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(54) **HOSPITAL BED WITH APPARATUS CAPABLE OF AUTOMATICALLY CHANGING BED SHEETS WITHOUT DISTURBING OCCUPIED PERSON, ALSO A METHOD OF PREVENTING AND RELIEVING ULCERS**

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(21) Appl. No.: **15/259,005**

(22) Filed: **Sep. 7, 2016**

Related U.S. Application Data

(63) Continuation-in-part of application No. 15/185,472, filed on Jun. 17, 2016, which is a continuation of application No. 14/213,785, filed on Mar. 14, 2014, now Pat. No. 9,370,250.

(60) Provisional application No. 61/784,948, filed on Mar. 14, 2013.

Publication Classification

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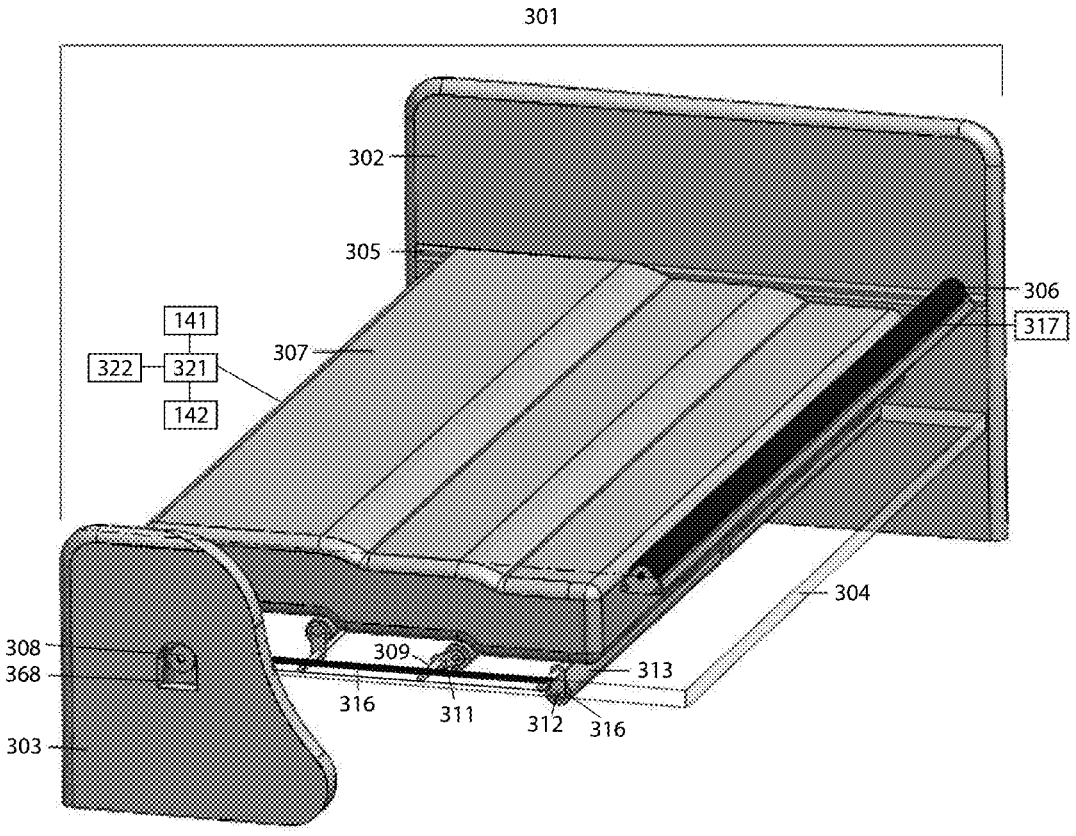
A61G 7/057	(2006.01)
A47C 21/02	(2006.01)

(52) **U.S. Cl.**

CPC ***A61G 7/0502*** (2013.01); ***A61G 7/0573*** (2013.01); ***A61G 7/05769*** (2013.01); ***A61G 7/05784*** (2016.11); ***A47C 21/028*** (2013.01); ***A61H 15/0078*** (2013.01); ***A61H 9/0085*** (2013.01); *A61G 2203/34* (2013.01); *A61H 2201/5071* (2013.01); *A61H 2015/0014* (2013.01)

(57) **ABSTRACT**

The present invention relates generally to an ultimate comfort n care bed, and a bed apparatus capable of seamlessly changing bed sheets while being occupied by a person, a method of relieving ulcers, and a method thereof. The present invention also relates to a medical or a hospital bed, and, more particularly, to a hospital bed capable of seamlessly changing bed-sheets while the hospital bed is occupied by a patient. The present invention also comprises of a medical bed apparatus which allows the seamlessly changing of a used bed sheet with a new bed sheet while the bed is occupied by a person, and a method thereof Optionally, the medical or hospital bed can also have an air bladder system to inflate or deflate the hospital bed mattress while a bed sheet is being changed.



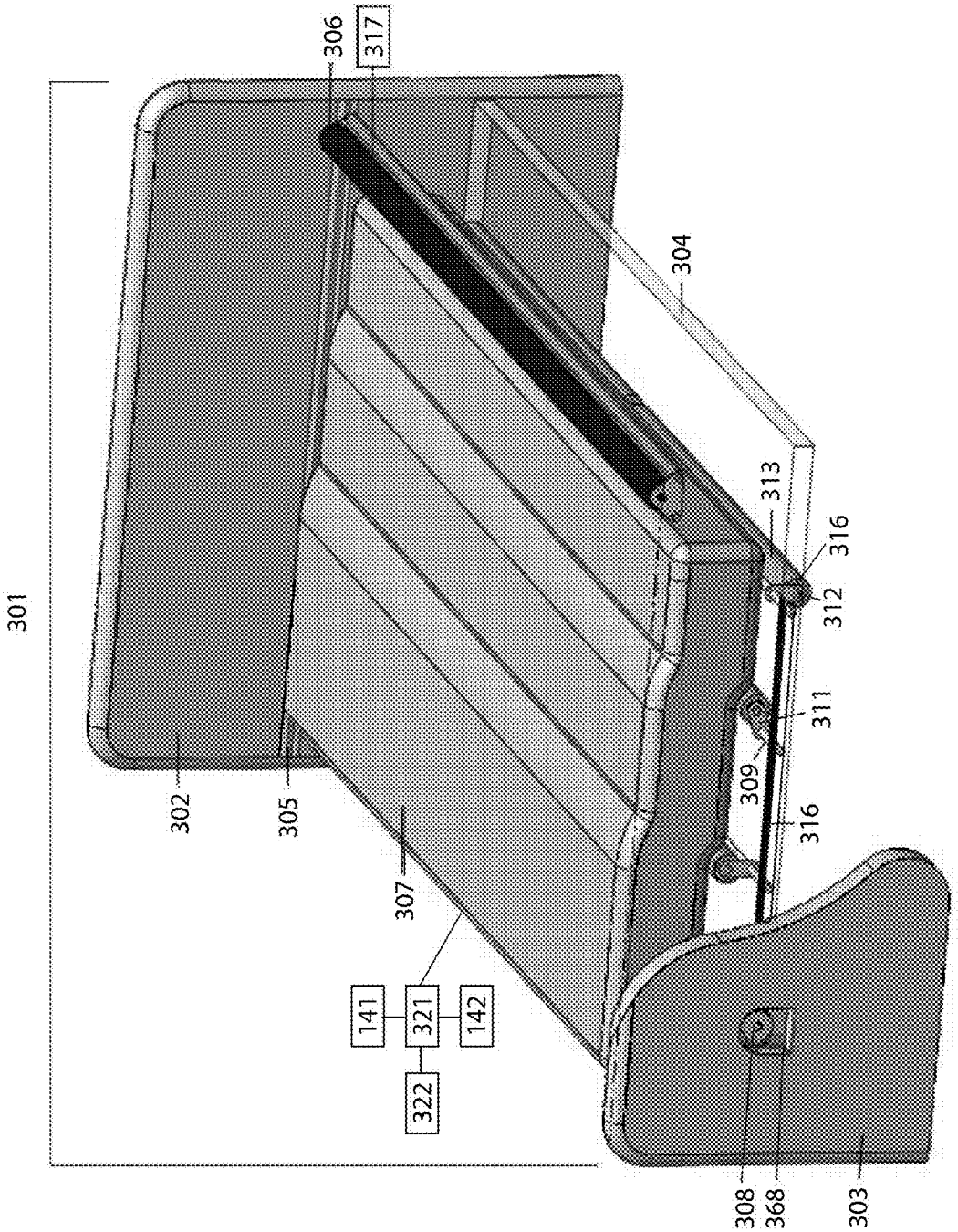

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FIG. 1

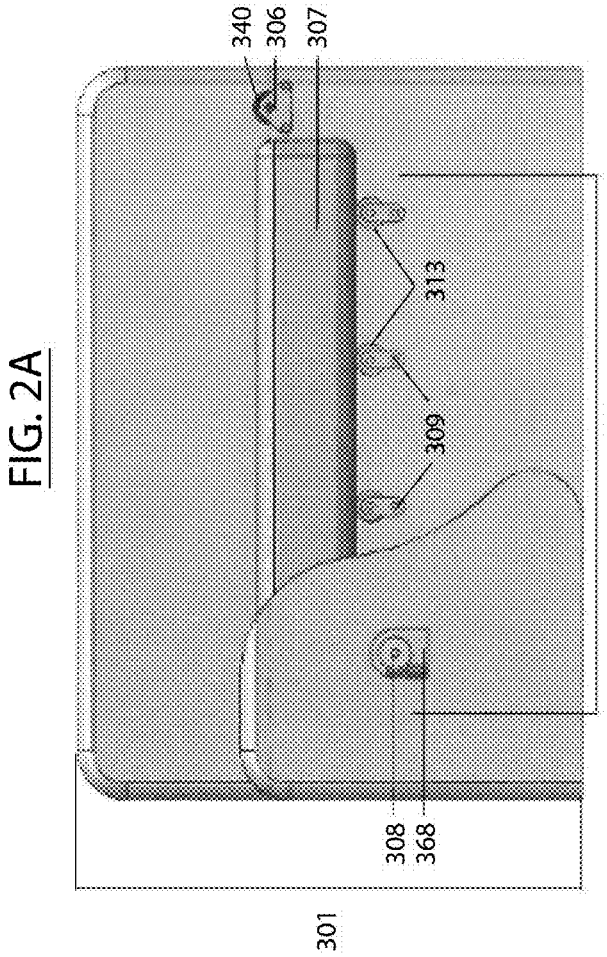

FIG. 2A

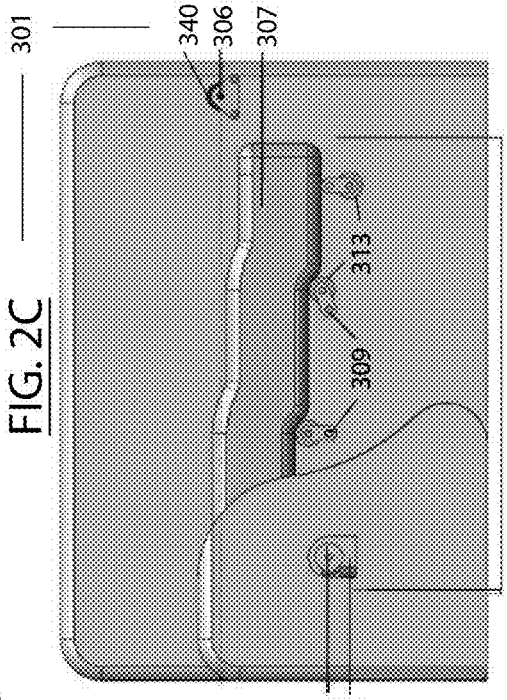

FIG. 2C

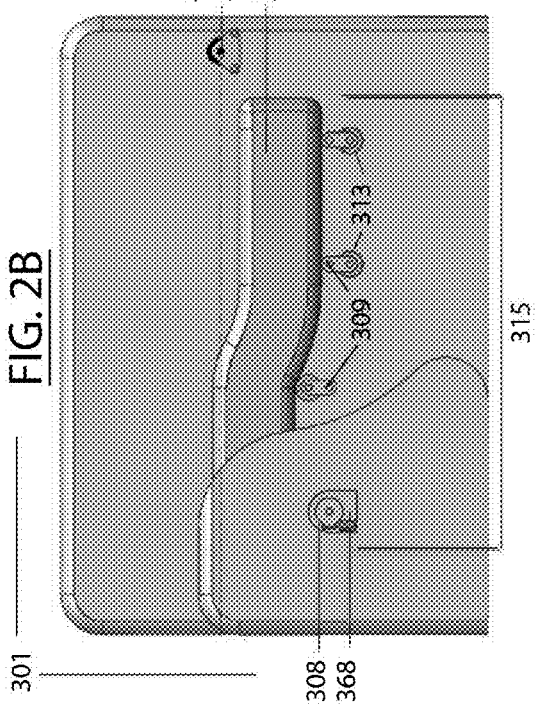

FIG. 2B

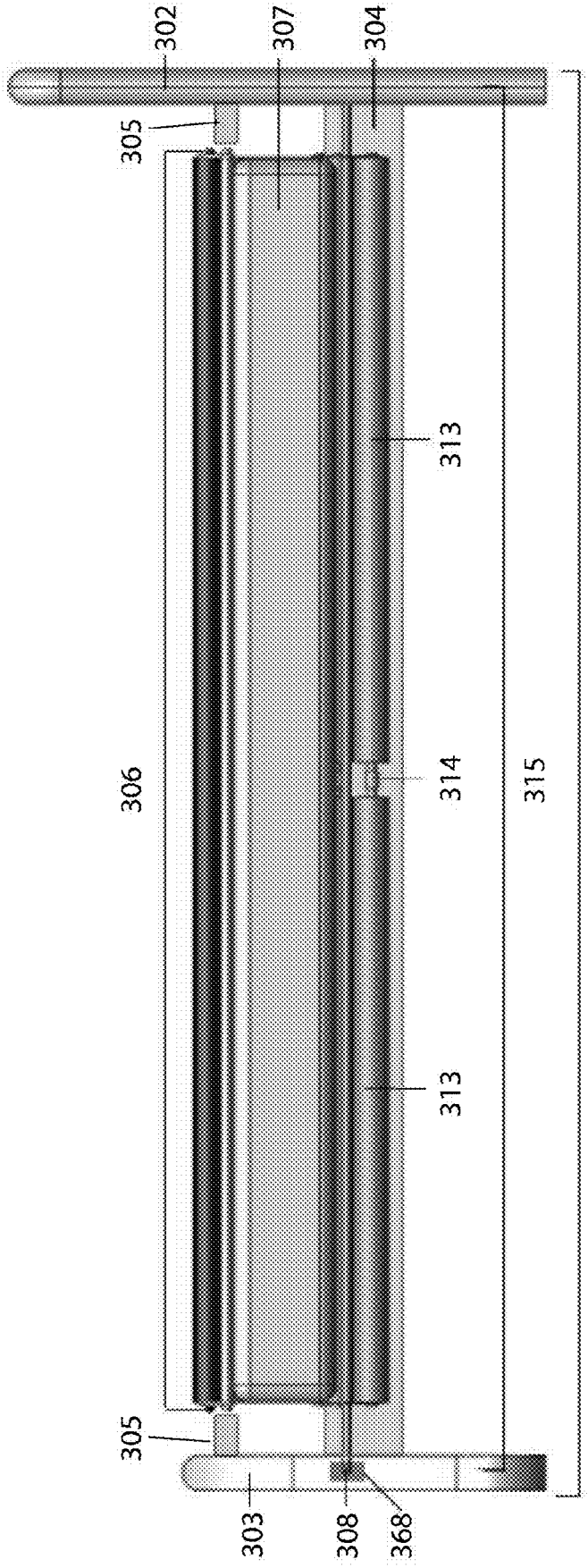

FIG. 3

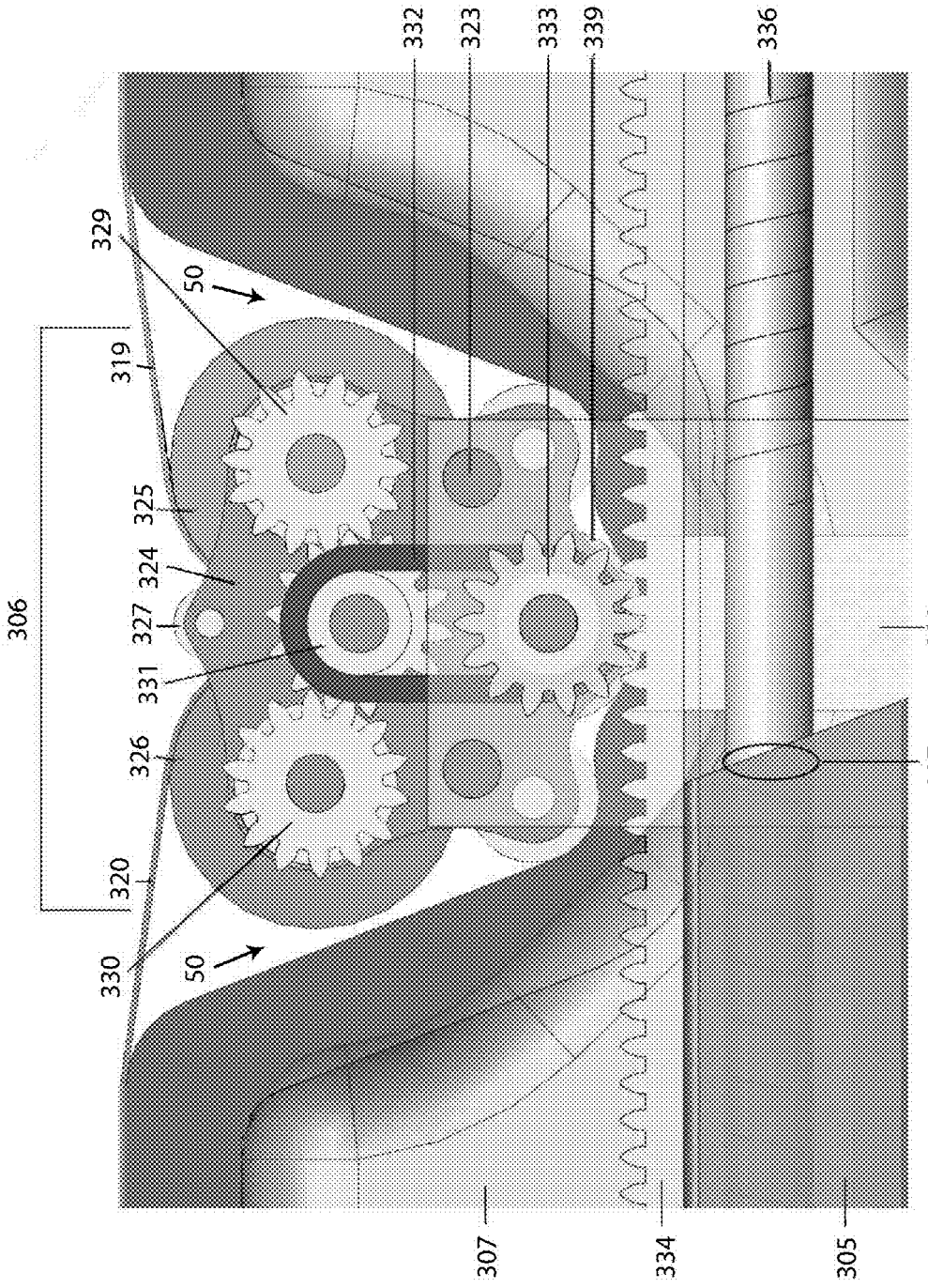
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FIG. 4

FIG. 5A

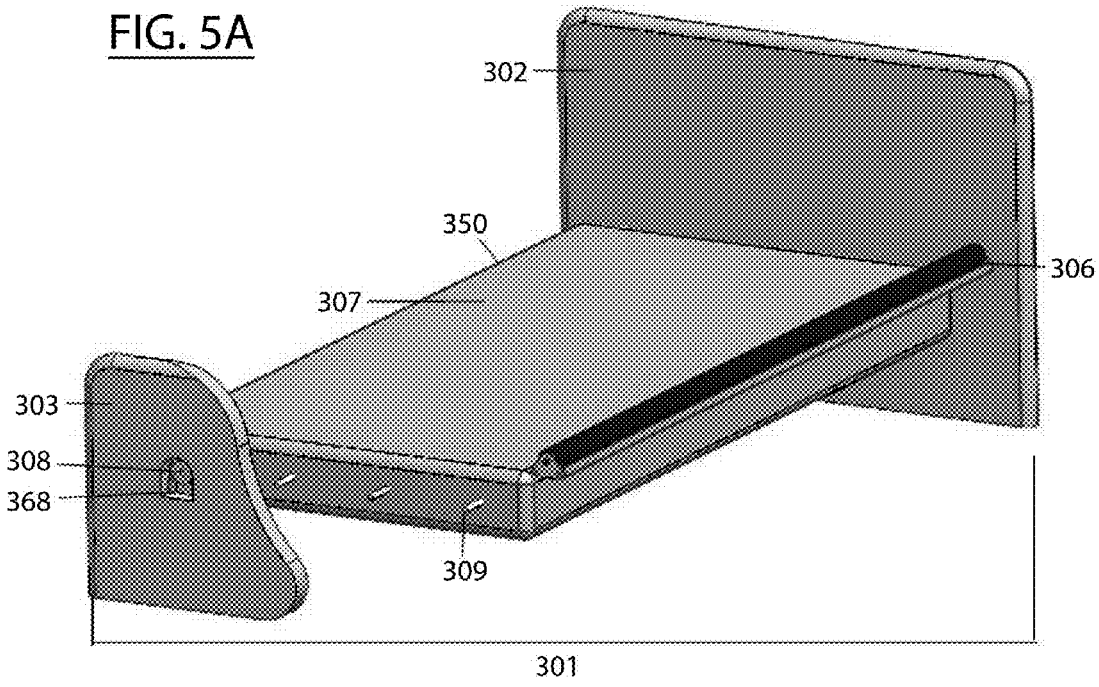
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FIG. 5B

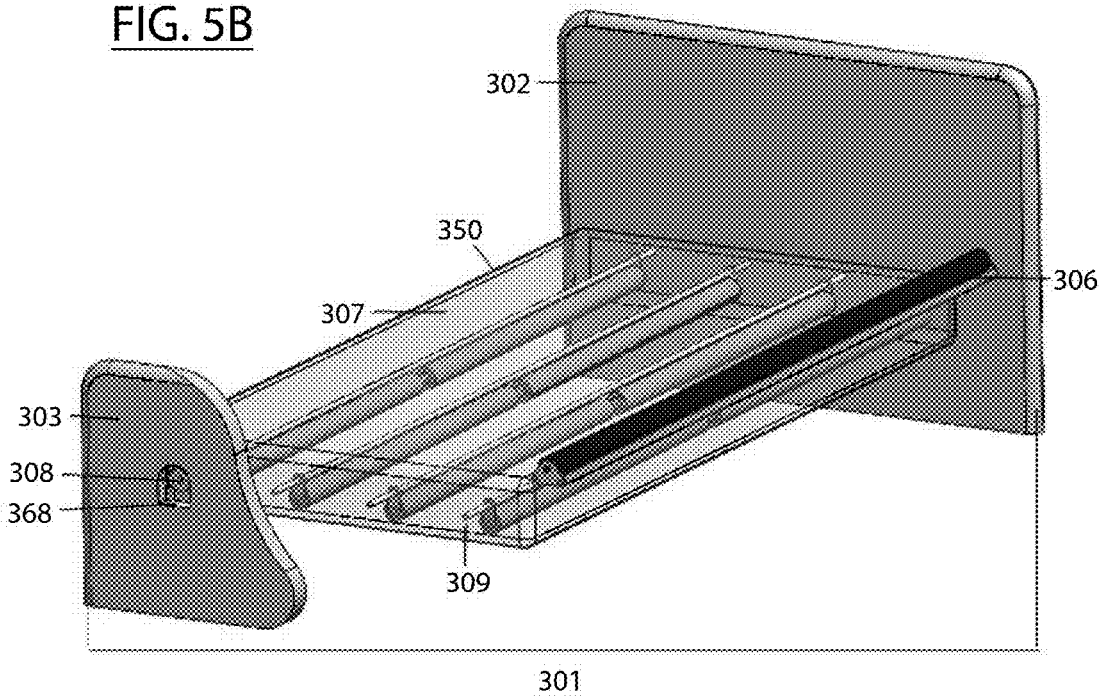
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FIG. 6A

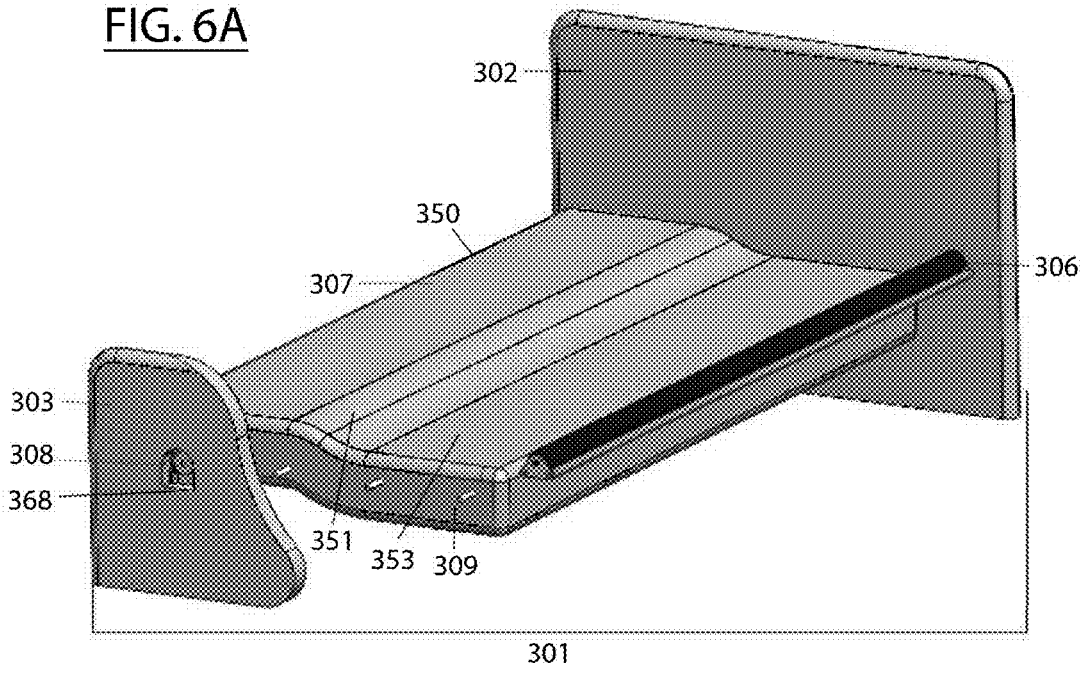
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FIG. 6B

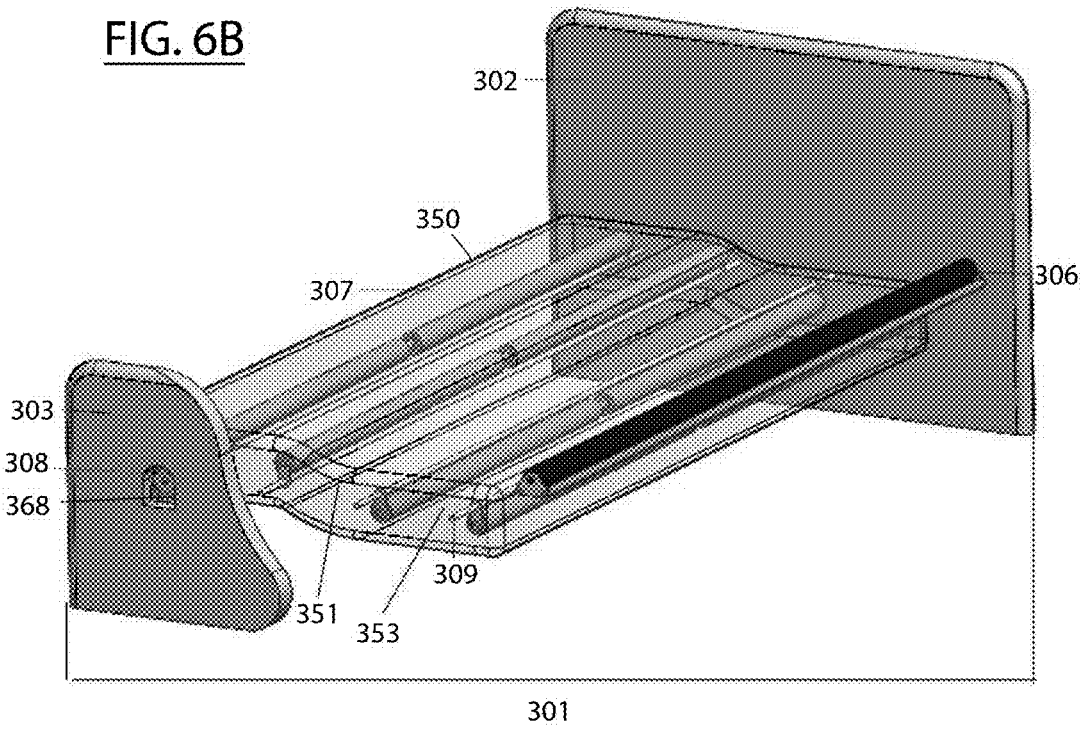
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FIG. 7A

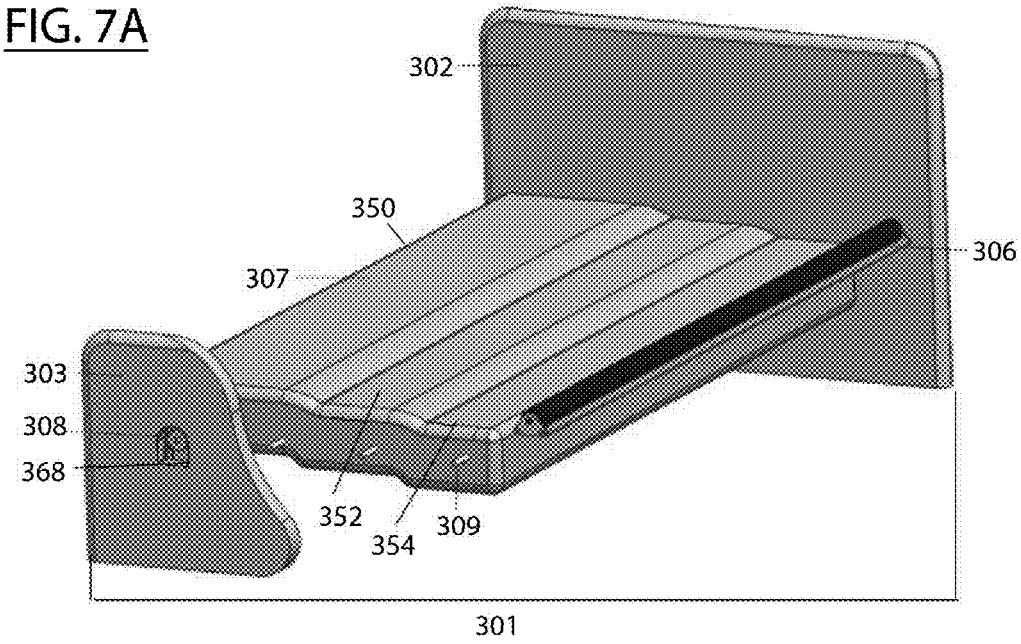
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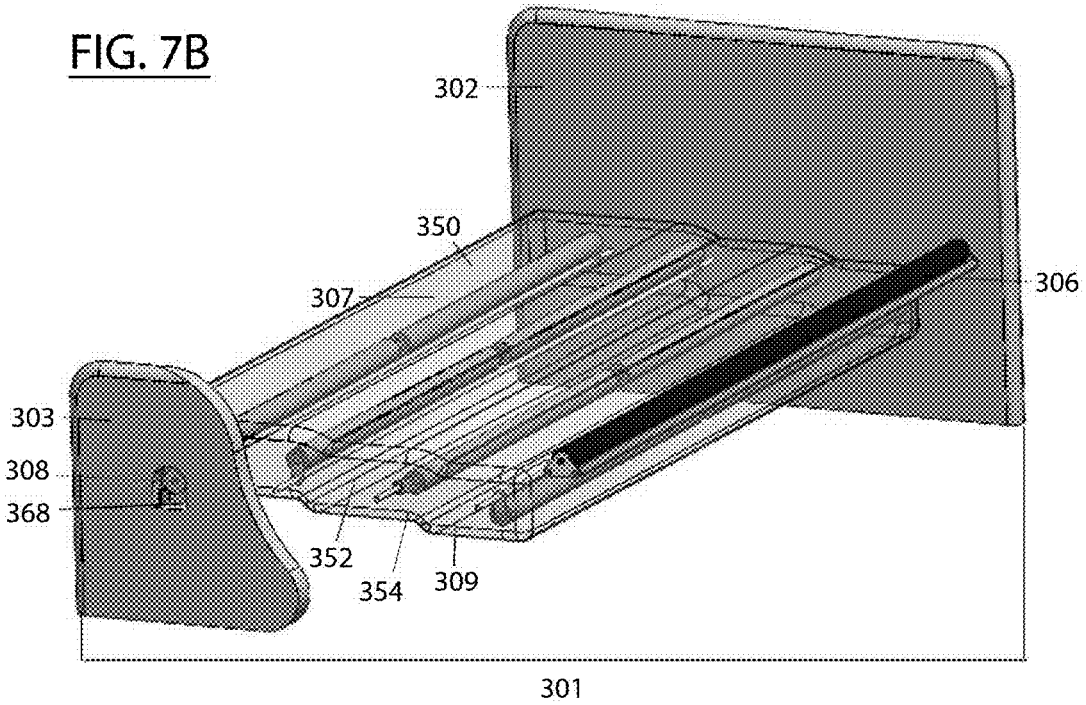
FIG. 7B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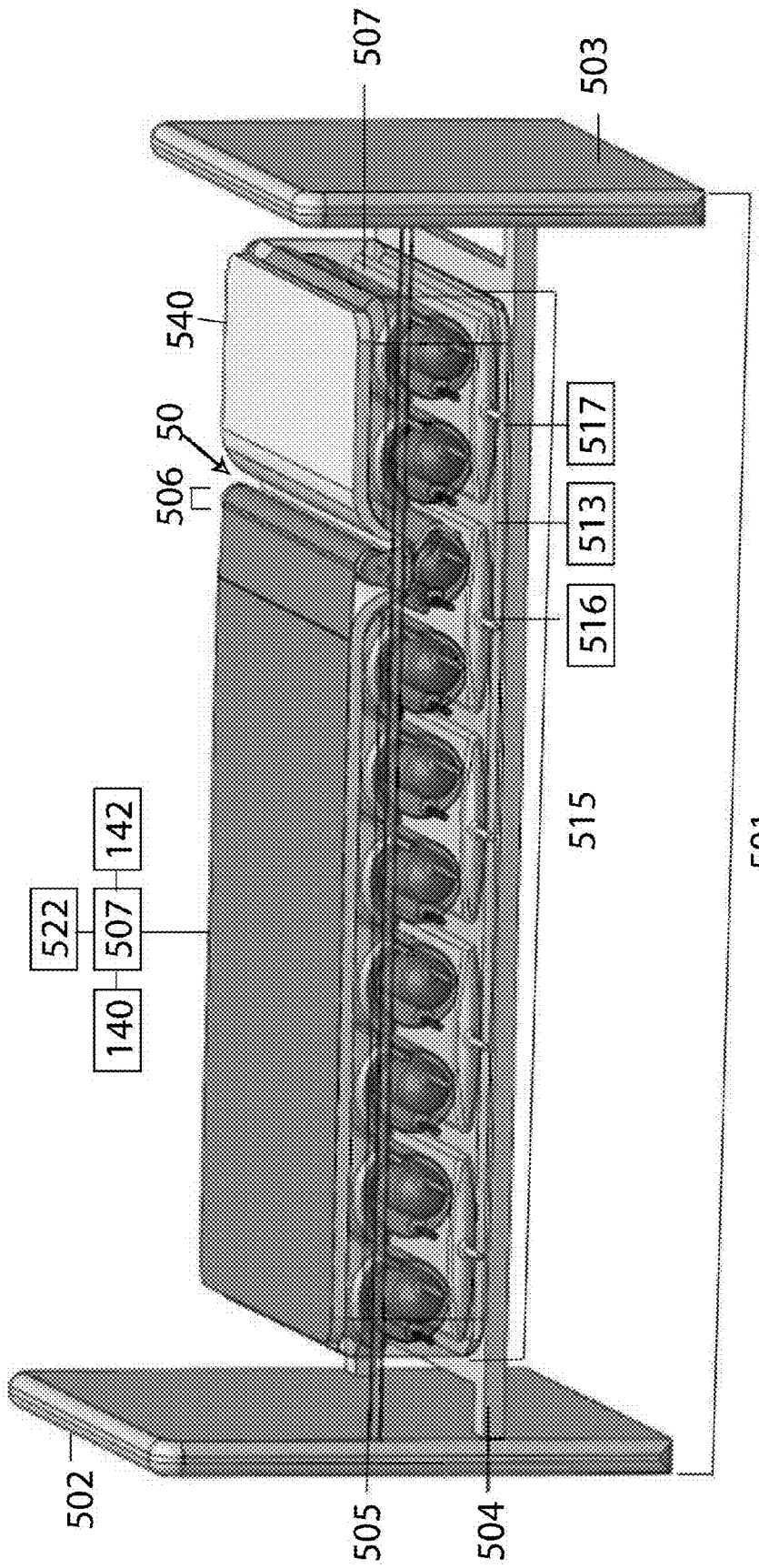
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FIG. 8

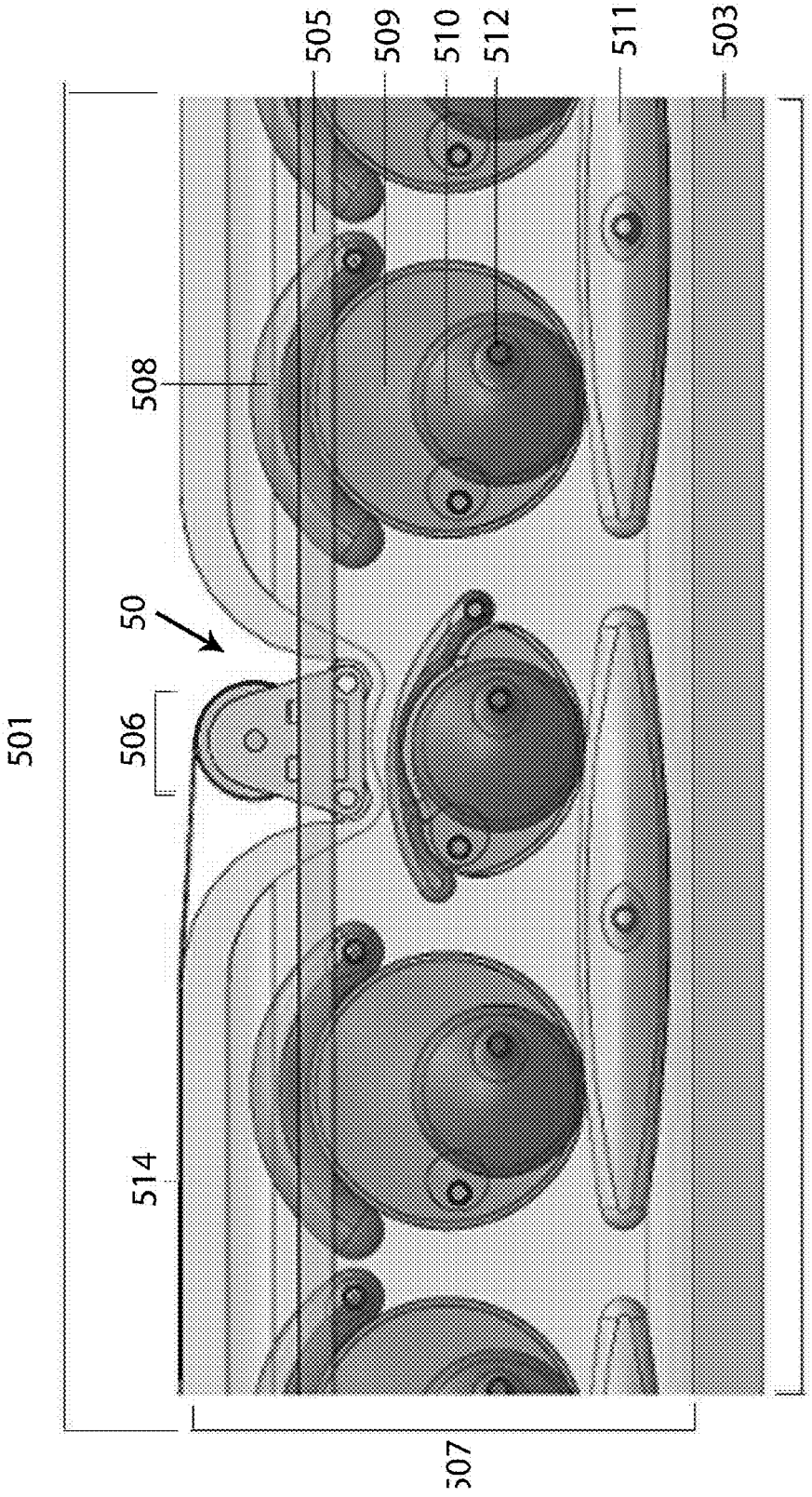

FIG. 9

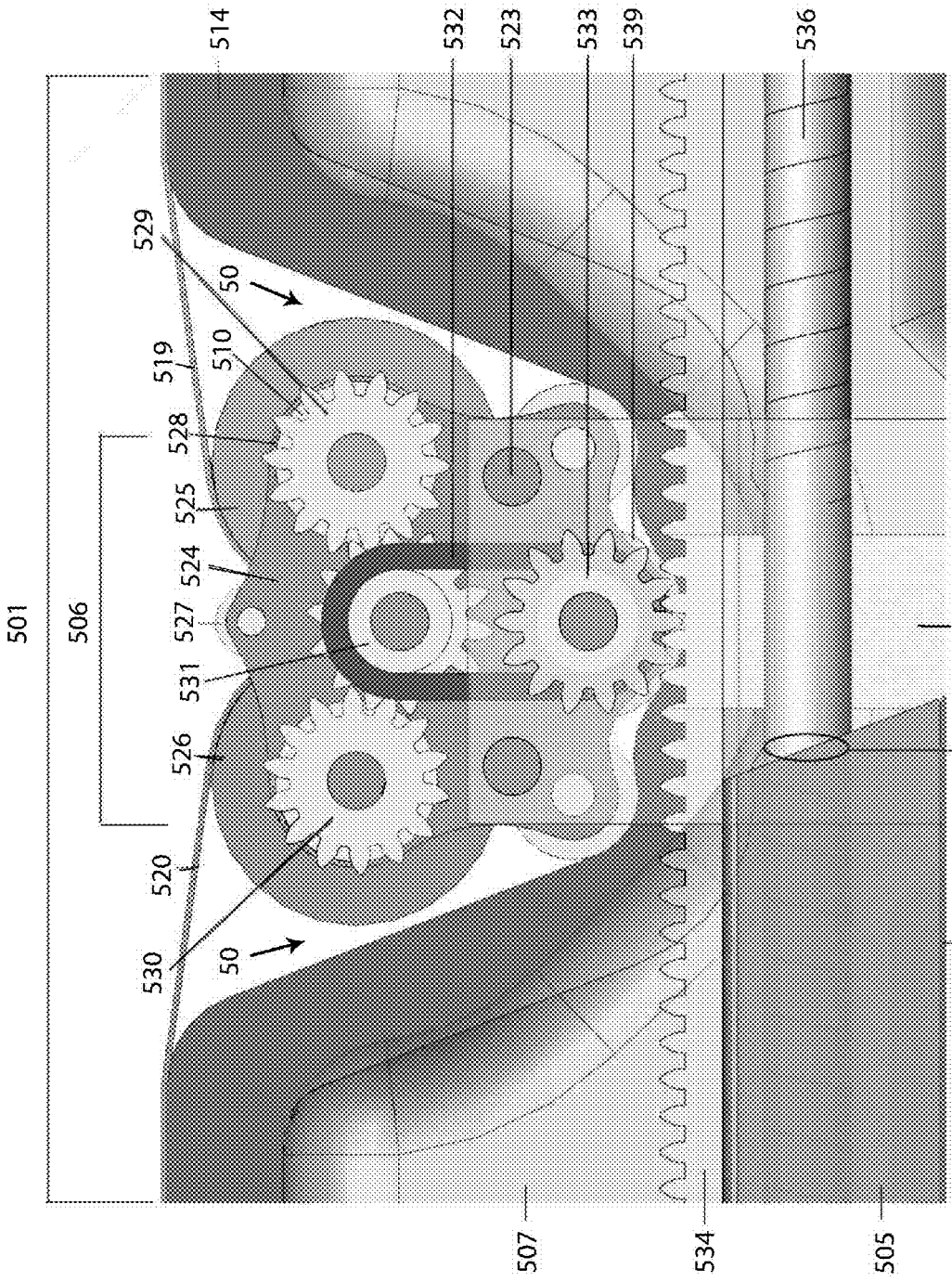
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FIG. 10

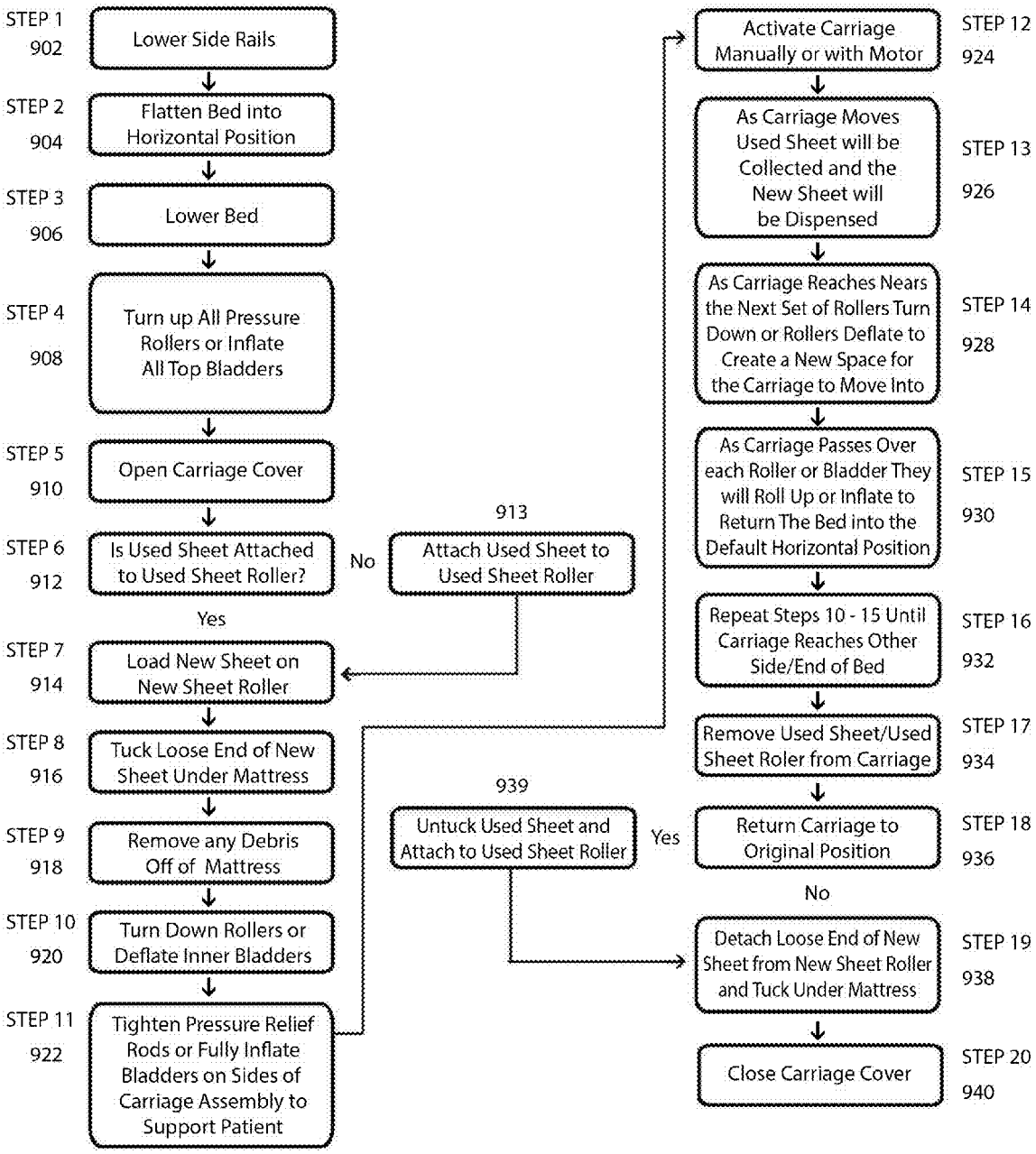

STEP 1
902
Lower Side Rails
STEP 2
904
Flatten Bed into Horizontal Position
STEP 3
906
Lower Bed
STEP 4
908
Turn up All Pressure Rollers or Inflate All Top Bladders
STEP 5
910
Open Carriage Cover
STEP 6
912
Is Used Sheet Attached to Used Sheet Roller?
No
913
Attach Used Sheet to Used Sheet Roller
Yes
STEP 7
914
Load New Sheet on New Sheet Roller
STEP 8
916
Tuck Loose End of New Sheet Under Mattress
STEP 9
918
Remove any Debris Off of Mattress
STEP 10
920
Turn Down Rollers or Deflate Inner Bladders
STEP 11
922
Tighten Pressure Relief Rods or Fully Inflate Bladders on Sides of Carriage Assembly to Support Patient
939
Untuck Used Sheet and Attach to Used Sheet Roller
Yes
No
STEP 12
924
Activate Carriage Manually or with Motor
STEP 13
926
As Carriage Moves Used Sheet will be Collected and the New Sheet will be Dispensed
STEP 14
928
As Carriage Reaches Nears the Next Set of Rollers Turn Down or Rollers Deflate to Create a New Space for the Carriage to Move Into
STEP 15
930
As Carriage Passes Over each Roller or Bladder They will Roll Up or Inflate to Return The Bed into the Default Horizontal Position
STEP 16
932
Repeat Steps 10 - 15 Until Carriage Reaches Other Side/End of Bed
STEP 17
934
Remove Used Sheet/Used Sheet Roler from Carriage
STEP 18
936
Return Carriage to Original Position
STEP 19
938
Detach Loose End of New Sheet from New Sheet Roller and Tuck Under Mattress
STEP 20
940
Close Carriage Cover

FIG. 11

FIG 12A

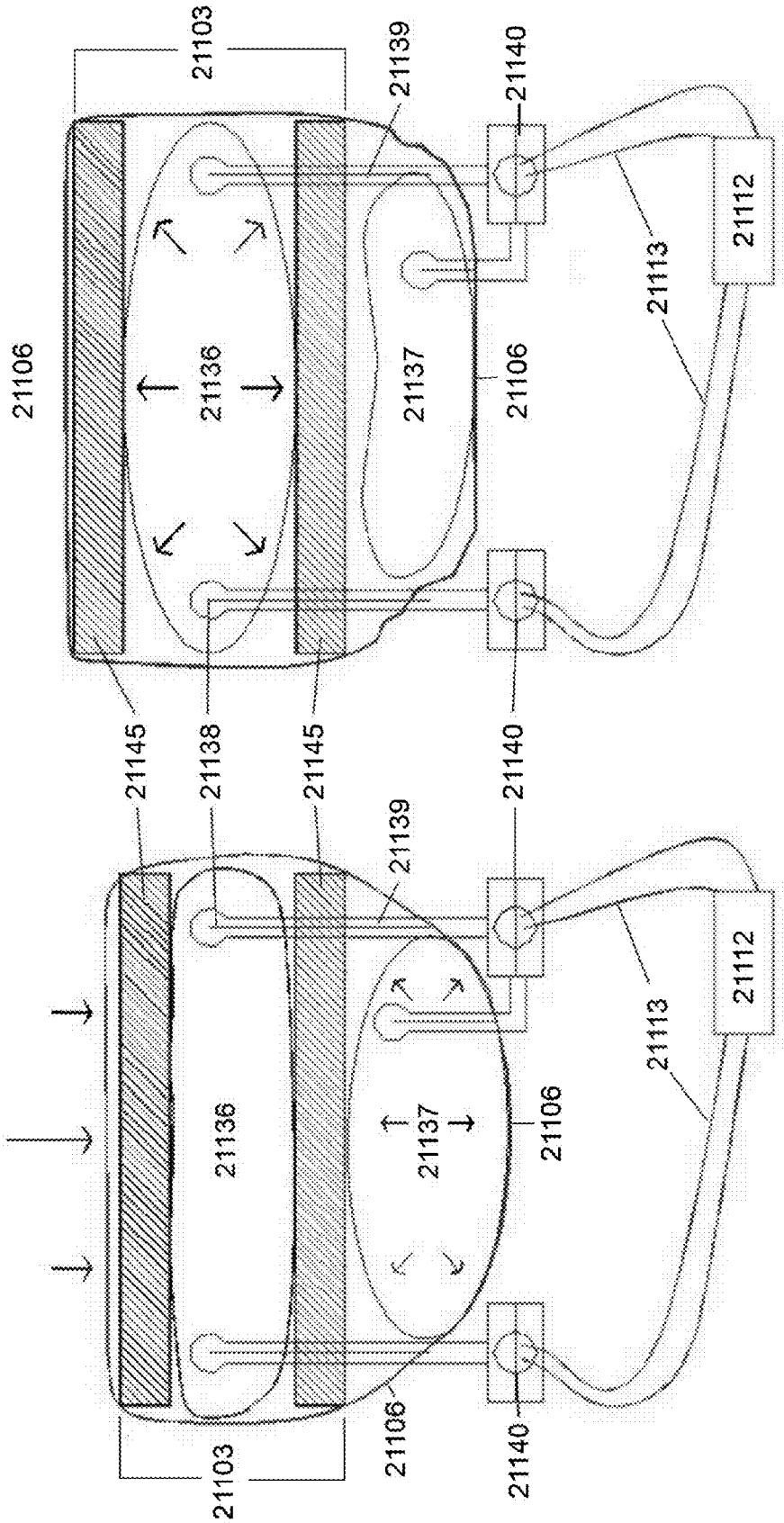


FIG 12B

FIG 12D

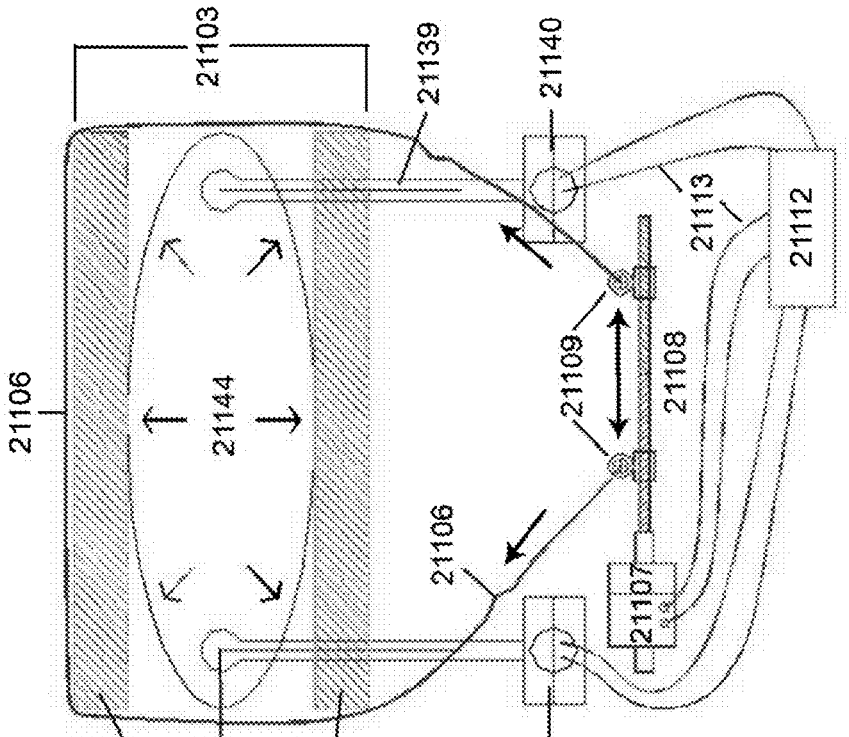


FIG 12 C

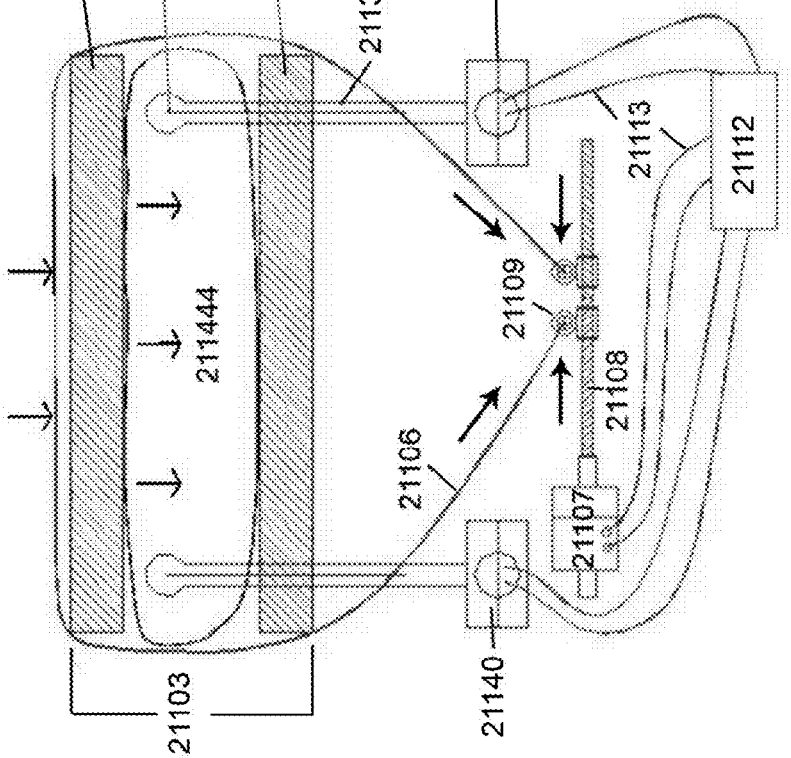


FIG 12 E

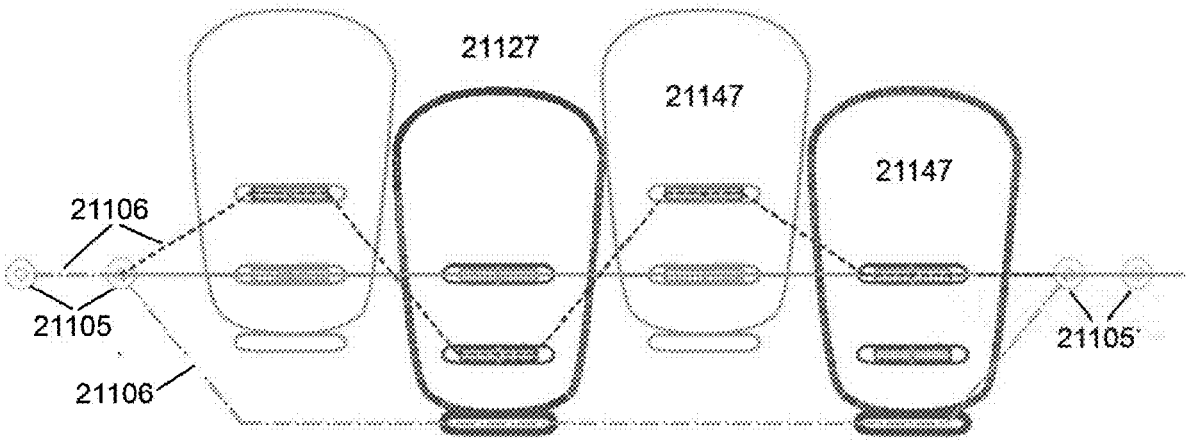
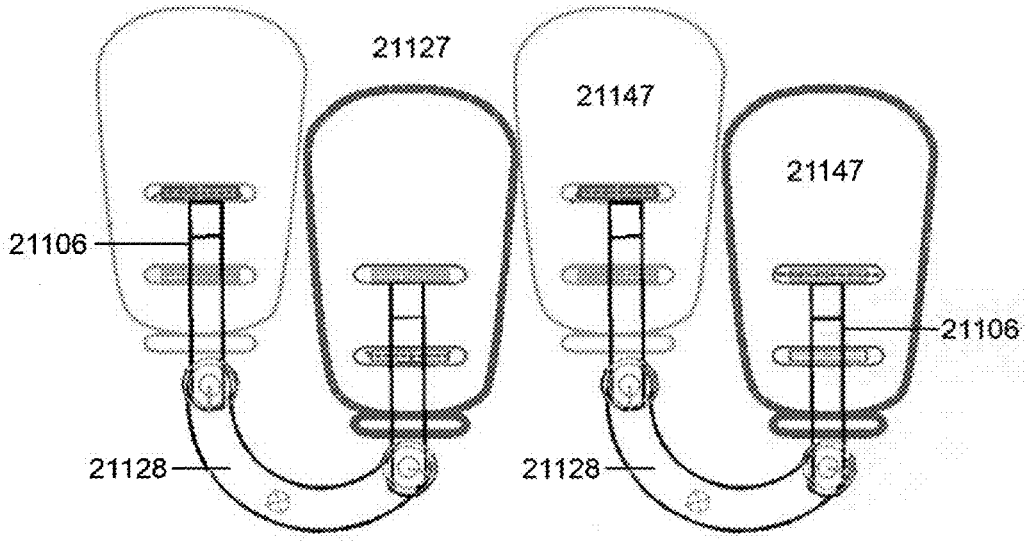


FIG 12 F



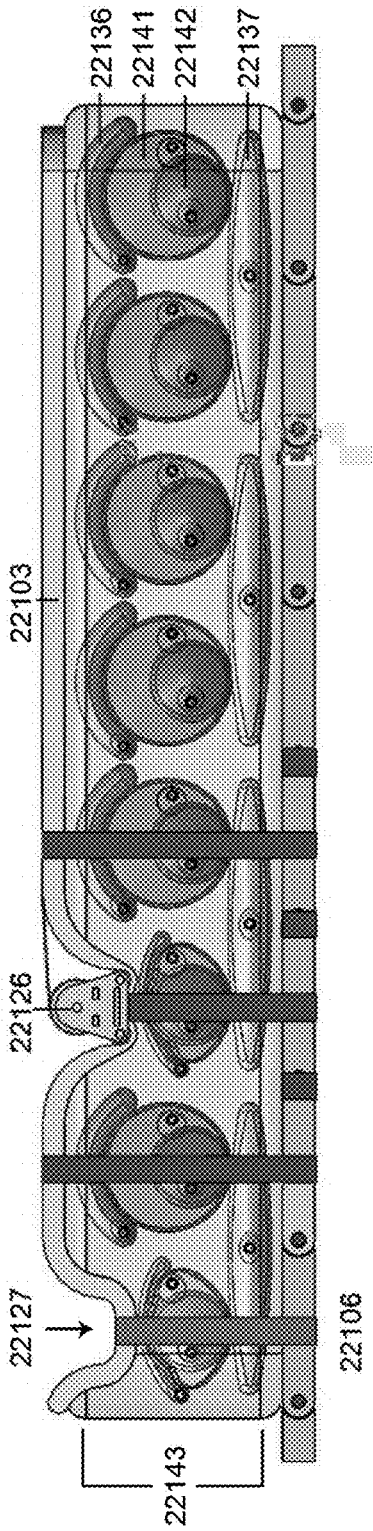


FIG 13A

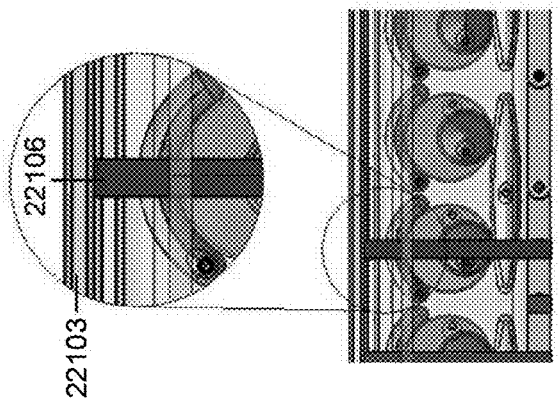


FIG 13C

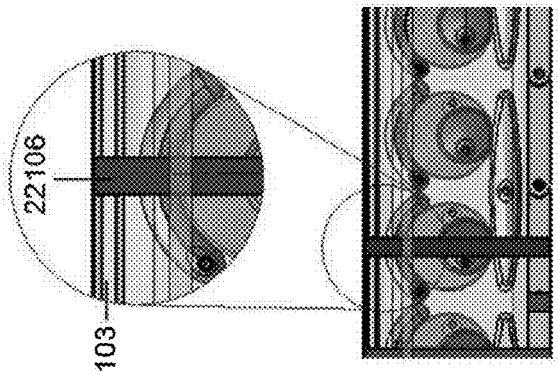


FIG 13B

FIG 14A

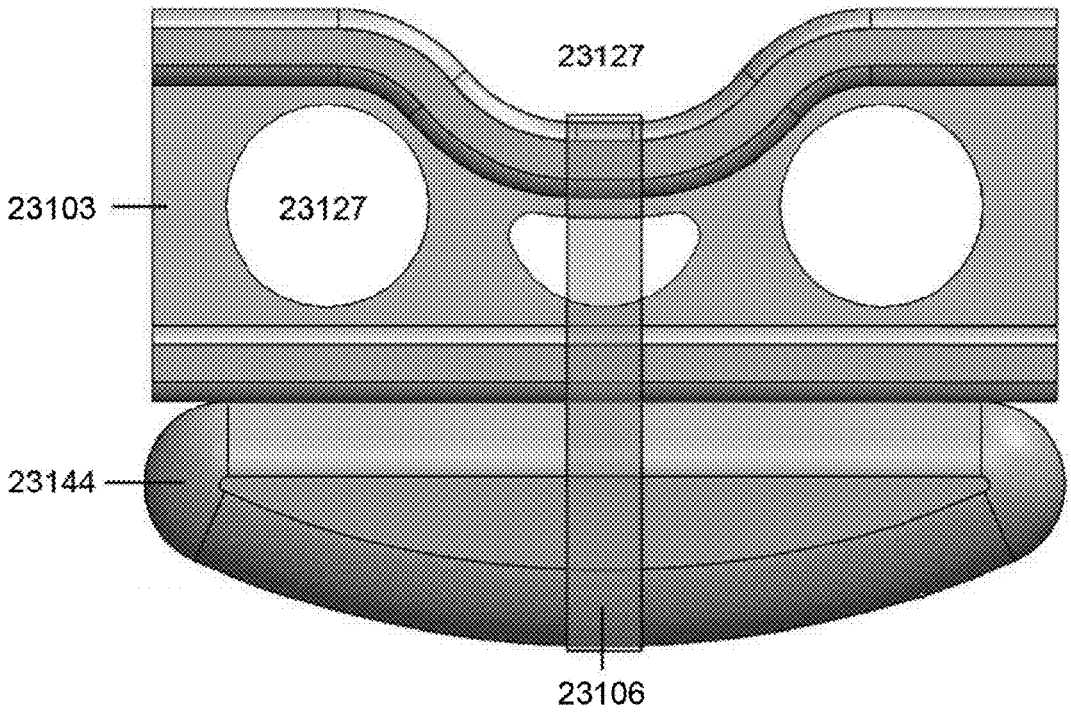


FIG 14B

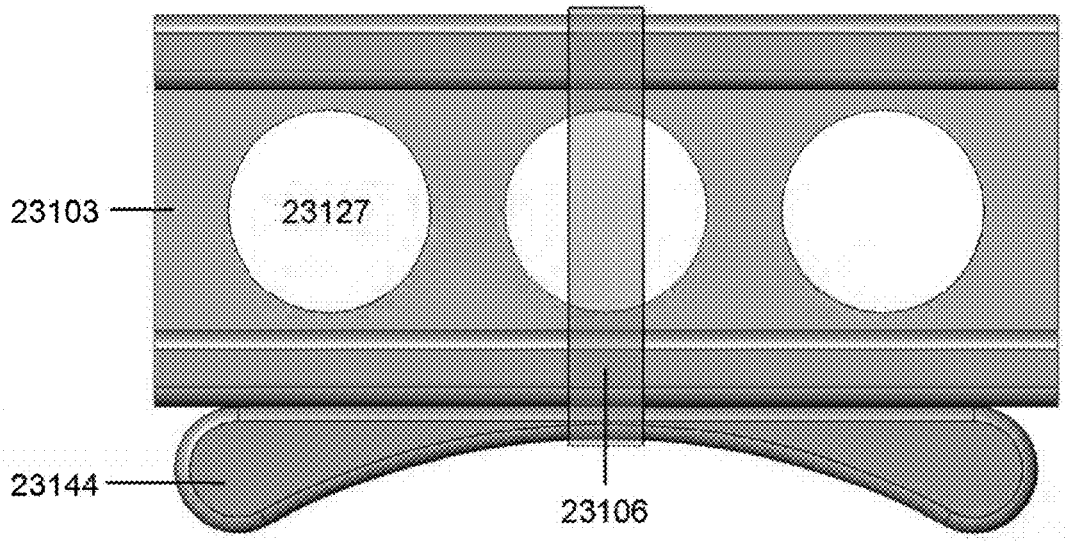


FIG 15A

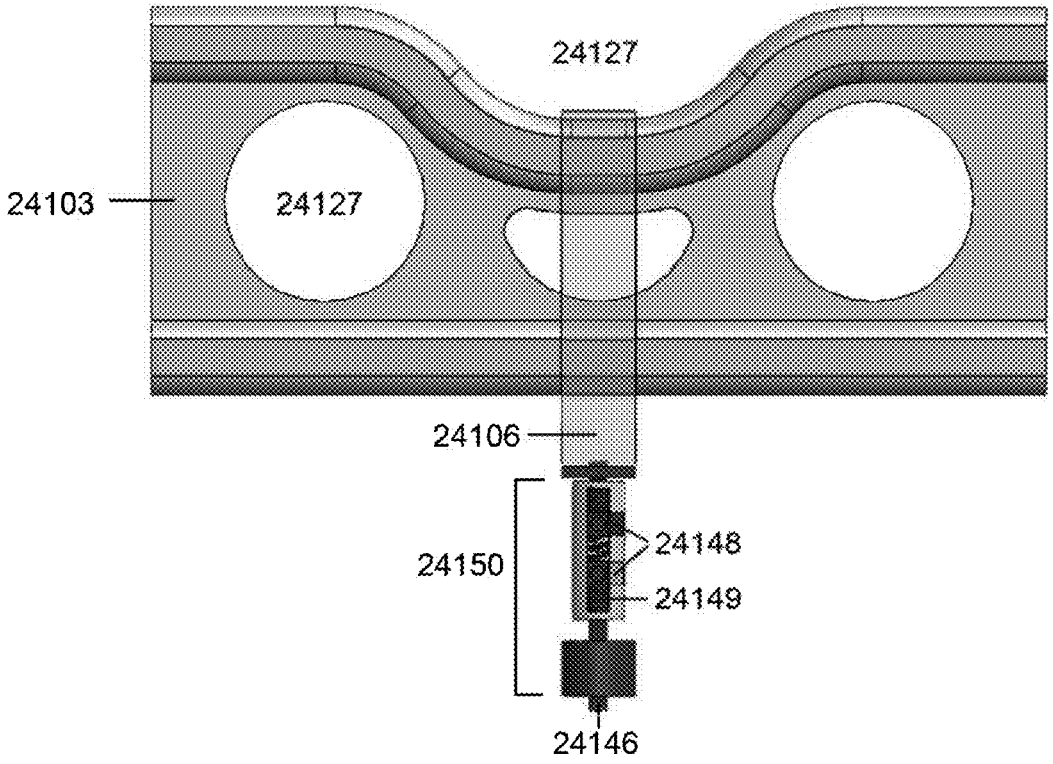


FIG 15B

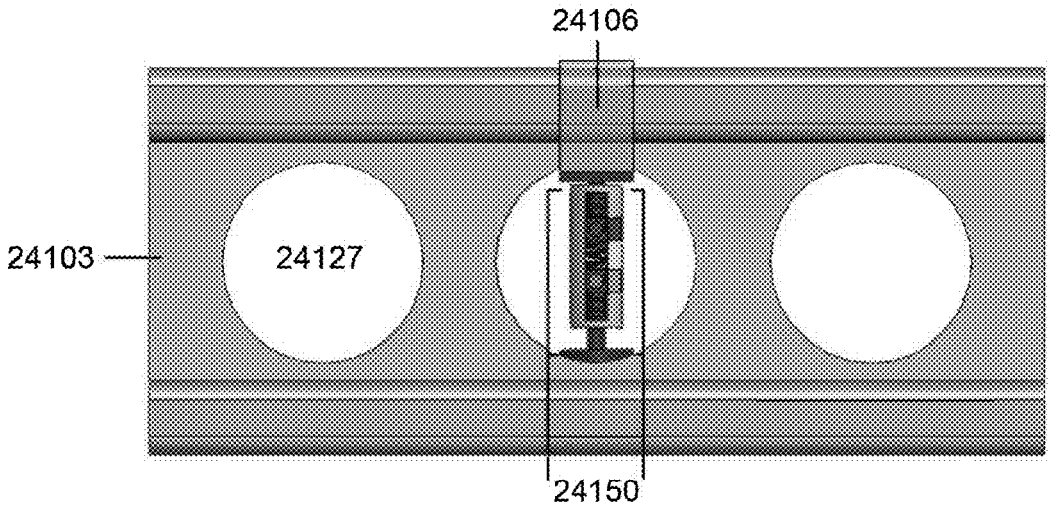


FIG 16

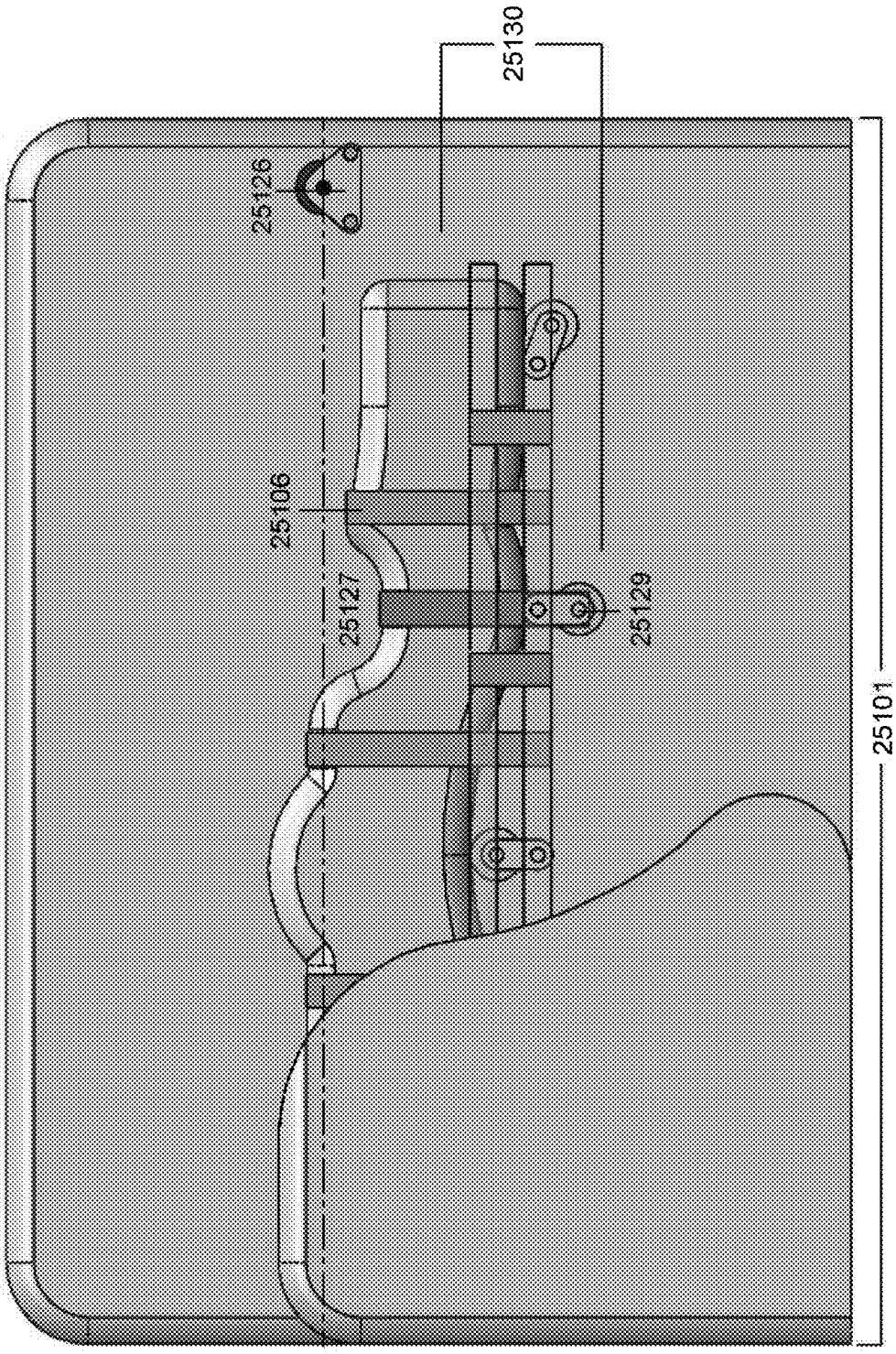


FIG 17

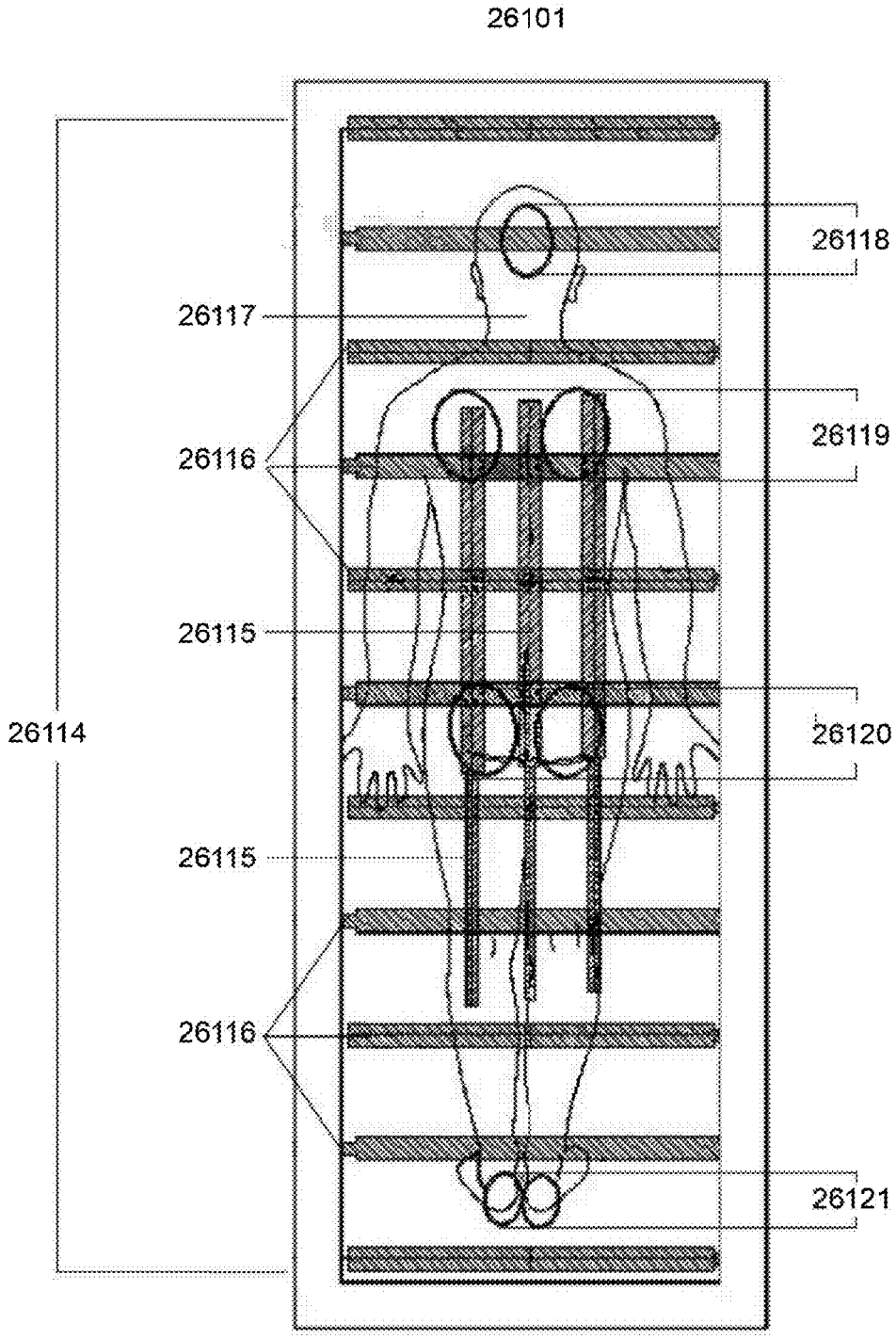

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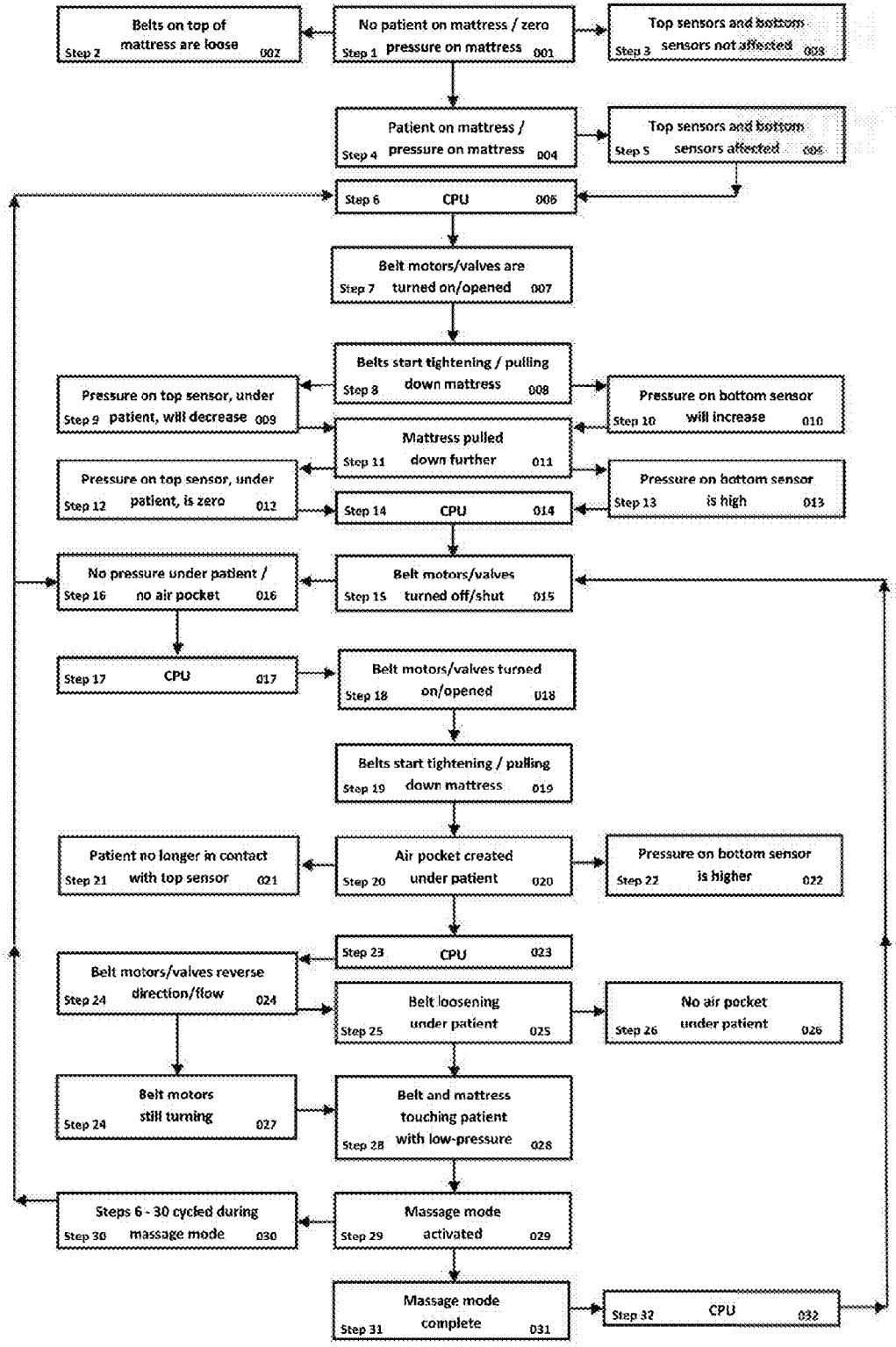
FIG 18


Belts on top of mattress are loose Step 2 002
No patient on mattress / zero pressure on mattress Step 1 001
Top sensors and bottom sensors not affected Step 3 003
Patient on mattress / pressure on mattress Step 4 004
Top sensors and bottom sensors affected Step 5 005
Step 6 CPU 006
Belt motors/valves are turned on/opened Step 7 007
Belts start tightening / pulling down mattress Step 8 008
Pressure on top sensor, under patient, will decrease Step 9 009
Pressure on bottom sensor will increase Step 10 010
Mattress pulled down further Step 11 011
Pressure on top sensor, under patient, is zero Step 12 012
Pressure on bottom sensor is high Step 13 013
Step 14 CPU 014
No pressure under patient / no air pocket Step 16 016
Belt motors/valves turned off/shut Step 15 015
Step 17 CPU 017
Belt motors/valves turned on/opened Step 18 018
Belts start tightening / pulling down mattress Step 19 019
Patient no longer in contact with top sensor Step 21 021
Air pocket created under patient Step 20 020
Pressure on bottom sensor is higher Step 22 022
Step 23 CPU 023
Belt motors/valves reverse direction/flow Step 24 024
Belt loosening under patient Step 25 025
No air pocket under patient Step 26 026
Belt motors still turning Step 24 027
Belt and mattress touching patient with low-pressure Step 28 028
Steps 6 - 30 cycled during massage mode Step 30 030
Massage mode activated Step 29 029
Massage mode complete Step 31 031
Step 32 CPU 032

HOSPITAL BED WITH APPARATUS CAPABLE OF AUTOMATICALLY CHANGING BED SHEETS WITHOUT DISTURBING OCCUPIED PERSON, ALSO A METHOD OF PREVENTING AND RELIEVING ULCERS

CROSS-REFERENCED TO RELATED APPLICATION

[0001] This application is a continuation-in-part of pending U.S. application Ser. No. 15/185,472, filed Jun. 17, 2016, and continuation of granted U.S. application Ser. No. 14/213,785, filed Mar. 14, 2014, now U.S. Pat. No. 9,370,250, which claims priority to and the benefit of expired U.S. Provisional Patent Application Ser. No. 61/784,948, filed on Mar. 14, 2013, titled "MALIX BED, AND A BED APPARATUS CAPABLE OF SEAMLESSLY CHANGING BED-SHEETS WHILE OCCUPIED BY AN IMMOBILE PERSON, AND A METHOD THEREOF", the entire disclosure of which provisional application is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] Field of the Invention

[0003] The present invention relates generally to an ultimate comfort n care bed, and a bed apparatus capable of seamlessly changing bed sheets while being occupied by a person, a method of relieving ulcers, and a method thereof the present invention also relates to a medical or a hospital bed, and, more particularly, to a hospital bed capable of seamlessly changing bed-sheets while the hospital bed is occupied by a patient. The present invention also comprises of a medical bed apparatus which allows the seamlessly changing of a used bed sheet with a new bed sheet while the bed is occupied by a person, and a method thereof. Optionally, the medical or hospital bed can also have an air bladder system to inflate or deflate the hospital bed mattress while a bed sheet is being changed.

[0004] Description of the Related Art

[0005] Hospital beds have been known and have been used for many years, and under a variety of applications.

[0006] Existing hospital beds, including various kinds of hospital beds, the patient must be moved before changing bed sheets. In many cases the disabled or some patients cannot leave the bed without the help of others. This is a hardship for patient family members and the nurses, and more importantly, it may cause pain and discomfort to the patients. For those who are injured in the cervical vertebra or the vertebra, suffering from various kinds of serious injuries or a patient recovering from a surgery, it often causes secondary injury if the patient is moved, and this also further hinders patient recovery.

[0007] Changing bed linens in a hospital or healthcare facility is necessary and advantageous. It allows the hospital staff and patients to promote cleanliness and prevents unnecessary infections, ulcers, injuries, or losing expensive hard-to-replace items. Changing the bed linen while the patient is still on the hospital bed carries significant challenges, both for the patient, and the caregiver. Multiple steps need to be taken to make the task possible. However, these steps are not without drawbacks and limitations, for example:

[0008] (1) Making arrangements for assistance: Assistance is required whether one is at a hospital, a skilled nursing facility, or at home. If one is at the home, then one would need a friend or a family member who would be willing to help out;

[0009] (2) Scheduling helpers: Learning how to provide the care needed without straining ones back or otherwise injuring oneself is not only important but it is very challenging too;

[0010] (3) Positioning the bed: The quality of the bed and adjustability are very crucial. Trying to work with a non-adjustable medical bed is not practical, as it will make bedside care extremely difficult Further it requires more people and this creates a crowded area around the bed, which restricts maneuverability, such as, having two to four people doing the task;

[0011] (4) Raising and lowering the ends of the bed: For example, when patients have congestive heart failure or respiratory disease, a hospital bed's ability to raise the head of the bed up will greatly help the patient to breathe more easily, moving the patient out of the bed or rolling him on either side or lifting him up;

[0012] (5) Side rails and safety: Side rails and safety are extremely important to have if the patient is confused or may become confused in the future, and this also prevents a patient from falling out of the medical bed:

[0013] (6) Keeping linens flat and smooth: Wrinkles in the bed, or the bed sheet, or any debris will irritate the skin and cause discomfort as well as injury to the skin. Some patients become so sensitive that they cannot tolerate anything at all lying on top of their feet, even a bed sheet;

[0014] (7) Need to reposition patient up in bed: If assistance is not provided, the patient remains slumped down too far toward the foot of the bed and will not only feel uncomfortable, but the position can interfere with ease in breathing and also cause unnecessary pressure on the base of the spline and result in skin breakdown;

[0015] (8) Need to avoid dragging: when a patient experiences difficulty turning him or pulling him up in bed, pulling or pushing him without lifting will result in dragging his body across the bed. Dragging him from side to side or up in bed can cause injury to the skin;

[0016] (9) Draw bed sheets used to lift or turn: Draw bed sheets used to lift or turn has been widely used to help changing the bed sheet. However, it needs high level of training and it is not without pain and discomfort;

[0017] (10) Turning the patient: In hospitals, it is a standard procedure to turn or roll a patient in bed every two hours to avoid skin breakdown and bedsores from developing, as these complication is associated with significant distress to both patient and caregiver and they are extremely difficult to treat when they occur. However, in some cases, at the very end, it will not be appropriate to turn the patient in bed, because this could be more disturbing or painful at the time;

[0018] (11) Changing the bed sheets: Changing the bed sheets job is very difficult, especially for the immobilized or paralyzed patient, and it needs a lot of patience and nursing technique. However, changing the bed sheets on a regular basis is extremely important not only because it can help patient feeling more comfort-

able; but also keeping clean and dry are part of preventing infection, skin breakdown, or bedsores, from happening;

[0019] (12) Dealing with urinary incontinence and bowel incontinence. If urinary and bowel incontinence are occurring on a regular basis, one will need to place incontinent pads underneath the patient. These can be reusable and washable (made of cloth) or disposable. One will also need to place incontinent briefs to absorb urine and help keep the skin dry. These will need to be changed and washed every few hours as needed as the pads are also used to collect feces and other discharges and must be removed before changing bed sheets.

[0020] U.S. Pat. No. 6,006,378 (Mitsuru Hayashi) discloses a bed which permits changing of bedclothes without moving the person on it and without substantial burden for either the patient or the care-taker. A left and a right carriage member **5** and **6**, wheels **15** to **18** and a shaft. **7** constitute a carriage. The carriage supports mats **11** and **12** via balancing members **3** and **4** and shafts **1** and **2** and advances the mats **11** and **12** along rails **31** and **32**. The mat **12** is stretched between the rails **31** and **32** by fasteners. The balancing members **3** and **4** are rotatably coupled by a shaft to downward extensions **5***a* and **6***a* of the carriage members **5** and **6**. The shafts **1** and **2** are rotatably mounted in the balancing members **3** and **4**. with advancement of the carriage caused by turning a grip **26**, the slides **52** and **54** cause the old mat **12** to be released from the fasteners and wound on the shaft **2**, while also causing the new mat **11** to be coupled to the fasteners and stretched between the mils **31** and **32**.

[0021] U.S. Pat. No. 6,594,837 (George Khait) discloses a service bed comprising a chassis, a guide mechanism movably supported by the chassis, and a mattress having an undulation formed by routing the mattress through the guide mechanism. The guide mechanism includes dispensing and collecting rollers for installing at ! east one first stratum between the mattress and the occupant of the service bed and for removing at least one second stratum installed between the mattress and the occupant.

[0022] U.S. Pat. No. 7,191,479 (Xiao-Zhou Cheng) discloses a hospital bed that changes bed sheets without moving the patient is composed of a bedstead (including a headboard, a footboard and a bed frame), a deformable bed top, a spool rack and roller shafts on both sides; the ends of the deformable bed top are fixed on the headboard and footboard respectively, and the bed top is pressed into between the roller axles by the spool rack which forms a tightened and leveled bed top that is sunken in the spool rack. Two bed sheets cover the bed, extending respectively from headboard and footboard into the spool rack and rolling on a roller axle. The roller axles and roller shafts are parallel to the cross section of the bed, and are movable between the headboard and footboard with the spool rack When the spool rack is moving, one bed sheet is spread, another one is roiled up automatically.

[0023] This invention improves on the deficiencies of the prior art and provides an inventive bed apparatus which allows the seamlessly changing of bed sheets while the bed is occupied by a person, and a method thereof

SUMMARY OF THE INVENTION

[0024] The invention is a novel ultimate comfort n care bed, and a bed apparatus capable of seamlessly changing bed sheets while being occupied by a person, a method of relieving ulcers, and a method thereof.

[0025] The inventive hospital bed contains multiple features that allow spool rack to transverse freely across a hospital bed mattress while removing/dispensing bed-sheets without moving the patient.

[0026] The inventive hospital bed also incorporates features that reduce the force required to move carriage assembly across the bed using a pulley assembly, a roller assembly, air bladders, belts, and any combination of them.

[0027] Therefore, one purpose of this invention is to provide a cost effective and durable hospital bed capable for allowing of seamlessly changing bed sheets while being occupied by a patient.

[0028] Another purpose of this invention is to provide a hospital bed where the changing mechanism for the bed sheets is below a patient and does not interfere with the comfort. of the patient.

[0029] Another purpose of this invention is to provide an inventive mechanism where while a used bed sheet is being removed from the medical bed a new bed sheet is automatically being replaced in its place.

[0030] Therefore, in one aspect this invention comprises a medical bed apparatus for seamlessly changing bed sheets, comprising: (a) a master bed frame having a first end and a second end, wherein said first end is secured to a headboard, and said second end is secured to a footboard; (b) a primary mattress over said frame, such that said primary mattress is longitudinally positioned between said headboard and said footboard; (c) at least one carriage assembly in engagement contact with an upper surface of said primary mattress and wherein said at least one carriage assembly is longitudinally positioned between said headboard and said footboard; (d) at least one pressure roller assembly below said primary mattress and in surface engagement with a bottom surface of said primary mattress; (e) at least one means to move said at least one pressure roller assembly under said primary mattress from a first position to a second position; and f) at least one means to move said at least one carriage assembly over said primary mattress from a first position to a second position.

[0031] In another aspect this invention comprises a medical bed apparatus for seamlessly changing bed sheets, comprising: (a) a master bed frame having a first end and a second end, wherein said first end is secured to a headboard, and said second end is secured to a footboard; (b) a primary mattress over said master bed frame, such that said primary mattress is longitudinally positioned between said headboard and said footboard; (c) at least one carriage assembly in engagement contact with said primary mattress and wherein said at least one carriage assembly is positioned between said headboard and said footboard, such that said at least one carriage assembly is substantially parallel to said headboard and said footboard; (d) at least one air bladder assembly, wherein said at least one air bladder assembly is inside said primary mattress; (e) at least one air supply to increase or decrease air pressure inside said at least one air bladder assembly; and (f) at least one means to move said at ! east one carriage assembly over said primary mattress from a first position to a second position.

[0032] In yet another aspect this invention comprises a medical bed apparatus for seamlessly changing bed sheets, comprising: (a) a master bed frame having a first end and a second end, wherein said first end is secured to a headboard,

and said second end is seemed to a footboard; (b) a primary mattress over said master bed frame, such that said primary mattress is longitudinally positioned between said headboard and said footboard (c) at least one carriage assembly in engagement contact with an upper surface of said primary mattress and wherein said at least one carriage assembly is longitudinally positioned between said headboard and said footboard; (d) at least one pressure roller assembly below said primary mattress and in surface engagement with a bottom surface of said primary mattress; (e) at least one means to move said at least one pressure roller assembly under said primary mattress from a first position to a second position; (f) at least one carriage motor for moving said at least one carriage assembly over said primary mattress from a first position to a second position; and (g) wherein said at least one carriage motor travels over the top surface of said primary mattress at said second position while said pressure roller assembly exerts pressure on the bottom surface of said primary mattress at said second location to pull said primary mattress down and away from surface contact with at least a portion of said carriage assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] Although the scope of the present invention is much broader than any particular embodiment, a detailed description of the preferred embodiment follows together with drawings. These drawings are for illustration purposes only and are not drawn to scale. Like numbers represent like features and components in the drawings. The invention may best be understood by reference to the ensuing detailed description in conjunction with the drawings in which:

[0034] FIG. **1** is a top elevation view of a hospital bed in accordance to one embodiment of the present invention in which the pressure roller assembly is shown positioned in such a way as to lower sections of the primary mattress 'While elevating others.

[0035] FIG. **2**A is a front view of hospital. bed in accordance to one embodiment of the present invention in which the primary mattress is resting in its default horizontal position.

[0036] FIG. **2**B is a front view of hospital bed in accordance to one embodiment of the present invention in which the pressure roller assembly is shown positioned in such a way as to lower sections of the primary mattress while elevating others.

[0037] FIG. **2**C is a front view of hospital bed in accordance to one embodiment of the present invention in which the pressure roller assembly is shown positioned in such a way as to further however sections of the primary mattress while elevating others.

[0038] FIG. **3** is an side view of the hospital bed in accordance to one embodiment of the present invention in which the tension arc assembly is shown positioned in such a way that the primary mattress is in it's default horizontal position.

[0039] FIG. **4** shows a hospital bed in accordance to one embodiment of the present invention in which the carriage assembly and is enlarged to show greater detail.

[0040] FIG. **5**A, shows a hospital bed in accordance to one embodiment of the present invention in which the primary mattress is in a substantially horizontal position while FIG. **5**B, shows the carriage assembly with the portions of the primary mattress removed.

[0041] FIG. **6**A, shows a hospital bed in accordance to one embodiment of the present invention in which the primary mattress has been forced to move to a first stage and the use of a carriage assembly, while FIG. **6**B, shows the carriage assembly with the portions of the primary mattress removed in the first stage.

[0042] FIG. **7**A, shows a hospital bed in accordance to one embodiment of the present invention in which the primary mattress has been forced to move to a second stage with the use of a carriage assembly, while FIG. **7**B, shows the carriage assembly with the portions of the primary mattress removed in the second stage.

[0043] FIG. **8** is a top elevation view of a hospital bed in accordance to another embodiment of the present invention in which the air bladder assembly and carriage assembly are shown.

[0044] FIG. **9** is a detailed view of hospital bed in accordance to another embodiment of the present invention in which the air bladder assembly is enlarged to show greater detail.

[0045] FIG. **10** is a detailed view of a hospital bed in accordance to another embodiment of the present invention in which the carriage assembly **506** is enlarged to show greater detail.

[0046] FIG. **11** is a block diagram explaining the sequence of operation for the entire bed including, but not limited to its ability to enable the bed frame assembly, carriage assembly and tension pulley assembly to function together in such a way as to facilitate the uninhibited movement of the carriage assembly across the bed to collect used bed sheets and dispense new bed sheets.

[0047] FIG. **12**A is a front cross-sectional view of a hospital bed in accordance to one embodiment of the present invention in which the mechanisms of the inflatable bladder are enlarged to show a method of compressing a section of the mattress.

[0048] FIG. **12**B is a front cross-sectional view of a hospital bed in accordance to one embodiment of the present invention in which the mechanisms of the inflatable bladder are enlarged to show a method of uncompressing a section of the mattress.

[0049] FIG. **12**C is a front cross-sectional view of a hospital bed in accordance to one embodiment of the present invention in which the mechanisms of the inflatable bladder and belt are enlarged to show a method of compressing a section of the mattress.

[0050] FIG. **12**D is a front cross-sectional view of a hospital bed in accordance to one embodiment of the present invention in which the mechanisms of the inflatable bladder and belt are enlarged to show a method of uncompressing a section of the mattress.

[0051] FIG. **12**E is a front cross-sectional views of a hospital bed in accordance to one embodiment of the present invention in which the mattress has been replaced with a series of sectional foam shapes which work in conjunction with a series of belts to raise and lower the sectional foam shapes to create air pockets.

[0052] FIG. **12**F is a front cross-sectional views of a hospital bed in accordance to one embodiment of the present invention in which a series of rotating tension could pull down and push up individual or multiple form rollers.

[0053] FIG. **13**A is a side cross-sectional view of a hospital bed in accordance to one embodiment of the present

invention in which the mechanisms of the inflatable bladder and belt are enlarged to show a method of compressing a section of the mattress.

[0054] FIG. **13**B is a side cross-sectional view of a hospital bed in accordance to one embodiment of the present invention in which the mechanisms of the inflatable bladder and belt are enlarged to show a method of compressing a section of the mattress with the belts placed above the sensor.

[0055] FIG. **13**C is a side cross-sectional view of a hospital bed in accordance to one embodiment of the present invention in which the mechanisms of the inflatable bladder and belt are enlarged to show a method of compressing a section of the mattress with the belts placed below the sensor.

[0056] FIG. **14**A is a side cross-sectional view of a hospital bed in accordance to one embodiment of the present invention in which the mechanisms of the inflatable bladder and belts are enlarged to show a method of compressing a section of the mattress.

[0057] FIG. **14**B is a side cross-sectional view of a hospital bed in accordance to one embodiment of the present invention in which the mechanisms of the inflatable bladder and belts are enlarged to show a method of uncompressing a section of the mattress.

[0058] FIG. **15**A is a side cross-sectional view of a hospital bed in accordance to one embodiment of the present invention in which the electro-magnetic solenoid and belts are enlarged to show a method of compressing a section of the mattress with the electro-magnetic solenoid located beneath the mattress.

[0059] FIG. **15**B is a side cross-sectional view of a hospital bed in accordance to one embodiment of the present invention in which the electro-magnetic solenoid and belts are enlarged to show a method of compressing a section of the mattress with the electro-magnetic solenoid located inside the mattress.

[0060] FIG. **16** is a front cross-sectional view of a hospital bed in accordance to one embodiment of the present invention in which the pressure rollers and belts are enlarged to show a method of compressing sections of the mattress and raising up others.

[0061] FIG. **17** is a top elevation view of a hospital bed in accordance to one embodiment of the present invention in which the mechanisms of the sensor assembly are enlarged to show a method of determining the position and pressure being applied by the head area, shoulders area, buttocks area and heels area of the patient, respectively, while laying on the mattress using flexible sensors in vertical and horizontal positions.

[0062] FIG. **18** is a flow chart explaining the sequence of operation for the entire hospital bed including, but not limited to its ability to enable the sensor, belt and/or inflatable bladder to function together in such a way as to determine the exact amount of pressure being applied by a specific area of the patient's body while lying on the mattress and automatically relieve that pressure, massage those areas and/or create air pockets underneath the patient.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0063] The embodiments of the present invention are described more fully hereinafter with reference to the accompanying drawings, which form a part hereof and which show, by way of illustration, specific exemplary embodiments by which the invention may be practiced. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, the disclosed embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art

[0064] Throughout the specification and claims, the following terms take the meanings explicitly associated herein, unless the context clearly dictates otherwise. The phrase "in one embodiment" as used herein does not necessarily refer to the same embodiment, though it may. Furthermore, the phrase "in another embodiment" as used herein does not necessarily refer to a different embodiment, although it may. Thus, as described below, various embodiments of the invention may be readily combined, without departing from the scope or spirit of the invention.

[0065] As shown in this invention, having the straps or the belts or the bladders or the mechanical carriage allows a service provider or a caregiver or a healthcare provider a much better access or room under the patient to remove the pads or mats or bed sheets while the patient or the person was still on the medical or hospital bed.

[0066] It would be advantageous to provide a hospital bed capable of seamlessly changing bed sheets while occupied by a patient because; it would be convenient to patients, caregivers, and healthcare providers by avoiding the traditional method, such as turning patient and/or lifting patient. It will reduce the cost of care for bedridden patient by decreasing the time spend and the number of the caregiver needed to assist in changing bed sheets. It will enhance safety of patients and caregivers by decreasing the hazard of physical injury and decreasing the health hazard of exposure to biological materials. It will help prevent pressure ulcers. Changing the bed sheet without moving the patient will eliminate the friction and shearing which are considered as major factor in development of pressure ulcer. It will reduce physical, psychological and emotional suffering that the bed bound patient and family are exposed to by using the traditional methods of changing the bed sheet. It would further be advantageous to provide a hospital bed capable of seamlessly changing bed sheets while occupied by a patient because it will reduce the risk of contamination and transmission of infections by increasing the frequency of changing the bed sheet and minimizing the caregiver contact with patient's body and secretion. Belts or straps can be used also with alternating bladder mattress to reduce or prevent pressure ulcers and to change bed sheets.

[0067] A hospital bed that changes bed sheets without moving the patient.

[0068] Comprised of a bedstead (foot/headboard), deformable bed top, spool rack and roller shafts on both sides. The ends of the deformable bed top are fixed on the head and footboard. The bed is pressed into and between the roller axles by the spool rack which forms a tightened and leveled bed top that is sunken in the spool rack. The two bed sheets cover the bed from head to foot board into spool rack and rolling on a roller.

[0069] As shown in FIGS. **1** through **7**B, a medical or hospital bed **301**, is capable of seamlessly changing bed sheets while being occupied by a patient, which includes a headboard **302** and footboard **303**, connected to one another via a master bed frame **304** which utilizes a pivoting

pressure roller assembly **315** atop of which there is placed a primary mattress **307**. When each pressure roller **313** is in its default horizontal position, the primary mattress **307** remains parallel to the ground. However, as individual pressure rollers **313** of the pressure roller assembly **315** engage with a rotating roller shaft **309**, they rotate away from the primary mattress **307** with the pressure roller **313** now supporting the primary mattress **307** at a lower level, if downward pressure is applied to the primary mattress **307** by either the weight of a patient or by the carriage assembly **306**, the primary mattress **307** will sink down in this section. This process enables the primary mattress **307** to deform in such a way as to relieve pressure from under specific areas of the patient's body in order to reduce the likelihood of bedsores and/or other similar pressure related conditions and to facilitate patient healing. This process also enables the carriage assembly **306** to complete the bed sheet changing process without moving the patient

[0070] Referring now to the FIGS. **1** through **7**B, where FIG. **1** is a top elevation view of a medical or a hospital bed **301** in accordance to one embodiment of the present invention in which the pressure roller assembly **315** is shown positioned in such a way as to lower sections of the primary mattress **307** while elevating others. Referring to FIG. **1**, the hospital bed **301**, includes a headboard **302**, and footboard **303**, held together by a master bed frame **304** to which there is attached a pressure roller assembly **315**, a primary mattress **307** and a carriage assembly **306**. Mounted along the ends of the master bed frame **304** is a series of pivoting or rotating roller shafts **309**. Attached to these roller shafts **309** me a series of slip clutches **310**, and roller brackets **311**, on the opposite side of which are pressure rollers **313** connected to the roller brackets **311** via roller pins **312**. The roller shafts **309** are turned a by a timing belt **316** connected to a roller motor **308** housed in the footboard **303**, such as, an opening **368**, or a pocket **368**, or a blind hole **368**, to name a few, of the hospital bed **301**. As the timing belt **316** rotates the roller shafts **309**, electric slip clutches **310** attached to the roller brackets **311** prevent the roller brackets **311** from rotating until engaged by the slip clutches **310**. Once engaged, the roller brackets **311** will be able to away from their default vertical position. If downward pressure is applied to the primary mattress **307** by the patient or the carriage assembly **306**, the primary mattress **307** will begin to sink as the pressure rollers **313** are turned away from the primary mattress **307** relieving pressure from underneath the patient and/or creating a pocket **50**, into which the carriage assembly **306** can fit. As the carriage motor **317** begins to turn it will engaging with the gear rack **334**, and move the carriage assembly **306** along the carriage sliding frame **305**. As the carriage assembly **306** moves across the primary mattress **307**, the pressure rollers **313** ahead of it win be turned down to create a new pocket **50**, while the pressure rollers behind will rotate back up to push the rest of the primary mattress **307** into its to default horizontal position. In this way, the pressure roller assembly **315** is able to lessen pressure from underneath the primary mattress **307** in such a way as to create moving pockets **50**, large enough to allow the carriage assembly **306** to pass freely over the primary mattress **307** from one end of the hospital bed **301** to another without tension. Thus, the carriage assembly **306**, will able to traverse from one side of the hospital bed **301**, to the other side, rolling up a used bed sheet **319**, and rolling out a new bed sheet **320**, simultaneously, as the pressure roller assembly **315**, maneuvers to allow the carriage assembly **306**, space to freely move therein and complete the bed sheet changing process. Alternatively, the roller motor **308**, could be housed in the headboard **302**, such as, an opening **368**, or a pocket **368**, or a blind hole **368**, to name a few, within the headboard **302**, similar to the one shown with reference to footboard **303**, or each roller shaft **309**, could feature its own roller motor **308**,

[0071] FIG. **2**A is a front view of hospital bed **30**! in accordance to one embodiment of the present invention in which the primary mattress **307** is resting in its default horizontal position.

[0072] FIG. **2**B is a front view of hospital bed **301** in accordance to one embodiment of the present invention in which the pressure rollers assembly **315** is rotating some of its pressure rollers **313** to allow the primary mattress **307** to deform in order lo relieve pressure from beneath the patient and/or create enough space for the carriage assembly **306** to fit therein.

[0073] FIG. **2**C is a front view of hospital bed **301** in accordance to one embodiment of the present invention in which the pressure roller **313** to allow the primary mattress **307** to further deform in order to relieve pressure from beneath the patient and/or create enough Space for the carriage assembly **306** to fit therein.

[0074] FIG. **3** is an side view of the hospital bed **301** in accordance to one embodiment of the present invention in which the primary mattress **307** in a default horizontal position in which the pressure roller assembly, and carriage assembly **306** and master bed frame **304** are shown. A union joint **314** connecting two pressure roller **313** together is also visible in order to allow the head or foot of the bed to be lifted without adversely affecting the ability of the pressure roller assembly **315** to support the primary mattress **307** at various levels of compression. Located within the control box **321**, as shown in FIG. **1**, there is a central processing unit (CPU) **141**, a power supply **142**, and any other necessary parts to make the hospital bed **301**, function along with a programmable logic control (PLC) **322**, to determine the sequence of operation for the entire hospital bed **301**.

[0075] FIG. **4** shows hospital bed **301** in accordance to one embodiment of the present invention in which the carriage assembly **306** is enlarged to show greater detail. The carriage assembly **306** is held together by series of mounting rods **323** and a mounting bracket **324** on either end on the top of which there are inserted a used bed sheet roller **325** and a new bed sheet roller **326** parallel to one another. Between these bed sheet rollers **325**, **326**, and at a slightly higher level, there is located a padded support roller **327** which prevents the patient's hack from touching the rotating bed sheet rollers **325**, **326**, as they simultaneously roll up the used bed sheet **319** and roll out the new bed sheet **320** as the carriage assembly **306** moves across the primary mattress **307**. Bearings **328**, are placed throughout the holes of the mounting bracket **324** to facilitate the free rotation of the attached rollers and gears. The carriage assembly **306** also includes a series of belts, gears and slip clutches which work together to both move the carriage assembly **306** across the primary mattress **307** as well as complete the bed changing process at the same time. This is accomplished using a used bed sheet roller gear **329** and a new bed sheet roller gear **330** which are attached to both ends of the used bed sheet roller **325** and new bed sheet roller **326** respectively, A slip clutch **310**, as shown in FIG. **1**, is inserted onto either end of the

bed sheet milers **325**, **326**, between the mounting bracket **324** the roller gears to prevent bed sheet rollers **325**, **326**, from rotating when anything obstructs the rolling process the used bed sheet **319**, and the new bed sheet **320**, in order to protect the patient and bed components from being injured and damaged. The used bed sheet roller gears **329**, and new bed sheet roller gear **330**, are connected via a center belt gear **331** located at the center of the mounting bracket **324**. Depending on the direction of the rotation of the center belt gear **331**, the bed sheet gears **329**, **330**, will either rotate clockwise or counter-clockwise in conjunction with the movement of the carriage assembly **306** in such a way that the used bed sheet roller **325** rolls up the used bed sheet **319** while the new bed sheet roller **326** rolls up the new bed sheet **320**. The center belt gear **331** is connected to the master rack gear **333** via a center belt **332** which transfers the rotation of the master rack gear **333** in the center belt **332** which in turn, rotates both bed sheet gears **329**, **330**, The master rack gear **333** engages a gear rack **334** affixed the carriage sliding frame **305**. The carriage assembly **306** is moved from one end of the bed **301**, to the other end by a carriage motor **317**, shown in FIG. **1**, to which there is attached a threaded carriage rod **336**. At the base of the mounting plate **338** there is attached a threaded hole **337**, into which the threaded carriage rod **336**, is inserted. As the threaded carriage rod **336** rotates, so does the master rack gear **333** moving the carriage along the sides of the bed and starting the bed changing process. A master rack gear **333** is affixed to both ends of a master pressure roller **339** to apply downward pressure on the primary mattress **307** to create clearance or pocket **50**, for the carriage assembly **306** to freely move across the bed. For safety reasons, a gear cover **340**, is used to cover all exposed gears and belts of the carriage assembly **306**. Located within the control box **321**, shown in FIG. **1**, there is a Central Processing Unit (CPU) **140**, a power supply **142**, and any other necessary parts to make the hospital bed **301**, function along with a programmable logic control (PLC) **322**, to determine the sequence of opera hon for the entire hospital bed **301**.

[0076] FIG. **5**A, shows a hospital bed **301**, in accordance to one embodiment of the present invention in which the primary mattress **307**, is in a substantially horizontal position **350**, while FIG. **5**B, shows the carriage assembly **306**, with the portions of the primary mattress **307**, removed for the substantially horizontal position **350**.

[0077] FIG. **6**A, shows a hospital bed **301**, in accordance to one embodiment of the present invention in which the primary mattress **307**, has been forced to move to a first stage **351** with the use of a carriage assembly **306**, while FIG. **6**B shows the carriage assembly with the portions of the primary mattress removed in the first stage **351**. As one can see that the primary mattress **307**, for the bed **301**, on one side is in a substantially horizontal position **350**, while a portion of the same primary mattress **307**, is in a dipped down position **353**, during the first stage **351**.

[0078] FIG. **7**A, shows a hospital bed in accordance to one embodiment of the present invention in which the primary mattress has been forced to move to a second stage **352**, with the use of a carriage assembly, while FIG. **7**B, shows the carriage assembly with the portions of the primary mattress removed in the second stage **352**. As one can see that the primary mattress **307**, for the bed **301**, on one side is in a substantially horizontal position **350**, while a portion of the same primary mattress **307**, is in a dipped down position **354**, during the second stage **352**.

[0079] As shown in FIGS. **8** through **11**, a medical or hospital bed **501**, is capable of seamlessly changing bed sheets while being occupied by a patient, which includes a headboard **502** and footboard **503**, connected to one another via a master bed frame **504** which utilizes a primary mattress **507** inside of which there is located an air bladder assembly **515** which inflates and deflates its series of air bladders as needed to relieve pressure from beneath the patient and provide an air exchange between the primary mattress **507** and the patient to reduce the likelihood of bedsores, infections and/or other similar pressure related conditions, to facilitate patient healing and to reposition the patient as needed. This process also enables the carriage assembly **506** to easily compress the primary mattress **507** and complete the bed sheet changing process without moving the patient.

[0080] Referring now to the FIGS. **8** through **11**, where FIG. **8**, is a top elevation view of a hospital bed **501** in accordance to one embodiment of the present invention in which the air bladder assembly **515** and carriage assembly **506** are shown. Referring to FIG. **8**, the hospital bed **501**, includes a headboard **502** and footboard **503** held together by a master bed frame **504** onto which there is placed a primary mattress **507** which contains an air bladder assembly **515**. A carriage assembly **506**, and carriage sliding frame **505**, are also shown.

[0081] FIG. **9** is a detailed view of hospital bed **501** in accordance to one embodiment of the present invention in which the air bladder assembly **515** is enlarged to show greater detail. The air bladder assembly **515** is comprised of a breathable top bladder **508**, an outer bladder **509**, an inner bladder **510**, an adjustment bladder **511**, a series of solenoid valves **512**, air tubes **516** and an air supply **513**. The breathable top bladders **508** used to create an air exchange between the patient's body and the primary mattress **507** in order maintain a dry, sterile environment under the patient which reduces the likelihood of bedsores, infections and/or other similar pressure related conditions and to facilitate patient healing and comfort. Positioned directly underneath each breathable top bladder **508** is an outer bladder **509** within which there is a smaller inner bladder **510**. The breathable top bladders **508**, outer bladders **509** and inner bladders **510** are designed in such a way that when downward pressure is applied to the primary mattress **507** by either the weight of a patient or by the carriage assembly **506** these bladders will automatically begin to deflate relieving pressure from underneath the patient and/or creating a pocket **50**, into which the carriage assembly **506** will be able to fit. The more pressure applied, the more the bladders will deflate. The order in which this deflation occurs is, breathable top bladders **508** first, outer bladders **509** second and inner bladders **510** last if pressure is relieved from the bladders **508**, **509**, **510**, order is reversed as the inner bladders **510**, outer bladders **509** and top bladders **508**, begin to inflate respectively bringing the primary mattress **507** back to its default horizontal position parallel to the ground, bottom adjustment bladders **511** are can be inflated and deflated under the rest of the bladders to raise up or lower sections of the primary mattress **507**, such as the head/chest, the knee or foot areas, as desired by the patient or the caregiver.

[0082] Every bladder features a solenoid valve **512** which will close to prevent air from escaping during the bed sheet

changing process. This will enable all the bladders which are not being compressed by the carriage assembly **506** to maintain full bladder inflation and support the patient. If downward pressure is applied to the primary mattress **507** by the patient or the carriage assembly **506**, the bladders directly underneath it will begin to deflate, while the bladders to either side of the carriage assembly **506** will maintain full inflation due to the dosing of their solenoid valves **512**. This process will cause the primary mattress **507** to sink down in the middle creating a pocket **50**, into which the carriage assembly **506** can fit. As the carriage motor **517**, begins to turn it will engaging with the gear rack **534**, and move the carriage assembly **506** along the carriage sliding frame **505**. As the carriage assembly **506** moves across the primary mattress **507**, the bladders ahead of it will deflate to create a new pocket **50**, while the bladders behind will inflate to push the rest of the primary mattress **507** back into its to default horizontal position. In this way, the air bladder assembly **515** is able to lessen pressure from underneath the primary mattress **507** in such a way as to create moving pockets **50**, large enough to allow the carriage assembly **506** to pass freely over the primary mattress **507** from one end of the hospital bed **501** to another without tension. Thus, the carriage assembly **506** will able to traverse from one side of the hospital bed **501**, to the other side, rolling up a used bed sheet **519**, and rolling out a new bed sheet **520**, simultaneously, as the air bladder assembly **515**, maneuvers to allow the carriage assembly **506** space to freely move therein and complete the bed sheet changing process. AH the bladders are inflated and deflated by an air supply **513** via a series of air tubes **516**. A thin breathable secondary mattress **514** is placed on top of the primary mattress **507** and under the bed sheets **519**, **520**, to enable the free air exchange of the breathable top bladders to the patient.

[0083] FIG. **10**, shows hospital bed **501** in accordance to one embodiment of the present invention in which the carriage assembly **506** is enlarged to show greater detail. The carriage assembly **506** is held together by series of mounting rods **523** and a mounting bracket **524** on either end on the top of which there are inserted a used bed sheet roller **525** and a new bed sheet roller **526** parallel to one another. Between these bed sheet rollers **525**, **526**, and at a slightly higher level, there is located a padded support roller **527** which prevents the patient's back front touching the rotating bed sheet rollers **525**, **526**, as they simultaneously roll up the used bed sheet **519** and roll out the new bed sheet **520** as the carriage assembly **506** moves across the primary mattress **507**. Bearings **528**, are placed throughout the holes of the mounting bracket **524** to facilitate the free rotation of the attached rollers and gears. The carriage assembly **506** also includes a series of belts, gears and slip clutches which work together to both move the carriage assembly **506** across the primary mattress **507** as well as complete the bed changing process at the same time. This is accomplished using a used bed sheet roller gear **529** and a new bed sheet roller gear **530** which are attached to both ends of the used bed sheet roller **525** and new bed sheet roller **526**, respectively. A slip clutch **510**, is inserted onto either end of the bed sheet rollers between the mounting bracket **524** the roller gears to prevent bed sheet rollers **525**, **526**, from rotating when anything obstructs the rolling process the used bed sheet **519**, and the new bed sheets **520**, in order to protect the patient and bed components from being injured and damaged The used bed sheet roller gears **529**, and a new bed sheet roller gear **530**, are connected via a center belt gear **531** located at the center of the mounting bracket **524**. Depending on the direction of the rotation of the center belt gear **531**, the bed sheet gears will either rotate clockwise or counter-clockwise in conjunction with the movement of the carriage assembly **506** in such a way that the used bed sheet roller **525** rolls up the used bed sheet **519** while the new bed sheet roller **526** rolls out the new bed sheet **520**. The center belt gear **531** is connected to the master rack gear **533** via a center belt **532** which transfers the rotation of the master rack gear **533** to the center belt **532** which in turn, rotates both bed sheet gears. The master rack gear **533** engages a gear rack **534** affixed the carriage sliding frame **505**, The carriage assembly **506** is moved from one end of the bed to the other by a carriage motor **517**, shown in FIG. **8**, to which there is attached a threaded carriage rod **536**. At the base of the mounting plate **538** there is attached a threaded hole **537**, into which the threaded carriage rod **536**, is inserted. As the threaded carriage rod **536** rotates, so does the master rack gear moving the carriage along the sides of the bed and starting the bed changing process. A master rack gear **533** is affixed to both ends of a master pressure roller **539** to apply downward pressure on the primary mattress **507** to create clearance for the carriage assembly **506** to freely move across the bed. For safety reasons, a gear cover **540**, as shown in FIG. **8**, is used to cover all exposed gears and belts: of the carriage assembly **506**. Located within the control box **507**, as shown in FIG. **8**, there is a Central Processing Unit (CPU) **140**, a power supply **142**, and any other necessary parts to make the hospital bed **501**, function along with a programmable logic control (PLC) **522**, to determine the sequence of operation for the entire hospital bed **501**.

[0084] FIG. **11** is a block diagram explaining the sequence of operation for the entire bed, including, but not limited to its ability to enable the bed frame assembly, carriage assembly, and tension pulley assembly, to function together in such a way as to facilitate the uninhibited movement of the carriage assembly across the bed to collect used bed sheets, and dispense new bed sheets. In step **1**, **902**, one would lower side rails, and then in step **2**, **904**, one would flatten the bed into a horizontal position. In step **3**, **906**, the bed would be lowered, and in step **4**, **908**, one would tighten the bottom belts to raise primary mattress during this process the center of the mattress will be slightly higher than the sides of the mattress. In step **5**, **910**, one would open the carriage cover **265**. In step **913**, one would attach the used bed sheet onto the used bed sheet roller, and then in step **7**, **914**, one would load the new bed sheet onto the new bed sheet roller. In step **8**, **916**, one would tuck the loose end of the new bed sheet under the mattress. In step **9**, **918**, one would remove any debris off the mattress. In step **10**, **920**, one would loosen bottom belts under and the near the carriage. In step **11**, **922**, one would tighten top belts under or near the carriage, In step **12**, **922**, one would activate the carriage manually or using a motor in step **13**, **926**, as the carriage moves the used bed sheets, and they will be collected and the new bed sheets will be dispensed onto the mattress, in step **14**, **928**, as the carriage moves and reaches near the next set of belts one would then tighten or loosen the belts to create new space or pocket **50**, for the carriage to move into. In step **15**, **930**, as the carriage passes over each set of belts one would tighten or loosen the belts to return them to their original position. In step **16**, **932**, one would repeat step **10**, **920**, to step **15**, **930**, until the carriage reaches the other side or end of the

bed. In step **17**, **934**, one would remove the used bed sheets from the used bed sheet roller from the carriage. In step **18**, **936**, one would return the carriage to the original position. In step **19**, **938**, one would detach the loose end of the new bed sheet from the new bed sheet roller and tuck it under the mattress. In step **939**, one would untuck the used bed sheet from the used bed sheet roller and attach the used bed sheet roller back into the carnage. In step **20**, **940**, one would close the carriage cover **265**.

[0085] A carriage assembly is used in conjunction with the pressure roller assembly to create space in which to move vertically and/or horizontally across the top of primary mattress in order to dispense and collect new and used bed sheets without disturbing the patient occupying the bed space and to apply pressure to mattress allowing said carriage assembly to move freely across the bed. Although the patient is not shown, it is understood that the space created by the carriage assembly in conjunction with the pressure roller assembly and/or air bladder assembly will enable the uninhibited movement of the carriage assembly under the patient to completed the bed sheet changing process as shown in the Figures, and more specifically in FIGS. **4**, **9**, and **10**.

[0086] A pressure roller assembly is used in conjunction with the carriage assembly for maneuvering a series of pressure rollers to deform the primary mattress and secondary mattress frame in order to create space into which the carriage assembly can pass freely over the primary mattress to complete the bed sheet changing process and is also able to relieve pressure from the patient's neck, shoulder, buttocks and foot areas of the patient lo reduce the likelihood of bedsores and/or other similar pressure related conditions and to facilitate patient healing. Although a patient is not shown, but it is understood that the space created by the maneuvering of the pressure rollers in conjunction with the downward pressure applied by the carriage assembly will function enable the uninhibited movement of the carriage assembly under the patient as well as being capable of removing pressure from underneath specific areas of the patient as specifically shown in the Figures, and more specifically in FIGS. **2**A-**2**C, **5**A-**5**B, **6**A-**6**B, and **7**A-**7**B.

[0087] An air bladder assembly is used in conjunction with the carriage assembly for relieving pressure from the primary mattress via a series of inflatable and deflatable air bladders to create enough space for the carriage assembly to fit in order to move from one side of the bed to the next side while completing the bed sheet changing process without tension and to relieve pressure from beneath the patient and provide an air exchange between the primary mattress and the patient in order to reduce the likelihood of bedsores, infections and/or other similar pressure related conditions, and also to facilitate patient healing and/or to reposition the patient as needed. Although the patient is not shown, it is understood that the space created by the deflation of the air bladders in conjunction with the downward pressure applied by the carriage assembly will enable the uninhibited movement of the carriage assembly under the patient to complete the bed sheet changing process as well as being capable of removing pressure from underneath specific areas of the patient as shown in the Figures, and more specifically as shown in FIGS. **8** and **9**.

[0088] FIG. **12**A and FIG. **12**B are front cross-sectional views of a hospital bed **21101** in accordance with one embodiment of the present invention in which the mechanisms of the bladder assembly **21104** are enlarged to show a method of compressing **21124** and uncompressing **21125** a section of the mattress **21103** as shown in FIG. **12**A and FIG. **12**B, respectively. The bladder assembly **21143** is comprised of a series of inflatable bladders **21144**, including but not limited to top bladders **21136** and bottom bladders **21137**, bladder ports **21138**, fluid lines **21139** and adjustable electro-mechanical pressure sensor valves **21140**. Top bladders **21136** and bottom bladders **21137** are placed inside a mattress **21103** between which a piece of foam **21145** is positioned. The mattress **21103** along with its inflatable bladders **21144** is firmly encircled by a series of belts **21106**. Attached to each inflatable bladder **21144** is a bladder port **21138** which is connected to an adjustable electro-mechanical pressure valve sensor **21140** via fluid lines **21139**. The adjustable electro-mechanical pressure valve sensors **21140** are connected to the CPU **21112** via wires **21113** or wirelessly **21135**. The bladder assembly **21143** works in such a way that when a command is sent from the CPU **21112** to inflate the bottom bladder **21137**, the top bladder **21136** is simultaneously deflated and when bottom bladder **21137** is deflated, the top bladder **21136** is simultaneously inflated. Because the bottom bladder **21137** touches the bottom of the belt **21106**, when the command is sent to inflate the bottom bladder **21137** and deflate the top bladder **21136**, the bottom bladder **21137** applies downward pressure to the bottom of the belt **21106** which pulls down the top of the belt **21106** into the space that had been previously filled by the inflated top bladder **21136**. This process of inflating and deflating the top bladders **21136** and bottom bladders **21137** in opposing manners allows for the deformation of the mattress **21103** which creates air pockets **21227**. When the top bladder **21136** is deflated, the bottom bladder **21137** is inflated, pulling down the belt **21106** and the top of the mattress **21103** and creating air pockets **21227** as shown in FIG. **12**A. When the bottom bladder **21137** is deflated, the top bladder **21136** is inflated, pushing up the belt **21106** and the top of the mattress **21103** to its default position as shown in FIG. **12**B.

[0089] FIG. **12**C and FIG. **12**D are front cross-sectional views of a hospital bed **21101** in accordance to one embodiment of the present invention in which the mechanisms of the bladder assembly **21143** and belt assembly **21104** are enlarged to show a method of compressing **21124** and uncompressing **21125** a section of the mattress **21103** as shown in FIG. **12**C and FIG. **12**D, respectively. In this embodiment the bladder assembly **21143** is comprised of a series of inflatable bladders **21144**, bladder ports **21138**, fluid lines **21139** and adjustable electro-mechanical pressure sensor valves **21140**. Attached to each inflatable bladder **21144** is a bladder port **21138** which is connected to an adjustable electro-mechanical pressure valve sensor **21140** via fluid lines **21139**. The adjustable electro-mechanical pressure valve sensors **21140** are connected to the CPU **21112** via wires **21113** or wirelessly **21135**. The belt assembly **21104** is comprised of a series of belt rollers **21105**, belts **21106**, belt motors **21107**, threaded nuts **21109** and bi-directional threaded rods **21108**. The mattress **21103**, along with its inflatable bladders **21144** is firmly encircled by a series of belts **21106**, the two ends of which are each affixed to one threaded nut **21109**, respectively. The threaded nuts **21109** are inserted into either end of a bi-directional threaded rod **21108** in such a way that when the bi-directional threaded rod **21108** is rotated in the one direction by

the belt motor **21107**, the threaded nuts **21109** move together, pulling either end of the belt **21106** around the belt rollers **21105** and applying downward pressure to the mattress **21103** to the mattress creating air pockets **21127** as shown in FIG. **12**D. When the belt motor **21107** rotates in the opposite direction, the threaded nuts **21109** move apart from one another, the ends of the belt **21106** are loosened and the downward pressure being applied to the mattress **21103** creating an air pocket **21127** is removed, causing the mattress **21103** to return to its uncompressed **21125** default position as shown in FIG. **12**D. The bladder assembly **21143** works in conjunction with belt assembly **21104** in such a way that when a command is sent from the CPU **21112** to deflate the bladders **21144** inside the mattress **21103**, the belt motor **21107** is simultaneously signaled to start rotating the bi-directional threaded rod **21108** in one direction to move the threaded nuts **21109** towards each other pulling either end of the belt **21106** around the belt rollers **21105** and applying downward pressure to the mattress **21103** creating air pockets **21127**. This process of deflating the bladder **21144**, moving the threaded nuts **21109** together and pulling the belt **21106** downwards allows for the creation of air pockets **21127** large enough to allow the carriage assembly **21126** (not shown) to pass freely over hospital bed **21101** from one end of the bed to another without tension to complete the bed sheet changing process and/or to relieve pressure from designated areas while being occupied by a patient as shown in FIG. **12**C. When the belt motor **21107** rotates in the opposite direction, the threaded nuts **21109** move apart from one another, the ends of the belt **21106** are loosened, the bladders **21144** are inflated and the downward pressure being applied to the mattress **21103** creating an air pocket **21127** is removed, causing the mattress **21103** to return to its uncompressed **21125** default position as shown in FIG. **12**D. These inflatable bladders **22144** are capable of sensing pressure being applied by the patient's various body parts and automatically transmitting this information to the CPU **21112** via wires **21113** or wirelessly **21135** (not shown) which in turn would send commands to the belt assembly **21104** to tighten the belts **21106** under the high-pressure areas in order to remove this pressure. When the inflatable bladders **21144** (not shown) sense that the pressure has been removed from these high-pressure areas of the patient **21118**, they could automatically transmit this information to the CPU **18112** via wires **21113** or wirelessly **21135** (not shown) which in turn would sends commands to the belt assembly **21104** to stop tightening the belts **21106** under these high-pressure areas. If the patient **21117** (not shown) gets up or changes position, the inflatable bladders **21144** could sense the change in pressure being applied to the belts **21106** and automatically transmit this information to the CPU **21112** via wires **21113** or wirelessly **21135** (not shown) which in turn would send commands to the belt assembly **21104** to loosen the belts **21106** and bring them back to their default position. Alternatively, the sensor assembly **21114** (not shown) could also be built directly into the mattress **21103** or into the belts **21106** themselves.

[0090] FIG. **12**E is front cross-sectional views of a hospital bed **21101** in accordance to one embodiment of the present invention in which the mattress **21103** has been replaced with a series of sectional foam shapes **21147** which work in conjunction with the belt assembly to raise and lower sectional foam shapes **21147** to create air pockets **21127**. These sectional foam shapes **21147** would be firmly encircled by a series of belts **21106**, the two ends of which are each affixed to one threaded nut **21109** (not shown), respectively. The threaded nuts **21109** (not shown) are inserted into either end of a bi-directional threaded rod **21108** (not shown) in such a way that when the bi-directional threaded rod **21108** (not shown) is rotated in one direction by the belt motor **21107** (not shown), the threaded nuts **21109** (not shown) move together, pulling either end of the belt **21106** around the belt rollers **21105** and applying downward pressure to the sectional foam shapes **21147** (not shown) creating air pockets **21127**. This process of moving the threaded nuts **21109** (not shown) together and pulling the belt **21106** downwards allows the creation of air pockets **21127** large enough to allow the carriage assembly **21126** (not shown) to pass freely over hospital bed **21101** from one end of the bed to another without tension to complete the bed sheet changing process and/or to relieve pressure from designated areas while being occupied by a patient. When the belt motor **21107** (not shown) rotates in the opposite direction, the threaded nuts **21109** (not shown) move apart from one another, the ends of the belt **21106** are loosened and the downward pressure being applied to the sectional foam shapes **21147** creating an air pocket **21127** is removed, causing the sectional foam shapes **21147** to return to their horizontal default position. This process would similarly allow individual sectional foam shapes **21147** to be lowered or raised individually or multiple sectional foam shapes **21147** to be lowered or raised simultaneously in order to relieve pressure from the patient **21117** (not shown) or apply a massaging effect to help circulate blood flow.

[0091] FIG. **12**F is a another embodiment of the hospital bed in which the belt assembly **21104** could be replaced with a series of rotating tension arcs **21128** which could pull down and push up individual or multiple form rollers **21147** in order to relieve pressure from the patient **21117** (not shown) or apply a massaging effect to help circulate blood flow.

[0092] FIG. **13**A is a side cross-sectional view of a hospital bed **22101** in accordance to one embodiment of the present invention in which the mechanisms of the bladder assembly **22143** and belt assembly **22104** are enlarged to show a method of compressing a section of the mattress **22103**. In this embodiment the bladder assembly **22143** is comprised of a series of breathable top bladders **22136**, outer bladders **22141**, inner bladders **22142**, adjustment bladder **22137**, bladder ports **22138**, fluid lines **22139** (not shown) and adjustable electro-mechanical pressure sensor valves **22140** (not shown). The breathable top bladders **22136** are used to create an air exchange between the patient's body and the mattress **22103** in order maintain a dry, sterile environment under the patient **22117** (not shown) which reduces the likelihood of bedsores, infections and/or other similar pressure related conditions and to facilitate patient healing and comfort. Positioned directly underneath each breathable top bladder **22136** is an outer bladder **22141** within which there is a smaller inner bladder **22142**. The breathable top bladders **22136**, outer bladders **22141** and inner bladders **22142** are designed in such a way that when downward pressure is applied to the mattress **22103** by either the weight of a patient **22107** (not shown) or by the carriage assembly **22126**, these bladders will automatically begin to deflate relieving pressure from underneath the patient and/or creating a pocket **22127**, into which the carriage assembly **22126** will be able to fit. The more

pressure applied, the more the bladders will deflate. The order in which this deflation occurs is, breathable top bladders **22136** first, outer bladders **22141** second and inner bladders **22142** last. If pressure is relieved from the bladders **22136**, **22141**, **22142**, order is reversed as the inner bladders **22142**, outer bladders **22141** and top bladders **22136**, begin to inflate respectively bringing the mattress **22103** back to its default horizontal position parallel to the ground. Bottom adjustment bladders **22137** are can be inflated and deflated under the rest of the bladders to raise up or lower sections of the mattress **22103**, such as the head/chest, the knee or foot areas, as desired by the patient or the caregiver. The bladder assembly **22143** works in conjunction with belt assembly **22104** (not shown) in such a way that when a command is sent from the CPU **22112** (not shown) to deflate the bladders inside the mattress **22103**, the belts **22106** encircling the mattress **22103** will be pulled downward creating air pockets **21127**. This process of deflating the bladders, and pulling the belts **22106** downwards allows for the creation of air pockets **22127** large enough to allow the carriage assembly **22126** to pass freely over hospital bed **22101** from one end of the bed to another without tension to complete the bed sheet changing process and/or to relieve pressure from designated areas while being occupied by a patient. When the CPU **22112** sends a command to loosen the belts **22106**, the bladders are inflated in the order mentioned above and the downward pressure being applied to the mattress **22103** creating an air pocket **22127** is removed, causing the mattress **22103** to return to its uncompressed default position. FIGS. **13**B and **13**C are side cross-sectional views of a hospital bed **22101** in accordance to one embodiment of the present invention in which the mechanisms of the bladder assembly **22143** and belt assembly **22104** are enlarged to show a method of compressing a section of the mattress **22103** with the belts **22106** placed above the sensor assembly **22114** (in FIG. **13**B) and with the belts **22106** placed below the sensor assembly **22114** (in FIG. **13**C);

[0093] FIG. **14**A is a side cross-sectional view of a hospital bed **23101** in accordance to one embodiment of the present invention in which the mechanisms of the bladder assembly **23143** and belts **23106** are enlarged to show a method of compressing a section of the mattress **23103**. In this embodiment the bladder assembly **23143** is comprised of series of inflatable bladders **22144**, bladder ports **22138** (not shown), fluid lines **22139** (not shown) and adjustable electro-mechanical pressure sensor valves **22140** (not shown). In this embodiment the mattress **22103** features a series of internal air pockets **22127** which allow for easy compression if enough downward pressure is applied to it. A series of inflatable bladders **23144** are placed directly underneath the mattress **23103**. A series of belts **23106** encircle both the mattress **23103** and the inflatable bladders **23144** in such a way that when the inflatable bladders **23144** are signaled to inflate, the belt encircling the mattress **23103** and the inflatable bladders **23144** is pulled downward by the inflating bladders **23144**, and the top of the mattress **23103** is compressed creating air pockets **23127** relieving pressure partially or completely from underneath the patient **23117** and large enough to allow the carriage assembly **22126** (not shown) to pass under the patient **23117** and complete the sheet changing process. When the signal is sent to deflate the inflatable bladders the process is reversed, the belts **23106** are loosened and the mattress **23103** returns to its default uncompressed position as shown in FIG. **14**B. Using a mattress with series of inflatable bladders **23144** would also enable the patient **23117** (not shown) to receive X-rays, MRIs and other important medical procedures without having to be moved from the mattress **18103** because such a design would not contain any metal components that would negatively affect or prohibit the use of such technologies.

[0094] FIG. **15**A is a side cross-sectional view of a hospital bed **24101** in accordance to one embodiment of the present invention in which the electro-mechanical solenoid assembly **24150** and belts **24106** are enlarged to show a method of compressing a section of the mattress **24103** with the electro-mechanical solenoid assembly **24150** located beneath the mattress. The electro-mechanical solenoid assembly is comprised of an electro-magnetic solenoid **24146**, sensors **24148** and a spring **24149**. When an electric current is sent to the electro-mechanical solenoid assembly **14150**, the electro-magnetic solenoid **24146** is energized, causing it to contract, pulling down the top of the mattress **24103** with the belts **24106**, creating air pockets **24127** which can relieve pressure partially or completely from underneath the patient **23117** (not shown) and large enough to allow the carriage assembly **22126** (not shown) to pass under the patient **23117** (not shown) and complete the sheet changing process. When the electric current is stopped, the electro-magnetic solenoid **24146** will stop pulling down the top of the mattress **24103** with the belts **24106**, causing it to return to its default uncompressed position with the help of the spring **24149**. The sensors **24148** housed in the electro-mechanical solenoid assembly **24150** are used to transmit signals to the CPU **24112** (not shown) to identify when the electro-magnetic solenoid **24146** is contracted. In an alternative embodiment the electro-mechanical solenoid assembly **24150** can be placed directly inside the mattress **24103** as shown in FIG. **15**B.

[0095] FIG. **16** is a front cross-sectional view of a hospital bed **25101** in accordance to one embodiment of the present invention in which the pressure roller assembly **25130** and belts are enlarged to show a method of compressing sections of the mattress and raising up others. When each pressure roller **25129** is in its default horizontal position, the mattress **25103** remains parallel to the ground. However, as individual pressure rollers **25129** are rotated downwards and away from the mattress **20103**, sections of the mattress **25103** will be pulled down the belts **25106** which encircle the mattress **25103** and are attached to the ends of the pressure rollers **25129**. This process enables the mattress **25103** to deform in such a way as to relieve pressure from under specific areas of the patient's body in order to reduce the likelihood of bedsores and/or other similar pressure related conditions and to facilitate patient healing. This process also enables the carriage assembly **25126** to complete the bed sheet changing process without moving the patient **25117** (not shown). When the individual pressure rollers **25129** are rotated upwards and toward the mattress **20103**, sections of the mattress **25103** will be pushed up by the pressure rollers **25129**.

[0096] FIG. **17** is a top elevation view of a hospital bed **26101** in accordance to one embodiment of the present invention in which the mechanisms of the sensor assembly **26114** are enlarged to show a method of determining the position and pressure being applied by the head area **26118**, shoulders area **26119**, buttocks area **26120** and heels area **26121** of the patient **26117**, respectively, while laying on the

mattress **26103** using flexible vertical sensors **26115** and flexible horizontal sensors **26116**. The sensor assembly **26114** is comprised of a series of flexible vertical sensors **26115** and flexible horizontal sensors **26116** positioned above or below the belts **26106** (not shown) or both and positioned beneath the head area **26118**, shoulders area **26119**, buttocks area **26120** and heels area **26121** of the patient **26117**. These sensors thereby map out the exact position of the patient **24117** and the amount of pressure being applied by their various body parts. This pressure information is automatically transmitted to a body mapping monitor **26136** (not shown) which can display the pressure being applied by the various pressure areas of the patient **26117**. This pressure information will also automatically be transmitted to the CPU **26112** (not shown) via wires **26113** (not shown) or wirelessly **26135** (not shown) which in turn sends commands to the belt assembly **26104** (not shown) to tighten the belts **26106** (not shown) under the high-pressure areas in order to lessen or completely remove the pressure being applied to these high-pressure areas or create air pockets **26127** (not shown) under the patient **26117**. Alternatively, the belt assembly **26104** (not shown) can alternate between tightening and loosening the belts **26106** (not shown) in order to apply a massaging effect to these areas to help circulate blood flow.

[0097] FIG. **18** is a flow chart explaining the sequence of operation for the entire hospital bed **27101** including, but not limited to its ability to enable the sensor assembly **27114**, belt assembly **27104** and/or bladder assembly **27143** to function together in such a way as to determine the exact amount of pressure being applied by a specific area of the patient's body while laying on the mattress **27103** and automatically relieve that pressure, massage those areas and/or create air pockets **27127** underneath the patient **27117**. This is achieved through a series of steps. Steps **1** through **3** show a mattress **27103** with zero pressure being applied to it due to having no patient **27117** laying on top it, with loose belts **27106** and unaffected top sensors **27110** and bottom sensors **27111**. Steps **4** through **7** show a mattress **27117** with a patient **27117** on top of it, applying pressure to both the top sensors **27110** and the bottom sensors **27111** which in turn signal the CPU **27112** to turn on and/or open the belt motors **27107** and/or adjustable electro-mechanical valve sensors **27140**. Steps **8** through **16** show belts **27106** being tightened and begin pulling down the mattress **27103** which increases the pressure on the bottom sensors **27111**, and lessens the pressure under the patient **27117** and the pressure being applied to the top sensors **27110** until it equals zero at which point the CPU **27112** signals the belt motors and/or electro-mechanical valve sensors **27140** to turn off and/or shut. Steps **18** through **22** shows the CPU **18112** signaling the belt motors **27107** and/or adjustable electro-mechanical valve sensors **27140** to turn on and/or open, causing the belts **27106** to pull down the mattress **27103** even further to create air pockets **27127** underneath the patient **27117**, at which point the pressure on the bottom sensors **27111** is very high and there is no more contact between the patient **271117** and the top sensors **27110**. Steps **23** through **28** show the CPU **27112** signaling the belt motors **27107** and/or adjustable electro-mechanical valve sensors **27140** to reverse direction/flow, causing the belts **27106** to loosen, removing the air pockets **27127** underneath the patient **27117**, bringing the entire mattress **27103** and top sensors **27110** back in more contact with the patient **271117** with low pressure. Steps **29** through **30** show the massage mode being activated in which Steps **6** through **30** are cycled until signaled to stop. Steps **31** through **32** show the massage cycle complete and the CPU signaling the belt motors **27107** and/or electro-mechanical valves to turn off and/or shut.

[0098] A hospital bed for seamlessly changing bed sheets while occupied by a patient,

[0099] (a) a pressure roller assembly for deforming the primary mattress and secondary mattress frame in order to relieve pressure from the patient and/or creating space into which the carriage assembly to pass freely over it to complete the bed sheet changing process and to relieve pressure from the patient's neck, shoulder, buttocks and foot areas to reduce the likelihood of bedsores and/or other similar pressure related conditions and to facilitate patient healing, wherein said tension arc assembly comprises

[0100] (a) a means in said pressure roller assembly for turning a tinting belt:

[0101] (b) a means in said pressure roller assembly for turning the roller shafts;

[0102] (c) a means in said pressure roller assembly for engaging the roller shafts or slipping around them to prevent the rotation of the roller brackets;

[0103] (d) a means in said pressure roller assembly for holding and changing the pressure rollers;

[0104] (e) a means in said pressure roller assembly for connecting the roller brackets to the pressure rollers and allowing them to pivot thereon;

[0105] (d) a means in said pressure roller assembly for supporting the primary mattress and/or relieving pressure therefrom in order to deform it along with the patient's weight and or that of the carriage assembly; and

[0106] (e) a means in said pressure roller assembly for connecting two pressure rollers together to allow part of the bed to be lifted without affecting the ability of the pressure roller assembly to support the primary mattress at various levels of compression.

[0107] A hospital bed for seamlessly changing bed sheets while occupied by a patient, comprising:

[0108] (a) a carriage assembly for moving vertically and/or horizontally across the top of the hospital bed in order to dispense and collect new and used bed sheets without disturbing the patient occupying the bed space and to apply pressure to mattress allowing said carriage assembly to move freely across the bed, wherein said carriage assembly comprises;

[0109] (b) a means in said carriage assembly for collecting the used bed sheets consisting of a removable rod that will rotate either counter clock-wise (ccw) or clock-wise (cw) depending on the motion of said carriage assembly;

[0110] (c) a means in said carriage assembly for dispensing the new bed sheet consisting of a removable rod that can rotate either counter clock-wise (ccw) or clock-wise (cw) depending on the motion of the carriage assembly;

[0111] (d) a means in said carriage assembly for applying downward pressure on top mattress and primary mattress to create clearance for the carriage assembly to freely move across the bed. works in conjunction with the top belts;

[0112] (e) a means in said carriage assembly for providing the master rack gear with a means of moving the carriage assembly linearly along the bed frame. The carriage assembly contains a circular rack gear that rests on rack and enables the carriage to travel along the rack as the circular gear rotates, turning rotational motion into linear action;

[0113] (f) a means in said carriage assembly for holding the mounting plates on either end of the carriage assembly together;

[0114] (g) a means in said carriage assembly for rotating the used bed sheet roller when the master rack gear rotates, connected to said means for rolling up the used bed sheet;

[0115] (h) a means in said carriage assembly for rotating the new bed sheet roller when the master rack gear rotates, connected to said means for rolling up the new bed sheet;

[0116] (i) a means in said carriage assembly for guiding the carriage along to the gear rack via a threaded hole that interacts with threaded rod to reduce slippage, connected to said means for holding the headboard and the footboard together;

[0117] (j) a means in said carriage assembly for slipping and thereby preventing said roller from rotating when anything obstructs the rolling process dispensing and collecting the two said bed sheets, in order to protect the patient and bed components from being injured/damaged, connected to said means for rotating the new bed sheet roller when the master rack gear rotates, connected to said means for rotating the used bed sheet roller when the master rack gear rotates;

[0118] (k) a means in said carriage assembly for allowing the rotation of the various rollers, gears and pulleys used throughout the hospital bed;

[0119] (l) a means in said carriage assembly for engaging the gear rack in order to move the carriage assembly along the bed;

[0120] (m) a means in said carriage assembly for rotating the center belt in order to turn the master rack gear;

[0121] (n) a means in said carriage assembly for rotating the master gear when the center belt gear rotates;

[0122] (o) a means in said carriage assembly for rotating the threaded rod to move the carriage assembly across the bed;

[0123] (p) a means in said carriage assembly for holding both sides of carriage assembly together as well as preventing the patient from touching the rotating bed sheet rollers;

[0124] (q) a means in said carriage assembly for moving the carriage assembly along gear rack, connected to said means for rotating the threaded rod to move the carriage assembly across the bed;

[0125] (r) a means in said carriage assembly for holding all the different parts of the carriage assembly together;

[0126] (s) a means in said carriage assembly for providing additional comfort and protection for the patient, placed between top belts and patient body: and

[0127] (t) a means in said carriage assembly for guiding the carriage along the threaded rod parallel to the gear rack, threadably inserted to said means for moving the carriage assembly along gear rack, and structurally embedded to said means for guiding the carriage along to the gear rack via a threaded hole that interacts with threaded rod to reduce slippage.

[0128] A hospital bed for seamlessly changing bed sheets while occupied by a patient, comprising:

[0129] (a) a programmable logic controller and/or microprocessor for determining the sequence of operation for the entire bed including, but not limited to its ability to enable the bed frame assembly, carriage assembly and pressure roller assembly to function together in such a way as to facilitate the uninhibited movement of the carriage assembly across the bed to collect used bed sheets and dispense new bed sheets. This is accomplished by elevating a section of the primary mattress via the pressure roller assembly, while simultaneously lowering another section thereon creating an empty space large enough to allow the carriage assembly to pass freely over the primary mattress from one end of the bed to another without tension.

[0130] A hospital bed for seamlessly changing bed sheets while occupied by a patient,

[0131] (a) an air bladder assembly for relieving pressure from the primary mattress via a series of inflatable and deflatable air bladders to create enough space for the carriage assembly to fit in order to move from one side of the bed to the next while completing the bed sheet changing process without tension and to relieve pressure from beneath the patient and provide an an air exchange between the primary mattress and the patient to reduce the likelihood of bedsores, infections and/or other similar pressure related conditions, to facilitate patient healing and to position the patient as needed, wherein said air bladder assembly comprises;

[0132] (a) a means in said air bladder assembly for forming a deformable soft outer casing that supports the patient and contains the various bladders, valves and tubes of the air bladder assembly;

[0133] (b) a means in said air bladder assembly for creating an air exchange between the patient's body and the primary mattress in order maintain a dry, sterile environment under the patient which reduces the likelihood of bedsores, infections and/or other similar pressure related conditions and to facilitate patient healing and comfort and to deflate and lower sections of the primary mattress when downward pressure is applied to it and inflate and elevating sections of the primary mattress when pressure is removed from it;

[0134] (b) a means in said air bladder assembly for deflating and lowering sections of the primary mattress when downward pressure is applied to it and inflating and elevating sections of the primary mattress when pressure is removed from it;

[0135] (c) a means in said air bladder assembly for deflating and lowerings sections of the primary mattress and inflating and elevating sections of the primary mattress such as the head/chest, the knee or foot areas, as desired by the patient or the caregiver;

[0136] (d) a means in said air bladder assembly for preventing air from escaping the various bladders during the bed sheet changing process, enable all the bladders which are not being compressed by the carriage assembly to maintain full bladder inflation and support the patient;

[0137] (e) a means in said air bladder assembly for enabling the free air exchange of the breathable top bladders to the patient;

[0138] (f) a means in said air bladder assembly for transferring air from the air supply to the various bladders throughout the mattress; and

[0139] (g) a means in said air bladder assembly for inflating and deflating the various bladders placed throughout the primary mattress.

[0140] A hospital bed for seamlessly changing bed sheets while occupied by a patient, comprising:

[0141] (a) a carriage assembly for moving across the top of the hospital bed in order to dispense and collect new and used bed sheets without disturbing the patient occupying the bed space and to apply pressure to mattress allowing said carriage assembly to move freely across the bed, wherein said carriage assembly comprises;

[0142] (b) a means in said carriage assembly for collecting the used bed sheets consisting of a removable rod that will rotate either counter clockwise (ccw) or clockwise (cw) depending on the motion of said carriage assembly;

[0143] (c) a means in said carriage assembly for dispensing the new bed sheet consisting of a removable rod that will rotate either counter clock-wise (ccw) or clock-wise (cw) depending on the motion of the carriage assembly;

[0144] (d) a means in said carriage assembly for applying downward pressure on lop mattress and primary mattress to create clearance for the carriage assembly to freely move across the bed. works in conjunction with the top belts;

[0145] (e) a means in said carriage assembly for providing the master rack gear with a means of moving the carriage assembly linearly along the bed frame. The carriage assembly contains a circular rack gear that rests on rack and enables the carriage to travel along the rack as the circular gear rotates, turning rotational motion into linear action;

[0146] (f) a means in said carriage assembly for holding the mounting plates on either end of the carriage assembly together;

[0147] (g) a means in said carriage assembly for rotating the used bed sheet roller when the master rack gear rotates, connected to said means for rolling up the used bed sheet;

[0148] (h) a means in said carriage assembly for rotating the new bed sheet roller when the master rack gear rotates, connected to said means for rolling up the new bed sheet;

[0149] (i) a means in said carriage assembly for guiding the carriage along to the gear rack via a threaded hole that interacts with threaded rod to reduce slippage, connected to said means for holding the headboard and the footboard together;

[0150] (j) a means in said carriage assembly for slipping and thereby preventing said roller from rotating when anything obstructs the rolling process dispensing and collecting the two said bed sheets, in order to protect the patient and bed components from being injured/damaged, connected to said means for rotating the new bed sheet roller when the master rack gear rotates, connected to said means for rotating the used bed sheet roller when the master rack gear rotates,

[0151] (k) a means in said carriage assembly for allowing the rotation of the various rollers, gears and pulleys used throughout the hospital bed;

[0152] (l) a means in said carriage assembly for engaging the gear rack in order to move the carriage assembly along the bed;

[0153] (m) a means in said carriage assembly for rotating the center belt in order to turn the master rack gear;

[0154] (n) a means in said carriage assembly for rotating the master gear when the center belt gear rotates;

[0155] (o) a means in said carriage assembly for rotating the threaded rod to move the carriage assembly across the bed;

[0156] (p) a means in said carriage assembly for holding both sides of carriage assembly together as well as preventing the patient from touching the rotating bed sheet rollers;

[0157] (q) a means in said carriage assembly for moving the carriage assembly along gear rack, connected to said means for rotating the threaded rod to move the carriage assembly across the bed;

[0158] (r) a means in said carriage assembly for holding all the different parts of the carriage assembly together;

[0159] (s) a means in said carriage assembly for providing additional comfort and protection for the patient, placed between top belts and patient body; and

[0160] (t) a means in said carriage assembly for guiding the carriage along the threaded rod parallel to the gear rack, threadably inserted to said means for moving the carriage assembly along gear rack, and structurally embedded to said means for guiding the carriage along to the gear rack via a threaded hole that interacts with threaded rod to reduce slippage.

[0161] A hospital bed for seamlessly changing bed sheets while occupied by a patient, comprising:

[0162] (a) a programmable logic controller and/or microprocessor for determining the sequence of operation for the entire bed including, but not limited to its ability to enable the carriage assembly and air bladder assembly to function together in such a way as to facilitate the uninhibited movement of the carriage assembly across the bed to collect used bed sheets and dispense new bed sheets. This is accomplished by elevating a section of the primary mattress via the air bladder assembly while simultaneously lowering another section thereof, creating an empty space large enough to allow the carriage assembly to pass freely over the primary mattress from one end of the bed to another without tension.

[0163] Thus, the present invention is not limited to the embodiments described herein and the constituent elements of the invention can be modified in various manners without departing from the spirit and scope of the invention. Various aspects of the invention can also be extracted from any appropriate combination of a plurality of constituent elements disclosed in the embodiments. Some constituent elements may be deleted in all of the constituent elements disclosed in the embodiments. The constituent elements described in different embodiments may be combined arbitrarily.

[0164] Still further, while certain embodiments of the inventions have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel methods and systems described herein may be embodied in

a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the methods and systems described herein may be made without departing from the spirit of the inventions.

[0165] While the present invention has been particularly described in conjunction with a specific preferred embodiment, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art in light of the foregoing description. It is therefore contemplated that the appended claims will embrace any such alternatives, modifications and variations as falling within the true scope and spirit of the present invention.

What is claimed is:

1. A hospital bed for changing bed sheets while being occupied by a patient and relieving pressure from designated areas, the hospital bed comprising:

a flexible mattress base;

a deformable mattress disposed over said flexible mattress base, the deformable mattress comprising a plurality of sectional foam shapes;

a carriage assembly, comprising:

at least one belt, engaged with a plurality of belt rollers, wherein the at least one belt is configured to pull down a section of the deformable mattress;

a deformable electro-magnetic solenoid under the mattress coupled with the at least one belt;

a rotatable threaded rod engaging a plurality of threaded nuts, wherein the plurality of threaded nuts are coupled to the plurality of belt rollers;

a plurality of sheet rollers configured to change the bed sheets on the mattress;

a pressure roller assembly, comprising:

at least one sensor configured to sense pressure exerted by the mattress on the patient's body;

a processing unit coupled to the at least one sensor; and

a plurality of pressure rollers configured to be raised and lowered thereby pushing up certain sections of the mattress,

wherein the processing unit is configured to transmit signals to components of the hospital bed and coordinate actions of changing sheets and relieving pressure.

2. The hospital bed of claim **1**, wherein the at least one sensor measures the locations and amounts of exerted pressure and transmits the pressure measurements to the processing unit.

3. The hospital bed of claim **2**, wherein the at least one sensor is a flexible pressure sensor.

4. The hospital bed of claim **2**, wherein the at least one sensor is an inflatable bladder.

5. The hospital bed of claim **1**, wherein the electro-magnetic solenoid is configured to deform the mattress to create air pockets under the patient.

6. The hospital bed of claim **1**, wherein the plurality of pressure rollers are individually raised and lowered to deform individual sections of the mattress.

7. The hospital bed of claim **1**, wherein the plurality of foam shapes are individually raised and lowered.

8. The hospital bed of claim **1**, wherein the mattress can be further configured to enable the patient to receive medical procedures without having to be moved from the mattress.

9. The hospital bed of claim **1**, further comprising a plurality of massage rollers to massage the patient.

10. A method for changing bed sheets on a hospital bed while being occupied by a patient and relieving pressure, the method comprising:

pulling down sections of a deformable mattress using a belt rolling over a plurality of belt rollers;

raising and lowering a deformable electro-magnetic solenoid under the mattress to create air pockets under the patient;

releasing a sheet to change on the mattress using a plurality of sheet rollers;

sensing the pressure on the patient using at least one inflatable bladder comprising at least one sensor to sense pressure;

transmitting the sensor measurement to a processing unit coupled to the at least one sensor; and

raising and lowering a plurality of pressure rollers to relieve pressure.

11. The method of claim **10**, wherein the deformable mattress comprises a plurality of sectional foam shapes.

12. The method of claim **10**, wherein sensing the pressure further comprises measuring the locations and amounts of pressure being exerted by the mattress on the patient, and transmitting the pressure measurements to the processing unit.

13. The method of claim **12**, wherein said sensor is a flexible pressure sensor.

14. The method of claim **10**, wherein said sensor is an inflatable bladder.

15. The method of claim **11**, wherein the plurality of foam shapes are individually raised and lowered.

16. The hospital bed of claim **10**, wherein the plurality of pressure rollers are individually raised and lowered to deform individual sections of the mattress.

17. The method of claim **10**, further comprising positioning the patient on the mattress so as to facilitate a medical procedure without having to be moved from the mattress.

18. The method of claim **10**, further comprising massaging the patient using a plurality of massage rollers.

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