

(19) **DANMARK**

(10) **DK/EP 3528764 T3**



(12) **Oversættelse af  
europæisk patentskrift**

Patent- og  
Varemærkestyrelsen

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- (51) Int.Cl.: **A 61 G 7/018 (2006.01)** **A 61 G 7/05 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2022-01-10**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2021-11-24**
- (86) Europæisk ansøgning nr.: **17783698.8**
- (86) Europæisk indleveringsdag: **2017-10-04**
- (87) Den europæiske ansøgnings publiceringsdag: **2019-08-28**
- (86) International ansøgning nr.: **CZ2017000063**
- (87) Internationalt publikationsnr.: **WO2018072765**
- (30) Prioritet: **2016-10-20 CZ 20160660**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
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- (54) Benævnelse: **ET HOSPITALSSTØTTEMIDDEL TIL PATIENTER**
- (56) Fremdragne publikationer:  
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# DESCRIPTION

## Technical field

[0001] The invention concerns hospital devices for patient support used in hospitals and care facilities and in systems for controlling their electrical peripherals, storing configuration data and vital function histories, and other similar functions.

## Background art

[0002] In the current state of the art, hospital devices such as hospital beds are equipped with a plurality of various peripherals and with a control unit containing firmware and data. In the event of damage to the control unit, the stored data and firmware is thus lost. This is undesirable due to the increased complexity of replacing a damaged control unit.

[0003] In the event that some of the existing peripherals are replaced or peripherals are added/removed, it is necessary to update the firmware in order to maintain faultless function. This firmware update may take place, for example, remotely as described in patent US7852208, whereby the hospital bed is wirelessly connected to the hospital network and the firmware can be uploaded to the hospital bed automatically from a remote computer. In a message from the bed, the remote computer receives data that also contains the version number of the current firmware, and if the firmware is obsolete, the remote computer uploads a new version of the firmware to the hospital bed. This connection method also allows the transmission of up-to-date information about the bed, such as information about its connection to the mains and information about the necessity to service or tilt parts of the bed, even when the hospital bed is being relocated. The disadvantage of this connection is the need to use a hospital network, which may not exist (especially in older hospitals). In the event of a non-existing hospital network, it is necessary to update the firmware through a direct connection to the control unit, which again increases the difficulty of updating the firmware, because a service technician is forced to use a computer with specialized software.

[0004] A hospital device where the behaviour is influenced by an electronic hardware key is disclosed in EP2 586 413 A2.

## Summary of the invention

[0005] The aforementioned shortcomings are eliminated by the hospital device for patient support containing the central control unit and the peripherals. The advantage is in that the electronic hardware key that has a data connection to the central control unit is a connectable component of the hospital device for patient support. The advantage is used to simplify the

installation of the hospital device or to update the data stored on the electronic hardware key when replacing or adding a new peripheral.

**[0006]** Preferably, it is used such that the electronic hardware key contains data comprising any of the following data types: configuration data for performing required peripheral operations, configuration data for the communication of the patient's communication interface with the hospital device for patient support, other configuration data that affects the behaviour and manifestations of the hospital device for patient support during its use, and data relating to the use of the hospital device for patient support and other similar information.

**[0007]** Other configuration data that has an influence on the behaviour and manifestations of the hospital device for patient support during its use is thought to be, for example, the particular constants of the end positions of the motors or the specific constants of the various sensors.

**[0008]** Preferably, the data is encrypted. The advantage is used to improve safety by preventing the use of unauthorized electronic hardware keys.

**[0009]** Advantageously, the electronic hardware key can be designed as a device containing non-volatile random access memory (NVRAM), i.e. static read only memory (ROM), programmable read only memory (PROM), semi-permanent erasable programmable read-only memory (EPROM), semi-permanent electrically erasable programmable read-only memory (EEPROM), ferroelectric random access memory (FRAM), resistive random access memory (RRAM), nano random access memory (NRAM) or any other appropriate data repository.

**[0010]** Advantageously, the hospital device for patient support includes also a port for connecting an electronic hardware key.

**[0011]** Advantageously, the port may be a module for physically connecting an electronic hardware key (e.g. a USB connector or SD card slot or a DIN / miniDIN connector or any other suitable connector or slot), or a module for wireless communication with the electronic hardware key (e.g. for Bluetooth transfer or near-field-communications or any other suitable form of wireless transfer). The communication protocol between the hospital device for patient support and the electronic hardware key can be standardized (USB, RS485, CAN, etc.) or proprietary.

**[0012]** Advantageously, the peripherals are sensors, drives, connectable accessories, compressors or control units.

### **Embodiment of the invention**

**[0013]** An exemplary embodiment of the invention is a hospital device for patient support such as a hospital bed, a transport bed, or a chair such as a birthing chair or a transport chair. The

hospital device for patient support includes, for example, a lying area, peripherals, a chassis and a central control unit. The peripherals include, for example, a brake sensor or electric brake control, castors, electric control of directional locking or castor rotation, a linear drive for positioning the parts of the lying area, a column drive for lifting or tilting the lying area, display devices, patient life sensors, a sheet-winder, a controller for the driven wheel, various foot controls, a chassis backlight, a massage device, entertainment equipment, physiotherapy equipment, a bed locking module, an automatic castor braking system, a Nurse Call connector, a weight module, controls in the side rails, a side rail limit switch, an RTG limit switch, motors, a patient mobilization system, other features for sensing the position and condition of the patient, a mattress equipped with communication electronics, an active anti-decubitus mattress compressor, a communication module for connecting the hospital device for patient support to a hospital network, a device for peripheral diagnostics and data-intensive peripherals, wherein the communication module may be equipped, inter alia, with a wireless communication device using the IEEE 802.11 standard of the Institute of Electrotechnical and Electronic Engineering, may provide video transmission within the communication network of the hospital device for patient support and other similar peripherals. The peripherals are electrically connected to the central control unit in order to ensure their controllability.

**[0014]** An electronic hardware key is connectable to the hospital device for patient support. The electronic hardware key is in the form of non-volatile random access memory, i.e. ROM, PROM, EPROM, EEPROM, FRAM, RRAM, NRAM or any other suitable data repository. Data is stored on the electronic hardware key. Such data may include, for example, various kinds of configuration data for performing required peripheral operations, configuration data for the communication interface for the patient's interaction with the hospital device for patient support, specific constants for the end positions of the motors, or specific constants for the various sensors. The communication interface for the patient's interaction with the hospital device for patient support may be, for example, a driver of the driven castor or various other types of hand-held controllers, foot controls, a touchscreen, or remote access devices such as tablets, mobile phones, computers, or specialized devices. A required peripheral operation may be, for example, the positioning of the lying area parts, measuring the weight of the patient, moving the hospital device over a surface in a certain direction, changing the height of the lying area, lateral therapy, positioning the lying area to the CPR position, positioning the lying area to the Trendelenburg position, positioning the lying area to the reverse Trendelenburg position, an indication of the elevation of the side rails, an indication that the patient has left the hospital device for patient support, or an indication that the patient intends to leave the hospital device for patient support, switching on the chassis lighting, calling the service staff, measuring the patient's life functions, transmitting the measured data to a remote repository, the transfer of status information about the hospital device for patient support to a remote repository or displaying such data on a display device, the positioning of the side rails, changing the pressure in the mattress, controlling the movement of the massage devices, controlling the device for physiotherapy, controlling the entertainment devices, controlling the electrical devices in the room where the hospital device for patient support is located, winding the sheet and other similar operations. The data stored on the electronic hardware key can be encrypted. The electronic hardware key is programmed, for example, with a specialized

programming device or with a computer that is equipped with specialized software. The hospital bed for patient support also includes a port. The port may be located on the central control unit or outside the central control unit, for example, on the bed frame or on the side rails with a data connection to the central control unit. The port allows communication between the control unit and the electronic hardware key. The port may be a module for physical connection, such as a USB or SD card slot, or a DIN / miniDIN connector, or any other suitable connector or slot, or a module for wireless communication, such as a Bluetooth or nearfieldcommunications (NFC) or any other suitable form of data transfer.

**[0015]** In another exemplary embodiment, only the password for access to a remote repository can be stored on the electronic hardware key. The data is then stored in the remote repository. The connection of the electronic hardware key to the remote repository is either wireless or wired.

**[0016]** Each peripheral has a unique serial number, wherein data can be adapted for work with a peripheral with a specific serial number, which is advantageous for the purpose of avoiding the use of unauthorized peripherals. When replacing a peripheral, for example, due to its failure or when adding/removing peripherals, it is therefore necessary to update the data. It is also necessary to update the data when calibrating the peripheral. When changing the data, it is necessary that the changes be authorized by an authorized person through the communication interface of the bed upon the connection of the electronic hardware key to the port.

**[0017]** When the electronic hardware key is being connected, the electronic hardware key is connected to the port when the hospital device for patient support is switched off. Another option is to connect the electronic hardware key when the hospital device for patient support is switched on, when the control unit continuously tests whether the electronic hardware key is connected. If the electronic hardware key is not connected or damaged while the hospital device for patient support is switched on, the configuration will not be loaded and the hospital device for patient support will work with limitations in emergency mode. The central control unit tests the connection of the electronic hardware key or allows the use of CPR (the cardiopulmonary resuscitation position) or allows for a message on the missing hardware key or a combination thereof to be sent when the device is running in the emergency mode. The message on the missing hardware key is sent via a signalling diode, for example, or remotely via the hospital network or the GSM module, for example. When the electronic hardware key is connected and a valid configuration is loaded into the control unit, the hospital device for patient support is switched on into its fully functional mode where the functionality of the individual elements depends on the configuration. If the configuration is not valid, for example, due to it being damaged by the loss of part of the data on the electronic hardware key, the hospital device for patient support remains in the emergency mode. In the fully functional mode, the electronic hardware key can be used to store, for example, the history of the patient's vital functions, the weight of the patient, etc. In the fully functional mode, the electronic hardware key can also be used as an event register wherein, for example, the failure of some peripheral may be an event that is registered.

**[0018]** During the standard disconnection of the electronic hardware key, it is preferable to switch off the hospital device for patient support. After the hospital device for patient support has been switched off, the electronic hardware key may be disconnected without the risk of data loss.

**[0019]** A non-standard disconnection of the electronic hardware key with the hospital device for patient support turned on, for example, due to a malfunction of the electronic hardware key or an unexpected disconnection of the electronic hardware key may result in a failure of the stored data or the event register. After a non-standard disconnection of the electronic hardware key, the hospital device for patient support may, for example, switch to the emergency mode or remain in the fully functional mode until the hospital device for patient support is switched off or reset, but without the possibility of storing data or the event register on the electronic hardware key.

## **REFERENCES CITED IN THE DESCRIPTION**

### Cited references

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### **Patent documents cited in the description**

- [US7852208B \[0003\]](#)
- [EP2586413A2 \[0004\]](#)

PATENTKRAV

1. Et hospitalsstøttemiddel til patienter omfattende en central styreenhed, en perifer og en aftagelig hardwarenøgle med data, som er forbundet til den centrale styreenhed, **kendetegnet ved, at** den elektroniske hardwarenøgle omfatter data af en hvilken som helst af følgende datatyper: konfigurationsdata til at udføre en ønsket periferdrift, konfigurationsdata til kommunikationsgrænsefladen mellem patienten og hospitalsstøttemiddelet til patienter, konfigurationsdata for specifikke motorslutpositionskonstanter for hospitalsstøttemiddelet til patienter og for specifikke sensorkonstanter af hospitalsstøttemiddelet til patienter ved brug og data vedrørende brugen af hospitalsstøttemiddelet til patienter, hvor i tilfælde af tilslutningen af en elektronisk hardwarenøgle til hospitalsstøttemiddelet til patienter, er dette hospitalsstøttemiddel til patienter i en fuldt funktionsdygtig tilstand bestemt af de data, der er lagret i den elektroniske hardwarenøgle, hvorimod uden tilslutningen af den elektroniske hardwarenøgle er hospitalsstøttemiddelet til patienter i nødstilstand, hvor den centrale styreenhed af hospitalsstøttemiddelet til patienter kun kan betjenes til at teste forbindelsen til den elektroniske hardwarenøgle og/eller til at tillade en meddelelse i den manglende elektroniske hardwarenøgle og/eller for at tillade brugen af hjerte-lunge-redningsstilling af hospitalsstøttemiddelet til patienter.
2. Hospitalsstøttemiddelet til patienter ifølge krav 1, **kendetegnet ved, at** data er krypteret.
3. Hospitalsstøttemiddelet til patienter ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** den elektroniske hardwarenøgle er udført som en indretning, der omfatter en ROM-hukommelse.
4. Hospitalsstøttemiddelet til patienter ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** hospitalsstøttemiddelet til patienter yderligere omfatter en port til tilslutning af en elektronisk hardwarenøgle.
5. Hospitalsstøttemiddelet til patienter ifølge krav 4 **kendetegnet ved, at** porten er et modul til fysisk at forbinde en elektronisk hardwarenøgle.

6. Hospitalsstøttemiddelet til patienter ifølge krav 4 **kendetegnet ved, at** porten er et modul til trådløs kommunikation med en elektronisk hardwarenøgle.
  
- 5 7. Hospitalsstøttemiddelet til patienter ifølge hvilket som helst af de foregående krav, **kendetegnet ved, at** periferier er sensorer, drev, tilslutningsbart tilbehør, kompressorer, hjælpestyreenheder, displayenheder, audioenheder, kommunikationsenheder forbundet til hospitalsstøttemiddelet til patienter eller andre enheder til interaktion med hospitalsstøttemiddelet til patienter.
  
- 10 8. Hospitalsstøttemiddelet til patienter ifølge hvilket som helst af de foregående krav, **kendetegnet ved, at** hospitalsstøttemiddelet til patienter er en hospitalsseng eller en transportseng.