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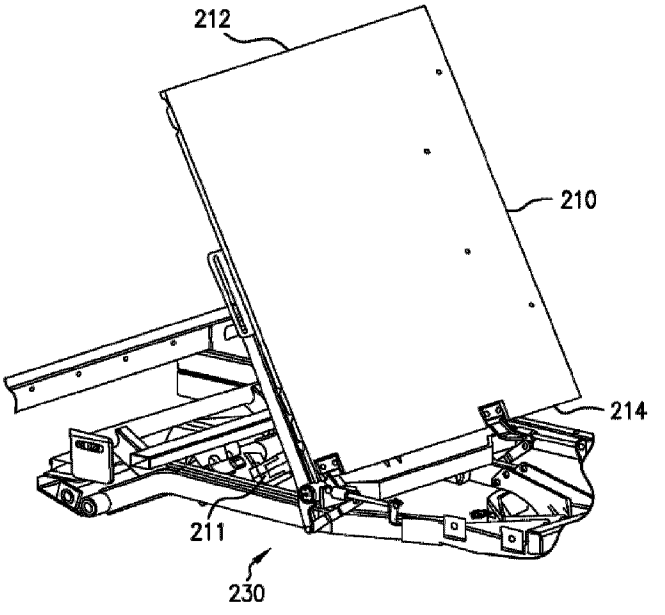

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(54) Title: APPARATUS AND METHOD FOR PROVIDING EMERGENCY CPR FUNCTIONALITY ON A PATIENT SUPPORT SURFACE

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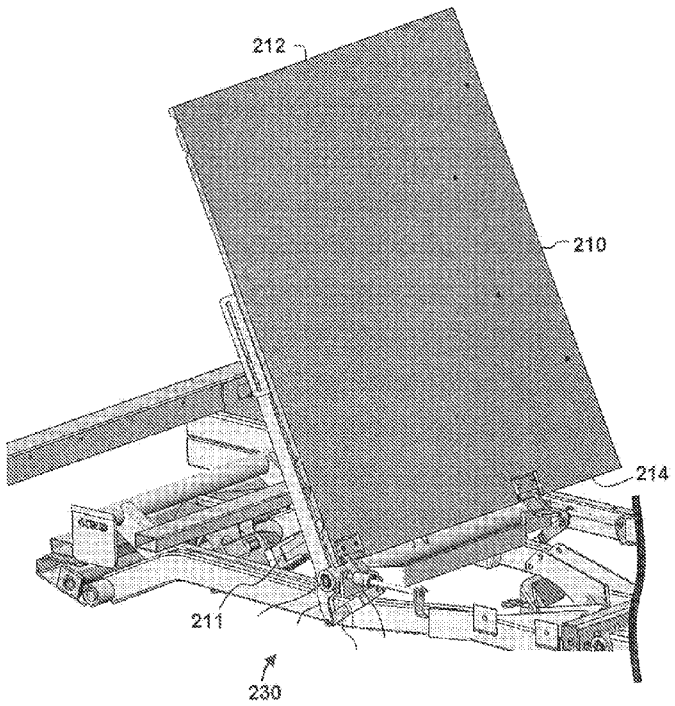

FIG. 2

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DESCRIPTION

APPARATUS AND METHOD FOR PROVIDING EMERGENCY CPR FUNCTIONALITY ON A PATIENT SUPPORT SURFACE

BACKGROUND

1. Field of the Invention

[0001] The present disclosure relates generally to patient support surfaces and more particularly to methods and apparatus for providing emergency CPR functions on a patient support surface.

2. Description of Related Art

[0002] Various apparatuses are known in the art for supporting patients. For example, some hospital and other beds include a mattress with a frame that is configured to raise and lower.

[0003] Some such support apparatuses have a frame that can articulate and include a back section, a seat section, and a leg section, each of which may be pivotable relative to one or more of the other sections. Often, the hospital beds employ linear actuators to lift and articulate the bed frame to various positions.

[0004] When the beds are connected to AC power and are functioning properly, software is used to control the position of the motors and thus the position of the bed. In an event where the clinician needs to initiate CPR or another emergency procedure on a patient in the bed, they will typically press a CPR button or pull a CPR lever and the bed software responds by controlling the motors to a position where the bed is flat and level. In cases where CPR is required but power to the bed is not available or there is an electrical problem with the bed, many beds have a provision for an emergency feature which mechanically lowers the head of the bed. Most often, this is accomplished by pulling a cable which releases a clutch on the linear actuator, causing the head motor to fall under gravity until the head of the bed is in a

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flat position. The limitation to this approach is that the head section is allowed to free fall onto the frame causing a potential for injury to the caregiver pulling the release handle and the patient in the bed due to the pinch points under the head section of the frame. Common feedback from nurses is that they are scared to pull the handle because the head section of the bed comes crashing down so loudly and abruptly.

[0005] In addition to increasing the risk of patient and caregiver injury, this back-up CPR method is more costly and requires more space to implement than the same actuator without the release clutch. A linear actuator equipped with a release clutch is approximately 40% more expensive than the same actuator without a release clutch. Additionally, routing the release cable and making room for the physically larger footprint of the actuator with the release clutch poses problems for low bed designs where space for additional components is very limited.

[0006] Some designs have attempted to solve the problem of having the head section fall rapidly by adding a gas spring in parallel with the head actuator. The limitations of this system are the additional cost of the gas spring and the space taken by the gas spring. Another limitation to the use of a gas spring is finding a constant that allows the head section to fall with very heavy and very light patients without heavy patients falling too quickly and light patient taking too long to descend to the flat position.

[0007] Accordingly, there is a need for improved apparatus and methods for providing CPR functionality on a hospital bed.

SUMMARY

[0008] This disclosure includes embodiments of patient support apparatuses, control units, and methods.

[0009] In accordance with an exemplary embodiment, a patient support surface is provided with an emergency CPR feature that does not require a mechanical clutch to lower the head section of the bed when there is a lack of AC power or an electrical problem with the bed.

[0010] By wiring the linear actuator that controls the head section of the bed directly to the battery, CPR can still be achieved when the bed is without AC power or there is an

internal failure of the bed electronics or software. Setting a "false bottom" in the software to prevent the batteries from ever completely depleting will ensure that battery power is available in the emergency situations described above. Using the power from the batteries to drive the motor will ensure that the head section is always lowered in a controlled rate of descent and that the head section is not allowed to slam down when the emergency CPR feature is activated.

[0011] The term "coupled" is defined as connected, although not necessarily directly, and not necessarily mechanically; two items that are "coupled" may be integral with each other. The terms "a" and "an" are defined as one or more unless this disclosure explicitly requires otherwise. The terms "substantially," "approximately," and "about" are defined as largely but not necessarily wholly what is specified, as understood by a person of ordinary skill in the art.

[0012] The terms "comprise" (and any form of comprise, such as "comprises" and "comprising"), "have" (and any form of have, such as "has" and "having"), "include" (and any form of include, such as "includes" and "including") and "contain" (and any form of contain, such as "contains" and "containing") are open-ended linking verbs. As a result, a method that "comprises," "has," "includes" or "contains" one or more steps possesses those one or more steps, but is not limited to possessing only those one or more steps.

[0013] Further, a device or structure that is configured in a certain way is configured in at least that way, but it can also be configured in other ways than those specifically described.

[0014] While exemplary embodiments of the present invention have been shown and described in detail below, it will be clear to the person skilled in the art that changes and modifications may be made without departing from the scope of the invention. As such, that which is set forth in the following description and accompanying drawings is offered by way of illustration only and not as a limitation. The actual scope of the invention is intended to be defined by the following claims, along with the full range of equivalents to which such claims are entitled.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The following drawings illustrate by way of example and not limitation. For the sake of brevity and clarity, every feature of a given structure is not always labeled in every figure in which that structure appears. Identical reference numbers do not necessarily

indicate an identical structure. Rather, the same reference number may be used to indicate a similar feature or a feature with similar functionality, as may non-identical reference numbers. The figures are drawn to scale (unless otherwise noted), meaning the sizes of the depicted elements are accurate relative to each other for at least the embodiment depicted in the figures.

[0016] FIG. 1 depicts a perspective view of an example of a patient support bed comprising an exemplary embodiment of a patient support apparatus;

[0017] FIG. 2 depicts a perspective view of a pivoting mechanism of the patient support apparatus of FIG. 1 in a fully elevated position;

[0018] FIG. 3 illustrates an exemplary embodiment of an emergency CPR switch; and

[0019] FIG. 4 illustrates an exemplary schematic for implementing an emergency CPR feature.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0020] Referring now to the drawings, and more particularly to FIGS. 1 and 2, shown therein and designated by the reference numeral 50 is a patient support bed with which the present features may be implemented individually or in any suitable combination. In the embodiment shown, patient support bed 50 comprises a frame or support apparatus 100 having a head end 110 and a foot end 120. Apparatus 100 further comprises an upper frame 200 and a base frame 400, as well as a lifting assembly 300 configured to raise and lower upper frame 200 relative to base frame 400. Lifting assembly 300 comprises a plurality of pivoting members and actuators configured to raise and lower upper frame 200. In the embodiment shown in FIGS. 1-2, patient support bed 50 comprises a patient support platform 215 comprising a first portion 210 proximal to head end 110 and a second portion 220 proximal to foot end 120. The first portion 210 and the second portion 220 may be pivoted between a flat position (shown in FIG. 1) and an inclined position (shown in FIG. 2). Patient support bed 50 also comprises a plurality of side guards 40, a head end guard 42, and a foot end guard 44.

[0021] As shown in FIG. 2, the first portion 210 of the patient support platform 215 may be pivoted into an inclined position so that first end 212 is higher than second end 214. In the

illustrated embodiment, the patient support platform 215 is pivoted using pivot mechanism 230. A linear actuator 211 exerts an upward force on the first portion 210 of the patient support platform to pivot the patient support platform into an inclined position. Further details regarding patient support bed 50 and pivot mechanism 230 are described in Provisional Patent Application No. 61/692,557 for a "Hospital Bed," filed on August 30, 2012.

[0022] Referring to FIG. 3, a back-up CPR handle is located on at least one side of the bed frame. Alternatively, back-up CPR handles may be located on both sides of the bed frame or any other desirable locations. In the illustrated embodiment, the handle is mechanically coupled to an electro-mechanical limit switch 340 which changes state from normally open to closed when the CPR handle is pulled.

[0023] As seen in FIG. 4, the limit switches 320,330 are coupled to two electrical relays 352,362 which close when the limit switch 340 moves to its closed state. The closing of the relays 352,362 connects battery power to the head motor (e.g., the linear actuator 211 for articulating the first portion 210 of the patient support bed) and disables or overrides the motor control signals from the main controller such that the head motor is forced to lower the first portion 210 into a flat position (i.e., a CPR position).

[0024] Because this system relies on the batteries 380 to drive down the head motor 211, it is important that the system always have a reserve of battery power to lower the head section 210 of the bed 50. In certain embodiments, reserve power is maintained by disconnecting battery power from the frame when the available power in the battery 380 drops below a set threshold. In this specific embodiment, reserve battery power is maintained by software action. Controller hardware associated with the frame measures the battery voltage and provides this value to the software. When the voltage drops below a threshold value, the software opens a relay that disconnects the battery 380 from the rest of the circuit, thereby preventing further usage of the battery 380 except for emergency CPR usage. In an exemplary embodiment the threshold value is 50% battery capacity.

[0025] A backup CPR system in accordance with the above described embodiments allows CPR to he initiated in the event of power loss or electrical failure without allowing the head section to rapidly descend placing the patient and caregiver at risk for injury or adding significant cost and components to the design. Furthermore, the disclosed embodiments of the

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backup CPR system reduce the number of components and the complexity of the design so that other features may be implemented or so that lower bed heights may be achieved, thereby benefiting caregivers and patients who use the product.

[0026] The various illustrative embodiments of the present devices, apparatus, and systems are not intended to be limited to the particular forms disclosed. Rather, they include all modifications and alternatives falling within the scope of the claims. For example, embodiments other than the one shown may include some or all of the features of the depicted embodiment.

[0027] The claims are not intended to include, and should not be interpreted to include, means-plus- or step-plus-function limitations, unless such a limitation is explicitly recited in a given claim using the phrase(s) "means for" or "step for," respectively.

[0028] It will be understood that the benefits and advantages described above may relate to one embodiment or may relate to several embodiments. It will further be understood that reference to 'an' item refers to one or more of those items, unless otherwise specified. The steps of the methods described herein may be carried out in any suitable order, or simultaneously where appropriate.

[0029] Where appropriate, aspects of any of the examples described above may be combined with aspects of any of the other examples described to form further examples having comparable or different properties and addressing the same or different problems. It will be understood that the above description of embodiments is given by way of example only and that various modifications may be made by those skilled in the art. The above specification, examples and data provide a complete description of the structure and use of exemplary embodiments. Although various embodiments have been described above with a certain degree of particularity, or with reference to one or more individual embodiments, those skilled in the art could make numerous alterations to the disclosed embodiments without departing from the scope of this invention.

CLAIMS

1. An emergency CPR switch, for a hospital bed with a patient support platform having a portion that is pivoted between a flat and an inclined position by a motor powered by a battery, in combination with said hospital bed comprising said platform, said pivotable platform portion, motor and battery, said emergency CPR switch comprising:

a relay disposed between the battery and the motor; and

a switch electrically connected to the relay, wherein when the switch is operated the relay is activated to drive the motor in a direction placing the pivotable portion in a flat position and disable or override any motor control signals from a main controller.

2. The emergency CPR switch of claim 1, further comprising:

a controller for controlling the motor; and

a second relay for deactivating the controller.

3. The emergency CPR switch of claim 2, wherein the controller disconnects battery power when the available power in the battery drops below a set threshold.

4. A patient support apparatus, comprising:

the emergency CPR switch according to any one of claims 1 to 3;

a frame having a head end and a foot end;

a patient support platform disposed on the frame, comprising a first portion proximal to the head end and a second portion proximal to the foot end;

a linear actuator operatively associated with the motor for pivoting the first portion between a flat position and an inclined position; and

a battery for powering the linear actuator.

5. A method of providing an emergency CPR function in a patient support surface, comprising the steps of:

providing an emergency CPR switch according to any one of claims 1 to 3;

detecting an actuation of an emergency CPR switch; and

supplying power to the motor to drive the bed into a CPR position upon actuation of the emergency CPR switch, wherein said relay disables or overrides any motor control signals from the main controller.

6. The method of claim 5, wherein the step of supplying power comprises activating the relay to connect the motor with the battery.

7. The method of claim 5 or 6, further comprising the steps of:
monitoring the voltage of the battery; and
reserving the battery for emergency CPR use when the voltage of the battery drops below a set value.

8. The method of claim 7, wherein the set value corresponds to 50% of battery capacity.

9. The method according to any one of claims 5-8, wherein the powered drive is normally controlled by a main controller.

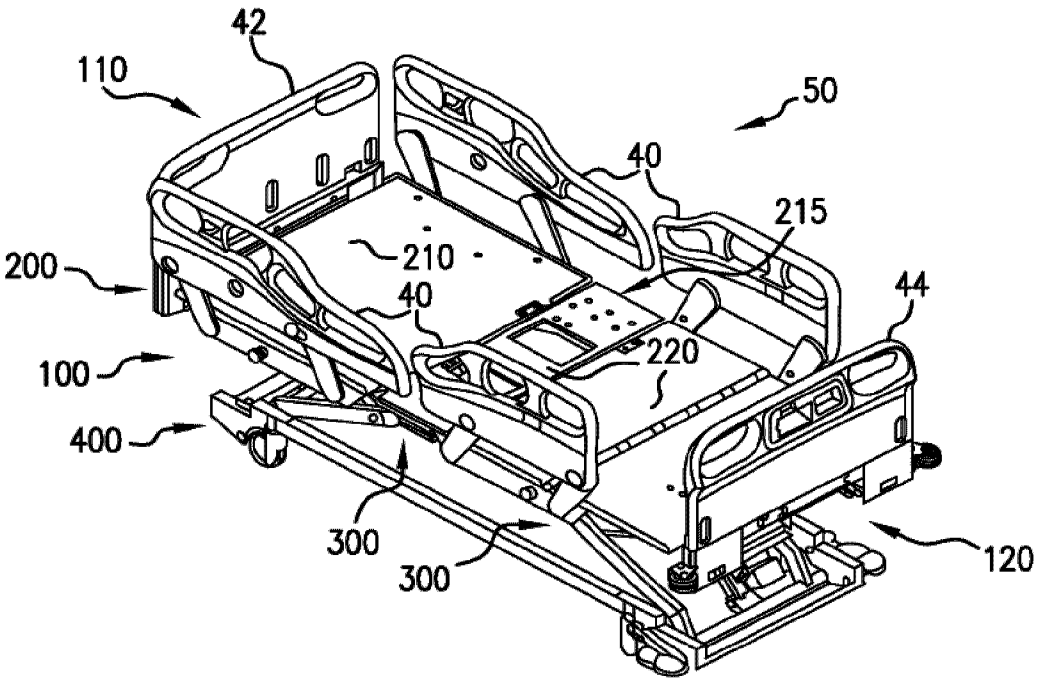

FIG. 1

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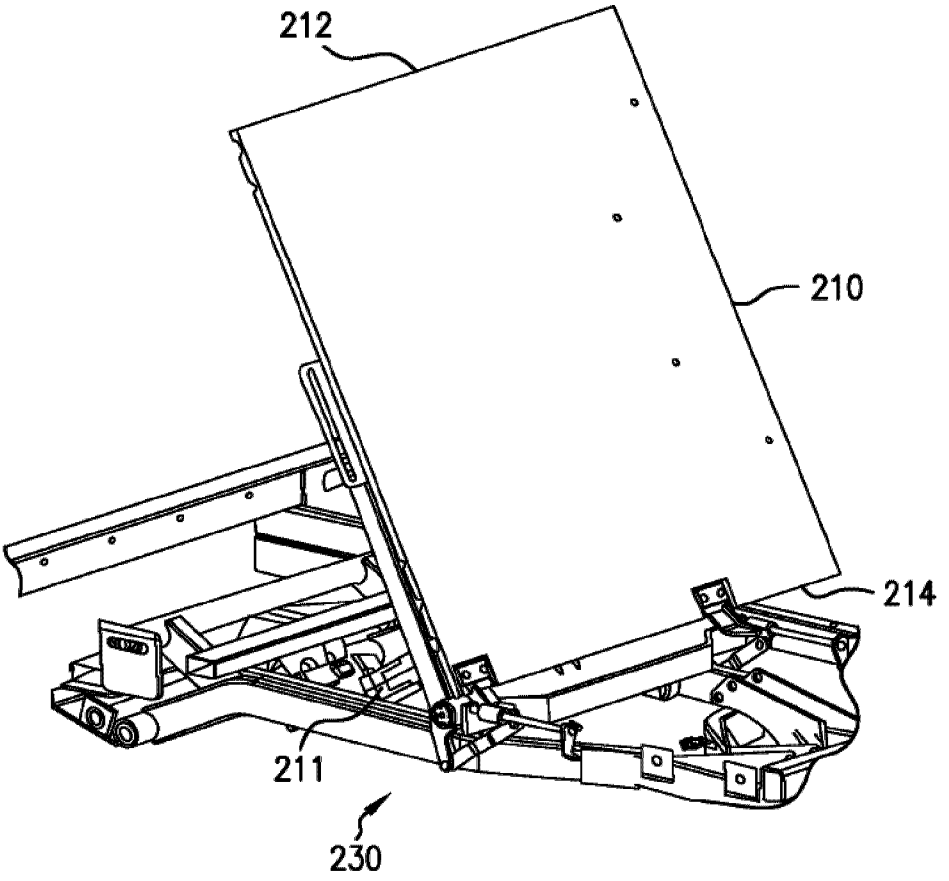

FIG.2

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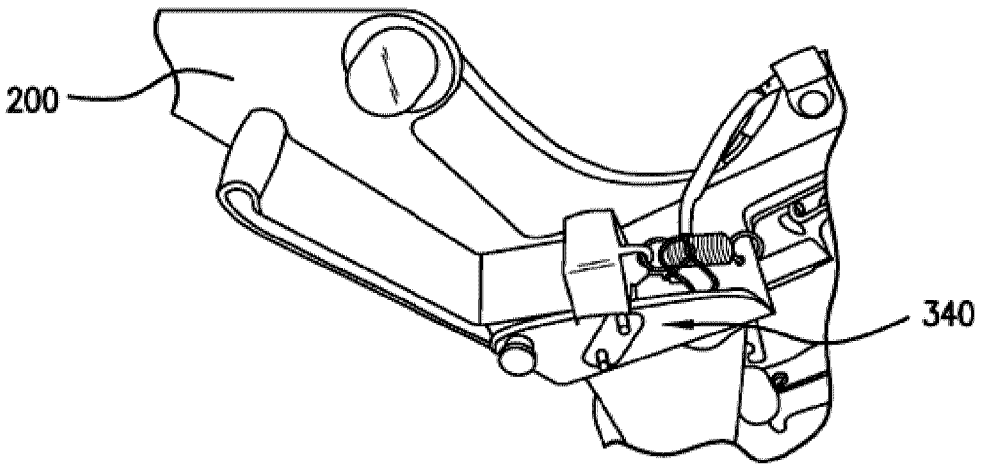

FIG.3

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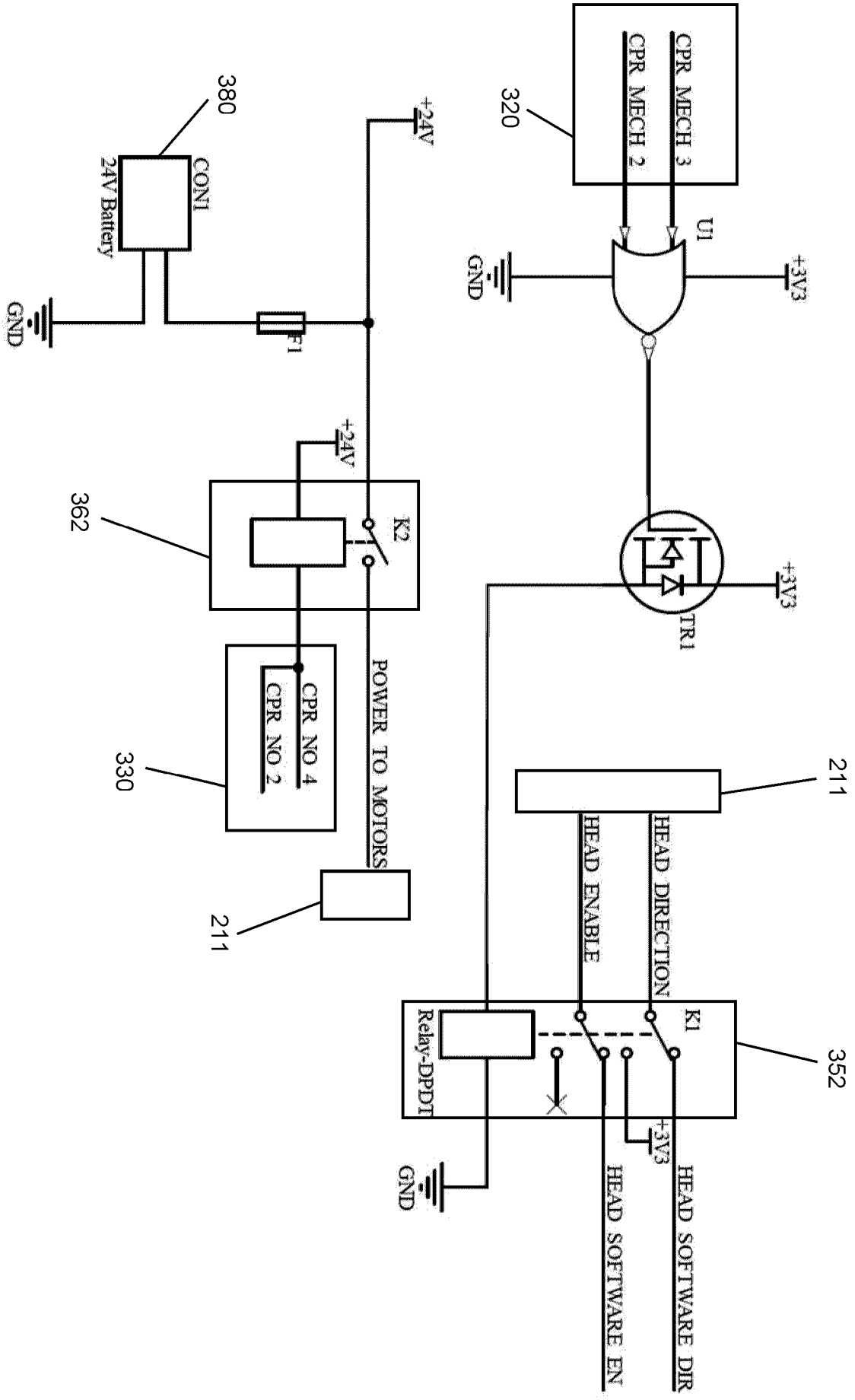

FIG. 4

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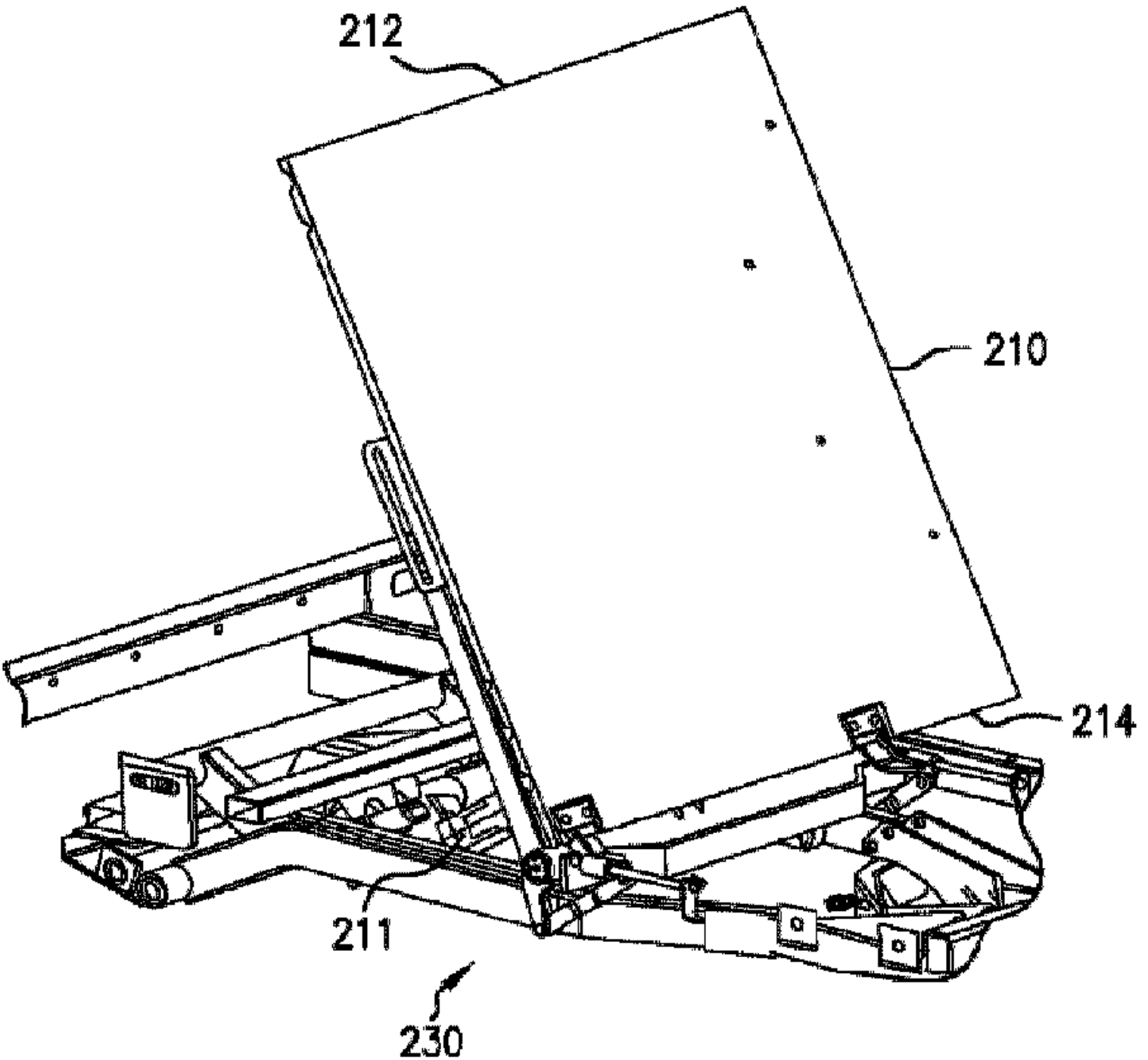
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