(19) DANMARK

(10) DK/EP 2424483 T3

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: *A 61 G 7/018 (2006.01)*

(45) Oversættelsen bekendtgjort den: **2018-07-09**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2018-04-18**

(86) Europæisk ansøgning nr.: **10721942.0**

(86) Europæisk indleveringsdag: **2010-05-03**

(87) Den europæiske ansøgnings publiceringsdag: **2012-03-07**

(86) International ansøgning nr.: **DK2010000060**

(87) Internationalt publikationsnr.: **WO2010124691**

(30) Prioritet: **2009-05-01 DK 200900568**

(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 SE SI SK SM TR**

(73) Patenthaver: **Linak A/S, Smedevænget 8 , Guderup, 6430 Nordborg, Danmark**

(72) Opfinder: **BRØNDUM, Peter, Poppelhegnet 33, 6400 Sønderborg, Danmark**

(54) Benævnelse: **BED**

(56) Fremdragne publikationer:
EP-A1- 2 027 844
WO-A2-01/85085
US-A1- 2007 169 268

[0001] The invention relates to a bed of the type defined in the preamble of claim 1.

[0002] Hospital beds and care beds are typically height adjustable, likewise the support frame is adjustable to a given shape with its backrest and legrest raised. An example of such a bed is known from e.g. WO 00/33785 Huntleigh Technology plc., on which the sub frame comprises a scissor mechanism. Also height adjustable beds based on columns with telescopic members are known. A column for a height adjustable bed is known from e.g. WO 09/33486 Linak A/S.

[0003] The purpose of adjusting the shape of the support frame is to create better comfort for the patient, or to support a part of the body. The height adjustment is carried out to create a better working position for the nursing staff in relation to the working area of the patient. When carrying out the work the bed is adjusted with the support frame raised. Having finished the working task, the height of the bed should be adjusted to a level at which the patient can leave the bed himself. Unfortunately, it happens that the nursing staff forgets to readjust the bed to the low level which increases the risk that the patient falls when he leaves the bed. The damages in connection with the fall are often extensive and result in worsening of the general condition of the patient. The same kind of problems arise when the patient, by faulty operation of the adjusting mechanisms of the bed, adjusts the height of the bed. WO 01/85085 A2 to Hill Rom discloses an overall hospital communication network, which among others can be used in connection with wireless operation of the hospital beds using a remote control. Since the remote control can be used to operate any hospital bed, there is a great risk that the caregiver carrying the remote control unintentionally operates the wrong bed.

[0004] The purpose of the invention is to provide a solution securing an adjustable bed, which in connection with the nursing of the patient has been height adjusted, is readjusted to a height position, making it safe for the patient to leave the bed. At the same time a solution is required which prevents the patient from operating the parts of the adjusting mechanism which can be dangerous for the patient.

[0005] According to the invention this can be achieved by a bed as stated in claim 1. By furnishing the control of the bed with means to register the proximity of an authorized person, it is possible to prevent the bed from being wrongly height adjusted, and the support frame hereby is raised to a level that high that the patient can be damaged when leaving the bed. The control will therefore only allow height adjustment of the support frame when

a person authorized to adjust the height of the bed, e.g. a nursing person is close to the bed.

[0006] In that the control is furnished with means to determine whether the support frame is raised to a level relative to a safe height for leaving the bed, and means to release an indication when it is determined that the support frame is adjusted to a height above said certain level, and it is further registered that the authorized person is moving outside the proximity zone, the control can determine whether it is a question of a potential dangerous situation with the support frame of the bed raised, and the nursing staff being absent.

[0007] The presence of a nursing person can be registered by furnishing the control with a receiver, for receiving a signal from a mobile unit carried by the nursing staff.

[0008] When a signal is received, the control determines whether it is a signal sent from an approved mobile unit after which the control interconnects the receiver and the sender as an interacting electronically locking mechanism allowing control of the bed for height adjustment of the bed.

[0009] Furthermore, the control is furnished with means to determine whether the nursing person again is moving away from the bed in that the connection between the two units functioning as interacting electronically locking mechanisms is broken. If then the support frame of the bed is raised and the responsible nursing person is outside normal working range in which the connection between the two units is maintained, the control is adapted to indicate that a potential risk of the patient falling out of bed is present.

[0010] The indication can be presented in the form of an acoustic or a visual signal given from a signal system in the bed. In another embodiment the signal system is placed in a position where the nursing staff can see it clearly. In an embodiment the signal is forwarded to a central watch system from which a signal can be sent to a mobile receiver carried by the nursing staff, in order to give assistance in order to prevent the problem.

[0011] The mobile unit carried by the nursing staff is particularly suitable in that it is both a sender and a receiver. The other part of the interacting electronically locking mechanism, arranged in connection with the control, is also both a sender and a receiver, a connection between the control and the mobile unit can therefore be sent from the control unit directly to the mobile unit and can be received by the mobile unit. First and foremost is thought of

that an indication of the bed being height adjusted to a potential dangerous height level can reach the nursing person when he is outside the range in which the connection between the two units is maintained. That the connection is broken indicates that the strength of the signal for communication between the two units has reached a certain low level. The threshold of the signal level of the connection between the two units does not necessarily mean that the communication between the two units is disconnected, but only serves to describe the spreading of the proximity zone.

[0012] A mobile unit suitable to be carried by a nursing person could be a mobile phone where the messenger (sms) function is used to send an indication of the dangerous situation from the unit attached to the control. The connection between the unit of the bed and the mobile unit is performed via Bluetooth whereby the two units either actively or automatically are interconnected when they are within a carefully metered range of each other. When the distance between the receiver in the control and the mobile unit is increased, the connection between the units is broken when a nursing person is moving outside their range. When the support frame of the bed is adjusted to a height which could lead to a potential dangerous situation for the user, the information is connected with the information about the absence of the nursing person, and is indicated as a potential risk. When the control is furnished with a list connecting the unique Bluetooth identification of the mobile unit with the phone number of the mobile unit, it is possible in a simple way to send an indication of the dangerous situation to the receiver in the form of a message (sms).

[0013] In an embodiment the mobile unit is adapted such that it indicates by itself when a connection is broken. In this way the nursing person is urged to consider whether the bed has been adjusted back to the low level. This function could very well be combined with a parallel function of the bed, whereby a message (sms) is sent to warn the nursing person about the bed being left in a height adjustment being potential dangerous. When the mobile unit has means to receive status messages from the bed via Bluetooth, the mobile unit can use the latest status from the bed before the connection between the two units is broken to determine whether the bed is adjusted to a height which is potential dangerous for the patient. In this case an indication can be given.

[0014] Besides, the connection between the two interacting electronically locking mechanisms is performed in a similar manner as between a mobile phone and a wireless headset or a carkit. When the phone is inside the working range of the equipment in question, a connection is established.

Similarly the connection between for example a RFID and a receiver adapted for the purpose could be established. ZigBee can also be used for the purpose.

[0015] Other electromechanically resonance circuits can also be used to establish an electronic connection between interacting electronically locking mechanisms. The connection could also be established with units functioning via ultrasound, infrared light or the like. It will be appreciated that the invention comprises the basic principle that a proximity between two units will be picked up, and will establish a connection which again when the connection is broken will effect a safety operation, checking whether the bed is adjusted to a height or in a way which do not imply potential danger for the safety of the patient.

[0016] One embodiment of the invention will in the following be explained more detailed referring to the accompanying drawing showing:

Fig. 1, a hospital bed as shown schematically,

Fig. 2, a sketch showing a proximity zone between a bed and a nursing person,

Fig. 3, a flow diagram for executing a safety test, and

Fig. 4, communication to a nursing person about a potential danger for the safety of the patient.

[0017] The hospital bed shown in the drawing comprises a height adjustable sub frame 1, furnished with drive wheels. The height adjustment is carried out with a scissor mechanism 2 upon which a support frame 3 for a mattress is mounted. The support frame is furnished with a height adjustable backrest 4, and legrest 5. Adjustments are made with linear actuators, mounted in a fixed middle section 6, in which a power supply and a control 7 also is mounted. In connection with the control a unit for wireless communication is arranged, comprising a wireless communication with short range (SR) and a parallel wireless communication with long range (LR). The bed can be adjusted by a hand operator and/or fixed operating panels as known.

[0018] Furthermore, the control is furnished with means to determine to which height the support frame is adjusted. This height is proportional with the displacement of the movable activating element of the actuator. The activating element is fastened to the spindle nut. The spindle nut is moving lengthwise direction of the spindle when the spindle nut is locked against

rotation, and the spindle at the same time is rotated in one or the other direction. The position of the spindle nut on its migration on the spindle can be determined with an absolute position determination system, e.g. a potentiometer. An incremental position determination system, counting the number of revolutions of the spindle and from the pitch of the spindle can generate the displacement of the spindle nut on the spindle, can also be used. An example of that is given in WO 07/131509 Linak A/S which is hereby by reference made a part of the application.

[0019] The control is hereby furnished with the necessary input for determining the height adjustment of the support frame. When the height exceeds a fixed threshold value, as defined in the control for being a safe height for leaving the bed, the control enters into a mode in which it is testing whether a nursing person is near.

[0020] As shown in Fig. 2 the control comprises a unit having means to communicate with a mobile unit carried by the nursing person. The communication unit is created to proceed via Bluetooth (SR) and GSM (LR). Thus the communication unit in the control and the mobile unit are as a first priority adapted to connect the two units (SR) when these are within a proximity zone of each other. The proximity zone in question has a very short working range which means that the connection again is broken when the nursing person is moving outside a certain range from the bed. When the connection between the two units is established, exclusive control units, reserved the nursing staff, but none the less put on the operating panel, are unlocked for use and can be operated by the nursing staff. When the mobile unit is moving outside the proximity zone, it becomes impossible to adjust the bed. At the same time it is tested whether the support frame is raised to a potential dangerous height for leaving the bed. Is this the case an indication about the dangerous situation is sent to the nursing staff as a sms via the GSM-net. Of course other mobile communication systems, e.g. UMTS can also be used for this purpose, to send an indication about the dangerous situation to a nursing person, therefore it will be appreciated whether the function to send an indication about the dangerous situation, as such, irrespective of the communication means, is comprised by the application

[0021] Fig. 3 is showing a flow diagram which in the control is converted to program code for execution of the application in a microprocessor. As it appears an indication is released when the support frame of the bed is adjusted to a height being potential dangerous when the patient is leaving the bed, and the nursing person is absent. Fig. 4 is showing the two units with SR and LR communication means build in. The function is as described to send a message (sms) when the bed is height adjusted, and the proximity

zone between the two units is broken to indicate that a dangerous situation has occurred.

[0022] According to the invention there is thus provided a bed with a high degree of safety against a person falling out of a height adjustable bed. An indication whether a nursing person is present together with a measurement indicating whether the support frame of the bed is in a potential dangerous height position, and an indication in the form of a message (sms) secures that the nursing person will observe the danger, and can prevent the situation. At the same time the invention secures that the height adjustment of the support frame of the bed can only be activated when a nursing person is present. Hereby is avoided that the patient by faulty operation of the operating panel causes a situation whereby the bed is potential dangerous to leave.

[0023] In spite of the fact that the focus here is on height adjustment of the bed, and the dangers which can occur in this connection, the invention also comprises other scenarios in connection with an adjustable bed of which an exclusive operation possibility for a present nursing person, in relation to the functions being at the disposal for the patient, is required.

[0024] Signing off the alarm situation happens automatically when the nursing person's mobile communication unit again is connected to the communication unit which is connected to the control. When the alarm is not signed off within a fixed period of time yet another message (sms) can be sent from the communication unit which is connected with the control. An additional safety measurement is created in that a message (sms) can be sent to an alternative receiver if the dangerous situation is not relieved within a fixed period of time. Hereby another possibility of relieving the dangerous situation is achieved, and hereby improved safety for the patient.

Patentkrav:

1. En seng omfattende:

en højdejusterbar bæreramme (3) for en madras og monteret på et understel (1,2),

et antal aktuatorer til at udvirke indstillingen af bærerammen (3),

en styring (7) for aktuatorerne, og

en betjening til manøvrering af aktuatorerne via styringen (7),

hvor styringen (7) er forsynet med midler til at registrere, om en person, der er autoriseret til at udføre en højdejustering af sengen, er inden for eller uden for en nærhedszone af sengen, hvilke midler til registreringen omfatter en enhed der har midler til at kommunikere med en mobil enhed, båret af den autoriserede person, hvorved styringen (7), der er forsynet med midler til at afgøre til hvilken højde bærerammen er justeret, og midler til at udløse en indikation

k e n d e t e g n e t ved, at styringen afgør om bærerammen er højdejusteret over et bestemt niveau, der er angivet som en sikker højde for udstigning af sengen, og såfremt dette er tilfældet udløser styringen en indikation, når forbindelsen mellem de to enheder, der fungerer som en samvirkende elektronisk låsemekaniske, er afbrudt.

2. En seng ifølge krav 1, k e n d e t e g n e t ved, at midlerne til at registrere, om en person, der er autoriseret til at udføre en højdejustering af sengen, befinder sig inden for eller uden for en nærhedszone af sengen, omfatter en modtager, til at modtage et signal fra en sender, i form at en mobil enhed, båret af en person autoriseret til at udføre en højdejustering af sengen.

3. En seng ifølge krav 2, k e n d e t e g n e t ved, at styringen (7) forbinder modtageren og senderen som en samvirkende elektronisk låsemekaniske, der åbner op for højdejusteringen af sengen, når både modtager og sender befinder sig i en fælles nærhedszone.

4. En seng ifølge krav 2 eller 3, k e n d e t e g n e t ved, at modtageren er en modtager til trådløs kommunikation med kort rækkevidde.

5. En seng ifølge krav 4, k e n d e t e g n e t ved, at styringen (7) yderligere omfatter en enhed til trådløs kommunikation med lang rækkevidde.

6. En seng ifølge krav 5, k e n d e t e g n e t ved, at de indikationer der udsendes af styringen (7) kan være akustiske, optiske eller elektroniske, og hvor en elektronisk indikation, fortrinsvis i form af en besked (sms), afsendes via den trådløse kommunikation med lang rækkevidde.

7. En seng ifølge krav 3, k e n d e t e g n e t ved, at forbindelsen mellem de to enheder, som er en mobil enhed og en enhed anbragt i forbindelse med styringen, foregår via Bluetooth og kommunikationen via GSM, fortrinsvist som tekstbeskeder.

8. En seng ifølge krav 2, k e n d e t e g n e t ved, at den mobile enhed, der bæres af den autoriserede person , er indrettet til i sig selv at hente data fra styringen (7) via Bluetooth om status på sengens højdejustering, og når forbindelsen mellem enhederne, der angiver nærhedszonen, brydes, kontrollerer tilstanden af sengen og efterfølgende, hvis det er tilfældet, advarer den autoriserererede person om at sengen er højdejusteret til en farlig højde for udstigning af sengen.

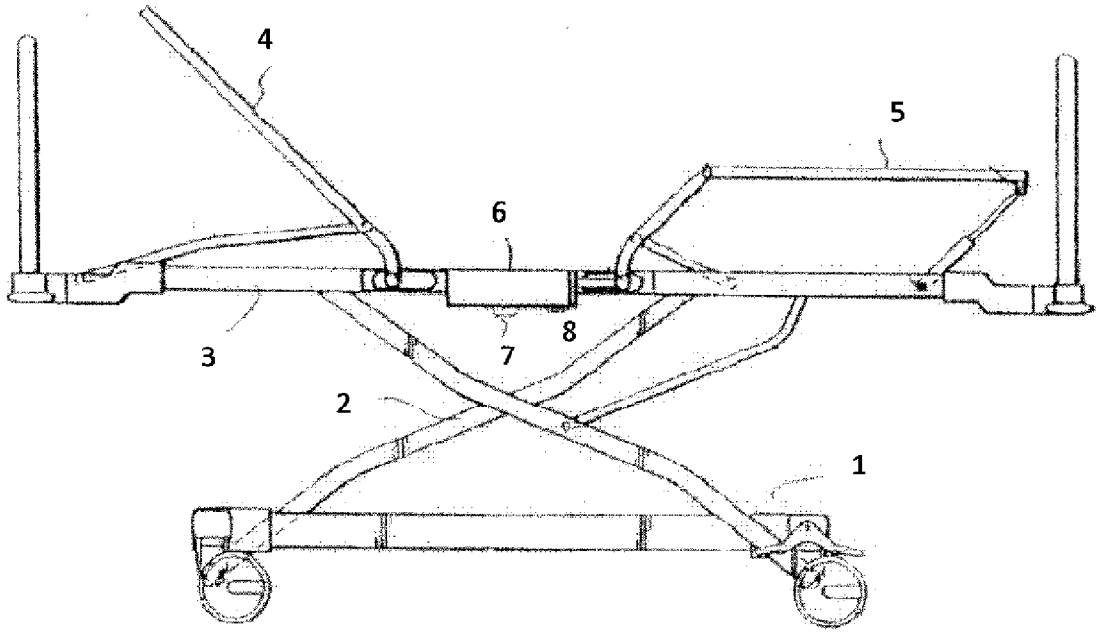

Fig. 1

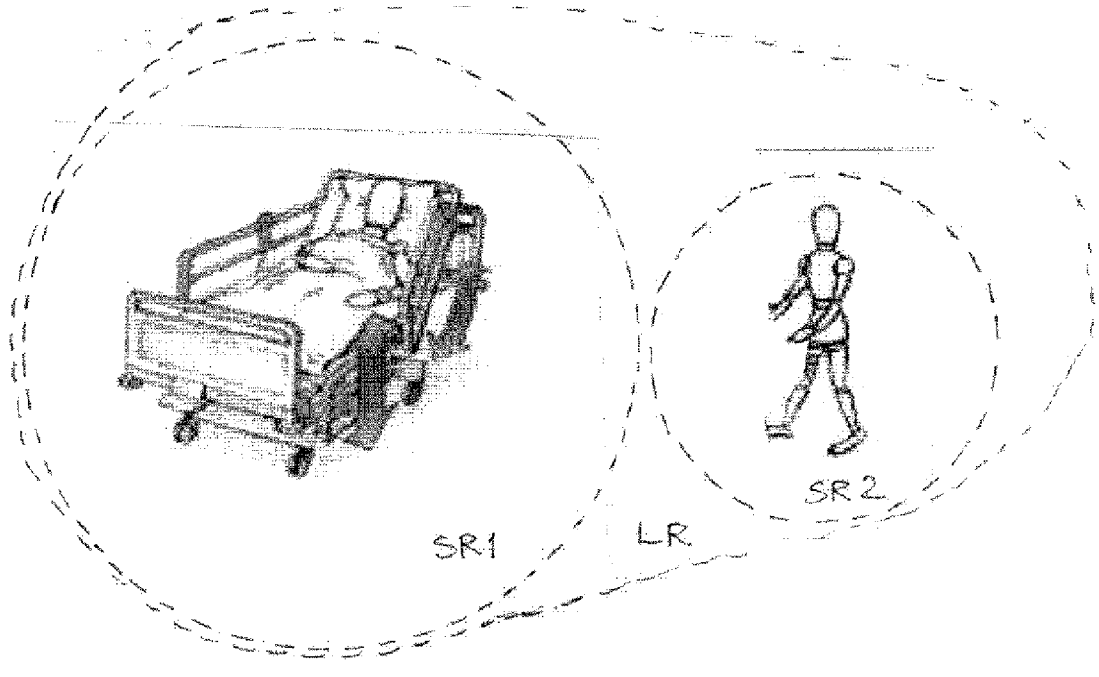

Fig. 2

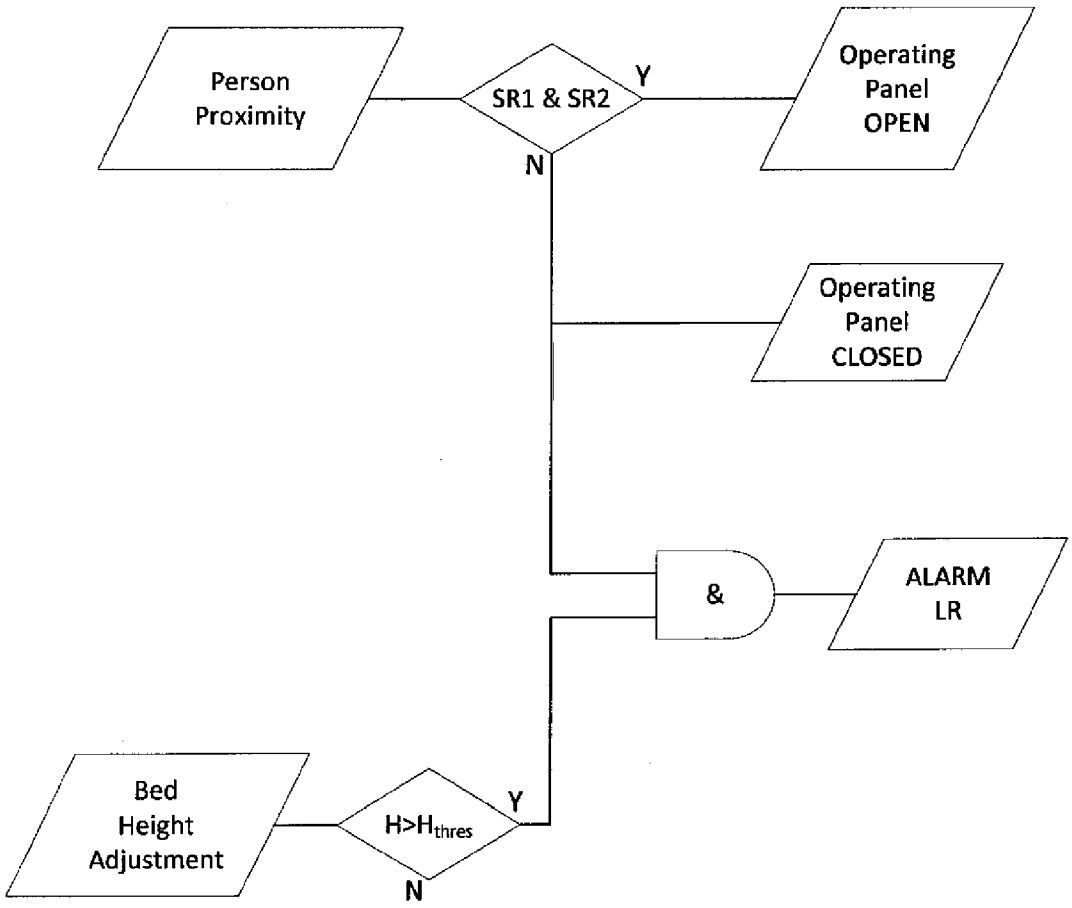
Person Proximity
SR1 & SR2
Y
N
Operating Panel OPEN
Operating Panel CLOSED
&
ALARM LR
Bed Height Adjustment
H>H thres
Y
N

Fig. 3

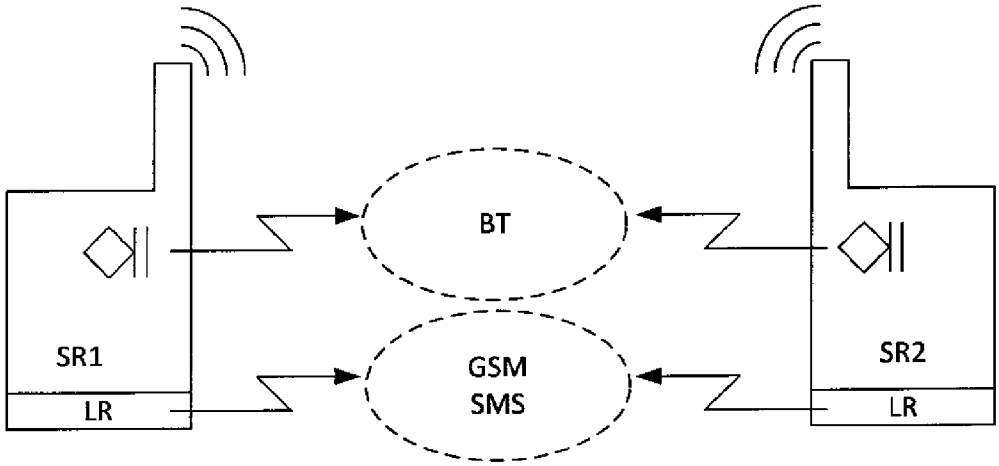
BT
GSM SMS
SR1
LR
SR2
LR

Fig. 4