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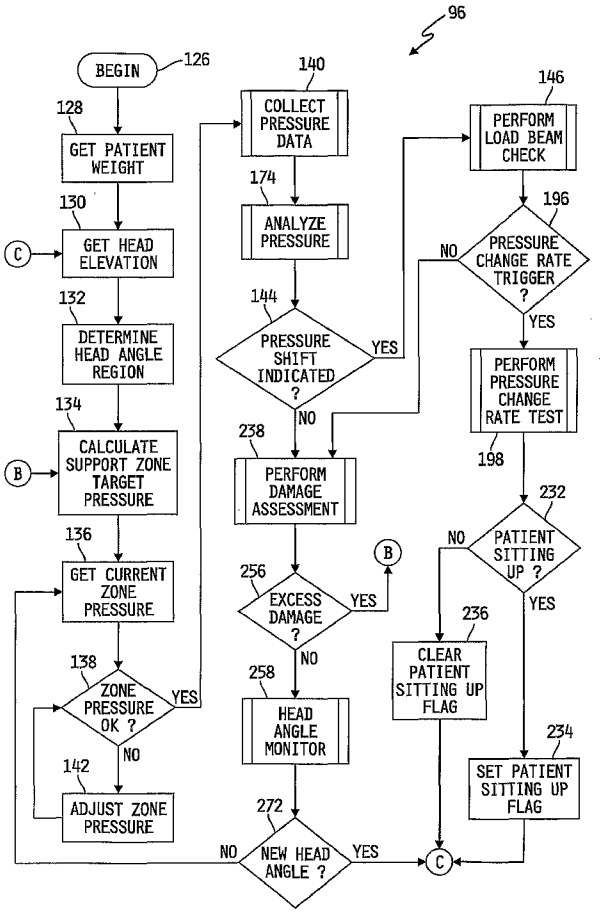
(54) Title: SYSTEM AND METHOD OF CONTROLLING AN AIR MATTRESS



(57) Abstract: A patient support (10, 14) includes a source of pressurized air (64), a bladder (30), a valve (66) in fluid communication with the source of pressurized air (64) and to the bladder (30), a pressure sensor (28) in fluid communication with the bladder (30), and a controller (26) responsive to a pressure signal from the pressure sensor (28). The controller (26) may determine a rate of change of pressure within the bladder (30) and may store historical pressure data.

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— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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SYSTEM AND METHOD OF CONTROLLING AN AIR MATTRESS

RELATED APPLICATIONS

This application claims the benefit under 35 U.S.C. § 119(e), of U.S. Provisional Patent Application Serial No. 60/702,645 filed July 26, 2005, which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present disclosure relates to a control system for the control of pressure in a patient support. More particularly, the present disclosure relates to a control system for an inflatable support surface that utilizes pressure data to determine a patient's position on the patient support.

Patient supports, such as hospital beds, and some beds used at home have inflatable support surfaces such as mattresses, for example, on which a person is supported. Such mattresses have one or more air bladders which are inflated and deflated to control the pressure in the bladders. The pressure in the bladders correlates to the interface pressure between the skin of the person supported on the surface and the support surface. Prolonged exposure to excessive pressure and/or skin shear tends to break down the skin and form pressure ulcers, also known as bed sores.

SUMMARY OF THE INVENTION

The present disclosure comprises one or more of the features recited in the appended claims and/or the following features which, alone or in any combination, may comprise patentable subject matter:

According to this disclosure, a patient support may comprise a source of pressurized air, a valve, a bladder, a pressure sensor and a controller. The valve may be in fluid communication with the source of pressurized air and with the bladder. The bladder may be in fluid communication with the pressure sensor. The controller may be in electrical communication with the source of pressurized air, the valve, and the first pressure sensor. The controller may comprise a processor, and a memory device electrically coupled to the processor. The memory device may store a plurality of instructions which, when executed by the processor, cause the processor to operate the source of pressurized air and the valve to inflate the bladder, monitor

the first pressure signal during the inflation to determine a rate of change of pressure in the bladder, and determine whether the patient is supported on the bladder based on the rate of change. The bladder may be inflated or deflated and the rate of change of pressure may be determined during inflation or deflation as the case may be. The patient support may have multiple bladders and the rate of change of pressure may be determined for one or more of the multiple bladders.

The processor may operate the valve to deflate the first bladder, monitor the first pressure signal during the deflation to determine a rate of change of pressure in the first bladder, and determine whether the patient is supported on the first bladder.

The processor may establish a target pressure for the first bladder, inflate the first bladder to a pressure within an acceptable tolerance of the target pressure, monitor the first pressure signal, compare the first pressure signal to the target pressure to determine a deviation of the first pressure signal from the target pressure, accumulate the magnitude of pressure deviation over time, and output a signal if the accumulated magnitude exceeds a maximum value. The system may inflate or deflate the bladder back to within the tolerance range in response to the signal. The processor, therefore, may allow a period of time to elapse when the pressure is outside of the tolerance range before pressure adjustments are made. The period of elapsed time may vary depending on how far outside of the tolerance the measured pressure deviates.

The patient support may comprise the source of pressurized air; the first bladder and a second bladder; the first valve and second, third and fourth valves; the first pressure sensor and a second pressure sensor; and the controller. The first valve may be in fluid communication with the source of pressurized air and with the first bladder and configured to control the flow of air between the source of pressurized air and the first bladder. The second valve may be in fluid communication with the first bladder and configured to control the flow of air out of the first bladder. The third valve may be in fluid communication with the source of pressurized air and with the second bladder and configured to control the flow of air between the source of pressurized air and the second bladder. The fourth valve may be in fluid communication with the second bladder and configured to control the flow of air out of the second bladder. The first pressure sensor may be in fluid

communication with the first bladder and produce a first pressure signal indicative of air pressure within the first bladder. The second pressure sensor may be in fluid communication with the second bladder and produce a second pressure signal indicative of air pressure within the second bladder. The controller may be in electrical communication with the source of pressurized air, valves, and pressure sensors. The processor may establish a position of the patient supported on the first bladder by comparing the rate of change of pressure in the first bladder to the rate of change of pressure in the second bladder, monitor the first and second pressure signals, and determine whether the patient has changed positions on the first and second bladders.

The processor may cause the processor to establish a target pressure for the first bladder, determine the acceptable tolerance for the target pressure by evaluating the stability of the first pressure signal over time, and control pressure in the first bladder to within an acceptable tolerance of the target pressure by operating the source of pressurized air and the first valve to inflate the first bladder and operate the second valve to deflate the first bladder and monitor the first pressure signal during the operation of the source of pressurized air and first and second valves.

The control system may be operable to control a pressure at which the at least one bladder is inflated, the pressure being determined automatically as a function of a weight of the patient, a position of the patient on the patient support, and an amount that a least a portion of the patient support is articulated, wherein the position of the person is automatically determined by the control system by monitoring a rate of change of pressure in the at least one inflatable bladder.

The controller may determine that the patient has changed positions by moving between a supine position and a side-lying position. The controller may determine that the patient has changed positions by moving between a sitting up position and a supine position. The controller may determine that the patient has changed positions by moving between a prone position and a side-lying position. The controller may determine that the patient has changed positions by moving between a sitting up position and a supine position.

A method of controlling pressure in an inflatable zone of a patient support surface supported on a patient support apparatus may comprise multiple steps. One step may comprise inflating the inflatable zone to a first target pressure. Another

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