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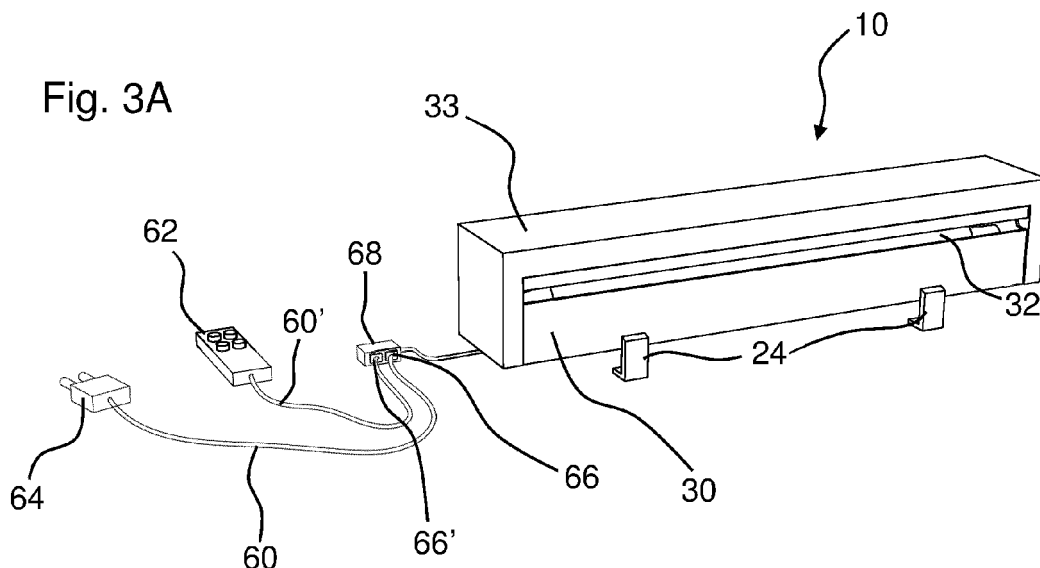
(54) **MATTRESS EXTENDER AND HEALTH CARE BED REPOSITIONING SYSTEM**

(57) A mattress extender (10) for a health care bed repositioning system (2) of a health care bed (12) is disclosed. The mattress extender (10) comprises (6):
- a housing (30) having two opposing side portions (31, 31') and a rear side provided with an elongated opening (32) arranged and configured to receive a sheet (14) of the health care bed (12),

- a rotatably mounted roller (34) extending between the two opposing side portions (31, 31'), wherein the roller (34) is provided with a repositioning device (8) comprising a motor (50) arranged and configured to rotate the roller (34) and hereby move the sheet (14).

The two opposing side portions (31, 31') are made from a soft material (6).

Fig. 3A



Description

Field of invention

[0001] The present invention relates to a mattress extender and a health care bed repositioning system for patient repositioning, and more particularly, to a safe and efficient system for repositioning a patient by moving the patient toward a head end of a bed.

[0002] The invention also relates to a mechanical clutch mechanism for repositioning systems and a repositioning system comprising such clutch mechanism.

[0003] The clutch mechanism is designed to be able to connect and disconnect a motor or other drive mechanism with a pipe or equivalent component in a repositioning system.

[0004] When the motor or drive mechanism is activated in one direction, a force transfer between the motor or other drive mechanism and the tube or equivalent component occurs through the clutch.

[0005] Upon activating the motor or other drive mechanism in the opposite direction, there is a disconnection between the motor or another drive mechanism and the tube or equivalent component through the clutch. This function allows the rotation of the motor or another drive mechanism in one direction to drive the tube or similar component around and, for example, wind up a sheet, a wire, or a strap. When the motor or drive mechanism rotates in the opposite direction, the clutch causes a disconnection between the motor or the drive mechanism and the tube or an equivalent component so that the tube or the like can rotate freely in relation to the motor or another drive mechanism in both directions.

[0006] The disconnected function enables a possibly wound-up medium, such as a sheet, a wire, or a strap, to be manually rewound by the tube or the like, without rotating the motor or another drive mechanism.

[0007] Advantages of this clutch mechanism include its ability to save space, its great strength, and its function to connect and disconnect by utilizing the motor's or another drive mechanism's ability to operate in two different directions. The clutch is designed to be able to connect and disconnect without being dependent on speed and remain in a connected or disconnect position without being dependent on a power source.

[0008] If a clutch mechanism is not used in a repositioning that moves people or things by, for example, winding up a medium such as a sheet, a wire, or a strap, the motor or another drive mechanism would have to rotate in the opposite direction to rewind the wound-up medium. This would, in some situations, limit the efficiency of the repositioning system.

[0009] Without a clutch mechanism, the motor or another drive mechanism and pipe or equivalent would remain connected, preventing, for example, effective manual extraction or easy replacement of the wound-up medium.

Prior art

[0010] Health care bed repositioning systems for patient repositioning are widely used to safely move and handle patients under the safety, health and welfare at work.

[0011] WO 2016022558 A1 discloses a patient repositioning system comprising a mattress, two rows of spaced retainers extending along the length of the mattress, a sheet residing on the upper surface. Each of the rows of spaced retainers are adapted to capture a corresponding side of the sheet. The system comprises a pulling device that is operatively connected to the sheet and adapted to pull the sheet toward the head end with a patient residing thereon. Accordingly, the system can reposition the patient.

[0012] In the prior art such as WO 2016022558 A1, however, the pulling device is integrated in the front part of the mattress. The pulling device has the same width as the mattress. Therefore, when the pulling device is used in some beds, there is a risk of experiencing a crush injury to a finger (between the pulling device and the bed frame or the side rails).

[0013] Since the pulling device is integrated in the mattress. It is not possible to use the pulling device together with an existing mattress. Accordingly, it is required to replace the complete the existing mattress in order to use the desired patient repositioning feature.

[0014] Thus, there is a need for a device which reduces or even eliminates the above-mentioned disadvantages of the prior art. It is an object to provide a solution that makes it possible to reuse an existing mattress and be able to reposition patients.

[0015] It is also an object to provide a solution that reduces or even eliminates the risk of experiencing a crush injury to a finger (between the pulling device and the bed frame or the side rails).

[0016] Some health care beds comprise an integrated bed extension allowing the length of the bed to be extended. Accordingly, the beds can be adjusted to meet specific patient needs. When a health care bed is extended a mattress extender is placed in extension of the existing mattress in order to fill out the space.

[0017] Clutches for connecting, for example, a motor to another object are available in many versions. For example, there are clutches that connect and disconnect based on speed, manually or electromagnetic clutches that depend on electricity. Accordingly, it is an object to provide an improved clutch mechanism.

Summary of the invention

[0018] The object of the present invention can be achieved by a mattress extender as defined in claim 1 and by a health care bed repositioning system as defined in claim 14. Preferred embodiments are defined in the dependent subclaims, explained in the following description and illustrated in the accompanying drawings.

[0019] The mattress extender according to the invention is a mattress extender for a health care bed repositioning system for a health care bed, wherein the mattress extender comprises a housing having two opposing side portions and a rear side, wherein the housing is provided with an elongated opening arranged and configured to receive a sheet of the health care bed and that mattress extender comprises a rotatably mounted roller extending between the two opposing side portions, wherein the roller is provided with a repositioning device comprising a motor arranged and configured to rotate the roller and hereby move the sheet.

[0020] Hereby, it is possible to provide a solution that enables repositioning of patients by using an existing mattress. By using the bed extension of the health care bed it is possible to extend the length of the health care bed and insert a mattress extender according to the invention in extension of the existing mattress.

[0021] The repositioning device is configured to reposition a patient supported on the sheet toward the head end of the health care bed.

[0022] In one embodiment, the mattress extender is box-shaped. It may be an advantage that the mattress extender has a uniform cross-sectional area along the entire length of the mattress extender.

[0023] In one embodiment, the motor is arranged inside the roller, wherein the motor configured to rotate the roller. Hereby, it is possible to reduce the size of the mattress extender and thus provide a mattress extender that is smaller than the prior art mattress extenders.

[0024] In one embodiment, the motor comprises a motor housing, wherein the motor is attached to a structure of the mattress extender outside the roller in such a manner that the motor housing remains fixed to said structure of the mattress extender during operation of the motor, wherein the motor comprises a shaft that is fixed to or integrated in a rotatably shaft that is fixed to the inside of a wall of the roller. Hereby, the motor housing does not move relative to the mattress extender and the required energy to rotate the roller can be minimised.

[0025] In one embodiment, a gap is provided between the outside surface of the motor housing and the inside wall of the roller.

[0026] In one embodiment, the two opposing side portions are made from a soft material. Hereby, the risk of experiencing a crush injury to a finger (between the pulling device and the bed frame) can be reduced or even eliminated.

[0027] In one embodiment, the mattress extender comprises a top portion made from a soft material. Hereby, the user comfort can be improved.

[0028] In one embodiment, the opposing side portions have a width of at least 10 mm.

[0029] In one embodiment, the opposing side portions have a width of at least 15 mm.

[0030] In one embodiment, the opposing side portions have a width of at least 20 mm.

[0031] In one embodiment, the opposing side portions

have a width of at least 30 mm.

[0032] In one embodiment, the opposing side portions have a width of at least 40 mm.

[0033] In one embodiment, the opposing side portions have a width of at least 50 mm.

[0034] In one embodiment, the soft material comprises a foam material. In one embodiment, the soft material comprises latex. In one embodiment, the soft material comprises fabric. In one embodiment, the soft material comprises polyfoam.

[0035] In one embodiment, the roller comprises a control box arranged inside the roller, wherein the control box is arranged and configured to control the motor, wherein the control box comprises:

- a) a control connection structure configured to be electrically connected to receive an electrical connection member that is electrically connected to a cable connected to a remote control or a wireless transmitter or
- b) a control connection structure having an integrated wireless receiver wirelessly connected to a wireless transmitter of a wireless remote control.

[0036] Hereby, it is possible to provide a more compact solution. By integrating the control box in the roller (arranging the control box inside the roller) space can be saved.

[0037] In one embodiment, the roller comprises a coupling that is arranged and configured to provide the roller in:

- a) a first configuration, in which the motor is coupled in such a manner that the roller rotates upon activation of the motor and
- b) a second configuration, in which the roller is uncoupled in such a manner that the roller can rotate upon without activation of the motor.

[0038] Hereby, it is both possible to use the motor to reposition a patient when required and rotate the roller with the motor being arranged in a configuration, in which the motor does not transfer torque to the roller.

[0039] In one embodiment, the coupling is arranged inside the housing of the motor. Hereby, it is possible to provide a simple and reliable mechanical coupling.

[0040] In one embodiment, the coupling is arranged next to the housing of the motor.

[0041] In one embodiment, the control box is arranged next to the coupling.

[0042] In one embodiment, at least one mounting member is attached to the rear side of the housing. Hereby, the housing can be attached to a section.

[0043] In one embodiment, the motor comprises a motor housing and a first shaft extending through the end portion of the roller, wherein the roller comprises another shaft extending through the opposite end portion of the roller, wherein the motor comprises a connection shaft

extending from the motor housing, wherein the connection shaft is connected to a rotatably shaft that is fixed to the inside of a wall of the roller, wherein the motor housing is fixed to the first shaft, wherein the first shaft is connected to the housing of the mattress extender.

[0044] In one embodiment, the roller comprises a centrally arranged cylindrical portion extending between two tracked portions, wherein the tracked portions are configured to receive the guiding structures of the sheet.

[0045] The health care bed repositioning system according to the invention is a health care bed repositioning system comprising a health care bed and a mattress extender according to one of the preceding claims.

[0046] In one embodiment, at least one mounting member is attached to the rear side of the housing. Hereby, attachment of the rear side of the mattress extender to a section can be eased.

[0047] In one embodiment, at least one mounting member is attached to at least one of the side portions of the housing. Hereby, attachment of at least one of the side portions of the housing of the mattress extender to a section can be eased.

[0048] In one embodiment, a control member is provided at the at least one of the side portions of the housing, wherein the control member is configured to control the motion of the repositioning device by pushing, turning or pulling the control member.

[0049] In one embodiment, a control member is provided at the at least one of the side portions of the housing, wherein the control member is configured to receive a wired remote control configured to control the motion of the repositioning device by pushing, turning or pulling the remote control.

[0050] In one embodiment, a mounting structure is provided at the at least one of the side portions of the housing, wherein the mounting structure comprises:

- a slot allowing the sheet to pass through the slot and
- a through-going bore arranged and configured to receive and guide a corresponding guiding structure attached to an edge portion of the sheet.

[0051] Hereby, it is possible to control the movement of the sheet in an easy and controlled manner.

[0052] In one embodiment, the motor is arranged in one end of the housing, wherein the motor comprises a first shaft extending through the end portion of the roller, wherein the roller comprises another shaft extending through the opposite end portion of the roller.

[0053] In one embodiment, the motor is rotatably mounted to the roller by means of a rotatably shaft that is fixed to the inside of the wall of the roller.

[0054] In a preferred embodiment, the motor is electrically operated and controlled by a control member.

[0055] In one embodiment, the motor is electrically operated and controlled by a wired remote control electrically or wirelessly connected to the control member.

[0056] In one embodiment, the health care bed com-

prises a:

- a support portion provided with wheels;
- a first section, a second section and a third section, wherein the first section is provided at the foot of the health care bed, the third section is provided in the head end of the health care bed, while the second section is provided between the first section and the third section, wherein the third section is rotatably mounted to the support portion.

[0057] In one embodiment, the health care bed comprises one or more manually operated components arranged and configured to rotate of the third section relative to the support portion.

[0058] In one embodiment, the health care bed comprises one or more electrical actuators arranged and configured to rotate of the third section relative to the support portion.

[0059] In one embodiment, the health care bed comprises a plurality of brackets attached to one or more of the sections, wherein each bracket is L-shaped and comprises a bracket base plate, wherein a mounting structure is provided at the lateral side of each bracket, wherein the mounting structure comprises:

- a slot allowing the sheet to pass through the slot and
- a through-going bore arranged and configured to receive and guide a corresponding guiding structure attached to an edge portion of the sheet.

[0060] In one embodiment, each bracket base plate is provided with a bore or an attachment structure to ease the attachment of the bracket base plate to a section.

[0061] In one embodiment, each bracket base plate is welded, glued or fixed by means of mechanical attachment structures to a section or another structure.

[0062] The clutch mechanism is designed to connect and disconnect solely by utilizing a motor's or another drive mechanism's ability to rotate in two different directions. Consequently, the clutch can connect and disconnect without depending on the speed of the motor or another drive mechanism, or needing to be manually connected or disconnected. The described clutch can also remain connected and disconnected without depending on electricity.

[0063] The invention provides a mechanical clutch mechanism of the aforementioned kind. This mechanism is integrated with a repositioning system and is designed to connect a motor or another drive mechanism to a pipe or a similar component. This new technique represents a solution to the previously identified technical problems in repositioning systems, by providing a more integrated, efficient, and space-saving solution.

[0064] The clutch mechanism consists of a series of components, including a ratchet, a spindle, a clutch nut, and a receiver.

[0065] The clutch mechanism operates by the spindle

being securely attached to the motor's or another drive mechanism's axis shaft, such that the spindle rotates in the same direction as the motor or other drive mechanism. The attachment can be done, for instance, through friction, key and keyseat, or a screw.

[0066] The ratchet is mounted in a way that it does not rotate with the motor or another drive mechanism.

[0067] Both the clutch nut and the receiver are mounted on the spindle. The receiver connects the clutch to a pipe or equivalent. When the clutch is disconnected, the receiver can rotate freely on the spindle. The receiver's free rotation can occur directly on the spindle or be optimized, for example, through grease or a bearing. The clutch nut, in at least one direction of rotation, can lock the receiver's free rotation on the spindle. It does this by having a series of angled teeth on one side that can mesh with a series of angled teeth on the other side of the receiver. The way the receiver and clutch nut's angled teeth connect and disconnect is that the clutch nut can move in both directions on the spindle. When the clutch nut moves away from the receiver, the angled teeth of the receiver and clutch nut disconnect. When the clutch nut moves towards the receiver, their teeth mesh together.

[0068] The clutch nut moves back and forth on the spindle by having internal threads that fit the threads on the spindle. It's this movement of the clutch nut that creates the connection and disconnection.

[0069] One of the ways the clutch nut moves back and forth on the spindle is by having a series of ratchet points on the clutch nut that fit the ratchet.

[0070] At these ratchet points, the ratchet can hold the clutch nut from rotating when the spindle rotates. Instead of the clutch nut rotating with the spindle, the clutch nut's position is held relative to the spindle's rotation, and the clutch nut moves forward or backward on the spindle. Whether the clutch nut moves forward or backward depends on which way the spindle rotates. Without the ratchet, the clutch nut, when the spindle rotates slowly enough, would neither move forward nor backward on the spindle but would instead rotate with the spindle.

[0071] The ratchet points on the clutch nut only allow for partial movement of the clutch nut necessary for a complete connection or disconnection.

[0072] The remaining movement of the clutch nut on the spindle can occur in two different ways depending on whether the clutch nut connects or disconnects from the receiver.

[0073] During the connection between the receiver and the clutch nut, the remaining movement of the clutch nut on the spindle is facilitated by the non-angled side of the clutch nut's and receiver's angled teeth. This non-angled side begins to engage before the ratchet releases the ratchet points, taking over the function that the ratchet and ratchet points had, completing the necessary movement of the clutch nut to achieve a full connection. When the connection is complete, the ratchet points of the clutch nut have released the ratchet. Thus, the clutch

nut's rotation is freed from the ratchet, and the clutch nut will now follow the spindle's rotation. To prevent the clutch nut from continuing to move on the spindle, a stop can be made on the spindle's threads.

[0074] During disconnection, the clutch nut begins to rotate with the spindle in the opposite direction of the connection. In this direction, the angled teeth of the clutch nut with their slanted side hit the slanted side of the receiver's angled teeth. The two slanted sides of the angled teeth are angled in such a way that when the clutch nut rotates to disconnect, the clutch nut and the receiver are pushed apart. But since the receiver is mounted on the spindle and cannot move forward or backward, the clutch nut will move away from the receiver. This movement of the clutch nut away from the receiver causes the ratchet points of the clutch nut to engage again with the ratchet, which, with continued rotation of the spindle, holds the clutch nut's rotation. Instead of rotating with the spindle, the clutch nut moves on the spindle, completing the disconnection of the receiver and the clutch nut's angled teeth. When the disconnection is complete, the receiver can rotate freely on the spindle. The use of the ratchet does two things. First, the clutch nut can always engage with the ratchet due to the ratchet's ability to click if they misalign. Secondly, the ratchet will click over the ratchet points in case the spindle continues to rotate in the disconnection direction.

[0075] In an embodiment, the clutch mechanism is mechanical clutch mechanism, comprising:

- a spindle provided with a thread and being arranged and configured to move with the rotation of a motor,
- a ratchet arranged and configured not to move with the rotation of the motor or another drive mechanism;
- a clutch nut that through a thread can move on the thread of the spindle,
- a receiver that through the clutch nut's movement on the spindle is configured to connect and disconnect from the spindle's rotation.

[0076] The motor may be replaced by another drive mechanism.

[0077] In an embodiment, the movable clutch nut comprises a track or internal threads having teeth arranged and configured to create a connection, wherein the clutch nut further comprises ratchet points consisting of elevations or depressions configured to interlock with the ratchet.

[0078] In an embodiment, the spindle is designed to follow the rotation from a motor or another drive mechanism), wherein the spindle comprises a track or threads onto which the clutch nut's internal track or threads fits. Additionally, the spindle comprises a rotation point at which the receiver, either directly or using a bearing, is rotatably mounted so the receiver can rotate freely when the clutch mechanism is in a disconnected state.

[0079] In an embodiment, the ratchet is mounted in such a manner that it does not move in relation to the

motor's or another drive mechanism's rotation, wherein the ratchet is designed to hold the clutch nut in motion from the motor's or drive mechanism's rotation, in such a manner that the clutch nut through its track or internal threads, regardless of the speed of rotation, can move forward or backward on the track or threads of the spindle.

[0080] In an embodiment, the ratchet is arranged and configured to click past the ratchet points of the clutch nut.

[0081] In an embodiment, the receiver comprises teeth designed to connect with the teeth of the clutch nut, wherein the receiver is mounted on the rotation point of the spindle in such a manner that the receiver in the clutch mechanism disconnected state, can rotate freely on the rotation point of the spindle.

[0082] In an embodiment, the receiver is arranged and configured to connect with a pipe. In an embodiment, the receiver is arranged and configured to connect with a rod.

[0083] In an embodiment, the receiver comprises teeth and the clutch nut comprises teeth which at least on one side are slanted and that the slanted sides are angled in such a manner that when rotated towards each other, the teeth push the receiver and the clutch nut apart.

[0084] In an embodiment, the clutch mechanism is constructed in such a manner that movement of the clutch nut during connection of the clutch mechanism, part of the way is facilitated by the ratchet and the clutch nut's ratchet points, wherein the movement is completed by a straight side of the receiver's teeth and the clutch nut's teeth, wherein the movement of the teeth moves the clutch nut's ratchet points free from the ratchet.

[0085] In an embodiment, the clutch mechanism is constructed in such a manner that movement of the clutch nut during disconnection of the clutch mechanism, is facilitated by the slanted side of the receiver's teeth pushing the slanted side of the clutch nut's teeth in such a manner that the clutch nut's ratchet points move into engagement with the ratchet, wherein the ratchet completes the disconnection of the clutch mechanism.

[0086] In an embodiment, the mechanical clutch mechanism comprises a motor or other drive mechanism arranged and configured to provide rotation to connect and disconnect independently of the motor or other drive mechanism's speed of rotation in such a manner that the clutch mechanism remains either connected or disconnected without depending on power.

[0087] The mechanical clutch mechanism includes a movable clutch nut arranged to be moved on a spindle through a track or threads. The spindle is driven in a rotating direction by a motor or another drive mechanism. This clutch mechanism contains a ratchet that keeps the clutch nut in motion from the motor or another drive mechanism. The clutch nut is designed to connect with the receiver by the receiver's teeth and the clutch nut's teeth interlocking with each other. The receiver can be attached to a pipe or a similar component in a repositioning system. The receiver contains teeth that assist in completing the connection, after which the clutch nut's ratchet

points release from the ratchet. When the motor or drive mechanism is activated in the opposite rotation direction, the slanted side of the receiver's teeth and the clutch nut's teeth help start the disconnection until the ratchet can engage with the clutch nut's ratchet points, thus completing the disconnection. These unique design features have potential applications within many different industrial systems that require reliable and efficient clutch mechanisms, where connection and disconnection need to be independent of speed and must remain connected or disconnected without using electricity.

Description of the Drawings

[0088] The invention will become more fully understood from the detailed description given herein below. The accompanying drawings are given by way of illustration only, and thus, they are not limitative of the present invention. In the accompanying drawings:

- Fig. 1A shows a schematic top view of some of the main components of a health care bed repositioning system according to the invention;
- Fig. 1B shows a side view of some of the main components of a health care bed repositioning system according to the invention;
- Fig. 2A shows a side view of a health care bed repositioning system according to the invention;
- Fig. 2B shows a mattress extender according to the invention;
- Fig. 3A shows a view of the mattress extender according to the invention;
- Fig. 3B shows a cross-sectional view of a mattress extender shown in Fig. 3A;
- Fig. 3C shows a cross-sectional view of the roller of a mattress extender according to the invention;
- Fig. 4A shows a sheet of a health care bed repositioning system according to the invention;
- Fig. 4B shows a prior art health care bed repositioning system;
- Fig. 5A shows a mounting structure of a health care bed repositioning system according to the invention;
- Fig. 5B shows the mounting structure shown in Fig. 5A attached to a bracket,
- Fig. 5C shows how a sheet is attached to a mounting structure as the one shown in Fig. 5A and Fig. 5B;
- Fig. 6A shows the main components of a mattress extender corresponding to the one shown in Fig. 3B;
- Fig. 6B shows a cross-sectional view of the roller of a mattress extender according to the invention;
- Fig. 7A shows a perspective side view of mattress extender used in a health care bed repositioning system according to the invention;

- Fig. 7B shows a side view of the mattress extender and the health care bed shown in Fig. 7A and
- Fig. 8A shows a perspective top view of the mattress extender; health care bed repositioning system shown in Fig. 7A;
- Fig. 9 shows a detailed perspective view of the mechanical clutch mechanism for repositioning systems from Fig. 1 and Fig. 2, where individual parts can be seen separated for illustrative reasons;
- Fig. 10 shows a detailed perspective view of an example of a mechanical clutch mechanism for repositioning systems, in a connected state;
- Fig. 11 shows a detailed perspective view of an example of a mechanical clutch mechanism for repositioning systems, in a disconnected state;
- Fig. 12 shows a detailed perspective view of an example of a ratchet;
- Fig. 13 shows a detailed perspective view of an example of a spindle;
- Fig. 14 shows a detailed perspective view of an example of a clutch nut and
- Fig. 15 shows a detailed perspective view of an example of a receiver.

Detailed description of the invention

[0089] Referring now in detail to the drawings for the purpose of illustrating preferred embodiments of the present invention, a schematic top view of some of the main components of a health care bed repositioning system 2 according to the invention is illustrated in Fig. 1A.

[0090] The health care bed repositioning system 2 is designed for being mounted and used in a health care bed. The health care bed repositioning system 2 is suitable for being used on a health care bed having a mattress 4. A side rail 52 extends along each of the side edges of the mattress 4.

[0091] The health care bed repositioning system 2 comprises a mattress extender 10 comprising a repositioning device 8 that is arranged and configured to receive and roll-up a sheet and hereby carry out a repositioning of a patient laying on the sheet of the health care bed. The repositioning device 8 is surrounded by a soft and resilient surrounding material 6. The surrounding material 6 may be a foam.

[0092] It can be seen that the width W_1 of the repositioning device 8 is smaller than the distance W_2 (width) between the two opposing side rails 52, 52' of the health care bed. Accordingly, the risk of crush injury to a finger between the bed frame 5 and the mattress extender 10 is eliminated. Compared to the prior art solution, the invention provides a safer and hereby improved solution.

[0093] The widths W_3 , W_4 of the side portions 31, 31' of the mattress extender 10 are indicated. It can be seen that the width W_3 of the first side portion 31 basically corresponds to the W_4 of the (opposite) second side por-

tion 31'. The width W_1 of repositioning device 8 is smaller than the width W_2 between the two opposing side rails 52, 52'.

[0094] Fig. 1B illustrates a side view of some of the main components of a health care bed repositioning system according to the invention. The health care bed repositioning system comprises a health care bed 12 having a support portion 9. In one embodiment, the support portion 9 is provided with wheels.

[0095] The health care bed 12 comprises a first section 20, a second section 20' and a third section 20". The first section 20 is provided at the foot end of the health care bed 12, the third section 20" is provided in the head end of the health care bed 12, while the second section 20' is provided between the first section 20 and the third section 20".

[0096] The third section 20" is rotatably mounted to the support portion 9. Even though it is not shown, rotation of the third section 20" relative to the support portion 9 can be accomplished by using manually operated components or one or more actuators (preferably one or more electrical actuators).

[0097] A plurality of brackets 18 are attached to the edge portions of the first section 20. A single bracket 18 is attached to each of the edge portions of the third section 20". A mounting structure 16 provided at the lateral side of the top portion of each of the brackets 18.

[0098] A mattress extender 10 is provided at the distal end of the third section 20". The mattress extender 10 comprises a repositioning device that is arranged and configured to receive and roll-up a sheet and hereby carry out a repositioning of a patient laying on a sheet of the health care bed 12. The repositioning device 8 is surrounded by a soft and resilient surrounding material 6. The mattress extender 10 comprises a mounting structure 16'. The mounting structures 16, 16' are arranged and configured to receive a guiding structure (see Fig. 5C) and hereby guide the sheet being moved by means of the repositioning device.

[0099] The mattress extender 10 is attached to the third section 20" by means of a mounting member 24. At the side portion of the mattress extender 10, a control member 26 is provided. In one embodiment, the control member 26 is formed as a control member 26 that allows the user to control the motion of the repositioning device by pushing, turning or pulling the control member 26. In one embodiment, the control member 26 is placed elsewhere (e.g. at the underside of the mattress extender 10).

[0100] In one embodiment, the mattress extender 10 comprises a motor that is electrically operated and controlled by a remote control that is connected to a cable provided with an electrical connection member in its distal end. In one embodiment, the mattress extender comprises an electrical socket (not shown) arranged and configured to receive the electrical connection member of the cable. In one embodiment, the electrical socket is provided on the underside of the housing of the mattress extender 10. In one embodiment, the remote control may

be replaced by a wireless transmitter and a wireless receiver (wireless remote control).

[0101] An elongated opening 32 extends along the rear portion of the mattress extender 10. The opening 32 is configured to receive the sheet being rolled on a roller placed inside the repositioning device (see Fig. 3A). The thickness of the opening 32 is preferably 8 mm or less. In one embodiment, the mounting structures 16' of the mattress extender 10 can be omitted.

[0102] Fig. 2A illustrates a side view of a health care bed repositioning system 2 according to the invention. The health care bed repositioning system 2 corresponds to the one shown in and explained with reference to Fig. 1B. The health care bed 12, however, comprises a mattress 4 covered by a sheet 14 having edges provided with a guiding structure 22. In one embodiment, the guiding structure 22 is made by surrounding a cord or robe by the sheet 14, providing a double layer sheet portion and stitching the double layer sheet portion together. In one embodiment, the guiding structure 22 is a beaded edge.

[0103] The sheet 14 is slidably attached to the mounting structures 16 of the brackets 18 by means of the guiding structure 22. The mattress 4 is arranged adjacent to the mattress extender 10.

[0104] Fig. 2B illustrates a mattress extender 10 according to the invention. The mattress extender 10 corresponds to the one shown in and explained with reference to Fig. 1B and Fig. 2A. The mattress extender 10 comprises a housing 30 having a first side portion 31 and a second side portion 31'. The first side portion 31 and the second side portion 31' are made from a soft material. In one embodiment, the first side portion 31 and the second side portion 31' are made from a foam material such as foam rubber.

[0105] The mattress extender 10 comprises top portion 28 made from a soft material. In one embodiment, the top portion 28 is made from a foam material. The top portion 28 may be a separate member that is attached to the housing 30. In one embodiment, however, the top portion 28 is an integrated part of the housing 30.

[0106] Mounting members 24 are attached to the rear portion of the housing and to the end surface of each of the side portions 31, 31'. The mounting members 24 are arranged and configured to attach the mattress extender 10 to an underlying structure. It can be seen that a control member 26 is provided at the first side portion 31. A mounting structure 16' is arranged at the first side portion 31. The mounting structures 16' is arranged and configured to receive a guiding structure.

[0107] The rear side of the housing is provided with an elongated opening 32 that is arranged and configured to receive the sheet 14 of a health care bed 12.

[0108] Fig. 3A illustrates a mattress extender 10 according to the invention. The mattress extender 10 corresponds to the one shown in and explained with reference to Fig. 1B and Fig. 2A. The mattress extender 10 comprises a housing 30 that is partly surrounded by an

outer portion 33 from a soft material, preferably a foam material such as foam rubber.

[0109] Two mounting members 24 are shown next to the mattress extender 10. The mounting members 24 are designed to prevent the mattress extender 10 from moving when placed in a bed as shown in and explained with reference to Fig. 2A.

[0110] An elongated opening 32 is provided in the housing 30 of the mattress extender 10. The opening 32 extends along the length of the housing 30.

[0111] The mattress extender 10 comprises a motor (not shown) that is electrically operated and controlled by a remote control 62. The remote control 62 is connected to a cable 60' provided with an electrical connection member 66 in its distal end. The mattress extender 10 comprises a power cable 60 provided with an electrical plug 64 designed to be connected to the mains.

[0112] The mattress extender 10 comprises an electrical socket 68 arranged and configured to receive the electrical connection member 66' of the cable 60' and the electrical connection member 66 of the power cable 60. The socket 68 is electrically connected to the motor by means of a cable.

[0113] In one embodiment, the electrical socket is provided on the underside of the housing 30. In one embodiment, the remote control 62 may be replaced by a wireless transmitter and a wireless receiver (wireless remote control).

[0114] Fig. 3B illustrates a cross-sectional view of the mattress extender 10 shown in Fig. 3A. The mattress extender 10 basically corresponds to the one shown in Fig. 3A.

[0115] It can be seen that a roller 34 is arranged inside the housing 30. The roller 34 is rotatably mounted and driven by a motor that is integrated into the roller 34 (see Fig. 3C). The roller 34 comprises a centrally arranged cylindrical portion extending between two tracked portion 36, 36'. The tracked portions 36, 36' are configured to receive the guiding structure of the sheet (see Fig. 4A).

[0116] The mattress extender 10 comprises an outer portion 33 that is preferably made from a soft material (e.g. a foam material). The outer portion 33 may comprise top portion formed as a separate member that is attached to the housing 30 or to side portions. The outer portion 33 may be an integrated part of the housing 30.

[0117] Fig. 3C illustrates a cross-sectional view of a mattress extender according to the invention. The roller 34 comprises a motor 50 that is integrated in the roller 34. The motor 50 comprises a first shaft 48 extending through the end portion of the roller 34. The roller 34 comprises another shaft 46 extending through the opposite end portion of the roller 34.

[0118] The motor 50 is fixed to the first shaft 48. The first shaft 48 is attached to a structure outside the roller 34. Accordingly, the motor housing remains fixed during operation of the motor 50. The motor 50, however, comprises a shaft that is fixed to a rotatably shaft 44 that is fixed to the inside of the wall of the roller 34. Therefore,

the motor 50 will rotate the roller 34 when being activated.

[0119] In one embodiment, the motor 50 is electrically operated and controlled by a control member as the one shown in Fig. 3A and Fig. 3B, or a wired remote control electrically or wirelessly connected thereto. In a preferred embodiment, a control box 56 is arranged inside the roller 34 adjacent to the motor 50.

[0120] Fig. 4A illustrates a sheet 14 of a health care bed repositioning system according to the invention. The sheet 14 comprises two rows of spaced guiding structures 22 extending along the length of the sheet 14. The guiding structures 22 are provided on each of the long edges of the sheet 14. The guiding structures 22 may be formed as beaded edge by way of example. Each of the guiding structures 22 may alternatively be designed as a single elongated, flexible structure. In an embodiment, the guiding structures 22 is made by surrounding a cord or robe by the sheet, providing a double layer sheet portion and stitching the double layer sheet portion together.

[0121] Fig. 4B illustrates a prior art health care bed repositioning system comprising a health care bed 112. A patient 100 is positioned on the health care bed 112. The health care bed 112 comprises a mattress 104 surrounded by a frame 105. A prior art repositioning device 108 is integrated in the head end of the mattress 104.

[0122] There is a risk of crush injury to a finger between the pulling device and the bed frame 105 (or a side rail if such is used).

[0123] Fig. 5A illustrates a mounting structure 16 of a health care bed repositioning system according to the invention. The mounting structure 16 comprises a slot 38 allowing a sheet to pass through the slot 38. The mounting structure 16 comprises a through-going bore 40 arranged and configured to receive and guide a guiding structure as the one shown in and explained with reference to Fig. 2A or Fig. 4A.

[0124] Fig. 5B illustrates the mounting structure 16 shown in Fig. 5A attached to a bracket 18. The bracket 18 is L-shaped and comprises a bracket base plate 19. The bracket base plate 19 may be provided with a bore or an attachment structure (not shown) in order to ease the attachment of the bracket base plate 19 to a section (as shown in Fig. 1B). The bracket base plate 19 may be welded, glued or fixed by means of mechanical attachment structures to a section or another structure.

[0125] Fig. 5C illustrates how a sheet 14 is attached to a mounting structure 16 as the one shown in Fig. 5A and Fig. 5B. The sheet 14 is provided with a guiding structure 22 extending along the edge of the sheet 14. The guiding structure 22 engages the bore 40 of the mounting structure 16 while the sheet 14 provided next to the guiding structure 22 passes through the slot of the mounting structure 16. The mounting structure 16 ensures that the sheet 14 is remained in a configuration, in which it can be rolled on the roller of the repositioning device of the health care bed repositioning system.

[0126] Fig. 6A illustrates the main components of a mattress extender 10 corresponding to the one shown in

Fig. 3. Fig. 6B illustrates the components shown in Fig. 6A, however, in larger detail. The mattress extender 10 comprises a housing 30 provided with an elongated opening 32 that extends along the rear portion of the mattress extender 10. In one embodiment, the housing 30 comprises a top portion 28 constituting a lid that is moveably attached (e.g. rotatably attached) to the remaining portion of the housing 30.

[0127] The mattress extender 10 comprises an outer portion 33 made from a soft material. The outer portion 33 is designed to cover the front side, the top side and the side portions of the housing 30. A bore 40, 40' is provided in each of the side portions of the housing 30.

[0128] The mattress extender 10 comprises a roller 34 that comprises a motor 50 that is integrated in the roller 34. The motor 50 may be a gear motor.

[0129] The motor comprises a first shaft 48 extending through the end portion of the roller 34. The roller 34 comprises another shaft 46 extending through the opposite end portion of the roller 34.

[0130] The motor 50 comprises a motor housing that is fixed to the first shaft 48. The first shaft 48 is mechanically connected to the housing 30 of the mattress extender 10. Thus, the motor housing is fixed to the housing 30 of the mattress extender 10. Accordingly, the motor housing remains fixed during operation of the motor 50. The motor 50, however, comprises a shaft that is fixed to a rotatably shaft 44 that is fixed to the inside of the wall of the roller 34. Therefore, the motor 50 will rotate the roller 34 when being activated. The opening 32 is configured to receive the sheet being rolled on a roller 34.

[0131] The motor 50 is electrically operated and controlled by a remote control 62. The remote control 62 is connected to a cable 60' provided with an electrical connection member 66 in its distal end. The mattress extender 10 comprises an electrical socket 68 arranged and configured to receive the electrical connection member 66' of the cable 60' and the electrical connection member 66' of the power cable 60. In one embodiment, the electrical socket 68 is provided on the underside of the housing 30. In one embodiment, the remote control 62 may be replaced by a wireless transmitter and a wireless receiver (wireless remote control).

[0132] . An electrical plug 64 is arranged in the end of the cable 60. The electrical plug 64 is designed to be connected to the mains. Accordingly, the mattress extender 10 can be powered through the cable 60.

[0133] The motor 50 may be an electrical gear motor.

[0134] The roller 34 comprises another shaft 46 extending through the opposite end portion of the roller 34. The roller 34 comprises a centrally arranged cylindrical portion extending between two tracked portion 36, 36'. The tracked portions 36, 36' are configured to receive the guiding structure of a sheet (see Fig. 4A).

[0135] The motor comprises a connection shaft 58 extending from the motor housing. In one embodiment, a connection shaft is connected to a rotatably shaft 44 that is fixed to the inside of the wall of the roller 34. Accord-

ingly, the motor 50 will rotate the roller 34 when being activated.

[0136] The motor 50 comprises a motor housing that is fixed to the first shaft 48. The first shaft 48 is connected to the housing 30 of the mattress extender 10 and thus the motor housing is fixed to the housing 30 of the mattress extender 10. Therefore, the motor housing remains fixed during operation of the motor 50.

[0137] A coupling may be arranged next to the housing of the motor. The coupling may be arranged and configured to couple the motor 50 to the first shaft 48 and to uncouple the motor 50 from the first shaft 48, respectively.

[0138] A control box 56 is arranged next to the motor 50. The control box 56 comprises the electrical components required to control the motor 50. In one embodiment, the control box 56 comprises an integrated power supply.

[0139] Fig. 7A illustrates a perspective side view of mattress extender 10 according to the invention used in a health care bed repositioning system 2 according to the invention. Fig. 7B illustrates a side view of the mattress extender 10 and the health care bed 12 shown in Fig. 7A. Fig. 8A illustrates a perspective top view of the mattress extender 10 and health care bed repositioning system 2 shown in Fig. 7A.

[0140] The health care bed repositioning system 2 comprises a health care bed 12 having several sections 20', 20" placed on a support portion 9. A side rail 52 extends along each of the two side portions of the health care bed 12. The section 20" arranged closes to the head end of the health care bed 12. This section 20" is arranged in an inclined configuration. Rotation of this section 20" relative to the support portion 9 may either be done by means of manual means or by means of an actuator (e.g. an electric actuator).

[0141] A mattress 4 is placed on the sections 20', 20". The mattress 4 is placed on the sections 20', 20" is attached to the sections 20', 20" by means of mounting structures 16, wherein each mounting structure 16 is attached to or integrated into a bracket 18 that is fixed to one of the sections 20', 20".

[0142] In Fig. 7A it can be seen that the mattress extender 10 is attached to the outermost section 20" by means of mounting members 24 attached to and extending from the rear side of the mattress extender 10. The mounting members 24 are attached to the outermost section 20". The mounting members 24 may be brought into engagement with the outermost section 20" or one or more structures attached to the outermost section 20".

[0143] The mattress extender 10 is arranged next to and bears against the head end portion of the mattress 4. The mattress extender 10 has the same height (thickness) as the mattress 4 in order to make it as comfortable as possible for patients to use the health care bed 12.

[0144] A sheet 14 is placed on and attached to the mattress 4. Each of the two long side edges of the sheet 14 are secure to mounting structures 16 arranged along

the side portions of the mattress 4. When the sheet 14 is secured in this manner, the health care bed repositioning system 2 is ready to be used.

[0145] The mattress extender 10 comprises a housing provided with an elongated opening 32 that extends along the entire length the rear portion of the mattress extender 10. The opening 32 is configured to receive the sheet 14 in such a manner that the sheet 12 is being rolled on a roller placed inside the repositioning device (see Fig. 3A, Fig. 6A and Fig. 6B).

[0146] Upon rotation of the roller, the sheet 14 is pulled toward the head end of the bed 12 with enough pulling force to pull a patient supported on the sheet 14. Hereby, the use of manual handling for moving the patient can be minimised.

[0147] Now referring to Fig. 9-15 showing an embodiment of a clutch mechanism 101 for repositioning system. The clutch mechanism 101 comprises a spindle 103 which is set in rotation by a motor or another drive mechanism 106.

[0148] A ratchet 115 is incorporated so it does not rotate with the motor or another drive mechanism 106. The ratchet 115 can hold the clutch nut's 114 rotation in relation to the motor's or drive mechanism's 106 and thus the spindle's 103 rotation. The ratchet 115 can, for example, use ratchet points 113 to hold the clutch nut's 114 rotation. By holding the clutch nut's 114 rotation, the clutch nut 114 moves forward or backward on the spindle 103. The clutch nut 114 moves by its internal threads 110 running over the spindle's 103 threads 109.

[0149] When connecting, the clutch nut 114 moves towards the receiver (2), so the clutch nut's 114 teeth 111 connect with the teeth 122 of the receiver 102. The flat side of the teeth (111 and 122) completes the connection and moves the clutch nut's 104 ratchet points 113 free from the ratchet 115. To prevent the clutch nut 114 from continuing to move on the spindle 103, a stop 118 can be made on the threads 109 of the spindle 103.

[0150] The receiver 102 can be connected with a pipe or another equivalent component in the repositioning system. During disconnection, the slanted angle of the teeth 122 of the receiver 102 and the slanted angle of the teeth 111 of the clutch nut 104 are used to push the ratchet points 113 of the clutch nut 104 back into the ratchet 115. Thus, the clutch mechanism 101 is in a disconnected position. In the disconnected position, the receiver 102 can rotate freely on the rotation point 107 of the spindle 103.

List of reference numerals

[0151]

2	Health care bed repositioning system
4	Mattress
6	Surrounding material (e.g. foam)
8	Repositioning device

9	Support portion		sitioning system (2) for a health care bed (12), where-
10	Mattress extender		in the mattress extender (10) comprises (6):
12	Health care bed		
14	Sheet		- a housing (30) having two opposing side por-
16, 16'	Mounting structure	5	tions (31, 31') and a rear side,
18	Bracket		
19	Bracket base plate		
20, 20', 20"	Section		characterised in that the housing (30) is provided
22	Guiding structure (e.g. beaded edge)	10	with an elongated opening (32) arranged and con-
24	Mounting member		figured to receive a sheet (14) of the health care bed
26	Control member		(12) and that mattress extender (10) comprises (6)
28	Top portion		a rotatably mounted roller (34) extending between
30	Housing		the two opposing side portions (31, 31'), wherein the
31, 31'	Side portion	15	roller (34) is provided with a repositioning device (8)
32	Opening		comprising a motor (50) arranged and configured to
33	Outer portion		rotate the roller (34) and hereby move the sheet (14).
34	Roller		2. A mattress extender (10) according to claim 1,
36, 36'	Tracked portion		wherein the motor (50) is arranged inside the roller
38	Slot	20	(34), wherein the motor (50) is configured to rotate
40, 40'	Bore		the roller (34).
42	Roller shaft		3. A mattress extender (10) according to claim 2,
44	Rotatably shaft		wherein the motor (50) comprises a motor housing
46	Shaft		and is attached to a structure of the mattress exten-
48	Motor shaft	25	der (10) outside the roller (34) in such a manner that
50	Motor		the motor housing remains fixed to said structure of
52, 52'	Side rail		the mattress extender (10) during operation of the
54	Coupling		motor (50), wherein the motor (50) comprises a shaft
56	Control box		that is fixed to or integrated in a rotatably shaft (44)
58	Connection shaft	30	that is fixed to the inside of a wall of the roller (34).
60, 60'	Cable (wired connection)		4. A mattress extender (10) according to one of the
62	Remote control		preceding claims, wherein the two opposing side
64	Electrical plug		portions (31, 31') are made from foam rubber (6) or
66, 66'	Electrical connection member		a material having similar compression properties.
68	Socket	35	
W ₁ , W ₂ , W ₃ , W ₄	Width		5. A mattress extender (10) according to one of the
100	Patient		preceding claims, wherein the opposing side por-
101	Clutch mechanism		tions (31, 31') have a width (W ₃) of at least 15 mm.
102	Receiver		
103	Spindle	40	
104	Mattress		6. A mattress extender (10) according to one of the
105	Frame		preceding claims, wherein the roller (34) comprises
107	Rotation point		a control box (56) arranged inside the roller (34),
108	Prior art repositioning device		wherein the control box (56) is arranged and config-
109	Thread	45	ured to control the motor (50), wherein the control
110	Thread		box (56) comprises:
111	Tooth		
112	Prior art health care bed		a) a control connection structure configured to
114	Clutch nut		be electrically connected to receive an electrical
113	Point	50	connection member that is electrically connect-
115	Ratchet		ed to a cable connected to a remote control (62)
118	Stop		or a wireless transmitter or
122	Tooth		b) a control connection structure having an in-
		55	tegrated wireless receiver wirelessly connected
			to a wireless transmitter of a wireless remote
			control.

Claims

1. A mattress extender (10) for a health care bed repo-
7. A mattress extender (10) according to one of the

preceding claims, wherein the roller (34) comprises a coupling (54) that is arranged and configured to provide the roller (34) in:

- a) a first configuration, in which the motor (50) is coupled in such a manner that the roller (34) rotates upon activation of the motor (50) and
 - b) a second configuration, in which the motor (50) is uncoupled in such a manner that the roller (34) does not rotate upon activation of the motor (50).
8. A mattress extender (10) according to one of the preceding claims, wherein at least one mounting member (24) is attached to the rear side of the housing (30).
9. A mattress extender (10) according to one of the preceding claims, wherein the motor (50) comprises a motor housing and a first shaft (48) extending through the end portion of the roller (34), wherein the roller (34) comprises another shaft (46) extending through the opposite end portion of the roller (34), wherein the motor (50) comprises a connection shaft (58) extending from the motor housing, wherein the connection shaft (58) is connected to a rotatably shaft (44) that is fixed to the inside of a wall of the roller (34), wherein the motor housing is fixed to the first shaft (48), wherein the first shaft (48) is connected to the housing (30) of the mattress extender (10).
10. A mattress extender (10) according to one of the preceding claims, wherein the roller (34) comprises a centrally arranged cylindrical portion extending between two tracked portion (36, 36'), wherein the tracked portions (36, 36') are configured to receive the guiding structure (22) of the sheet (14).
11. A mattress extender (10) according to one of the preceding claims, wherein the mattress extender (10) comprises a mechanical clutch mechanism (101), comprising:
- a spindle (103) provided with a thread (109) and being arranged and configured to move with the rotation of a motor (50) or another drive mechanism,
 - a ratchet (115) arranged and configured not to move with the rotation of the motor (50) or another drive mechanism;
 - a clutch nut (114) that through a thread (110) can move on the thread (109) of the spindle (103),
 - a receiver (102) that through the clutch nut's movement on the spindle (103) is configured to connect and disconnect from the spindle's rotation.

12. A mattress extender (10) according to claim 11, wherein the movable clutch nut (114) comprises a track or internal threads (110) having teeth (111) arranged and configured to create a connection, wherein the clutch nut (114) further comprises ratchet points (113) consisting of elevations or depressions configured to interlock with the ratchet (115).
13. A mattress extender (10) according to claim 11 or 12, wherein the spindle (103) is designed to follow the rotation from a motor (50) or another drive mechanism, wherein the spindle (103) comprises a track or threads onto which the clutch nut's internal track or threads (109) fits, wherein the spindle (103) comprises a rotation point (107) at which the receiver (102), either directly or using a bearing, is rotatably mounted so the receiver (102) can rotate freely when the clutch mechanism (101) is in a disconnected state.
14. A health care bed repositioning system (2) comprising a health care bed (12) and a mattress extender (10) according to one of the preceding claims.
15. A health care bed repositioning system (2) according to claim 14, wherein the health care bed (12) comprises a:
- a support portion (9) provided with wheels;
 - a first section (20), a second section (20') and a third section (20''), wherein the first section (20) is provided at the foot of the health care bed (12), the third section (20'') is provided in the head end of the health care bed (12), while the second section (20') is provided between the first section (20) and the third section (20''), wherein the third section (20'') is rotatably mounted to the support portion (9).

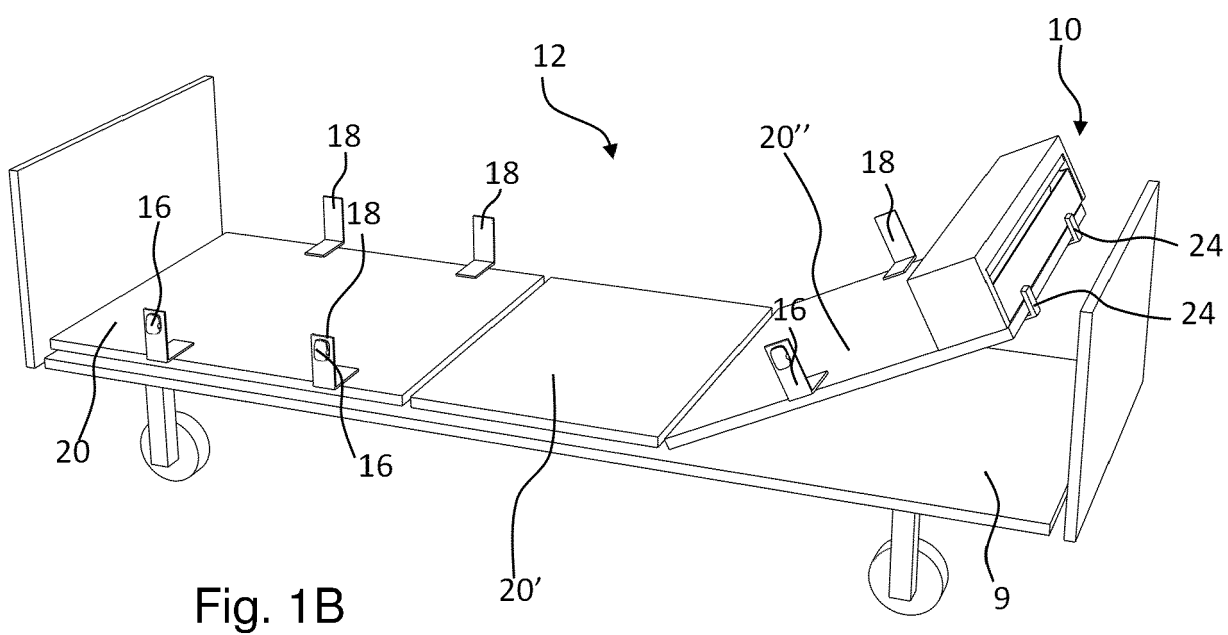
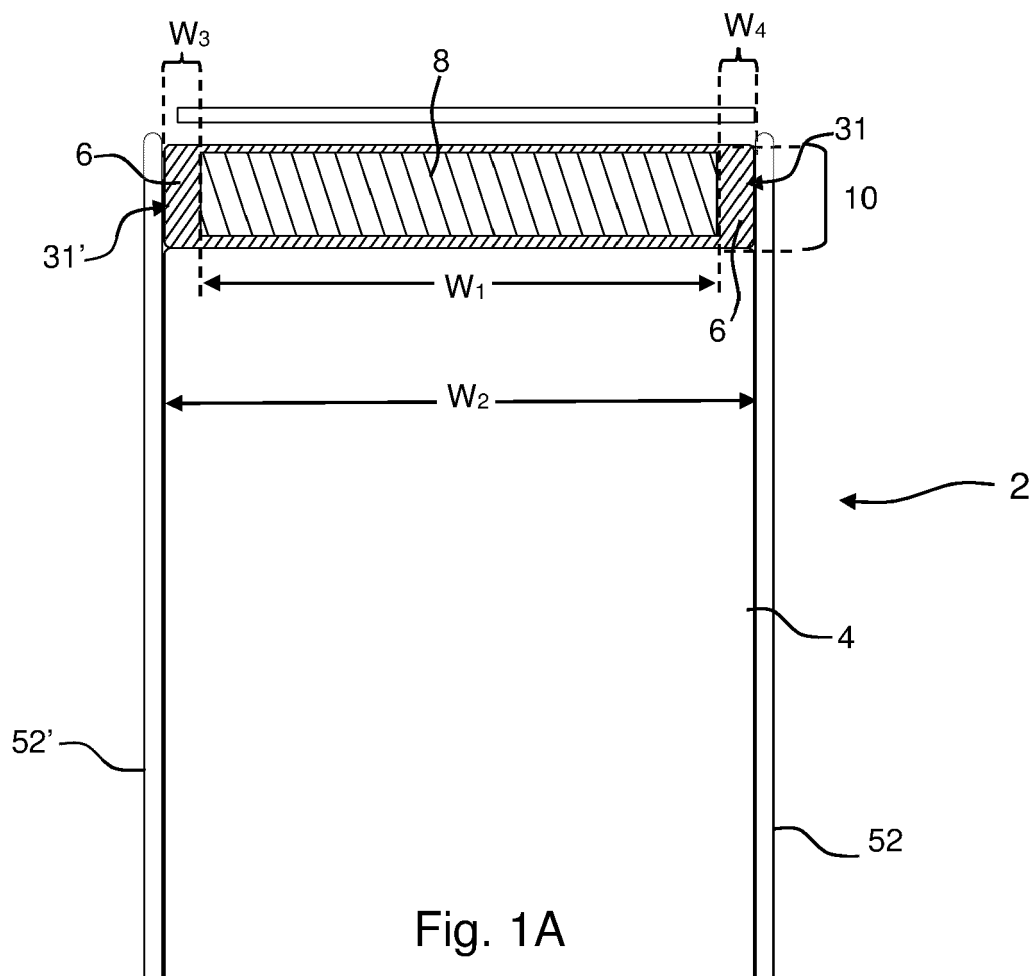


Fig. 2A

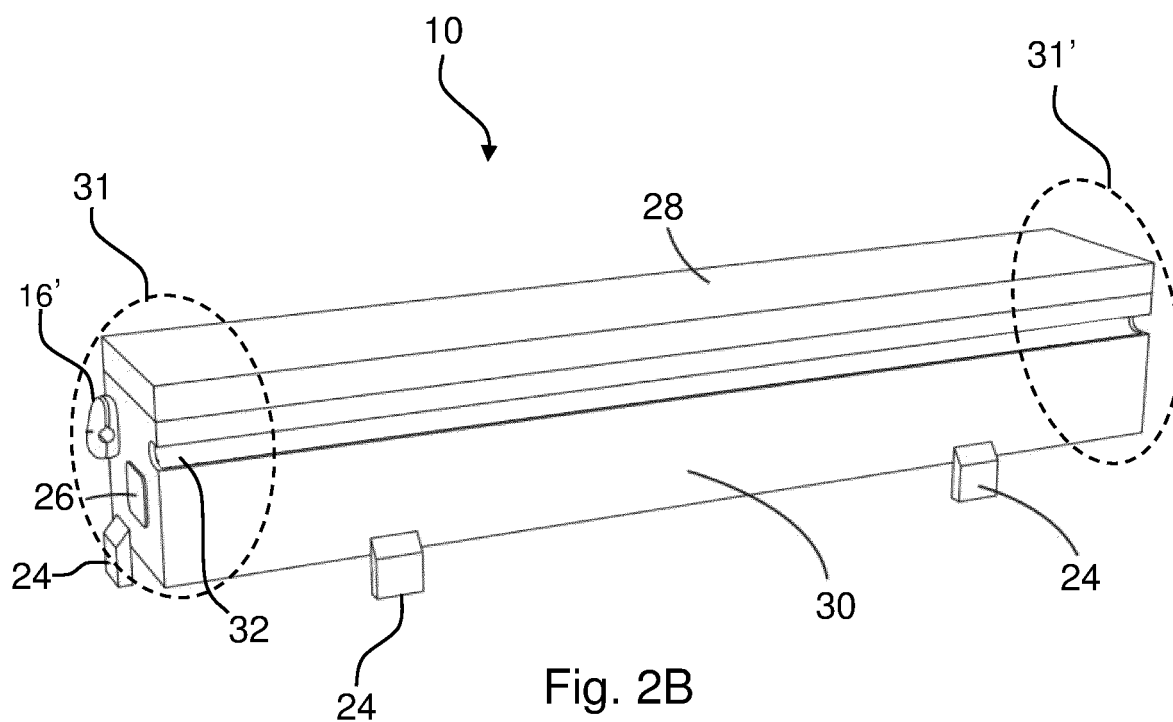
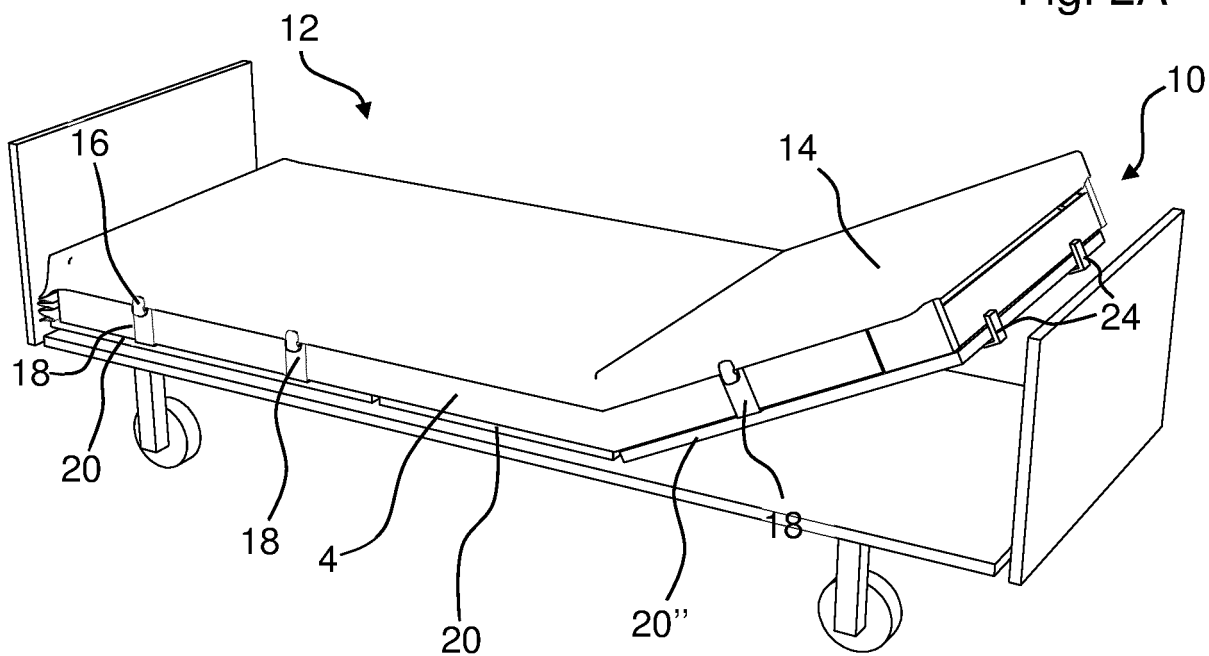


Fig. 2B

Fig. 3A

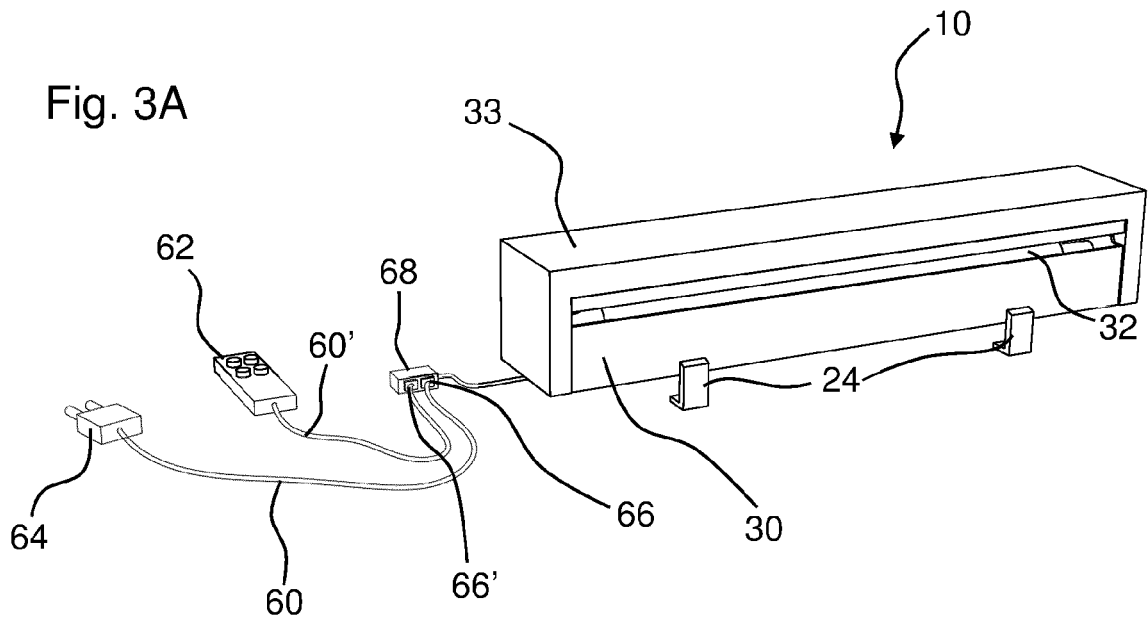


Fig. 3B

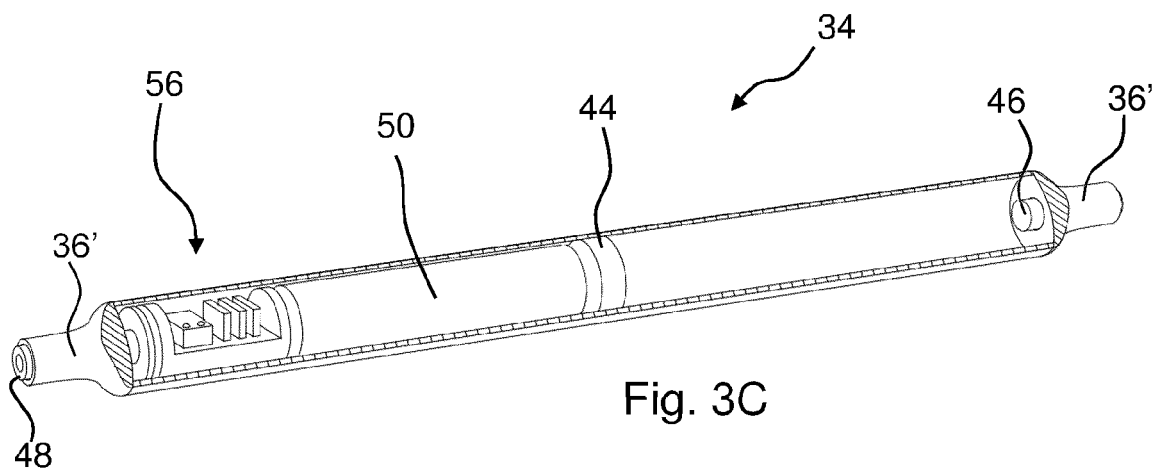
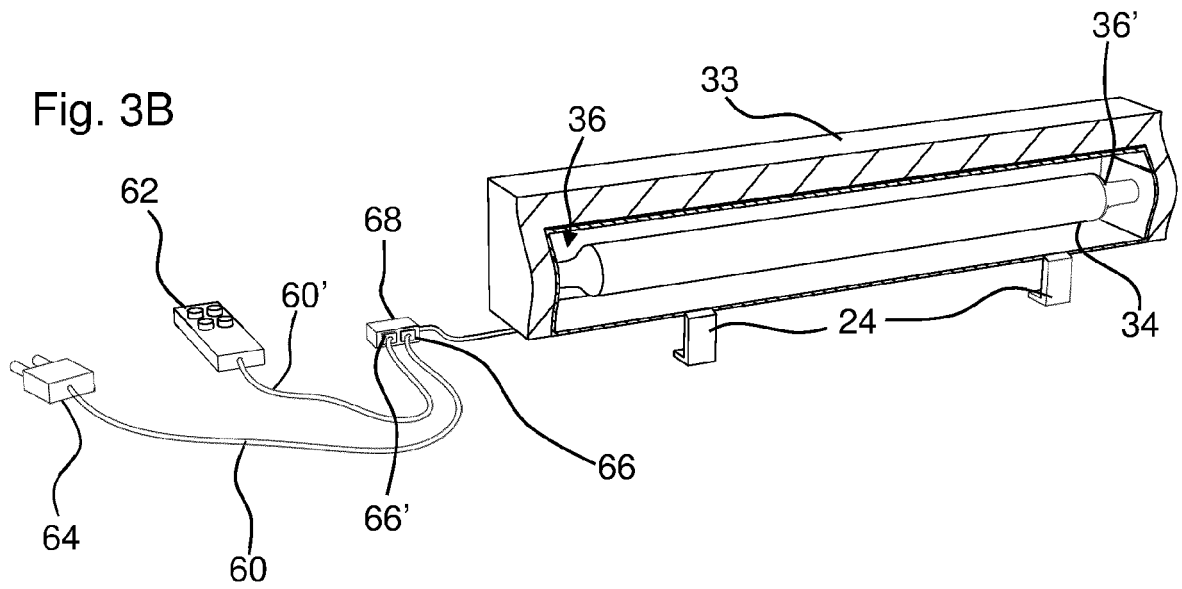


Fig. 3C

Fig. 4A

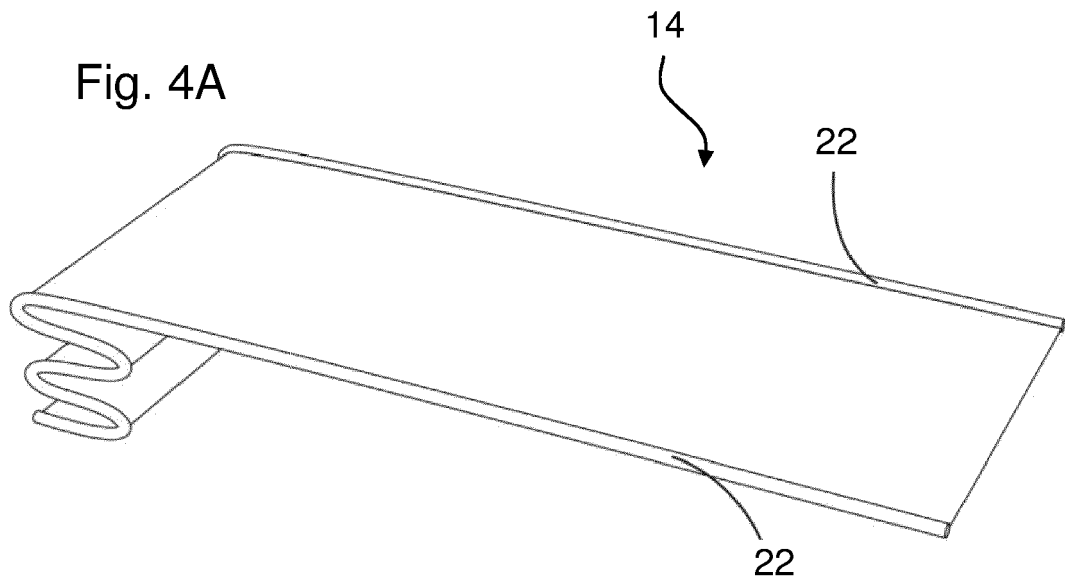
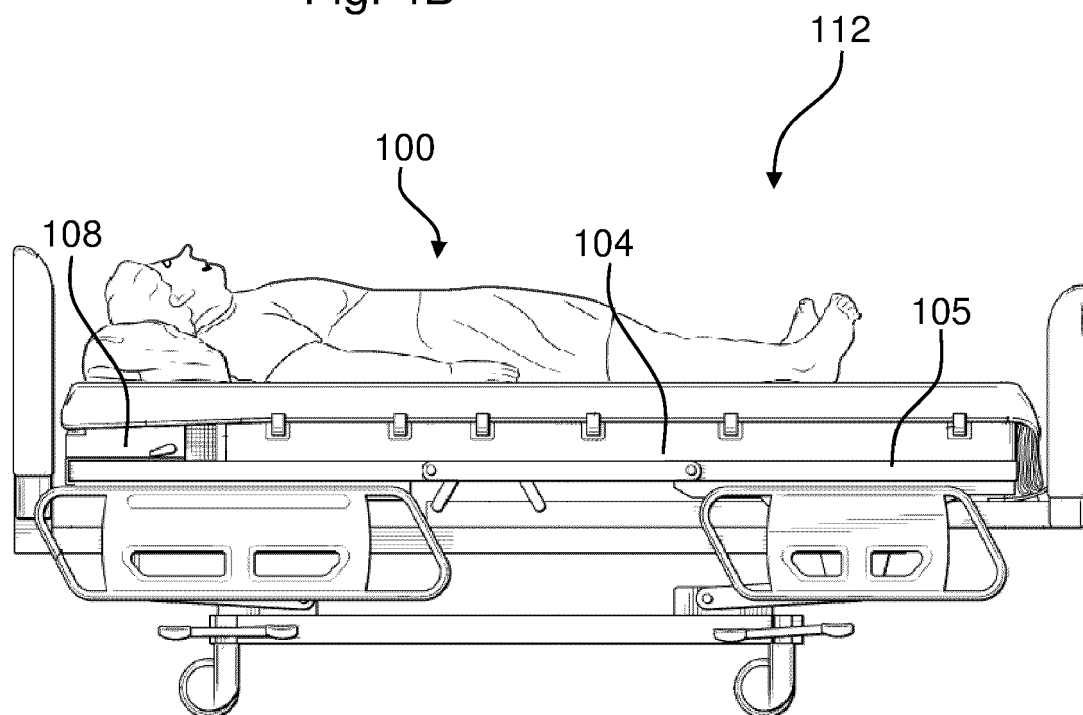


Fig. 4B



Prior Art

Fig. 5A

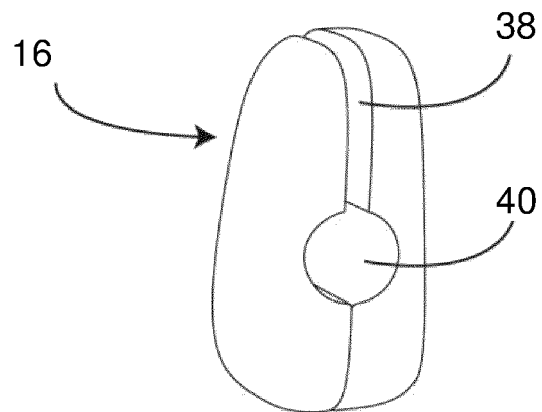


Fig. 5B

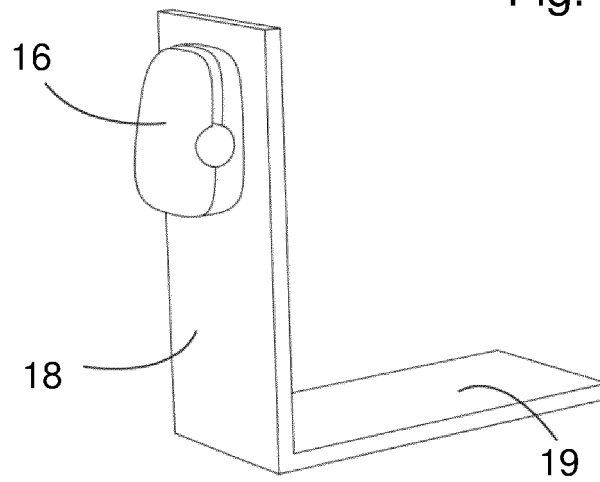


Fig. 5C

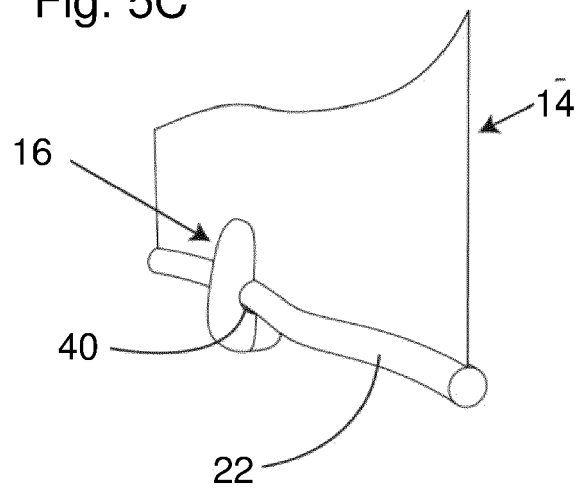


Fig. 6A

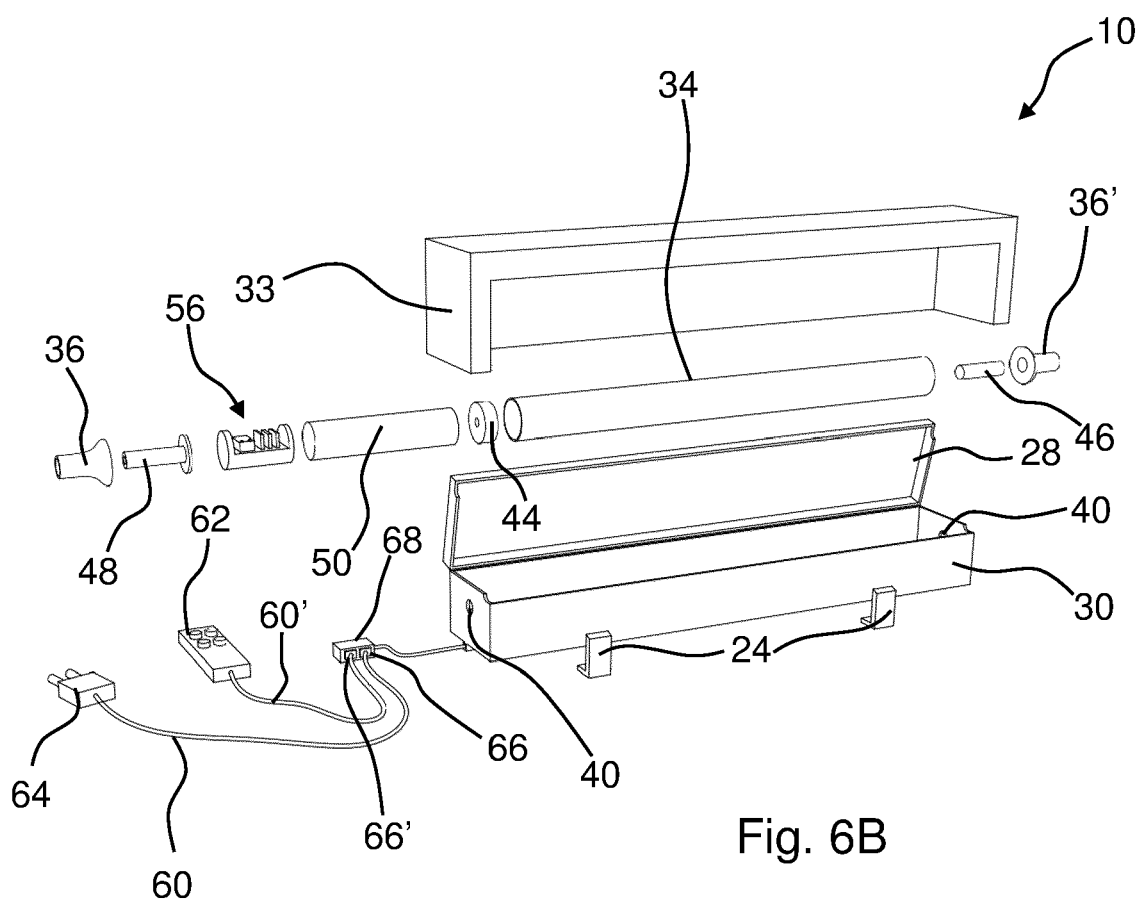
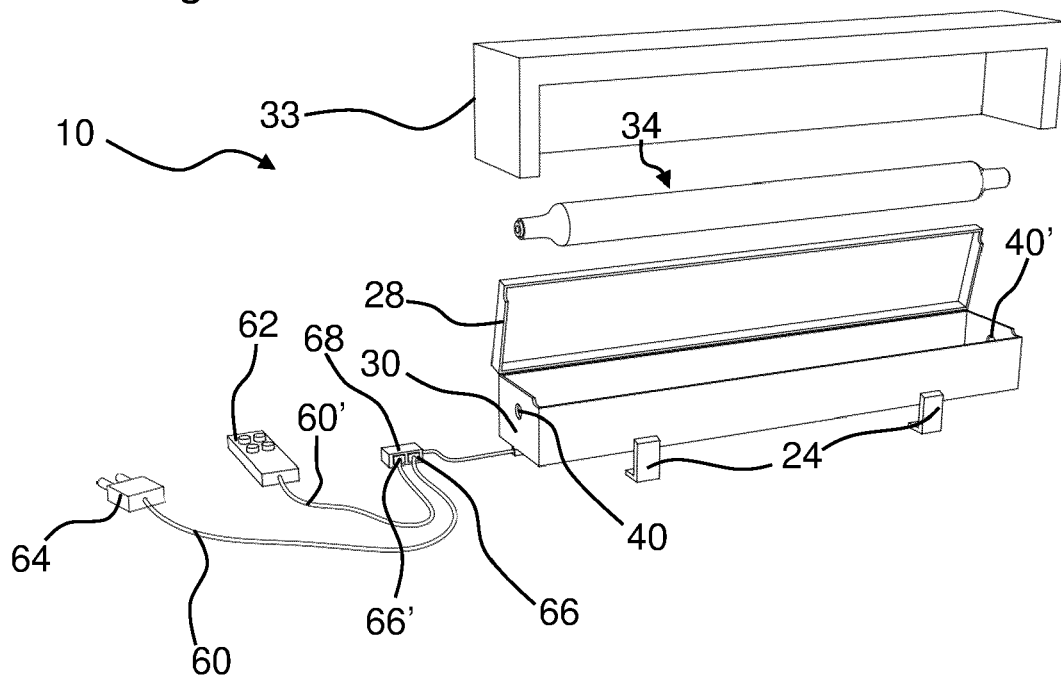


Fig. 6B

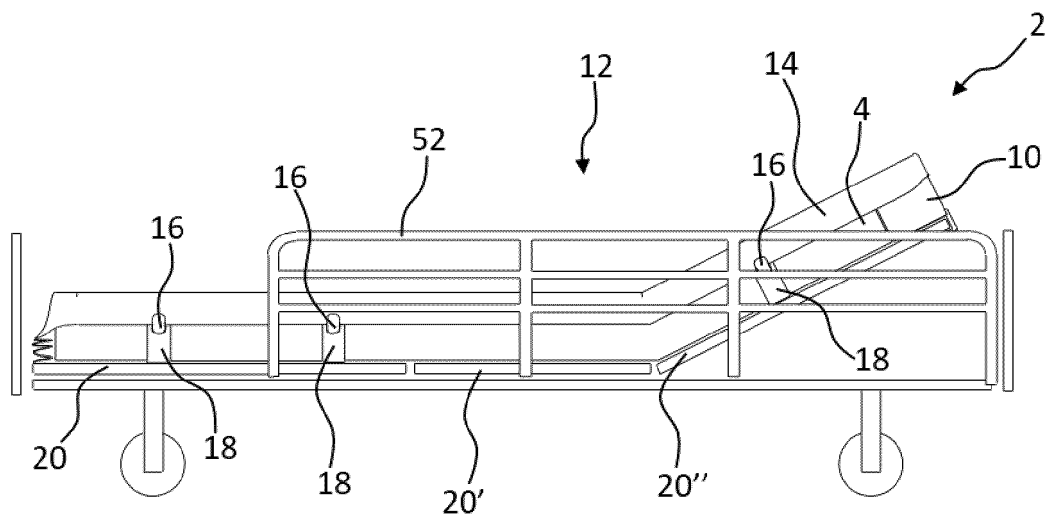
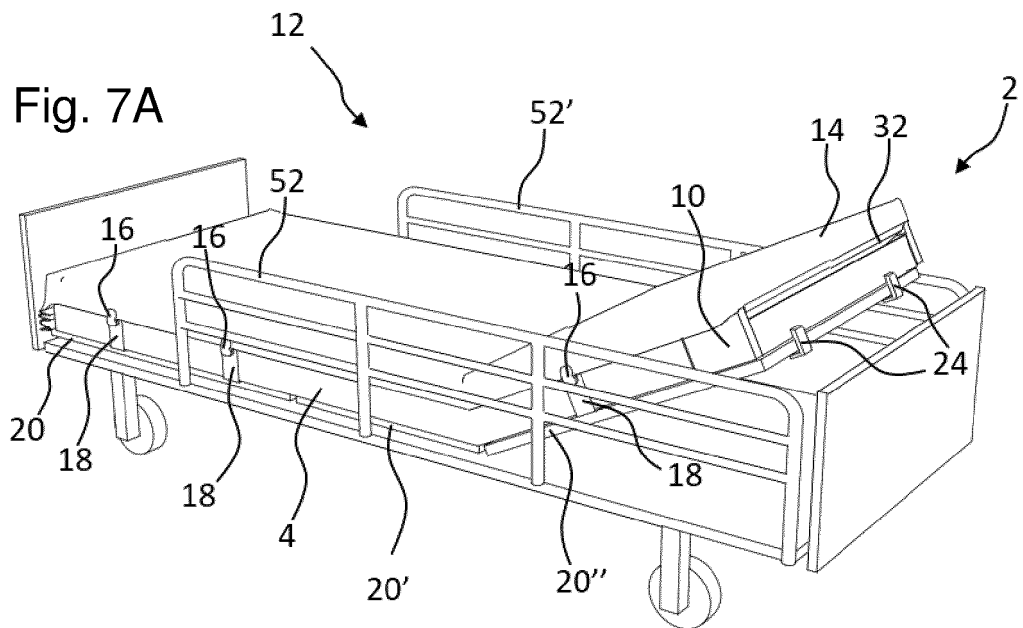


Fig. 7B

Fig. 8

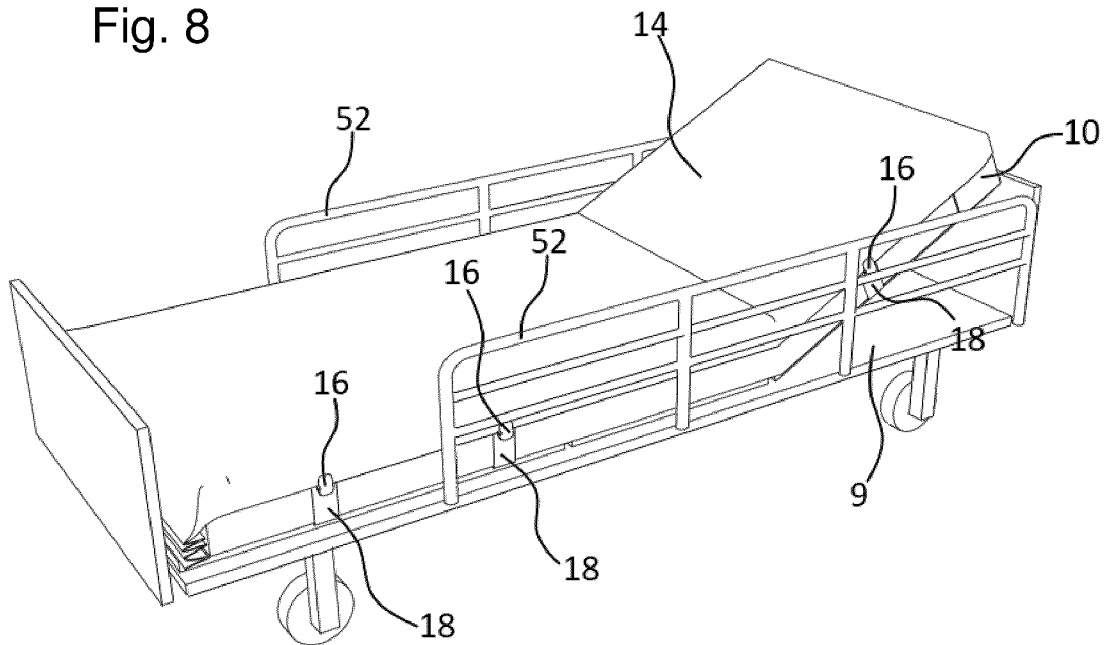


Fig. 9

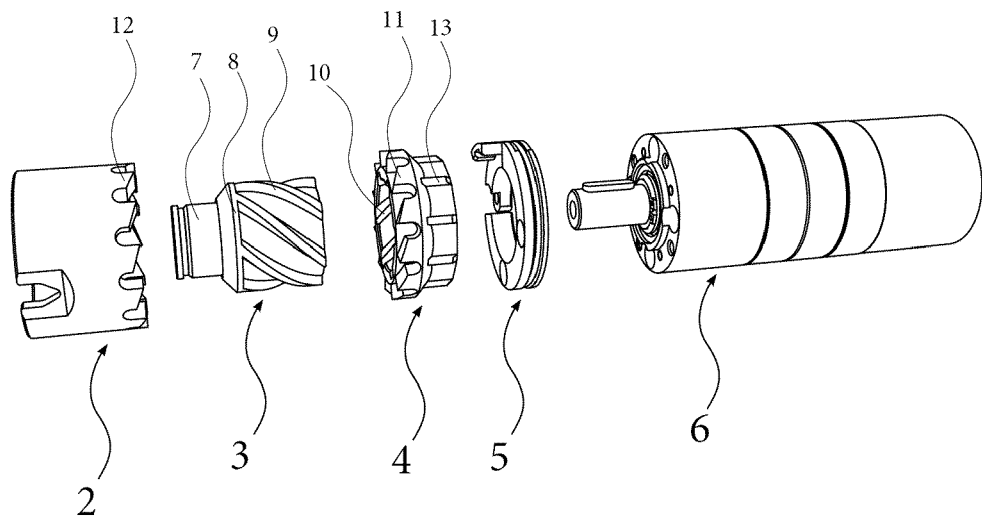


Fig. 10

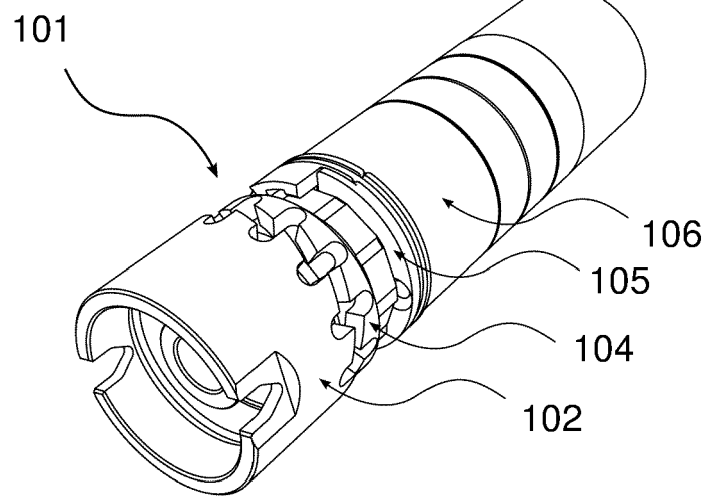
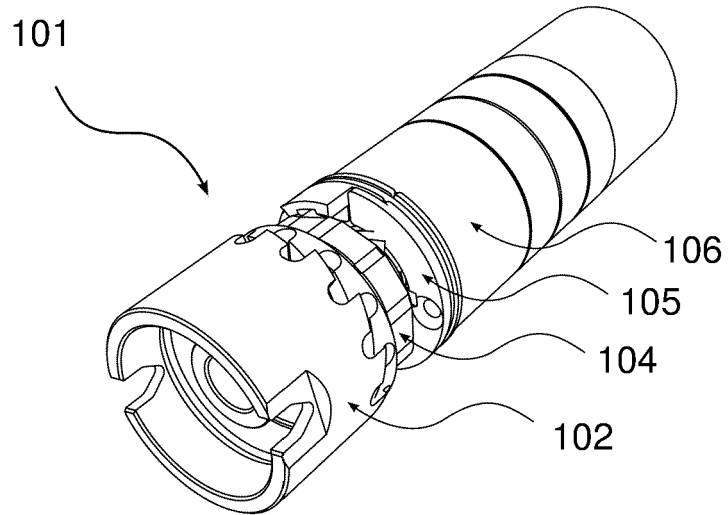


Fig. 11

Fig. 12

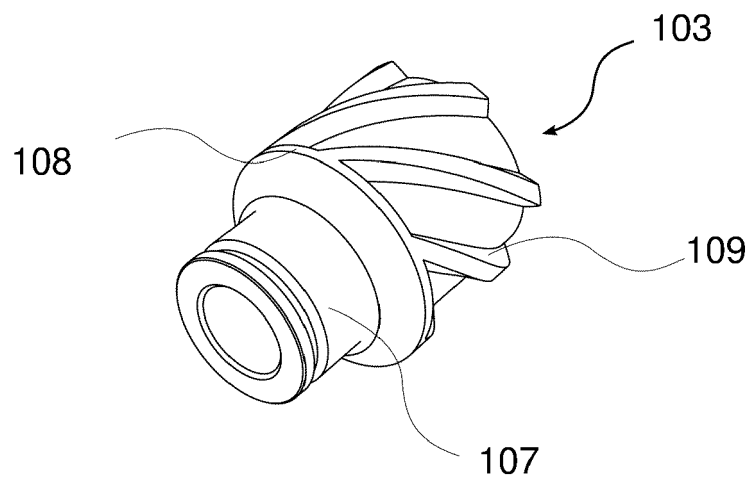
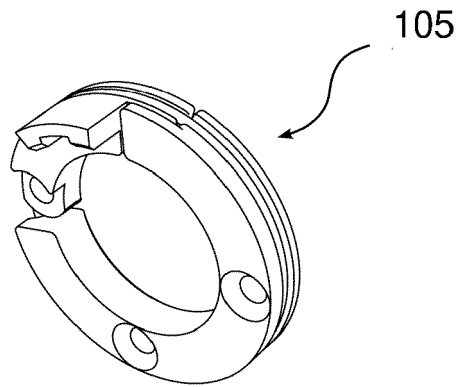


Fig. 13

Fig. 14

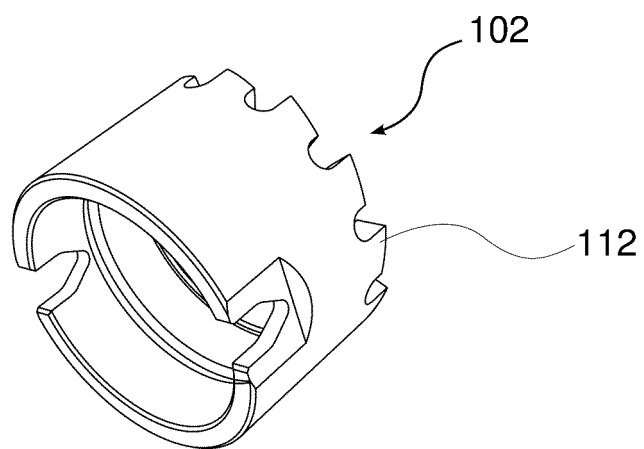
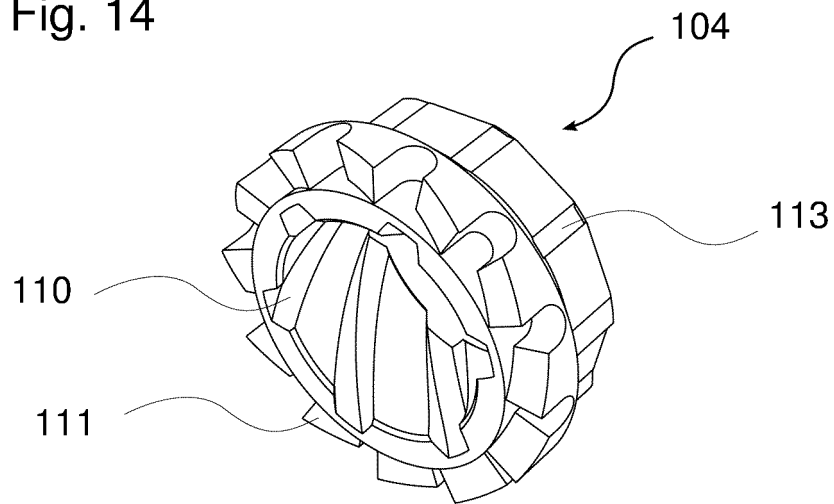


Fig. 15



EUROPEAN SEARCH REPORT

Application Number

EP 23 19 1448

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CN 109 199 750 A (LIU ZUNQUN) 15 January 2019 (2019-01-15)	1-5, 7-10, 14, 15	INV. A61G7/015 A47C21/02
A	* paragraph [0053]; figures 1-26 * -----	6, 11-13	A61G7/05
X	WO 2016/022558 A1 (HILLENBRAND MAN COMPANY LLC [US]) 11 February 2016 (2016-02-11)	1, 4, 5, 7, 8, 10-12, 14, 15	
A	* figures 1A-24B * -----	6, 9, 13	
X	US 2017/231847 A1 (HILLENBRAND II WILLIAM [US] ET AL) 17 August 2017 (2017-08-17)	1, 4, 5, 7, 8, 10, 14, 15	
A	* figures 1A-14B * -----	2, 3, 6, 9, 11-13	
			TECHNICAL FIELDS SEARCHED (IPC)
			A61G A47D A47C
The present search report has been drawn up for all claims			

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EPO FORM 1503 03.82 (P04C01)

Place of search	Date of completion of the search	Examiner
The Hague	9 January 2024	Gkama, Alexandra
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document		

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 23 19 1448

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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09-01-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 109199750 A	15-01-2019	NONE	
WO 2016022558 A1	11-02-2016	NONE	
US 2017231847 A1	17-08-2017	US 2017231847 A1	17-08-2017
		WO 2016022564 A1	11-02-2016

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2016022558 A1 [0011] [0012]