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(54) Title: CASTOR CONTROL SYSTEM

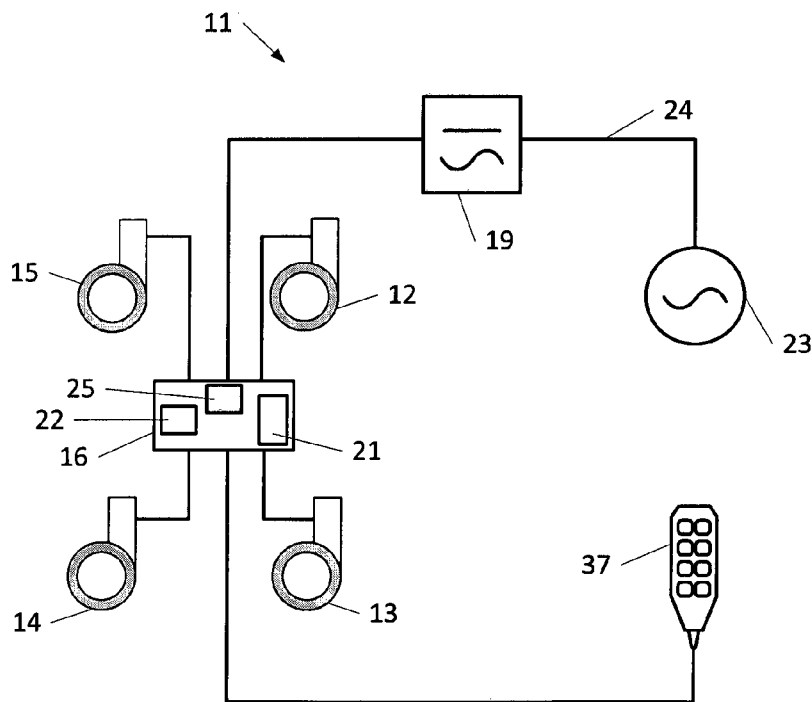


Fig. 4

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TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG). **Published:**

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(57) Abstract: A castor control system for controlling at least two castors in a castor control system is provided. The castors comprise an electric motor which can be used to set the castor in three different positions: directional lock, neutral or braked. The castors can be operated individually from an operating panel of the castor control system. The system can also set all castors in the braked position if a motion sensor of the castor control system detects motion and the castor control system is connected to mains voltage.

Castor control system

The present invention relates to a castor control system and methods for operating such a system.

5

Castors usually comprise a fork from which a mounting pin projects vertically. In the fork a running wheel is mounted via a horizontal axle. The fork can swivel about the vertical axis of the mounting pin and the running
10 wheel can rotate about the horizontal axis of its mounting axle. Mounted on hospital and care furniture, the castors are normally equipped with means for locking the swivel and means for braking the wheel. These means can be applied either alone or in combination. Such a
15 castor is described in GB 2 457 787 to Oy Mannerin Konepaja AB.

In many hospital beds the brake and locking means of the castors are mechanically interconnected such that they
20 can be operated via a pedal, for example pairwise and/or all of them. Such a bed is disclosed in EP 618 088 A2 to Hill-Rom. A further development of this principle is described in EP 1 945 166 A2 to LINET SPOL S.R.O. Here, the hospital bed comprises an actuation device which is
25 connected to the mechanical interconnections of the castors, which can thus be operated by the actuation device. If a motion sensor on hospital bed has not detected movement for a specified period of time, a central processor unit will automatically apply the
30 brakes of the castor wheels by means of the actuation device. The braking and/or locking of the hospital bed is easier with the use of the common actuation device. However, adding the common actuation device to the mechanically interconnected castors merely increases the

total weight of the undercarriage, which makes it very heavy to move around and to maneuver.

This drawback is overcome in WO 2008/148169 A1 to
5 Fallshaw Holdings PTY LTD which discloses a castor having a manual brake activator (pedal) which can be set in three different positions to put the castor in a directional lock, neutral or braked position. The castor can be equipped with an electronic brake activator
10 connected to the manual brake activator of the castor. The three positions can thereby be reached by activating the manual brake activator via the electric brake activator. Hence, the castor can be operated both manually and automatically. This type of castor is
15 however cost-intensive and thus less attractive in many contexts.

GB 2 457 787 to Oy Mannerin Konepaja AB describes a
20 castor with a swivel lock and a wheel brake having a common activation shaft. In a first position the common activation shaft locks the swivel. In a second position the activation shaft locks the swivel and activates the wheel brake. Each castor includes a pedal for manual operation. In another embodiment the pedal is replaced
25 with a motor actuator, such as an electric motor mounted thereon. Manual operation of the pedal or actuation of the motor will cause the common activation shaft to move between the positions mentioned.

30 The objective of the invention is to provide a simplified castor control system with an increased reliability, usability and safety.

According to the invention this is solved by providing a
35 castor control system comprising an electric brake

controller, a power supply, an operating panel, a motion sensor and at least two castors, where the at least two castors comprise a mounting pin with a vertical rotational axis about which the castor can swivel, at least one wheel rotatable about a horizontal axis and an electric motor cooperating to set the castor in:

5 a directional lock position where the castor cannot swivel about the vertical axis of the mounting pin and the wheel can rotate freely about the horizontal axis, or

10 a brake position where the wheel cannot rotate about the horizontal axis and where the castor cannot swivel about the vertical axis of the mounting pin, or

a neutral position where the castor can swivel freely about the vertical axis of the mounting pin and the wheel

15 can rotate freely about the horizontal axis,

and where the electric motor of each castor is connected to the electric brake controller which can operate each castor individually.

20 The castor control system thus provides control of the castors either individually, in pairs or as a plurality.

In a further development the electric brake controller of the castor control system comprises a printed circuit

25 board which comprises the motion sensor. The motion sensor can be an accelerometer. Further the electric brake controller of the castor control system comprises a microprocessor.

30 In another development the electric brake controller of the castor control system comprises a voltage source detector to determine whether or not the castor control system is connected to mains voltage.

The present invention also provides a method for operating a castor control system where the electric brake controller, via the electric motor of each castor, can set each castor in the brake position if the motion sensor detects motion and the voltage source detector detects that the castor control system is connected to mains voltage, or the motion sensor has not detected movement for a specified period of time. In the case that the castor control system is installed in an article of hospital or care furniture the mains power supply is normally provided via a cable with a plug connected to a wall socket. The castor control system will here prohibit that this cable is ripped out of the wall thus avoiding damages to equipment and personal injury. In addition hidden damages to the cable, such as cutting off conducting wires or short circuiting of the conducting wires, caused by tearing out the cable of the wall are also avoided. If the castor control system is installed in an article of hospital or care furniture and the castors are set in the brake position due to non-movement, this can prohibit fall accidents because a patient will be able to use the hospital bed or care furniture as anchor for example when (s)he is leaving a hospital bed.

25

In a further development the present invention provides a hospital bed or an article of care furniture comprising a castor control system mentioned above operating according to the method also mentioned above.

30

The present invention also relates to a patient lift comprising a castor control system as described above.

Further characteristics of the present invention are described in the following, where:

35

Fig. 1 illustrates a castor,

fig. 2 illustrates the three positions, in which the
5 brake activator of the castor in figure 1 can be set,

fig. 3 schematically illustrates a castor control system
comprising four castors of the type illustrated in figure
1,

10

fig. 4 schematically illustrates a castor control system
comprising four castors of the type illustrated in figure
1, where the system further comprises a main voltage
detector,

15

fig. 5 illustrates a linear actuator system incorporating
a castor control system of the type illustrated in figs.
3 and 4,

20 fig. 6 illustrates a hospital or care bed incorporating
the linear actuator system illustrated in fig. 5, and

fig. 7 illustrates a patient lift incorporating the
linear actuator system illustrated in fig. 5.

25

Fig. 1 illustrates a castor 1 with a mounting pin 2
having a vertical rotational axis 3 about which the
castor 1 can swivel. The castor 1 comprises a set of
wheels 4,5 which can rotate about a horizontal axis 6. An
30 electric motor is arranged inside the mounting pin 2. By
operating the electric motor the castor can be set in
three different positions. As illustrated in fig. 2 in
position 7 (directional lock) the castor 1 is locked in a
given direction 8. This means that the wheel 4,5 can
35 rotate freely, however the mounting pin 2 is locked in a

preferred direction. This allows the castor 1 to travel along a surface in the direction 8. If the electric motor is set in position 9 (Braked), the castor 1 will be fully locked or braked. This means that the castor 1 cannot swivel about the vertical axis 3 of the mounting pin 2 and the wheels 4,5 cannot rotate about the horizontal axis 6. Hence, the castor 1 is completely immovable. Setting the electric motor in position 13 (neutral) will allow the castor 1 to swivel freely about the vertical axis 3 of the mounting pin 2 and the wheels 4,5 to rotate freely about the horizontal rotation axis 6.

Fig. 3 schematically illustrates a castor control system 11 comprising four castors 12,13,14,15 of the castor 1 type with the electric motor described above. The castor control system 11 could purposefully be utilized when mounted in an article of hospital or care furniture (see fig. 6) or a patient lift (see fig. 7). Each of the castors 12,13,14,15 is connected to the electric brake controller 16 via the connector cable 17 having a plug 18. The electric brake controller 16 houses a printed circuit board to which the the power supply 19 and the operating panel 20 is connected. The printed circuit board comprises a controller 21 such as a microprocessor and a motion sensor 22.

All four castors 12,13,14,15 can be set in any of the positions 7,9,10 by operating the operating panel 20.

When the castor control system 11 is mounted in an article of hospital or care furniture it is convenient if one or a pair of the castors 12,13,14,15 can be set in the directional lock position 7. This will allow the operator to better move the article of hospital or care furniture from one place to another. Also here the

castors 12,13,14,15 can be operated via the operating panel 20 to obtain this setting. When one or a pair of the castors 12,13,14,15 is set in the position 7 (directional) the others are at the same time set in the position 9 (neutral).

Fig. 4 illustrates a castor control system comprising a main voltage detector. Seeking to increase the safety, the castor control system 11 installed in the article of hospital or care furniture is programmed with a brake time delay for setting all the castors 12,13,14,15 in the locked position 9 if the hospital or care furniture has not been in motion in a predetermined period of time. Whether or not there has been motion is detected by the motion sensor 22 and the data from the motion sensor 22 is processed by the controller 21.

As illustrated in fig. 4 the electric brake controller 16 is connected to the power supply 19. The electric brake controller 16 can optionally be supplied with power from a mains voltage source mains 23 via a cable 24 inserted in a wall socket. In the event that the article of hospital or care furniture comprising the castor control system 11 is moved without being disconnected from the mains 23, the cable 24 could cause a dangerous situation for people or equipment in proximity of the article of furniture. Further, if the cable 24 is pulled out of the wall socket this could damage the wall socket and the plug of the cable could hit people or equipment in proximity thereof. Even worse, hidden damages to the cable 24 could be caused by tearing the cable 24 out of the wall. Such damages could e.g. be cutting the conducting wires of cable 24 or damaging the isolation of the conducting wires such that a short circuit could occur. Consequently the electric brake controller 16

comprises a voltage source detector 25 for determining whether the electric brake controller 16 is connected to mains voltage 23.

5 If the voltage source detector 25 detects that the electric brake controller 16 is connected to mains voltage 23 and the motion sensor 22 registers motion, the castor control system 11 sets the castors 12,13,14,15 in the braked position 9 and/or provides a
10 visual/audible/tactile alarm. By disconnecting the electric brake controller 16 from mains voltage 23, the hospital or care furniture can be moved without triggering the brake activation and/or the alarm.

15 Fig. 5 illustrates the castor control system 11 incorporated in a linear actuator system 26. The linear actuator system 26 comprises a control box 27 supplied with power from a battery 28 or mains voltage 23. The linear actuator system 26 further comprises a number of
20 linear actuators 29 and an operating panel 30 both connected to the control box 27. The electric brake controller 16 is connected to and powered by the controller 31 in the control box 27. The castor control system 11 can hereby be controlled by the operating panel
25 30 via the control box 27. Through the same connection the electric brake controller 16 can provide feedback to the control box 27. In the linear actuator system 26 the control box 27 operates as a master and the electric brake controller 16 as a slave. However, the electric
30 brake controller 16 still comprises a controller 21. Although not illustrated the linear actuator system 26 could also comprise an additional operating panel. As illustrated the motion sensor 22 is arranged in the electric brake controller 16, but could also be arranged
35 in the control box 27 or in a linear actuator 29. The

voltage source detector 25 has conveniently been arranged in the control box 27. The linear actuators 29 are of a type comprising a thrust rod. This type of linear actuator comprises a spindle with a spindle nut. The spindle is driven by a reversible electric motor through a transmission. When the spindle is driven, the spindle nut is moved in an inwards or outwards direction depending on the direction of rotation of the electric motor. The linear actuator is a separate product with the spindle, transmission and electric motor enclosed in a housing. The housing typically consists of a motor housing and an outer tube. An inner tube is secured to the spindle nut. The inner tube is displaced in and out of the outer tube as the spindle nut is moved in and out on the spindle. In the opposite end of the spindle nut the inner tube comprises a front mounting. The outer side of the motor housing is furnished with a rear mounting. The front mounting and rear mounting are used to secure the linear actuator in the structure which should be adjusted.

Fig. 6 illustrates another embodiment of the linear actuator system 26 in fig. 5. The linear actuator system 32 in fig. 6 comprises a junction box 33 connected to the electric brake controller 16, the operating panel 30 and the linear actuator 29. Further an under bed light 34 is added to the linear actuator system 29 and connected to the junction box 33. The junction box 33 is connected to the control box 27 in a single connection. In this embodiment the motion sensor 22 is arranged in the junction box 33.

Fig. 7 schematically illustrates a hospital or care bed 35 incorporating the linear actuator system 26 shown in fig. 5. Although not shown the hospital or care bed 31

comprises four castors 12,13,14,15, hence the double references for the two castors illustrated. The linear actuators 29 can be used to elevate the upper frame carrying the mattress of the bed relative to the undercarriage. The linear actuators 29 can also be used to elevate the head rest, back rest and leg rest of the bed 31.

Fig. 8 illustrates a patient lift 36 incorporating the linear actuator system 26 of fig. 5. Here, the linear actuator 29 is used to move the arm 37 up and down, so as to lift a patient.

Claims:

1. A castor control system comprising
a controller (21),
5 a power supply (19),
an operating panel (20),
a motion sensor (22),
and at least two castors (1,12,13,14,15), where the at
least two castors (1,12,13,14,15) comprises a mounting
10 pin (2) with a vertical rotational axis (3) about which
the castor (1,12,13,14,15) can swivel, at least one wheel
(4,5) rotatable about a horizontal axis (6) and an
electric motor cooperating to set the castor
(1,12,13,14,15) in:
15 a directional lock position (7) where the castor
(1,12,13,14,15) cannot swivel about the vertical axis (3)
of the mounting pin (2) and the wheel (4,5) can rotate
freely about the horizontal axis (6), or
a brake position (9) where the wheel (4,5) cannot rotate
20 about the horizontal axis (6) and where the castor
(1,12,13,14,15) cannot swivel about the vertical axis (3)
of the mounting pin (2) or,
a neutral position (10) where the castor (1,12,13,14,15)
can swivel freely about the vertical axis (3) of the
25 mounting pin (2) and the wheel (4,5) can rotate freely
about the horizontal axis (6),
and where the electric motor of each castor
(1,12,13,14,15) is connected to the controller (21) which
can operate each castor (1,12,13,14,15) individually.
30
2. A castor control system according to claim 1, where
the controller (21) is a microprocessor.

3. A castor control system according to claim 1, comprising a printed circuit board on which the controller (21) and the motion sensor (22) are arranged.
- 5 4. A castor control system according to claim 3, comprising a voltage source detector (25) to determine whether or not the castor control system is connected to mains voltage (23).
- 10 5. A castor control system according to claim 3, where the motion sensor (22) is an accelerometer.
- 15 6. A method for operating a castor control system (11) according to one or more of claims 1-5, where the electric brake controller (16), via the electric motor of each castor (1,12,13,14,15), can set each castor (1,12,13,14,15) in the brake position if the motion sensor (22) detects motion and the voltage source detector (25) detects that the castor control system (11) is connected to mains voltage (23), or
20 the motion sensor (22) has not detected movement for a specified period of time.
- 25 7. A hospital or care bed comprising a castor control system (11) according to one or more of claims 1-5.
8. A hospital or care bed according to claim 7, comprising at least one linear actuator (29).
- 30 9. A hospital bed or care bed according to claim 7 or 8, characterized in that the castor control system (11) operates according to the method of claim 6.
- 35 10. A patient lift comprising a castor control system according to one or more of claims 1-5.

11. A patient lift according to claim 10, comprising at least one linear actuator (29).

5 12. A patient lift according to claim 10 or 11, characterized in that the castor control system operates according to the method of claim 6.

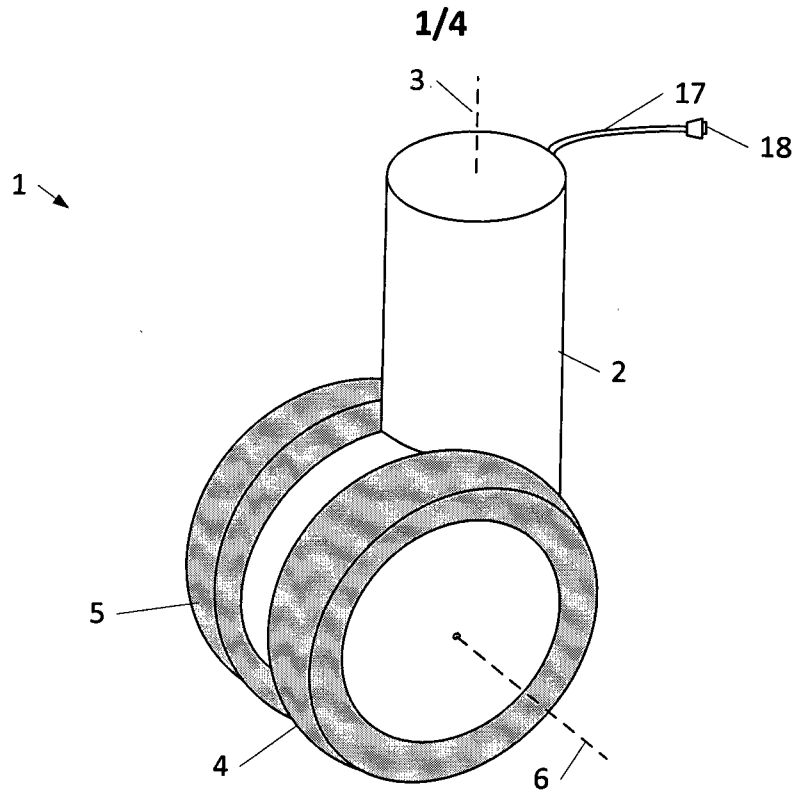


Fig. 1

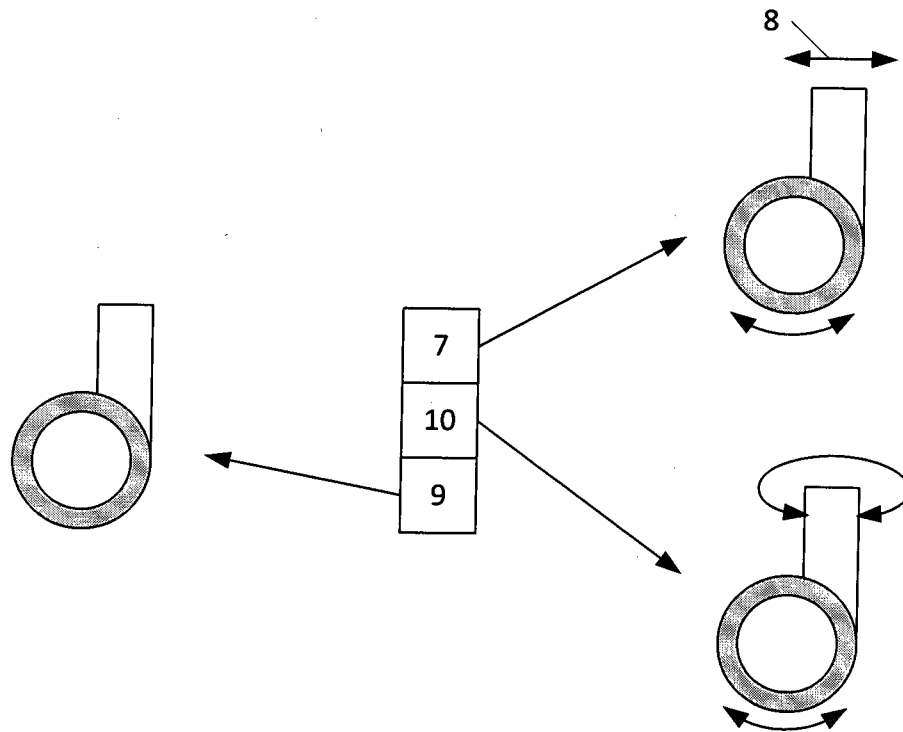


Fig. 2

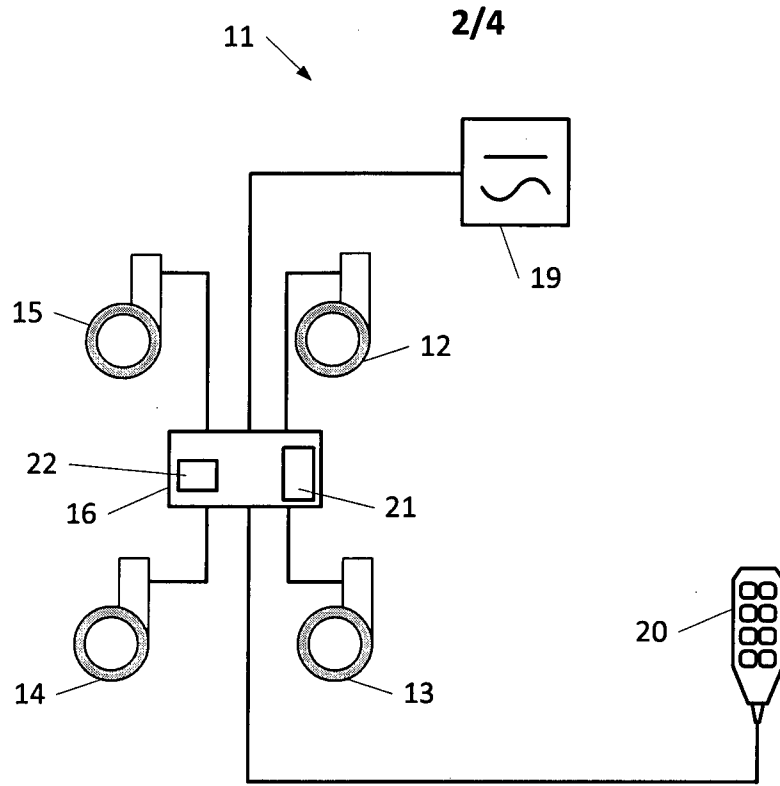


Fig. 3

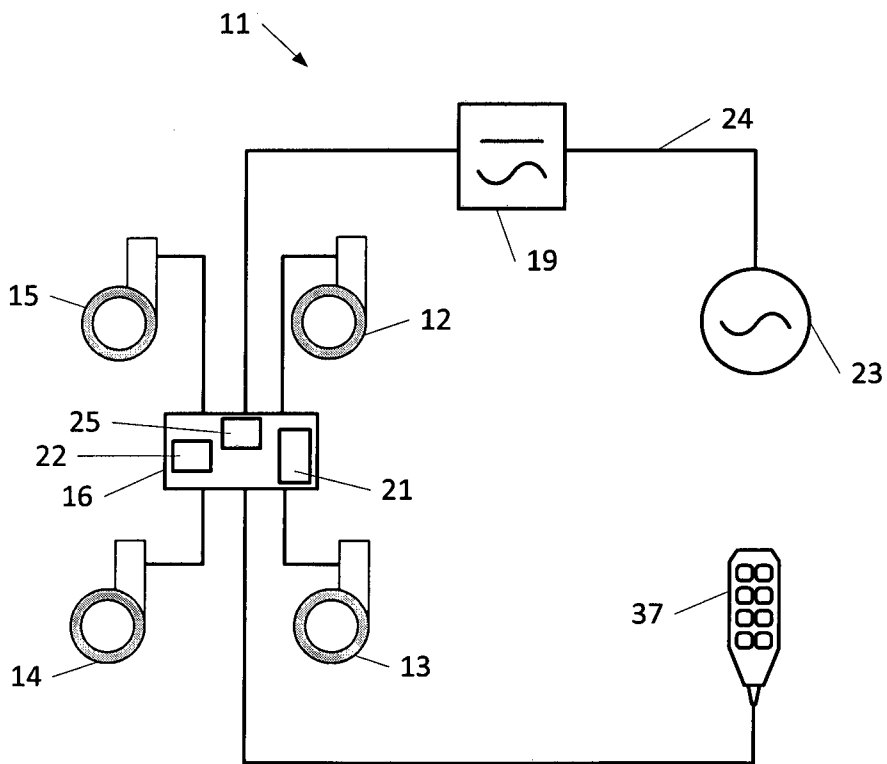


Fig. 4

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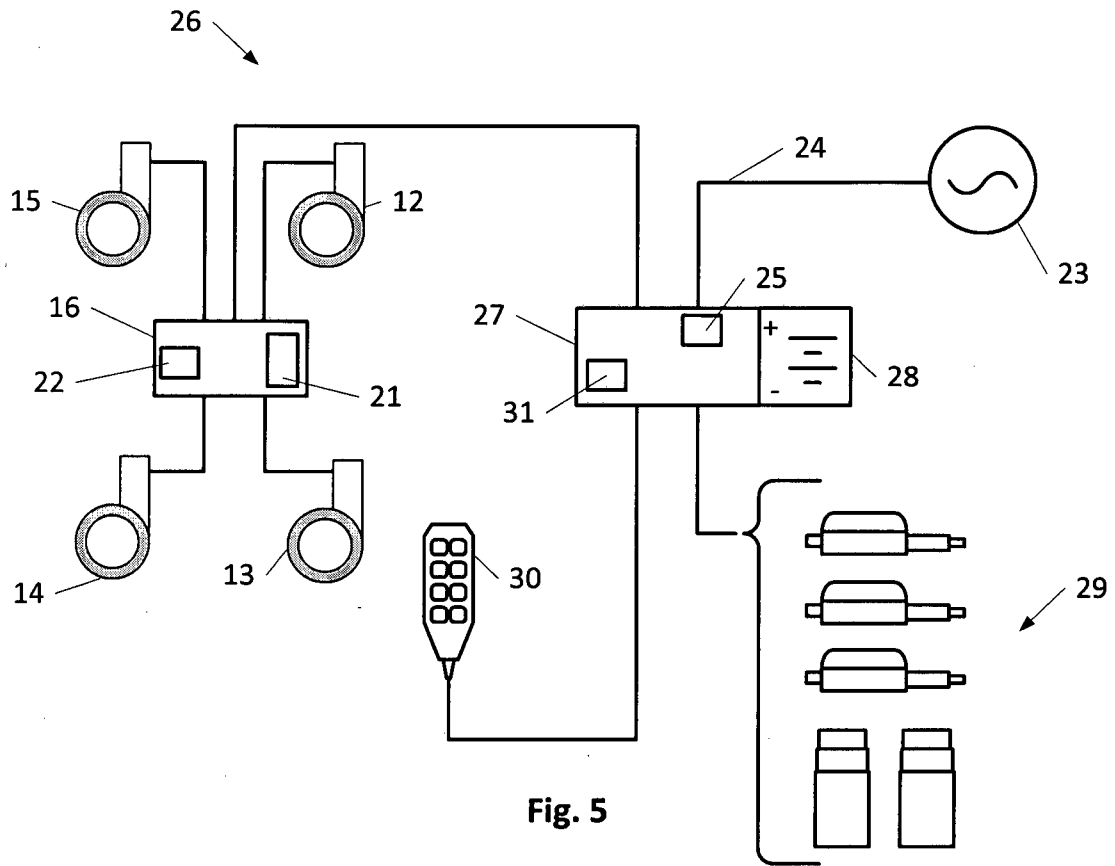


Fig. 5

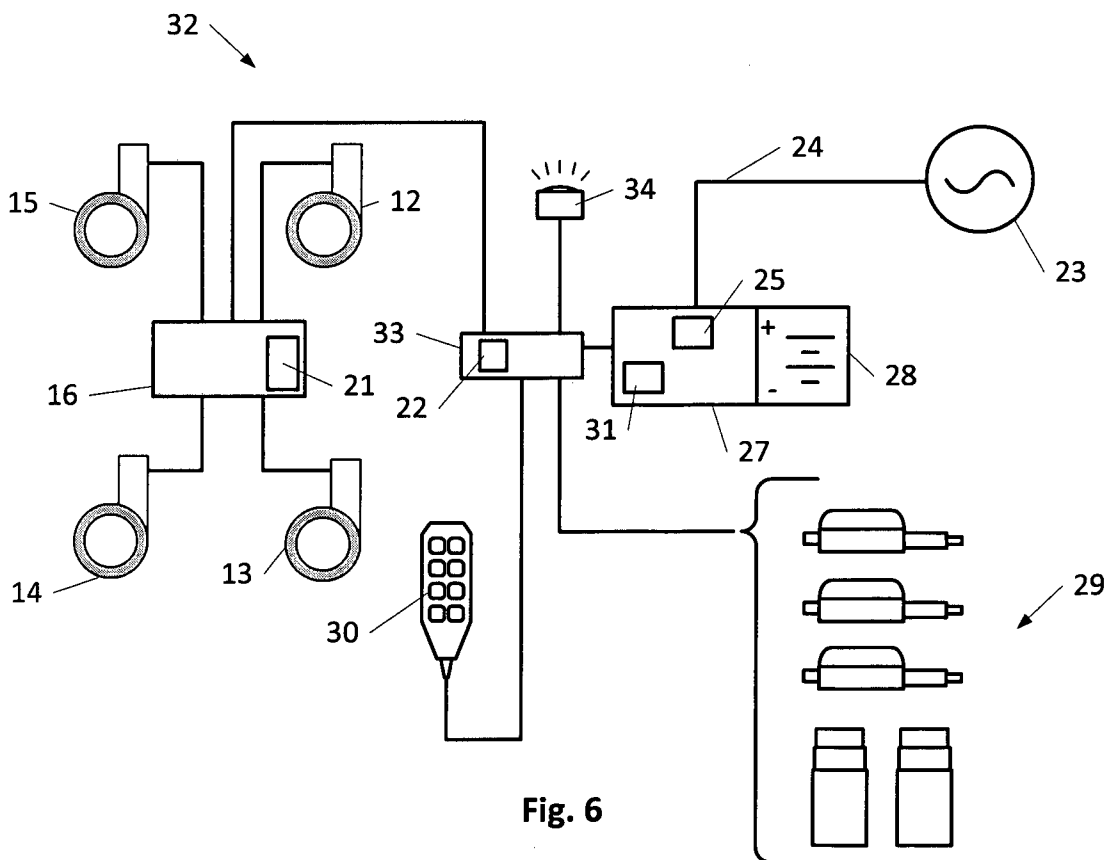


Fig. 6

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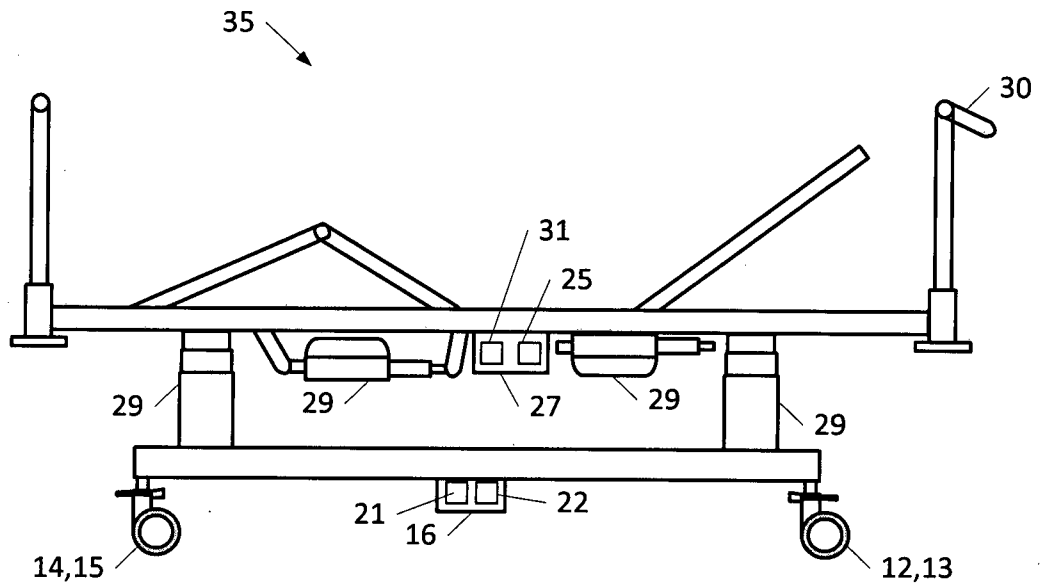


Fig. 7

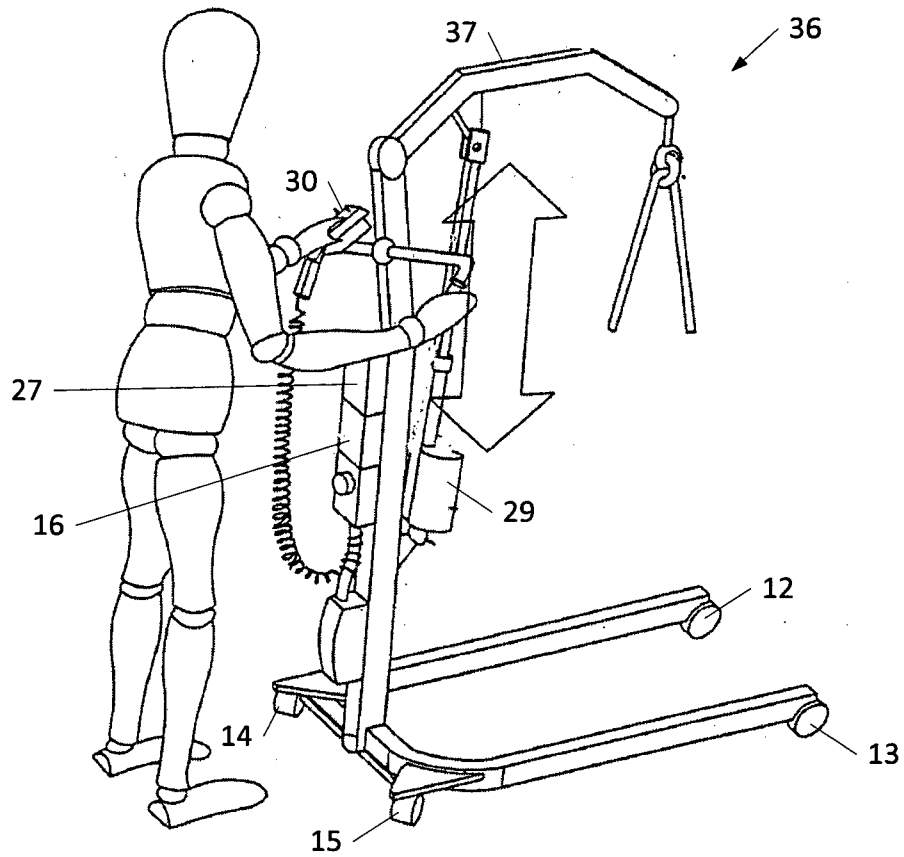


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/DK2013/000078

A. CLASSIFICATION OF SUBJECT MATTER INV. B60B33/02 ADD. A61G7/08		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) B60B A61G		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 101 05 614 A1 (TENDE ROLLEN GMBH & CO [DE]) 18 July 2002 (2002-07-18)	1-3,5,7
Y	column 2, lines 57-64	4,6,8
A	column 2, lines 41-46	9-12
	paragraphs [0036] - [0059]; figures 1, 5	

Y	EP 2 407 138 A2 (HILL ROM SERVICES INC [US]) 18 January 2012 (2012-01-18)	4,8
	paragraphs [0027] - [0037]	

A	DE 43 18 546 A1 (SCHULTE SOEHNE GMBH CO A [DE]) 8 December 1994 (1994-12-08)	1-12
	column 2, line 12 - column 3, line 33	

Y	WO 2011/144185 A2 (LINET SPOL SRO [CZ]) 24 November 2011 (2011-11-24)	6
	abstract	

<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents :		
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	
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Date of the actual completion of the international search	Date of mailing of the international search report	
26 February 2014	06/03/2014	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Schreck, Mathias	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/DK2013/000078

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