventilation (I/E), spontaneous ventilation rate, exhaled tidal volume (Vte), total lung ventilation per minute (Ve), peak expiratory flow rate (PEFR), peak inspiratory flow rate (PIFR), mean airway pressure, peak airway pressure, an average end-tidal expired CO_2 or total ventilation rate, and
wherein the operating parameters comprise at least one of a ventilation mode, a set mandatory tidal volume, a set positive end respiratory pressure (PEEP), an apnea interval, a bias flow, a breathing circuit compressible volume, a patient airway type and size, a fraction of inspired oxygen *(Fi02),* a breath cycle threshold, or a breath trigger threshold, wherein a respective modified configuration profile is configured to be implemented by a respective one of the plurality of hospital ventilation devices (118) when the modified configuration profile is approved by a clinician associated with the respective one of the plurality of hospital ventilation devices (118), and wherein the respective modified configuration profile is configured to be implemented by a respective one of the plurality of home ventilation devices (130) when the modified configuration profile is approved by the patient associated with the respective one of the plurality of home ventilation devices(130).

2. The system of Claim 1, wherein the processor is further configured to provide the modified configuration profile to the respective one of the plurality of hospital ventilation devices (118) or one of the plurality of home ventilation devices (130) for modifying operating parameters of the respective one of the plurality of hospital ventilation devices or one of the plurality of home ventilation devices.

3. The system of Claim 2, wherein the modified configuration profile is provided for display on the respective one of the plurality of hospital ventilation devices (118) or one of the plurality of home ventilation devices (130).

4. The system of Claim 1, wherein the processor is further configured to receive the initial configuration profile from the respective one of the plurality of hospital ventilation devices (118) or one of the plurality of home ventilation devices (130), and wherein the modification to the configuration profile is also determined based on the initial configuration profile.

5. The system of Claim 1, wherein the memory (152) further comprises historical patient data, and wherein determining the modification to the configuration profile comprises:
comparing the physiological statistics of the patient with the historical patient data to identify a modification to at least one operating parameter of the initial configuration profile; and
modifying the at least one operating parameter based on the identification.

6. The system of Claim 1, wherein the memory (152) further comprises historical patient data, and wherein determining the modification to the configuration profile comprises
comparing the patient data with the historical patient data to identify a modification to at least one operating parameter of the initial configuration profile; and
modifying the at least one operating parameter based on the identification.

7. The system of Claim 1, wherein the ventilator data is received over a network from the respective one of the plurality of hospital ventilation devices (118) or one of the plurality of home ventilation devices (130) in a native message format of the ventilation device and converted into an internal messaging format configured for use with the ventilator management system.

8. A method for managing a plurality of ventilators, the method comprising:

- receiving ventilator data over a local area network (119) from a plurality of hospital ventilation devices (118) and over a wide area network (120) from a plurality of home ventilation devices (130), the ventilator data comprising at least one of operating parameters for each of the hospital ventilation devices and the plurality of home ventilation devices, or physiological statistics of a patient associated with each of the hospital ventilation devices (118) and the plurality of home ventilation devices (130);
- determining, for each of the plurality of hospital ventilation devices (118) and each of the plurality of home ventilation devices (130) and based on the ventilator data, a modification to an initial configuration profile for each of the plurality of hospital ventilation devices and each of the plurality of home ventilation devices; and
- generating a modified configuration profile for each of the plurality of hospital ventilation devices (118) and each of the plurality of home ventilation devices (130) based on the determined modification to the initial configuration profile for each of the plurality of hospital ventilation devices and each of the plurality of home ventilation devices,

wherein the physiological statistics comprise at least one of a statistic for compliance of the lung (Cdyn,

Cstat), resistance of the patient airways (Raw), inverse ratio ventilation (I/E), spontaneous ventilation rate, exhaled tidal volume (Vte), total lung ventilation per minute (Ve), peak expiratory flow rate (PEFR), peak inspiratory flow rate (PIFR), mean airway pressure, peak airway pressure, an average end-tidal expired C02 or total ventilation rate, and a set mandatory tidal volume, a set positive end respiratory pressure (PEEP), an apnea interval, a bias flow, a breathing circuit compressible volume, a patient airway type and size, a fraction of inspired oxygen *(Fi02),* a breath cycle threshold, or a breath trigger threshold, wherein a respective modified configuration profile is configured to be implemented by a respective one of the plurality of hospital ventilation devices (118) when the modified configuration profile is approved by a clinician associated with the respective one of the plurality of hospital ventilation devices (118), and wherein the respective modified configuration profile is configured to be implemented by a respective one of the plurality of home ventilation devices (130) when the modified configuration profile is approved by the patient associated with the respective one of the plurality of home ventilation devices(130).

9. The method of Claim 8, wherein the method further comprises providing the modified configuration profile to the respective one of the plurality of hospital ventilation devices (118) or one of the plurality of home ventilation devices (130) for modifying operating parameters of the respective one of the plurality of hospital ventilation devices (18) or one of the plurality of home ventilation devices (130).

10. The method of Claim 9, wherein the modified configuration profile is provided for display on the respective one of the plurality of hospital ventilation devices (118) or one of the plurality of home ventilation devices (130).

11. The method of Claim 8, wherein the method further comprises receiving the initial configuration profile from the respective one of the plurality of hospital ventilation devices (118) or one of the plurality of home ventilation devices (130), and wherein the modification to the configuration profile is also determined based on the initial configuration profile.

12. The method of Claim 8, wherein determining the modification to the configuration profile comprises:

comparing the physiological statistics of the patient with historical patient data to identify a modification to at least one operating parameter of the initial configuration profile; and
modifying the at least one operating parameter based on the identification.

13. The method of Claim 8, wherein the ventilator data is received by a ventilator management system over a network from the respective one of the plurality of hospital ventilation devices or one of the plurality of home ventilation devices in a native message format of the respective one of the plurality of hospital ventilation devices or one of the plurality of home ventilation devices, and converted into an internal messaging format configured for use with the ventilator management system.

14. A machine-readable storage (806) medium comprising machine-readable instructions for causing a processor (154) to execute a method for managing a plurality of ventilators, the method comprising:

receiving ventilator data over a local area network (119) from a plurality of hospital ventilation devices (118) and over a wide area network (120) from a plurality of home ventilation devices (130) the ventilation device, the ventilator data comprising at least one of operating parameters for each of the hospital ventilation devices and the plurality of home ventilation devices, or physiological statistics of a patient associated with each of the hospital ventilation devices and the plurality of home ventilation devices;
determining, for each of the plurality of hospital ventilation devices and each of the plurality of home ventilation devices and based on the ventilator data, a modification to an initial configuration profile for the ventilation device each of the plurality of hospital ventilation devices and the plurality of home ventilation devices; and
generating a modified configuration profile for each of the plurality of hospital ventilation devices and each of the plurality of home ventilation devices the ventilation device based on the determined modification to the initial configuration profile for each of the plurality of hospital ventilation devices and each of the plurality of home ventilation devices,
wherein the physiological statistics comprise at least one of a statistic for compliance of the lung (Cdyn, Cstat), resistance of the patient airways (Raw), inverse ratio ventilation (I/E), spontaneous ventilation rate, exhaled tidal volume (Vte), total lung ventilation per minute (Ve), peak expiratory flow rate (PEFR), peak inspiratory flow rate (PIFR), mean airway pressure, peak airway pressure, an average end-tidal expired CO_2 or total ventilation rate, and
wherein the operating parameters comprise at least one of a ventilation mode, a set mandatory tidal volume, a set positive end respiratory pressure (PEEP), an apnea interval, a bias flow, a breathing circuit compressible volume, a patient airway type and size, a fraction of inspired oxy-

gen *(Fi02),* a breath cycle threshold, or a breath trigger threshold,
wherein a respective modified configuration profile is configured to be implemented by a respective one of the plurality of hospital ventilation devices when the modified configuration profile is approved by a clinician associated with the respective one of the plurality of hospital ventilation devices, and wherein the respective modified configuration profile is configured to be implemented by a respective one of the plurality of home ventilation devices when the modified configuration profile is approved by the patient associated with the respective one of the plurality of home ventilation devices.

15. The machine-readable storage medium of Claim 14, wherein the method further comprises providing the modified configuration profile to the respective one of the plurality of hospital ventilation devices or one of the plurality of home ventilation devices for modifying operating parameters of the respective one of the plurality of hospital ventilation devices or one of the plurality of home ventilation devices.

Patentansprüche

1. Beatmungsmanagementsystem (150), das folgendes umfasst:

einen Speicher (152), der ein Ausgangskonfigurationsprofil umfasst, das für die Bestimmung von Betriebsparametern für eine Beatmungsvorrichtung (118, 130) konfiguriert ist; und
einen Prozessor (154), der für folgende Zwecke gestaltet ist:

- Empfangen von Beatmungsvorrichtungsdaten über ein lokales Netzwerk (119) von einer Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118) und über ein Wide Area-Netzwerk (120) von einer Mehrzahl von Haushalts-Beatmungsvorrichtungen (130), wobei die Beatmungsvorrichtungsdaten mindestens einen der Betriebsparameter für jede der Krankenhaus-Beatmungsvorrichtungen (118) und der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130) umfassen, oder physiologische Statistiken eines Patienten, die jeder der Krankenhaus-Beatmungsvorrichtungen (118) und jeder der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130) zugeordnet sind;
- Bestimmen für jede der Krankenhaus-Beatmungsvorrichtungen (118) und jede der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130) und auf der Basis der Beatmungsvorrichtungsdaten einer Modifikation des Ausgangskonfigurationsprofils für jede der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118) und der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130); und
- Erzeugen eines modifizierten Konfigurationsprofils für jede der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118) und jede der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130) auf der Basis der bestimmten Modifikation des Ausgangskonfigurationsprofils für jede der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen und jede der Mehrzahl von Haushalts-Beatmungsvorrichtungen;

wobei die physiologischen Statistiken mindestens eine der folgenden umfassen: eine Statistik in Bezug auf die Compliance der Lunge (Cdyn, Cstat), den Widerstand der Atemwege des Patienten (Raw), des Inverse-Ratio-Verhältnisses der Beatmung (I/E), der spontanen Beatmungsrate, des ausgeatmeten Atemzugvolumens (Vte), der Lungenbeatmung insgesamt pro Minute (Ve), des Spitzenwerts der exspiratorischen Strömungsrate (PEFR), des Spitzenwerts der inspiratorischen Strömungsrate (PIFR), des mittleren Atemwegdrucks, des Spitzenatemwegdrucks, des durchschnittlichen endexspiratorischen exspirierten CO_2 oder der Beatmungsrate insgesamt; und
wobei die Betriebsparameter mindestens einen der folgenden umfassen: einen Beatmungsmodus, ein eingestelltes verbindliches Atemzugvolumen, einen eingestellten positiven endexspiratorischen Druck (PEEP), ein Apnoe-Intervall, einen Bias Flow, ein verdichtbares Volumen des Beatmungskreises, einen Typ und eine Größe eines Patientenatemweges, einen Teil des inspirierten Sauerstoffs *(Fi02),* einen Grenzwert für den Atemzyklus oder einen Atmungsauslösungsgrenzwert, wobei ein entsprechendes modifiziertes Konfigurationsprofil gestaltet ist für die Implementierung durch eine entsprechende der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118), wenn das modifizierte Konfigurationsprofil durch einen Kliniker bestätigt ist, welcher der entsprechenden einen der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118) zugeordnet ist, und wobei das entsprechende modifizierte Konfigurationsprofil gestaltet ist für die Implementierung durch eine entsprechende der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130), wenn das modifizierte Konfigurationsprofil durch den Patienten bestätigt ist, welcher der entsprechenden ei-

nen der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130) zugeordnet ist.

2. System nach Anspruch 1, wobei der Prozessor ferner so gestaltet ist, dass er das modifizierte Konfigurationsprofil an die entsprechende eine der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118) bereitstellt oder an eine entsprechende der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130), zur Modifikation der Betriebsparameter der entsprechenden einen der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen oder der entsprechenden einen der Mehrzahl von Haushalts-Beatmungsvorrichtungen.

3. System nach Anspruch 2, wobei das modifizierte Konfigurationsprofil bereitgestellt wird zur Anzeige auf der entsprechenden einen der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118) oder der entsprechenden einen der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130).

4. System nach Anspruch 1, wobei der Prozessor ferner gestaltet ist zum Empfangen des Ausgangskonfigurationsprofils von der entsprechenden einen der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118) oder der entsprechenden einen der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130), und wobei die Modifikation des Konfigurationsprofils ferner auf der Basis des Ausgangskonfigurationsprofils bestimmt wird.

5. System nach Anspruch 1, wobei der Speicher (152) ferner Patientendaten aus der Vergangenheit umfasst, und wobei das Bestimmen der Modifikation des Konfigurationsprofils folgendes umfasst:

Vergleichen der physiologischen Statistiken des Patienten mit den Patientendaten aus der Vergangenheit, um eine Modifikation mindestens eines Betriebsparameters des Ausgangskonfigurationsprofils zu identifizieren; und
Modifizieren des mindestens einen Betriebsparameters auf der Basis der Identifizierung.

6. System nach Anspruch 1, wobei der Speicher (152) ferner Patientendaten aus der Vergangenheit umfasst, und wobei das Bestimmen der Modifikation des Konfigurationsprofils folgendes umfasst:

Vergleichen der physiologischen Statistiken des Patienten mit den Patientendaten aus der Vergangenheit, um eine Modifikation mindestens eines Betriebsparameters des Ausgangskonfigurationsprofils zu identifizieren; und
Modifizieren des mindestens einen Betriebsparameters auf der Basis der Identifizierung.

7. System nach Anspruch 1, wobei die Beatmungsvorrichtungsdaten über ein Netzwerk von der entsprechenden einen der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118) oder der entsprechenden einen der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130) in einem nativen Nachrichtenformat der Beatmungsvorrichtung empfangen werden und in ein internes Nachrichtenformat umgewandelt werden, das zur Verwendung mit dem Beatmungsmanagementsystem gestaltet ist.

8. Verfahren zum Management einer Mehrzahl von Beatmungsvorrichtungen, wobei das Verfahren folgendes umfasst:

- Empfangen von Beatmungsvorrichtungsdaten über ein lokales Netzwerk (119) von einer Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118) und über ein Wide Area-Netzwerk (120) von einer Mehrzahl von Haushalts-Beatmungsvorrichtungen (130), wobei die Beatmungsvorrichtungsdaten mindestens einen der Betriebsparameter für jede der Krankenhaus-Beatmungsvorrichtungen und der Mehrzahl von Haushalts-Beatmungsvorrichtungen umfassen, oder physiologische Statistiken eines Patienten, die jeder der Krankenhaus-Beatmungsvorrichtungen (118) und jeder der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130) zugeordnet sind;
- Bestimmen für jede der Krankenhaus-Beatmungsvorrichtungen (118) und jede der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130) und auf der Basis der Beatmungsvorrichtungsdaten einer Modifikation des Ausgangskonfigurationsprofils für jede der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen und der Mehrzahl von Haushalts-Beatmungsvorrichtungen; und
- Erzeugen eines modifizierten Konfigurationsprofils für jede der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118) und jede der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130) auf der Basis der bestimmten Modifikation des Ausgangskonfigurationsprofils für jede der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen und jede der Mehrzahl von Haushalts-Beatmungsvorrichtungen;

wobei die physiologischen Statistiken mindestens eine der folgenden umfassen: eine Statistik in Bezug auf die Compliance der Lunge (Cdyn, Cstat), den Widerstand der Atemwege des Patienten (Raw), des Inverse-Ratio-Verhältnisses der Beatmung (I/E), der spontanen Beatmungsrate, des ausgeatmeten Atemzugvolumens (Vte), der Lungenbeatmung insgesamt pro Minute (Ve), des Spitzenwerts der exspiratorischen Strömungsrate (PEFR), des Spitzen-

werts der inspiratorischen Strömungsrate (PIFR), des mittleren Atemwegdrucks, des Spitzenatemwegdrucks, des durchschnittlichen endexspiratorischen exspirierten CO_2 oder der Beatmungsrate insgesamt, und ein eingestelltes verbindliches Atemzugvolumen, einen eingestellten positiven endexspiratorischen Druck (PEEP), ein Apnoe-Intervall, einen Bias Flow, ein verdichtbares Volumen des Beatmungskreises, einen Typ und eine Größe eines Patientenatemweges, einen Teil des inspirierten Sauerstoffs *(Fi02),* einen Grenzwert für den Atemzyklus oder einen Atmungsauslösungsgrenzwert;
wobei ein entsprechendes modifiziertes Konfigurationsprofil gestaltet ist für die Implementierung durch eine entsprechende der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118), wenn das modifizierte Konfigurationsprofil durch einen Kliniker bestätigt ist, welcher der entsprechenden einen der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118) zugeordnet ist, und wobei das entsprechende modifizierte Konfigurationsprofil gestaltet ist für die Implementierung durch eine entsprechende der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130), wenn das modifizierte Konfigurationsprofil durch den Patienten bestätigt ist, welcher der entsprechenden einen der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130) zugeordnet ist.

9. Verfahren nach Anspruch 8, wobei das Verfahren ferner das Bereitstellen des modifizierten Konfigurationsprofils an die entsprechende eine der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118) oder an eine entsprechende der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130) umfasst, zur Modifikation der Betriebsparameter der entsprechenden einen der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (18) oder der entsprechenden einen der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130).

10. Verfahren nach Anspruch 9, wobei das modifizierte Konfigurationsprofil bereitgestellt wird zur Anzeige auf der entsprechenden einen der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118) oder der entsprechenden einen der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130).

11. Verfahren nach Anspruch 8, wobei das Verfahren ferner folgendes umfasst: Empfangen des Ausgangskonfigurationsprofils von der entsprechenden einen der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118) oder der entsprechenden einen der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130), und wobei die Modifikation des Konfigurationsprofils ferner auf der Basis des Ausgangskonfigurationsprofils bestimmt wird.

12. Verfahren nach Anspruch 8, wobei das Bestimmen der Modifikation des Konfigurationsprofils folgendes umfasst:

Vergleichen der physiologischen Statistiken des Patienten mit Patientendaten aus der Vergangenheit, um eine Modifikation mindestens eines Betriebsparameters des Ausgangskonfigurationsprofils zu identifizieren; und
Modifizieren des mindestens einen Betriebsparameters auf der Basis der Identifizierung.

13. Verfahren nach Anspruch 8, wobei die Beatmungsvorrichtungsdaten durch ein Beatmungsmanagementsystem über ein Netzwerk von der entsprechenden einen der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen oder der entsprechenden einen der Mehrzahl von Haushalts-Beatmungsvorrichtungen in einem nativen Nachrichtenformat der entsprechenden einen der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen oder der entsprechenden einen der Mehrzahl von Haushalts-Beatmungsvorrichtungen empfangen werden und in ein internes Nachrichtenformat umgewandelt werden, das zur Verwendung mit dem Beatmungsmanagementsystem gestaltet ist.

14. Maschinenlesbares Speichermedium (806), das maschinenlesbare Anweisungen umfasst, die dazu dienen, zu bewirken, dass ein Prozessor (154) ein Verfahren zum Management einer Mehrzahl von Beatmungsvorrichtungen ausführt, wobei das Verfahren folgendes umfasst:

Empfangen von Beatmungsvorrichtungsdaten über ein lokales Netzwerk (119) von einer Mehrzahl von Krankenhaus-Beatmungsvorrichtungen (118) und über ein Wide Area-Netzwerk (120) von einer Mehrzahl von Haushalts-Beatmungsvorrichtungen (130), wobei die Beatmungsvorrichtungsdaten mindestens einen der Betriebsparameter für jede der Krankenhaus-Beatmungsvorrichtungen und der Mehrzahl von Haushalts-Beatmungsvorrichtungen umfassen, oder physiologische Statistiken eines Patienten, die jeder der Krankenhaus-Beatmungsvorrichtungen und jeder der Mehrzahl von Haushalts-Beatmungsvorrichtungen (130) zugeordnet sind;
Bestimmen für jede der Krankenhaus-Beatmungsvorrichtungen und jede der Mehrzahl von Haushalts-Beatmungsvorrichtungen und auf der Basis der Beatmungsvorrichtungsdaten einer Modifikation des Ausgangskonfigurationsprofils für jede der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen und der Mehrzahl von Haushalts-Beatmungsvorrichtungen; und
Erzeugen eines modifizierten Konfigurationsprofils für jede der Mehrzahl von Krankenhaus-

Beatmungsvorrichtungen und jede der Mehrzahl von Haushalts-Beatmungsvorrichtungen auf der Basis der bestimmten Modifikation des Ausgangskonfigurationsprofils für jede der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen und jede der Mehrzahl von Haushalts-Beatmungsvorrichtungen;
wobei die physiologischen Statistiken mindestens eine der folgenden umfassen: eine Statistik in Bezug auf die Compliance der Lunge (Cdyn, Cstat), den Widerstand der Atemwege des Patienten (Raw), des Inverse-Ratio-Verhältnisses der Beatmung (I/E), der spontanen Beatmungsrate, des ausgeatmeten Atemzugvolumens (Vte), der Lungenbeatmung insgesamt pro Minute (Ve), des Spitzenwerts der exspiratorischen Strömungsrate (PEFR), des Spitzenwerts der inspiratorischen Strömungsrate (PIFR), des mittleren Atemwegdrucks, des Spitzenatemwegdrucks, des durchschnittlichen endexspiratorischen exspirierten CO_2 oder der Beatmungsrate insgesamt; und
wobei die Betriebsparameter mindestens einen der folgenden umfassen: einen Beatmungsmodus, ein eingestelltes verbindliches Atemzugvolumen, einen eingestellten positiven endexspiratorischen Druck (PEEP), ein Apnoe-Intervall, einen Bias Flow, ein verdichtbares Volumen des Beatmungskreises, einen Typ und eine Größe eines Patientenatemweges, einen Teil des inspirierten Sauerstoffs *(Fi02),* einen Grenzwert für den Atemzyklus oder einen Atmungsauslösungsgrenzwert;
wobei ein entsprechendes modifiziertes Konfigurationsprofil gestaltet ist für die Implementierung durch eine entsprechende der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen, wenn das modifizierte Konfigurationsprofil durch einen Kliniker bestätigt ist, welcher der entsprechenden einen der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen zugeordnet ist, und wobei das entsprechende modifizierte Konfigurationsprofil gestaltet ist für die Implementierung durch eine entsprechende der Mehrzahl von Haushalts-Beatmungsvorrichtungen, wenn das modifizierte Konfigurationsprofil durch den Patienten bestätigt ist, welcher der entsprechenden einen der Mehrzahl von Haushalts-Beatmungsvorrichtungen zugeordnet ist.

15. Maschinenlesbares Speichermedium nach Anspruch 14, wobei das Verfahren ferner das Bereitstellen des modifizierten Konfigurationsprofils an die entsprechende eine der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen oder an eine entsprechende der Mehrzahl von Haushalts-Beatmungsvorrichtungen umfasst, zur Modifikation der Betriebsparameter der entsprechenden einen der Mehrzahl von Krankenhaus-Beatmungsvorrichtungen oder der entsprechenden einen der Mehrzahl von Haushalts-Beatmungsvorrichtungen.

Revendications

1. Système de gestion de ventilateur (150), comprenant :

une mémoire (152) comprenant un profil de configuration initial conçu pour désigner des paramètres de fonctionnement pour un dispositif de ventilation (118, 130) ; et
un processeur (154) conçu pour :

recevoir des données de ventilateur sur un réseau local (119) à partir d'une pluralité de dispositifs de ventilation d'hôpital (118) et sur un réseau étendu (120) à partir d'une pluralité de dispositifs de ventilation de domicile (130), les données de ventilateur comprenant au moins un paramètre de fonctionnement pour chacun des dispositifs de ventilation d'hôpital (118) et la pluralité de dispositifs de ventilation de domicile (130), ou les statistiques physiologiques d'un patient associées avec chacun des dispositifs de ventilation d'hôpital (118) et chacun des dispositifs de ventilation de domicile (130);
déterminer, pour chacun de la pluralité de dispositifs de ventilation d'hôpital (118) et chacun de la pluralité de dispositifs de ventilation de domicile (130) et sur la base des données de ventilateur, une modification du profil de configuration initial pour chacun de la pluralité de dispositifs de ventilation d'hôpital (118) et la pluralité de dispositifs de ventilation de domicile (130) ; et
générer un profil de configuration modifié pour chacun de la pluralité de dispositifs de ventilation d'hôpital (118) et chacun de la pluralité de dispositifs de ventilation de domicile (130) sur la base de la modification déterminée du profil de configuration initial pour chacun de la pluralité de dispositifs de ventilation d'hôpital et chacun de la pluralité de dispositifs de ventilation de domicile,

les statistiques physiologiques comprenant une statistique pour la conformité du poumon (Cdyn, Cstat), la résistance des voies respiratoires du patient (Raw), la ventilation à rapport inverse (I/E), le débit de ventilation spontanée, le volume courant expiré (Vte), la ventilation pulmonaire totale par minute (Ve), le débit expiratoire maximal (PEFR), le débit inspiratoire maximal (PI-

FR), la pression moyenne des voies respiratoires, la pression maximale des voies respiratoires, un débit de CO_2 expiré courant final moyen et/ou un débit de ventilation total, et
les paramètres de fonctionnement comprenant un mode de ventilation, un volume courant obligatoire établi, une pression respiratoire finale positive établie (PEEP), un intervalle d'apnée, un débit de biais, un volume compressible du circuit respiratoire, un type et une taille de voies respiratoires de patient, une fraction d'oxygène inspiré (FiO_2), un seuil de cycle respiratoire, et/ou un seuil déclencheur de respiration, un profil de configuration modifié respectif étant conçu pour être mis en œuvre par un dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital (118) lorsque le profil de configuration modifié est approuvé par un clinicien associé au dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital (118), et le profil de configuration modifié respectif étant conçu pour être mis en œuvre par un dispositif respectif de la pluralité de dispositifs de ventilation de domicile (130) lorsque le profil de configuration modifié est approuvé par le patient associé au dispositif respectif de la pluralité de dispositifs de ventilation de domicile (130).

2. Système selon la revendication 1, le processeur étant en outre conçu pour fournir le profil de configuration modifié au dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital (118) ou au dispositif de la pluralité de dispositifs de ventilation de domicile (130) pour modifier des paramètres de fonctionnement du dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital ou du dispositif de la pluralité de dispositifs de ventilation de domicile.

3. Système selon la revendication 2, le profil de configuration modifié étant fourni pour être affiché sur le dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital (118) ou un dispositif de la pluralité de dispositifs de ventilation de domicile (130).

4. Système selon la revendication 1, le processeur étant en outre conçu pour recevoir le profil de configuration initial du dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital (118) ou du dispositif de la pluralité de dispositifs de ventilation domestique (130), et la modification du profil de configuration étant également déterminée sur la base du profil de configuration initial.

5. Système selon la revendication 1, la mémoire (152) comprenant en outre des données historiques du patient, et la détermination de la modification du profil de configuration comprenant les étapes consistant à :

comparer les statistiques physiologiques du patient avec les données historiques du patient pour identifier une modification d'au moins un paramètre opérationnel du profil de configuration initial ; et
modifier l'au moins un paramètre de fonctionnement sur la base de l'identification.

6. Système selon la revendication 1, la mémoire (152) comprenant en outre des données historiques du patient, et la détermination de la modification du profil de configuration comprenant les étapes consistant à
comparer les données du patient avec les données historiques du patient pour identifier une modification d'au moins un paramètre opérationnel du profil de configuration initial ; et
modifier l'au moins un paramètre de fonctionnement sur la base de l'identification.

7. Système selon la revendication 1, les données de ventilateur étant reçues sur un réseau à partir du dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital (118) ou du dispositif de la pluralité de dispositifs de ventilation de domicile (130) dans un format de message natif du dispositif de ventilation et converties dans un format de messagerie interne conçu pour une utilisation avec le système de gestion de ventilateur.

8. Procédé de gestion d'une pluralité de ventilateurs, le procédé comprenant les étapes consistant à :

recevoir des données de ventilateur sur un réseau local (119) à partir d'une pluralité de dispositifs de ventilation d'hôpital (118) et sur un réseau étendu (120) à partir d'une pluralité de dispositifs de ventilation de domicile (130), les données de ventilateur comprenant au moins un paramètre de fonctionnement pour chacun des dispositifs de ventilation d'hôpital et la pluralité de dispositifs de ventilation de domicile, ou les statistiques physiologiques d'un patient associées avec chacun des dispositifs de ventilation d'hôpital (118) et la pluralité de dispositifs de ventilation de domicile (130) ;
déterminer, pour chacun de la pluralité de dispositifs de ventilation d'hôpital (118) et chacun de la pluralité de dispositifs de ventilation de domicile (130) et sur la base des données de ventilateur, une modification d'un profil de configuration initial pour chacun de la pluralité de dispositifs de ventilation d'hôpital et chacun de la pluralité de dispositifs de ventilation de domicile ; et
générer un profil de configuration modifié pour chacun de la pluralité de dispositifs de ventilation d'hôpital (118) et chacun de la pluralité de

dispositifs de ventilation de domicile (130) sur la base de la modification déterminée du profil de configuration initial pour chacun de la pluralité de dispositifs de ventilation d'hôpital et chacun de la pluralité de dispositifs de ventilation de domicile,
les statistiques physiologiques comprenant une statistique pour la conformité du poumon (Cdyn, Cstat), la résistance des voies respiratoires du patient (Raw), la ventilation à rapport inverse (I/E), le débit de ventilation spontanée, le volume courant expiré (Vte), la ventilation pulmonaire totale par minute (Ve), le débit expiratoire maximal (PEFR), le débit inspiratoire maximal (PIFR), la pression moyenne des voies respiratoires, la pression maximale des voies respiratoires, un débit de CO_2 expiré courant final moyen et/ou un débit de ventilation total, et un volume courant obligatoire établi, une pression respiratoire finale positive établie (PEEP), un intervalle d'apnée, un débit de biais, un volume compressible du circuit respiratoire, un type et une taille de voies respiratoires de patient, une fraction d'oxygène inspiré (FiO_2), un seuil de cycle respiratoire, et/ou un seuil déclencheur de respiration,
un profil de configuration modifié respectif étant conçu pour être mis en œuvre par le dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital (118) lorsque le profil de configuration modifié est approuvé par un clinicien associé au dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital (118), et le profil de configuration modifié respectif étant conçu pour être mis en œuvre par un dispositif respectif de la pluralité de dispositifs de ventilation de domicile (130) lorsque le profil de configuration modifié est approuvé par le patient associé au dispositif respectif de la pluralité de dispositifs de ventilation de domicile (130).

9. Procédé selon la revendication 8, le procédé comprenant en outre l'étape consistant à fournir le profil de configuration modifié au dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital (118) ou au dispositif de la pluralité de dispositifs de ventilation de domicile (130) pour modifier les paramètres de fonctionnement du dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital (18) ou du dispositif de la pluralité de dispositifs de ventilation de domicile (130).

10. Procédé selon la revendication 9, le profil de configuration modifié étant fourni pour être affiché sur le dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital (118) ou un dispositif de la pluralité de dispositifs de ventilation de domicile (130).

11. Procédé selon la revendication 8, le procédé comprenant en outre l'étape consistant à recevoir le profil de configuration initial à partir du dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital (118) ou du dispositif de la pluralité de dispositifs de ventilation domestique (130), et la modification du profil de configuration étant également déterminée sur la base du profil de configuration initial.

12. Procédé selon la revendication 8, la détermination de la modification du profil de configuration comprenant les étapes consistant à :

comparer les statistiques physiologiques du patient avec les données historiques du patient pour identifier une modification d'au moins un paramètre opérationnel du profil de configuration initial ; et
modifier l'au moins un paramètre de fonctionnement sur la base de l'identification.

13. Procédé selon la revendication 8, les données de ventilateur étant reçues par un système de gestion de ventilateur sur un réseau à partir du dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital ou du dispositif de la pluralité de dispositifs de ventilation de domicile dans un format de message natif du dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital ou du dispositif de la pluralité de dispositifs de ventilation de domicile, et converties dans un format de messagerie interne conçu pour une utilisation avec le système de gestion de ventilateur.

14. Support de stockage lisible par machine (806) comprenant des instructions lisibles par machine pour amener un processeur (154) à exécuter un procédé pour gérer une pluralité de ventilateurs, le procédé comprenant les étapes consistant à :

recevoir des données de ventilateur sur un réseau local (119) à partir d'une pluralité de dispositifs de ventilation d'hôpital (118) et sur un réseau étendu (120) à partir d'une pluralité de dispositifs de ventilation de domicile (130), les données de ventilateur comprenant au moins un paramètre de fonctionnement pour chacun des dispositifs de ventilation d'hôpital et la pluralité de dispositifs de ventilation de domicile ou des statistiques physiologiques d'un patient associées avec chacun des dispositifs de ventilation d'hôpital et à la pluralité de dispositifs de ventilation de domicile ;
déterminer, pour chacun de la pluralité de dispositifs de ventilation d'hôpital et chacun de la pluralité de dispositifs de ventilation de domicile et sur la base des données de ventilateur, une modification d'un profil de configuration initial

pour le dispositif de ventilation, chacun de la pluralité de dispositifs de ventilation d'hôpital et la pluralité de dispositifs de ventilation de domicile ; et

générer un profil de configuration modifié pour chacun de la pluralité de dispositifs de ventilation d'hôpital et chacun de la pluralité de dispositifs de ventilation de domicile, le dispositif de ventilation sur la base de la modification déterminée du profil de configuration initial pour chacun de la pluralité de dispositifs de ventilation d'hôpital et chacun de la pluralité de dispositifs de ventilation de domicile,

les statistiques physiologiques comprenant une statistique pour la conformité du poumon (Cdyn, Cstat), la résistance des voies respiratoires du patient (Raw), la ventilation à rapport inverse (I/E), le débit de ventilation spontanée, le volume courant expiré (Vte), la ventilation pulmonaire totale par minute (Ve), le débit expiratoire maximal (PEFR), le débit inspiratoire maximal (PIFR), la pression moyenne des voies respiratoires, la pression maximale des voies respiratoires, un débit de CO_2 expiré courant final moyen et/ou un débit de ventilation total, et

les paramètres de fonctionnement comprenant un mode de ventilation, un volume courant obligatoire établi, une pression respiratoire finale positive établie (PEEP), un intervalle d'apnée, un débit de biais, un volume compressible du circuit respiratoire, un type et une taille de voies respiratoires de patient, une fraction d'oxygène inspiré (FiO_2), un seuil de cycle respiratoire, et/ou un seuil déclencheur de respiration,

un profil de configuration modifié respectif étant conçu pour être mis en œuvre par le dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital lorsque le profil de configuration modifié est approuvé par un clinicien associé au dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital, et le profil de configuration modifié respectif étant conçu pour être mis en œuvre par un dispositif respectif de la pluralité de dispositifs de ventilation domestique lorsque le profil de configuration modifié est approuvé par le patient associé au dispositif respectif de la pluralité de dispositifs de ventilation de domicile.

15. Support de stockage lisible par machine selon la revendication 14, le procédé comprenant en outre l'étape consistant à fournir le profil de configuration modifié au dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital ou au dispositif de la pluralité de dispositifs de ventilation de domicile pour modifier les paramètres de fonctionnement du dispositif respectif de la pluralité de dispositifs de ventilation d'hôpital ou du dispositif de la pluralité de dispositifs de ventilation de domicile.

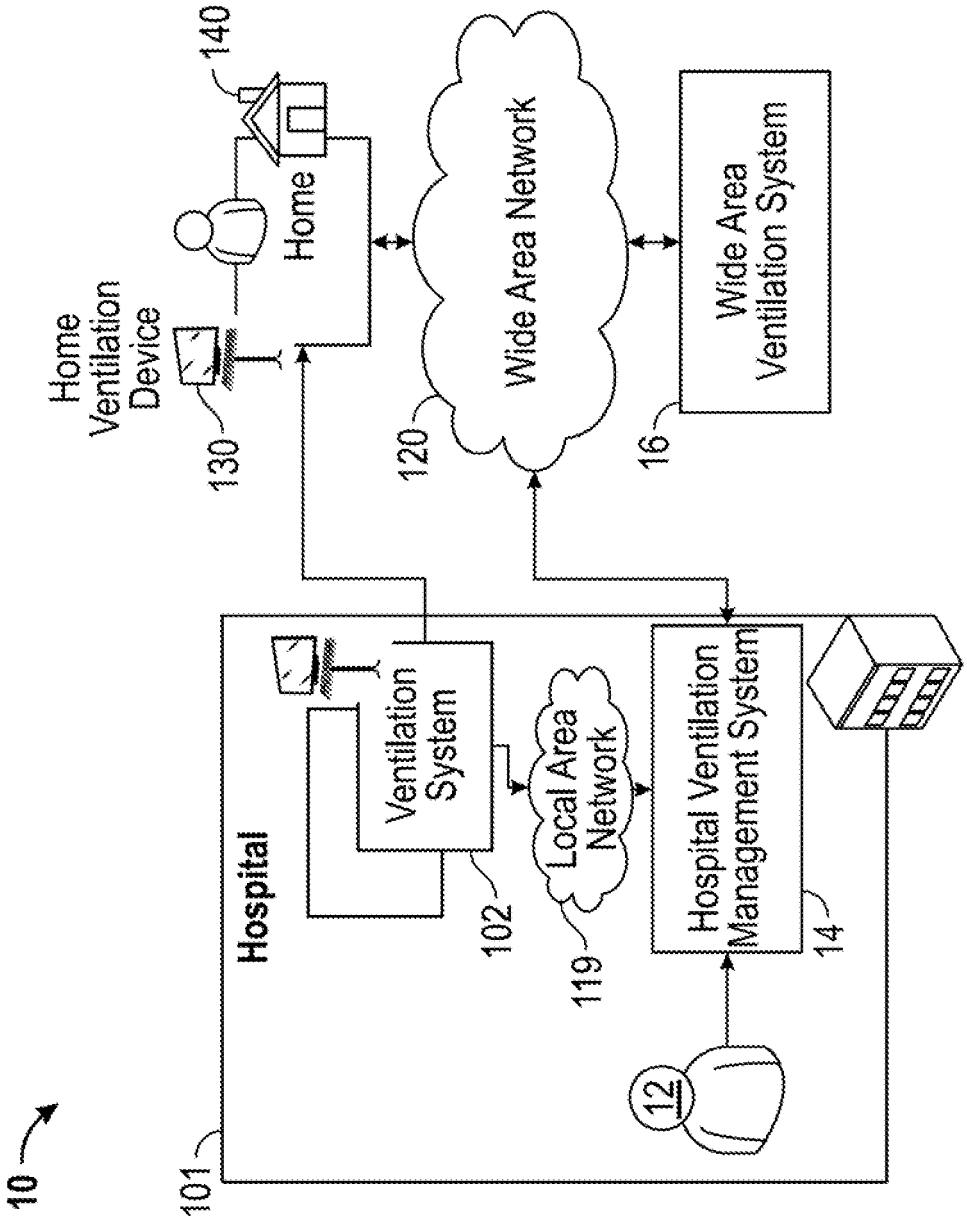
10
101
Hospital
Ventilation System
102
Local Area Network
119
Hospital Ventilation Management System
14
12
Home Ventilation Device
130
Home
140
Wide Area Network
120
Wide Area Ventilation System
16

FIG. 1

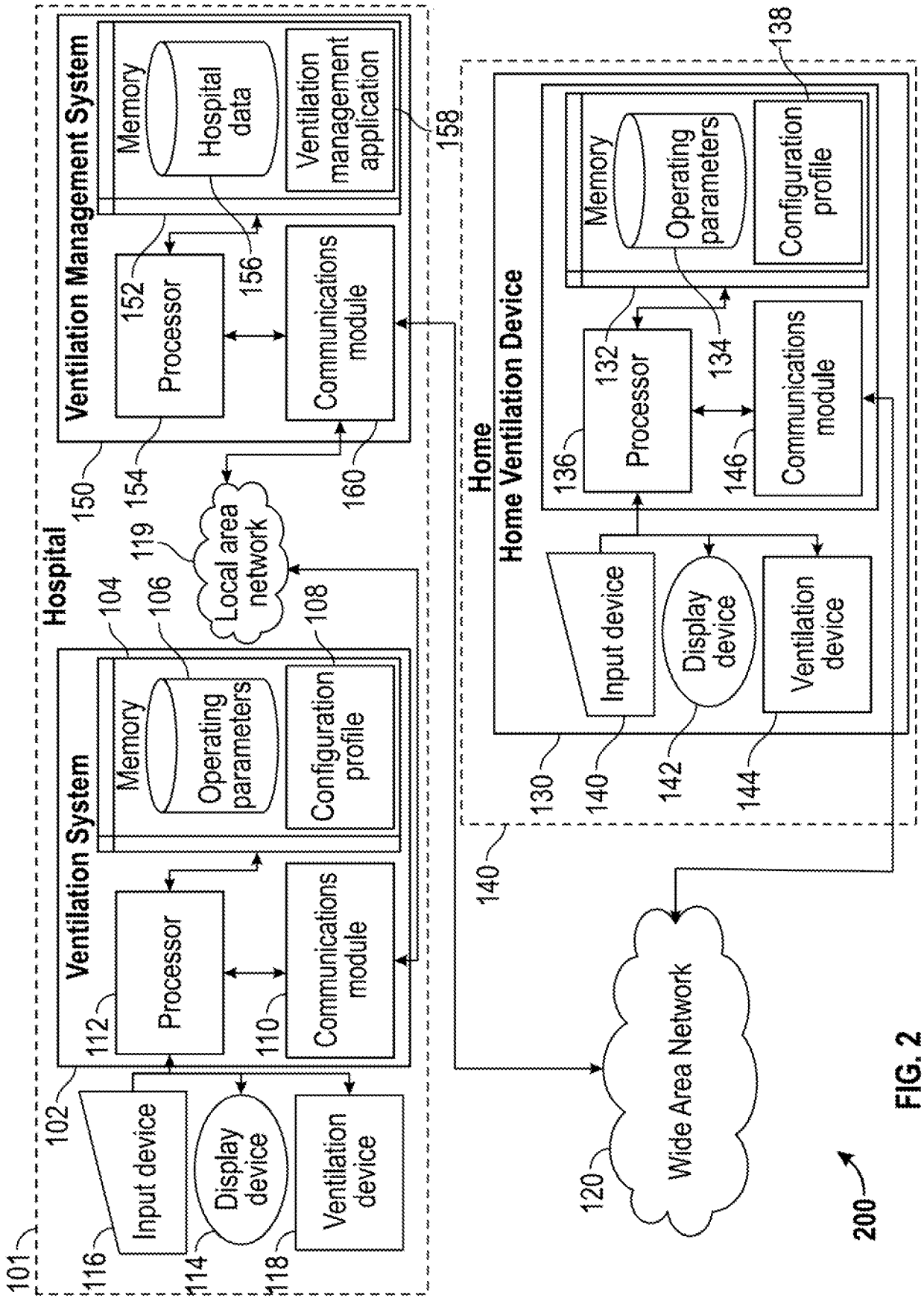
Hospital
Ventilation Management System
Memory
Hospital data
Ventilation management application
158
152
Processor
156
Communications module
150
154
160
119
Local area network
104
106
108
Ventilation System
Memory
Operating parameters
Configuration profile
112
Processor
110
Communications module
102
Input device
Display device
Ventilation device
116
114
118
101
Home
Home Ventilation Device
Memory
Operating parameters
Configuration profile
138
132
Processor
134
136
146
Communications module
Input device
Display device
Ventilation device
130
140
142
144
140
Wide Area Network
120
200

FIG. 2

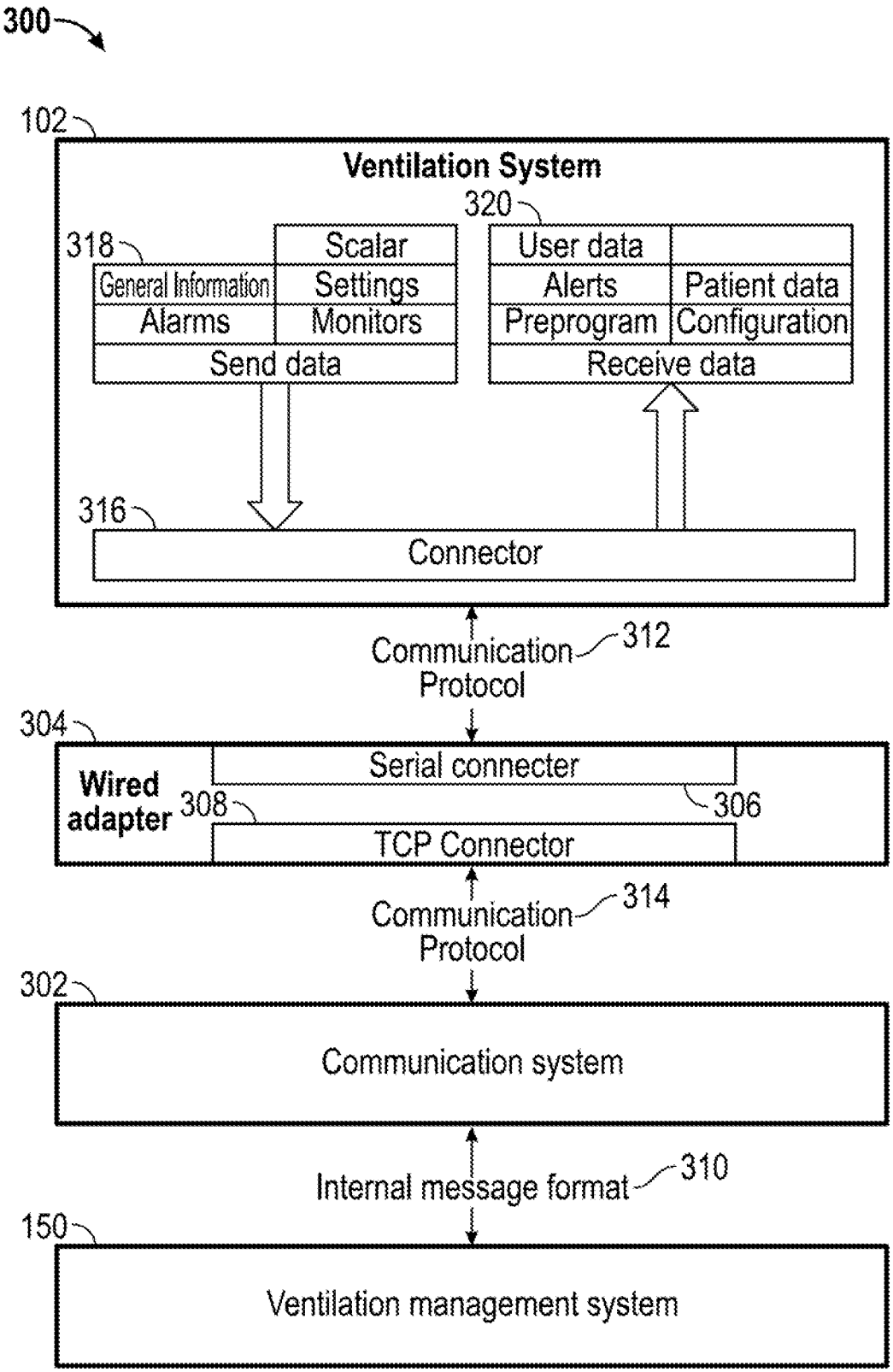
300
102
Ventilation System
320
318
Scalar
User data
General Information
Settings
Alerts
Patient data
Alarms
Monitors
Preprogram
Configuration
Send data
Receive data
316
Connector
Communication Protocol
312
304
Wired adapter
308
Serial connecter
306
TCP Connector
Communication Protocol
314
302
Communication system
Internal message format
310
150
Ventilation management system

FIG. 3

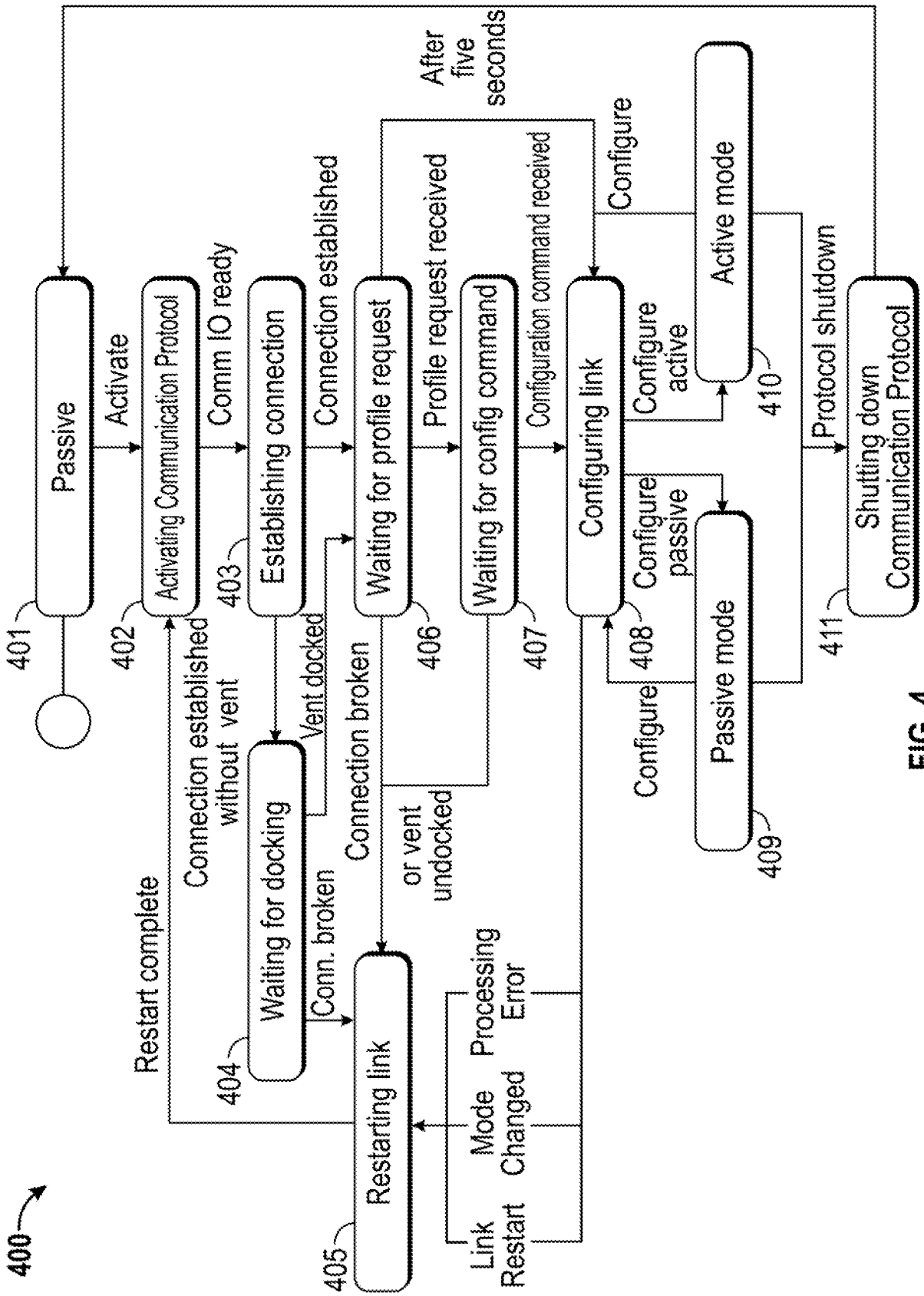
400
Passive
401
Activate
Activating Communication Protocol
402
Comm IO ready
Establishing connection
403
Connection established
Waiting for profile request
406
Profile request received
Waiting for config command
407
Configuration command received
Configuring link
408
Configure
Configure active
Configure passive
Active mode
410
Passive mode
409
After five seconds
Protocol shutdown
Shutting down Communication Protocol
411
Vent docked
Waiting for docking
404
Conn. broken
Connection broken
or vent undocked
Restarting link
405
Restart complete
Connection established without vent
Link Restart
Mode Changed
Processing Error

FIG. 4

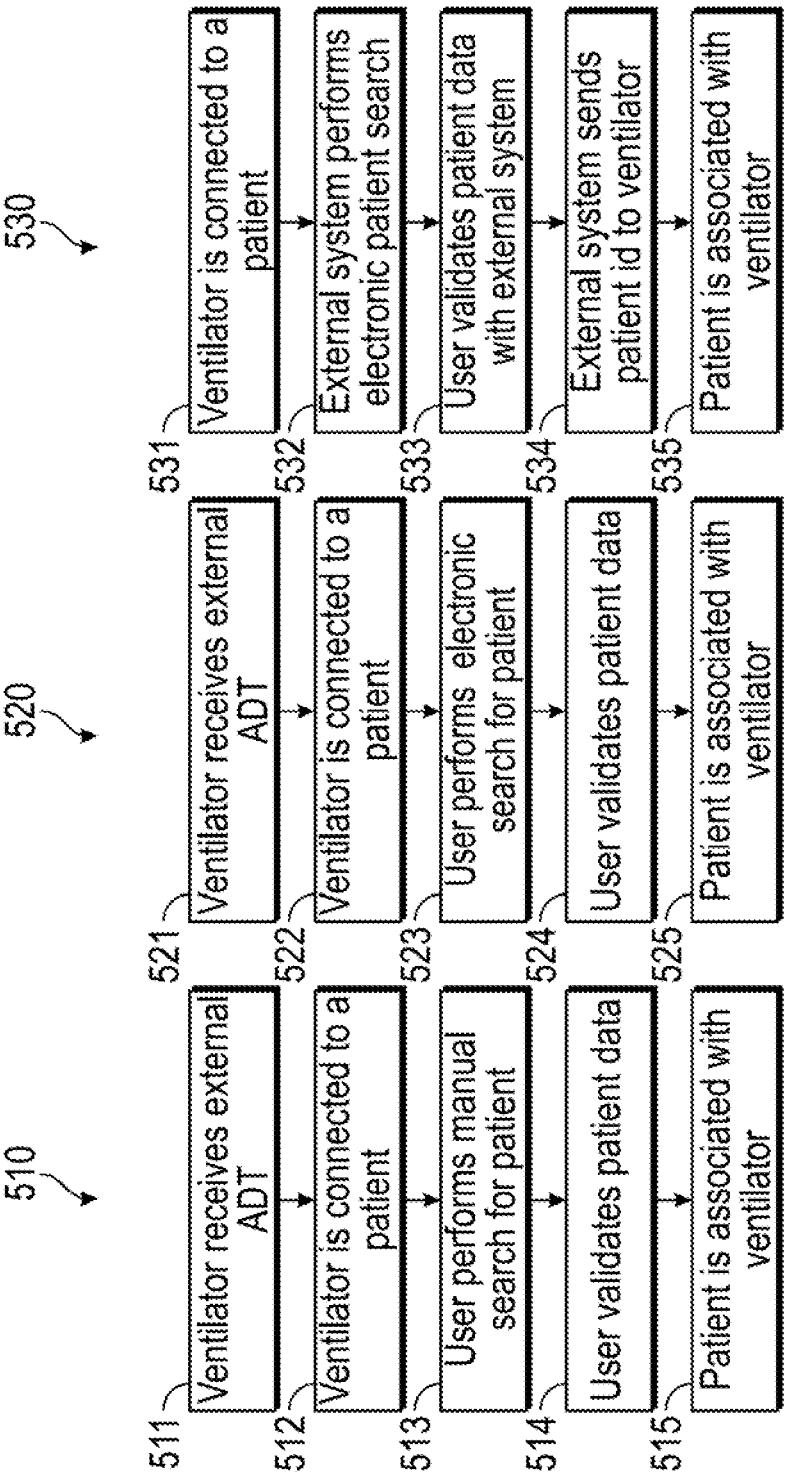
510
520
530
511
Ventilator receives external ADT
512
Ventilator is connected to a patient
513
User performs manual search for patient
514
User validates patient data
515
Patient is associated with ventilator
521
Ventilator receives external ADT
522
Ventilator is connected to a patient
523
User performs electronic search for patient
524
User validates patient data
525
Patient is associated with ventilator
531
Ventilator is connected to a patient
532
External system performs electronic patient search
533
User validates patient data with external system
534
External system sends patient id to ventilator
535
Patient is associated with ventilator

FIG. 5

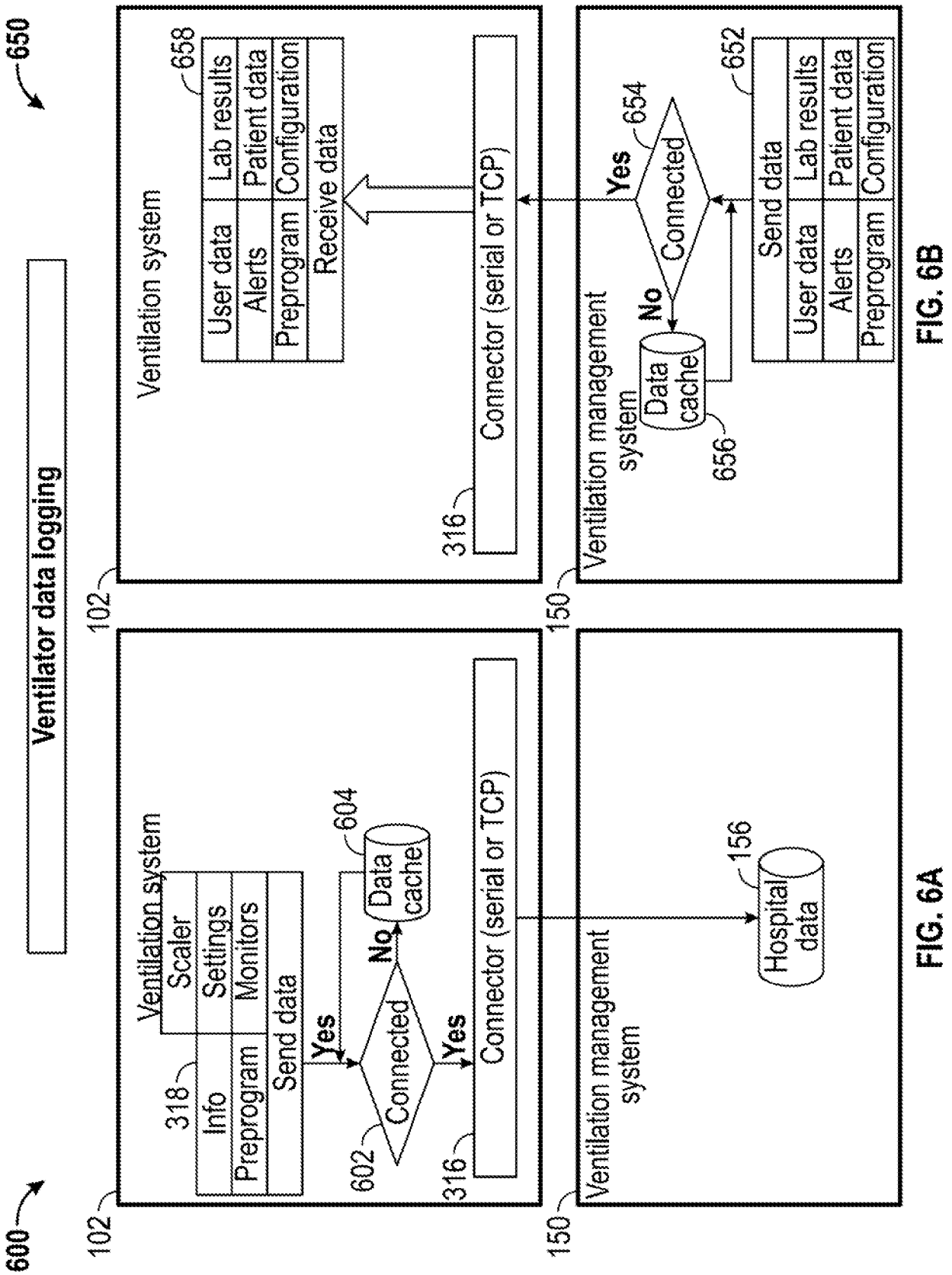
600
650
Ventilator data logging
102
Ventilation system
Scaler
318
Info
Settings
Preprogram
Monitors
Send data
Yes
604
Data cache
No
Connected
602
Yes
316
Connector (serial or TCP)
150
Ventilation management system
156
Hospital data
102
Ventilation system
658
User data
Lab results
Alerts
Patient data
Preprogram
Configuration
Receive data
316
Connector (serial or TCP)
150
Ventilation management system
Yes
654
Connected
No
Data cache
656
652
Send data
User data
Lab results
Alerts
Patient data
Preprogram
Configuration

FIG. 6A

FIG. 6B

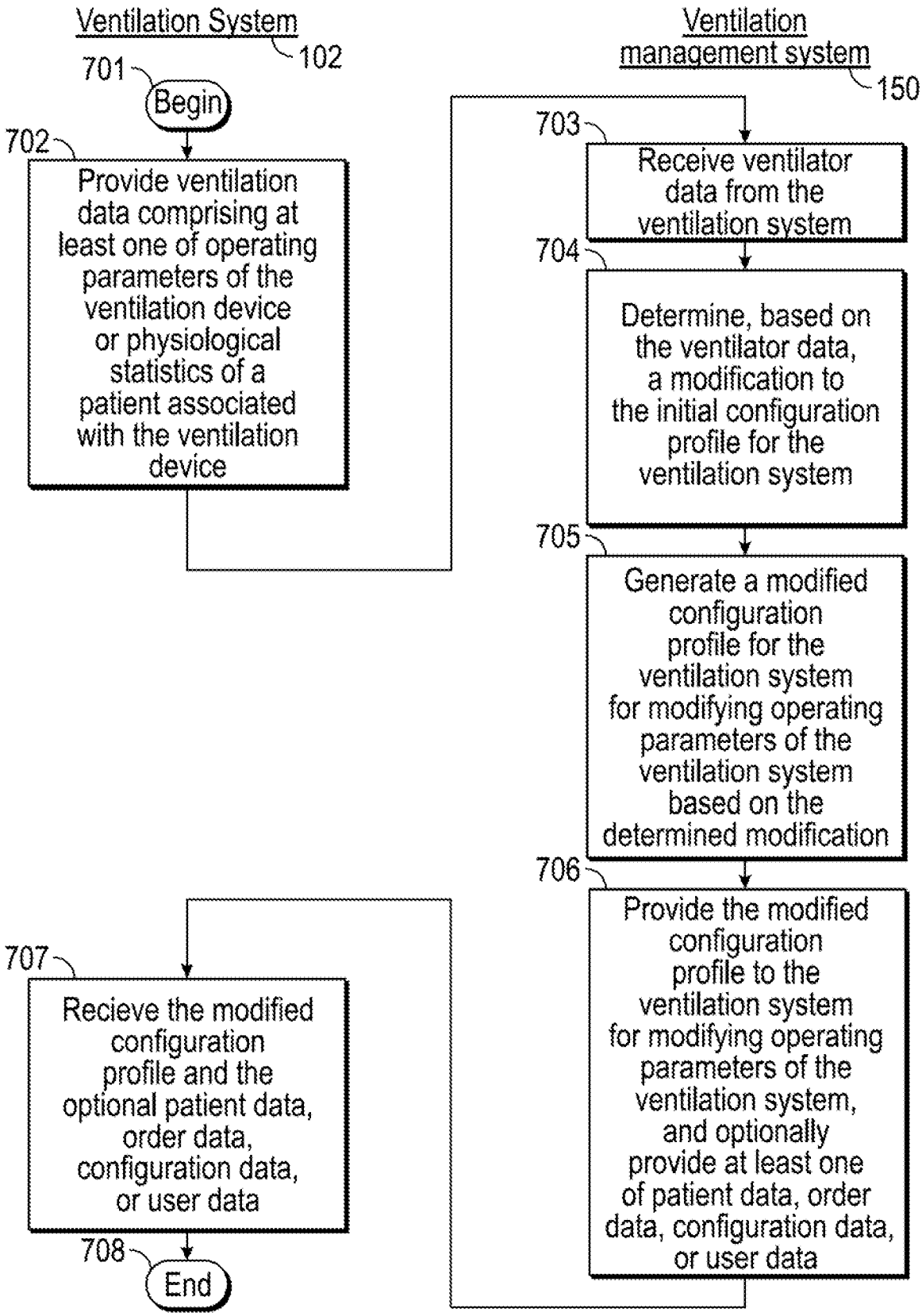
Ventilation System
102
701
Begin
702
Provide ventilation data comprising at least one of operating parameters of the ventilation device or physiological statistics of a patient associated with the ventilation device
Ventilation management system
150
703
Receive ventilator data from the ventilation system
704
Determine, based on the ventilator data, a modification to the initial configuration profile for the ventilation system
705
Generate a modified configuration profile for the ventilation system for modifying operating parameters of the ventilation system based on the determined modification
706
Provide the modified configuration profile to the ventilation system for modifying operating parameters of the ventilation system, and optionally provide at least one of patient data, order data, configuration data, or user data
707
Recieve the modified configuration profile and the optional patient data, order data, configuration data, or user data
708
End

FIG. 7

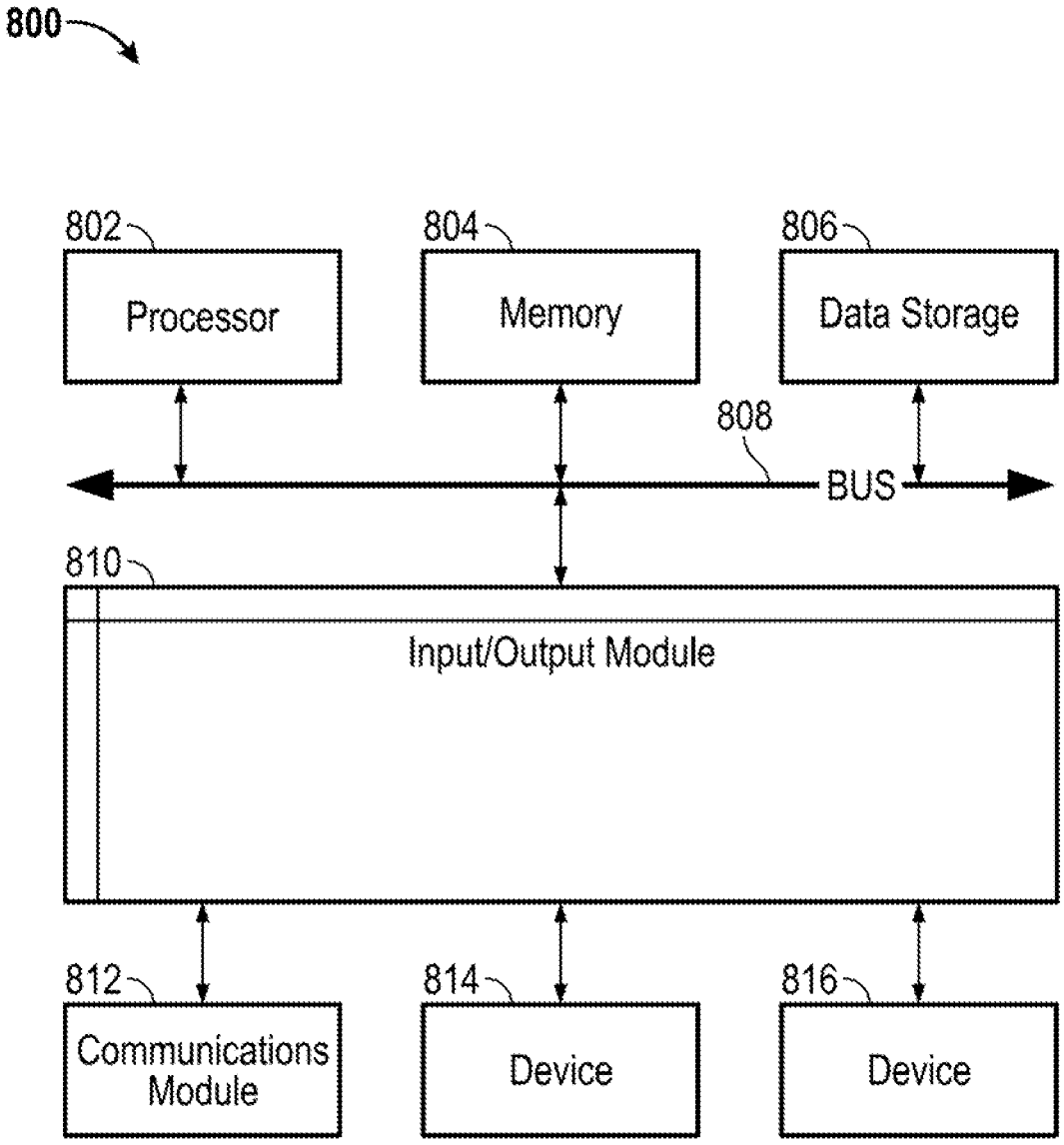
800
802
Processor
804
Memory
806
Data Storage
808
BUS
810
Input/Output Module
812
Communications Module
814
Device
816
Device

FIG. 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 2009326389 A **[0003]**
- US 2010108064 A **[0004]**
- US 42177612 **[0033]**

专利名称(译)	通风管理系统		
公开(公告)号	EP2973360A1	公开(公告)日	2016-01-20
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申请(专利权)人(译)	CAREFUSION 303 INC.		
当前申请(专利权)人(译)	CAREFUSION 303 INC.		
[标]发明人	STEINHAUER TOM LAM WILLIS ROGERS MARK BLANSFIELD TERRY BIRCH STEPHEN J		
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IPC分类号	G06Q50/22 A61B5/00 A61M16/00 G06F19/00		
CPC分类号	A61B5/085 A61B5/087 A61B5/091 A61B5/14542 A61M16/0051 A61M16/021 A61M2205/3553 A61M2205/502 A61M2205/52 F24F11/30 F24F2221/38 G06F19/3481 G06Q50/22		
代理机构(译)	FARRINGTON，GRAHAM		
优先权	13/830730 2013-03-14 US		
其他公开文献	EP2973360B1 EP2973360A4		
外部链接	Espacenet		

摘要(译)

提供了通风机管理系统。 一方面，呼吸机管理系统包括存储器和处理器，该存储器包括初始配置配置文件，该初始配置配置文件被配置为指定通风设备的操作参数。 所述处理器被配置为从所述通风设备接收呼吸机数据，所述呼吸机数据包括所述通风设备的操作参数或与所述通风设备相关联的患者的生理统计中的至少一项，并且基于所述呼吸机数据来确定修改。 到通风设备的初始配置文件。 处理器还被配置为基于所确定的修改来生成用于通风设备的修改后的配置文件。 还提供了方法和机器可读介质。