US 20220313514A1

(19) **United States**

(12) **Patent Application Publication**

Kirtikar et al.

(10) **Pub. No.: US 2022/0313514 A1**

(43) **Pub. Date: Oct. 6, 2022**

(54) **ARTICULATING BEDDING SYSTEMS**

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(21) Appl. No.: **17/708,042**

(22) Filed: **Mar. 30, 2022**

Related U.S. Application Data

(60) Provisional application No. 63/168,673, filed on Mar. 31, 2021.

Publication Classification

(51) **Int. Cl.**

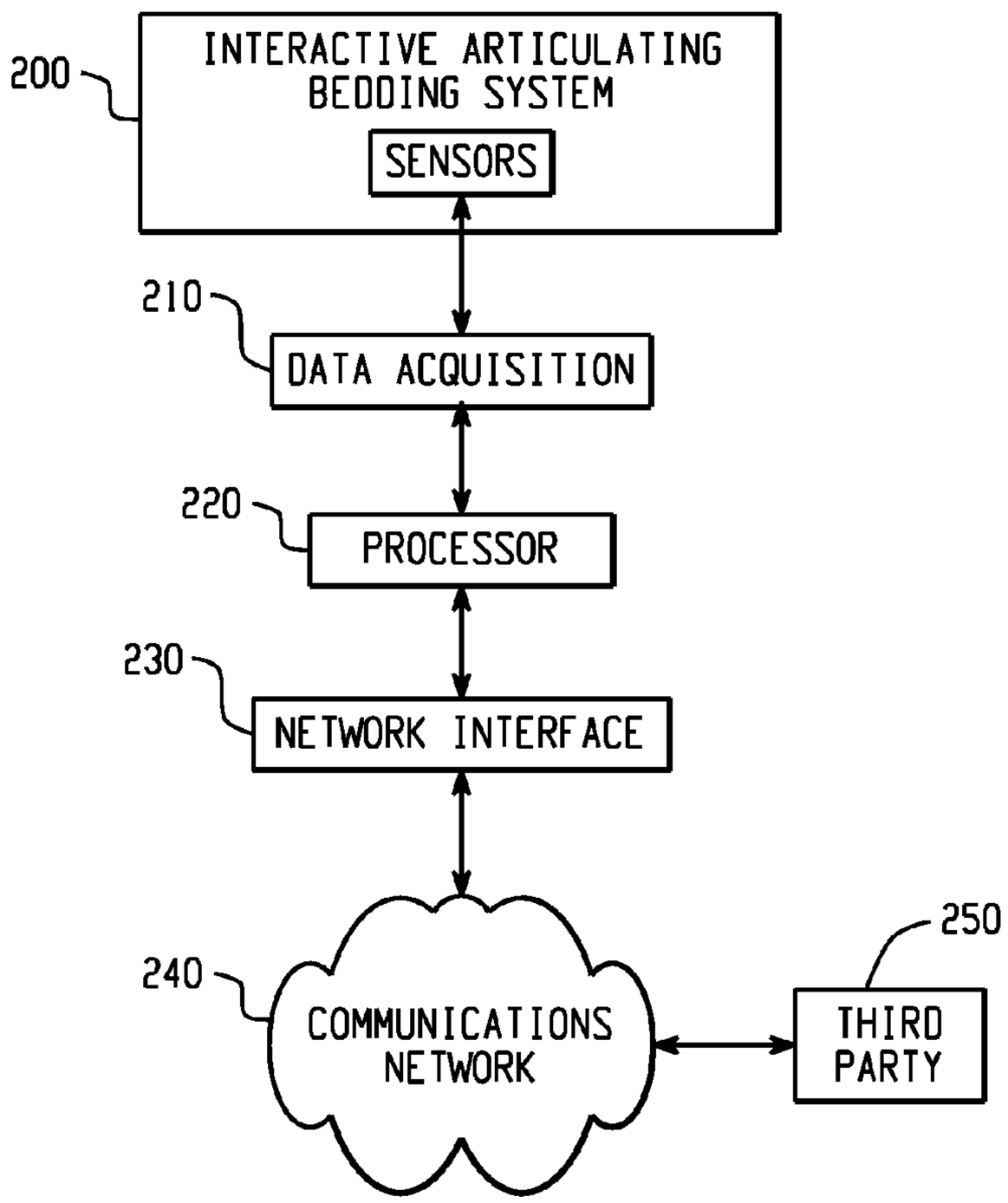
A61G 7/018	(2006.01)
A61G 7/015	(2006.01)
A61B 5/00	(2006.01)
G16H 40/67	(2006.01)
G05B 15/02	(2006.01)

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

CPC ***A61G 7/018*** (2013.01); ***A61G 7/015*** (2013.01); ***A61B 5/4806*** (2013.01); ***A61B 5/6892*** (2013.01); ***G16H 40/67*** (2018.01); ***G05B 15/02*** (2013.01); *A61G 2203/30* (2013.01)

(57) **ABSTRACT**

Interactive articulating bedding systems for caring comfort of an individual in need thereof and processes generally include and a mattress and an adjustable foundation supporting the mattress. The interactive articulating bedding system and process generally include sleep diagnostics including a plurality of sensors at different locations within the interactive articulating bedding system configured to measure at least one health condition comprising heart rate, respiration rate, blood pressure, and/or oxygen level and provide output signals indicative of the at least one health condition. The at least one health condition can be provided to a third party so that they may remotely monitor wellness of the individual.



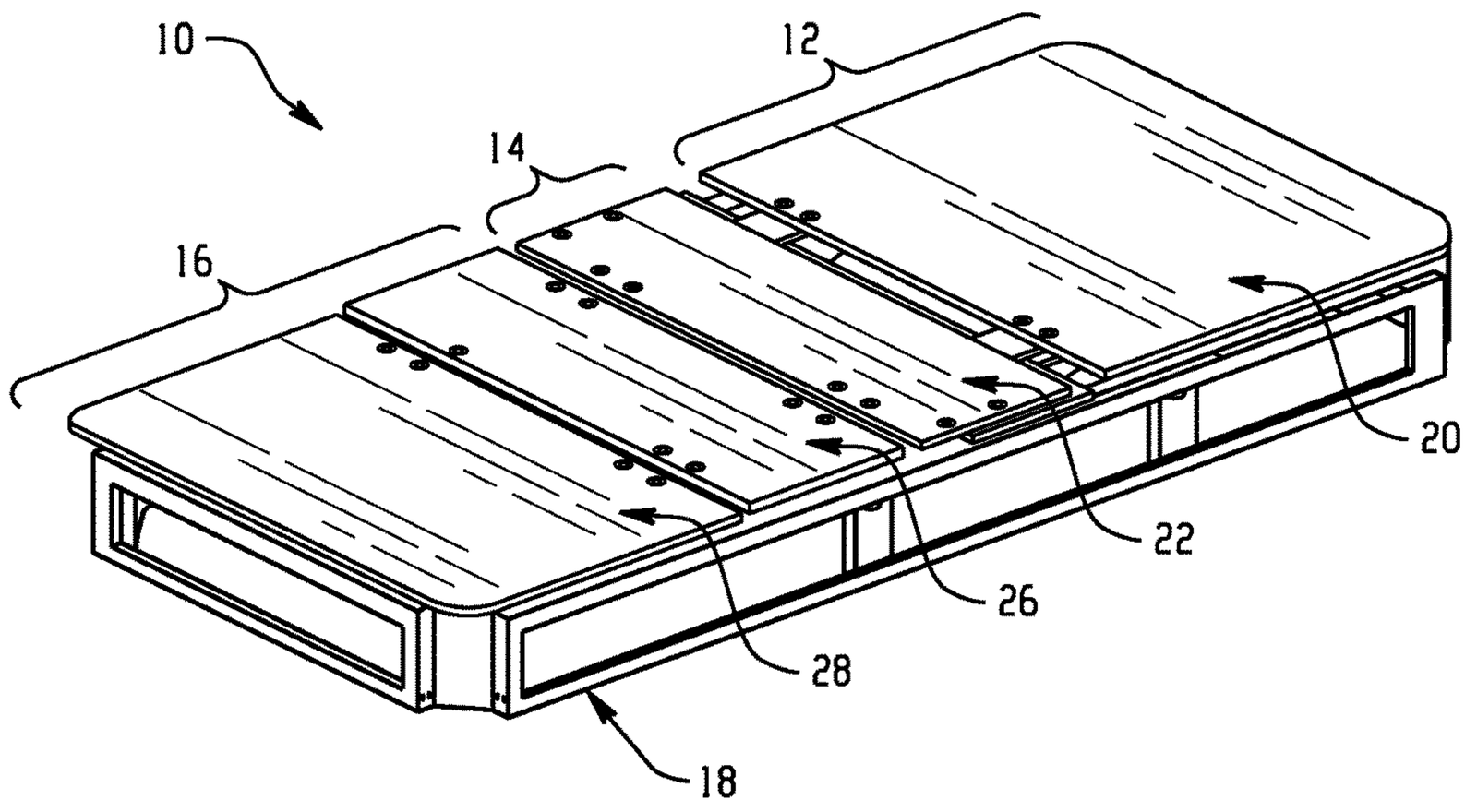


Fig. 1

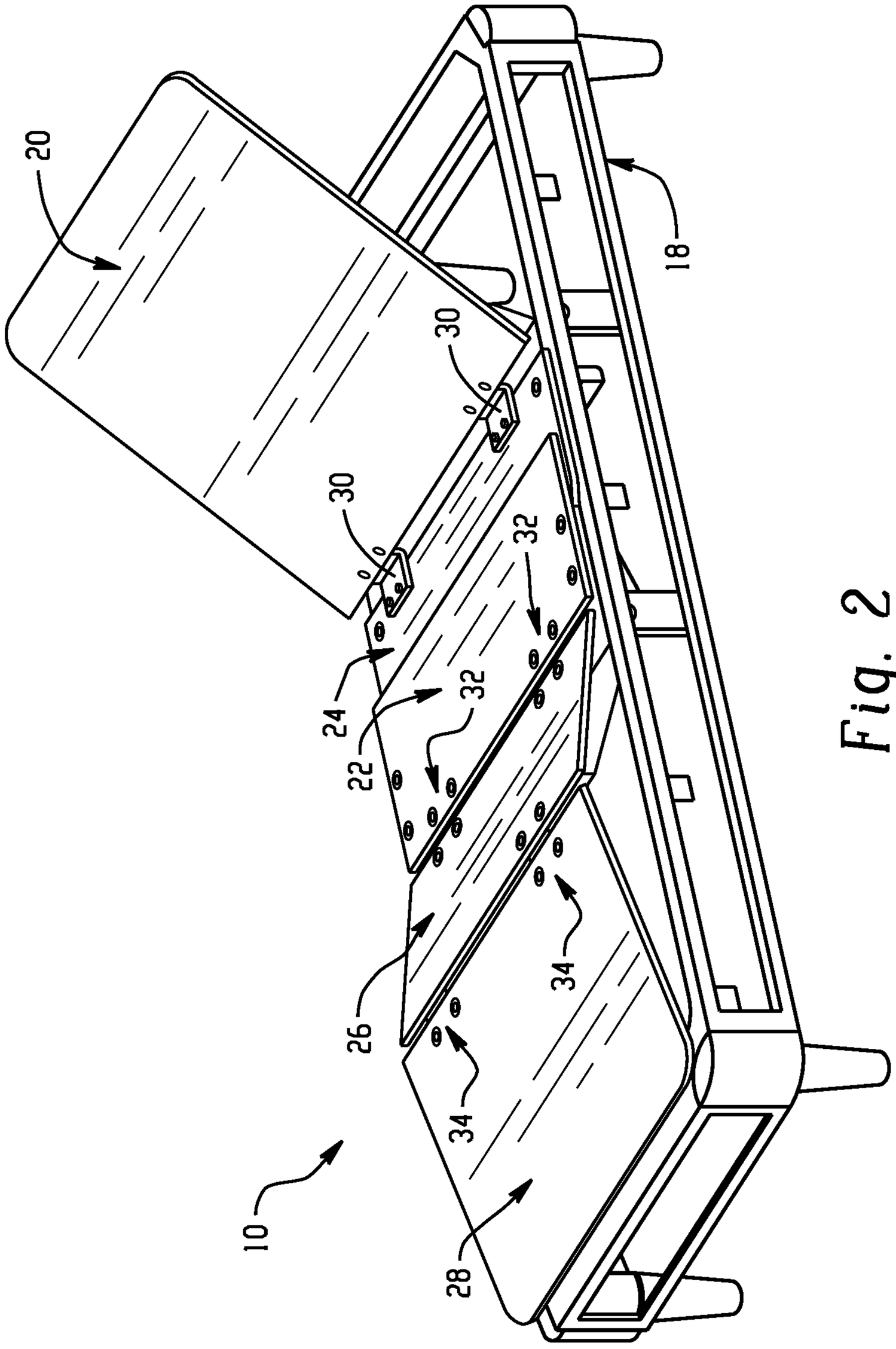


Fig. 2

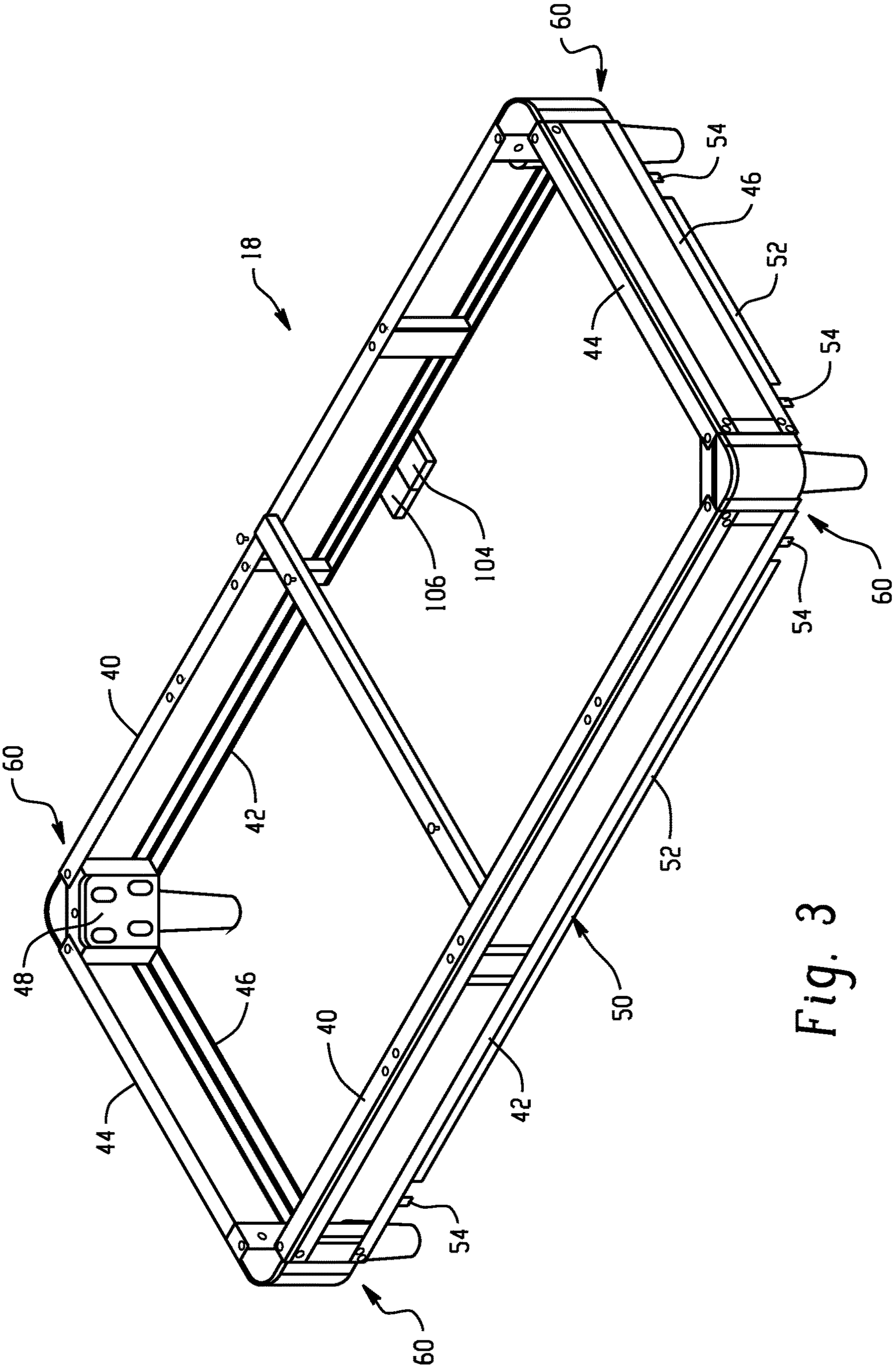


Fig. 3

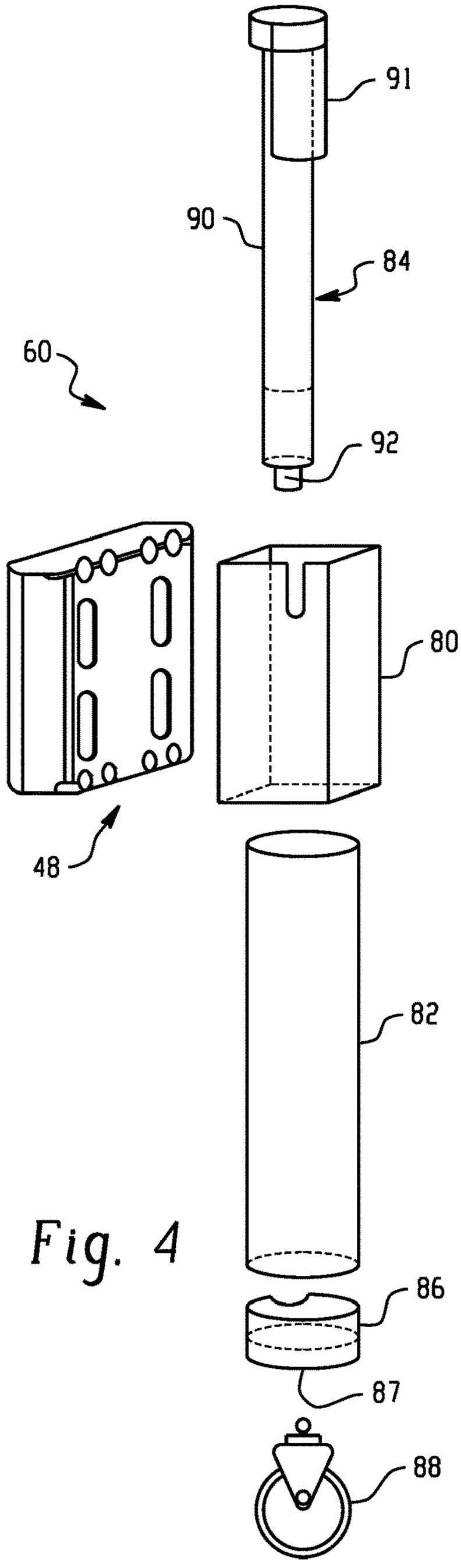


Fig. 4

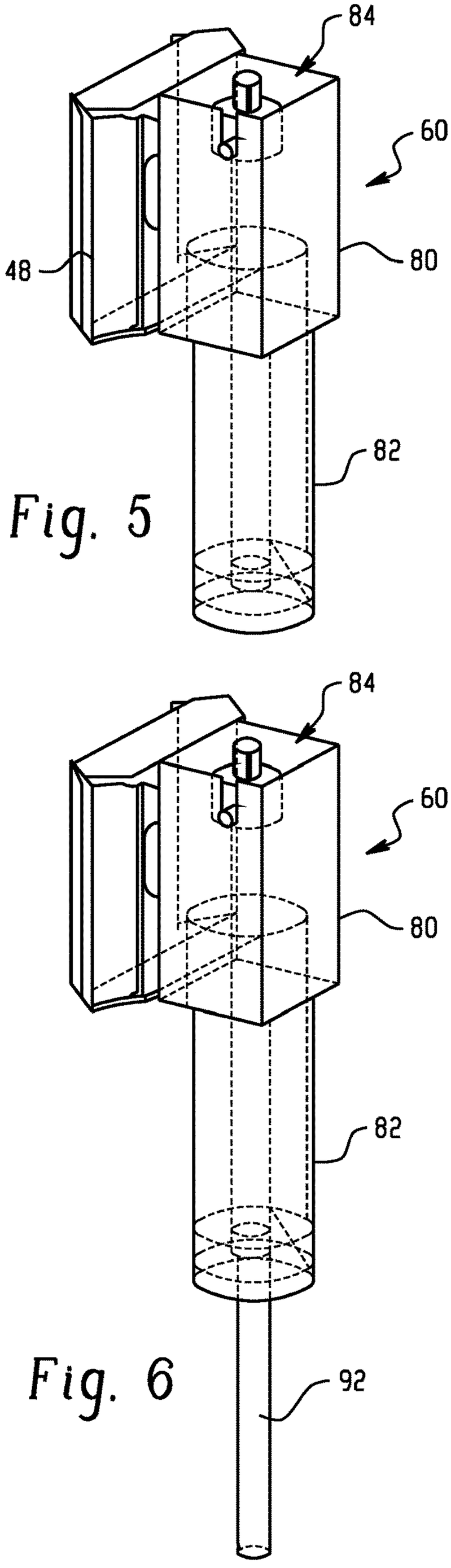


Fig. 5

Fig. 6

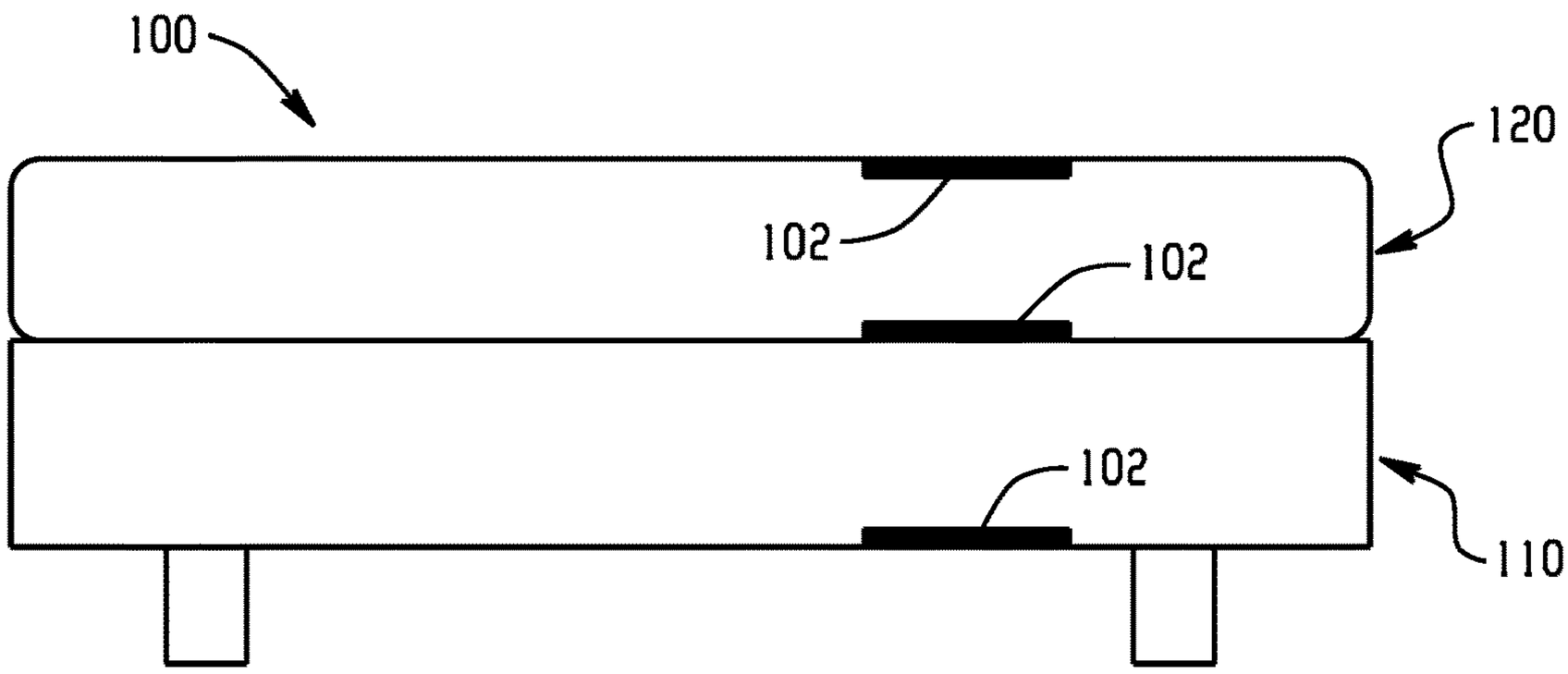

100
120
102
102
102
110

Fig. 7

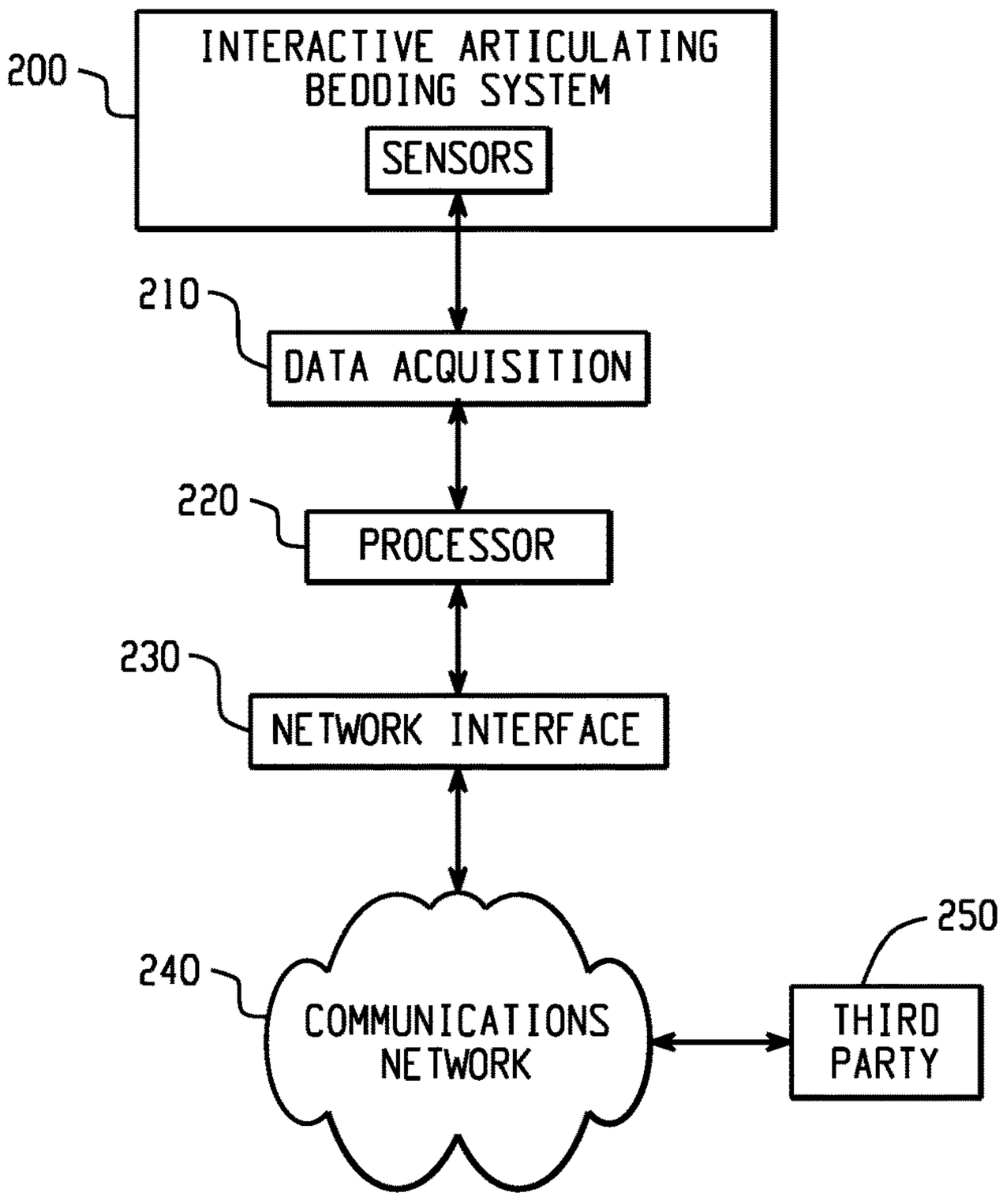

200
INTERACTIVE ARTICULATING BEDDING SYSTEM
SENSORS
210
DATA ACQUISITION
220
PROCESSOR
230
NETWORK INTERFACE
240
COMMUNICATIONS NETWORK
250
THIRD PARTY

Fig. 8

ARTICULATING BEDDING SYSTEMS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the benefit of U.S. Provisional Application No. 63/168,673 filed on Mar. 31, 2021, the contents of which are incorporated herein by reference in its entirety.

BACKGROUND

[0002] The present disclosure generally relates to articulating bedding systems and, more specifically, to interactive articulating bedding systems configured for enhanced comfort for those less mobile such as the elderly, surgically compromised individuals, and the like, wherein the interactive bedding system alerts the status of thee les mobile to a third party such as friends, families, and/or health care professionals.

[0003] Powered bedding systems such as articulated bedding systems have long been used in the home as well as in hospital and healthcare facilities to allow positioning of an end user in a reclining position, sitting position, elevated leg position or combinations of these positions. Some powered bedding systems feature massaging action. General usage of powered beds has been rapidly expanding due to the comfort and convenience provided to the end user. For example, a typical powered articulating bedding system may include an articulating foundation consisting of wood decking sections connected together with hinges for articulating different sections of the bed to allow various positions of the overlying mattress. There are actuators connected between the bed frame and the wood decking for moving the adjustable sections into user-desired positions. The adjustable bed may have a "wall hugging" feature that maintains a consistent distance between the mattress and the wall as the bed is adjusted. Some articulating bedding systems may use wooden or plastic slats to support the mattress instead of a solid wood platform.

[0004] Typically, these powered bedding systems are generally static devices, wherein an end user is required to manually select the degree of articulation or a desired feature using a remote control in communication with a control unit coupled to movably actuate the actuators or other features the powered bedding system may include. For example, if the end user desires to watch television, the end user through trial and error selects the desired degree of articulation using the remote control. Moreover, powered bedding systems do not possess modularity as the various features provided in these bedding systems are intended to be permanent.

BRIEF SUMMARY

[0005] According to an aspect of the disclosure, an interactive articulating bedding system configured for caring comfort includes a mattress; and an adjustable foundation supporting the mattress comprising a linkage assembly operable to articulate one or more surfaces of the foundation from a planar configuration to a non-planar configuration, height adjustable legs, and motion activated lights coupled to a rigid member of the adjustable foundation. The bedding system further includes sleep diagnostics comprising a plurality of sensors at different locations within the articulating bedding system configured to measure at least one health condition comprising heart rate, respiration rate, blood pressure, and/or oxygen level and provide output signals indicative of the at least one health condition; and a data acquisition device configured to receive the output signals from the sleep diagnostics, wherein the data acquisition device includes a processor and a network interface, wherein the processor is configured to communicate with the articulating bedding system to adjust a height of one or more of the height adjustable legs upon a command; automatically and periodically articulate the adjustable foundation to reposition the individual on the mattress, and process the output signals to determine whether the output signals are below or above a threshold, and wherein the network interface is configured to receive processed information from the processor and communicate the processed information with a third party related to the at least one health condition.

[0006] A process for monitoring at least one health condition while an individual is sleeping includes providing an interactive articulating bedding system comprising a mattress, an adjustable foundation supporting the mattress, a sleep diagnostic system including a plurality of sensors at different locations within the interactive articulating bedding system configured to measure at least one health condition comprising heart rate, breathing rate, blood pressure, and/or oxygen level and provide output signals indicative of the at least one health condition to a data acquisition device including a processor, and a network interface for communicating processed information to a third party; wherein the adjustable foundation comprises a linkage assembly operable to articulate one or more surfaces of the adjustable foundation from a planar configuration to a non-planar configuration, height adjustable legs, and motion activated lights coupled to a rigid member of the adjustable foundation; detecting ingress and egress from the interactive bedding system and illuminating an area about the adjustable foundation with the motion activated lights; adjusting a height of a sleeping surface of the mattress relative to ground by adjusting a height of one or more of the height adjustable legs upon a command; automatically and periodically articulating the adjustable foundation to reposition the individual on the mattress; and communicating processed information related to the at least one health condition from the processor via the network interface to a third party.

[0007] These and other advantages and features will become more apparent from the following description taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The subject matter, which is regarded as the disclosure, is particularly pointed out and distinctly claimed in the claims at the conclusion of the specification. The foregoing and other features and advantages of the disclosure are apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

[0009] FIG. **1** is a perspective view of an adjustable foundation for an interactive articulating bedding system in a planar configuration according to one or more embodiments of the present disclosure;

[0010] FIG. **2** is a perspective view of the adjustable foundation of FIG. **1** for the interactive articulating bedding system in a non-planar configuration according to one or more embodiments of the present disclosure;

[0011] FIG. **3** is a bottom plan view of the adjustable foundation of FIG. **1** for the interactive articulating bedding system according to one or more embodiments of the present disclosure;

[0012] FIG. **4** is an exploded perspective view of an exemplary automatically adjustable support suitable for the adjustable foundation of FIG. **1** according to one or more embodiments of the present disclosure

[0013] FIG. **5** is a perspective view of the exemplary automatically adjustable support for the adjustable foundation of FIG. **1** in a retracted position according to one or more embodiments of the present disclosure

[0014] FIG. **6** is a perspective view of the exemplary automatically adjustable support for the adjustable foundation of FIG. **1** in an extended position according to one or more embodiments of the present disclosure;

[0015] FIG. **7** is a side view of an exemplary interactive articulating bedding system according to one or more embodiments of the present disclosure;

[0016] FIG. **8** is a block diagram of a process flow for operating the interactive articulating bedding system, according to one or more embodiments of the present disclosure.

[0017] These and other advantages and features will become more apparent from the following description taken in conjunction with the drawings.

DETAILED DESCRIPTION

[0018] Disclosed herein are interactive articulating bedding systems configured to provide caring comfort to those individuals who need or desire to be actively monitored for wellness, e.g., those individuals who may benefit from letting others know how they are doing such as self-sufficient elderly living on their own, surgically compromised individuals, and the like. The particular individual is not intended to be limited. The interactive articulating bedding system generally includes innovative sensors and biometric readers that are configured to monitor the individual's vital signs such as heart rate, oxygen levels, blood pressure, and the like, wherein alerts can be provided to an external party, e.g., a caretaker, should assistance be needed. Moreover, the interactive articulating bedding system can be programmed by the caretaker, e.g., a parent, babysitter, health care provider, or the individual to adjust the interactive articulating bedding systems so as to assist the individual's access ingress and egress into/from the bedding system, assist with repositioning the individual to prevent bed sores, and activate underbed lighting should the individual desire to exit the bedding system when light is insufficient, e.g., at night.

[0019] The interactive articulating bedding systems generally includes a mattress and an adjustable foundation supporting the mattress. The mattresses utilized in the interactive bedding systems are not intended to be limited and can generally include any mattress known in the art, which can be fabricated with one or more layers of foam, spring coils, air bladders, combinations thereof, or the like. An exemplary mattress is disclosed in U.S. Pat. No. 6,408,469. The mattress may be a twin, queen, king, California king or any other size.

[0020] As will be described in greater detail below, the adjustable foundation generally includes a rectangular frame and one or more articulating sections mounted to the rectangular frame configured to support the mattress, wherein the rectangular frame comprises a head end, a foot end, and sidewalls extending from the head end to the foot end, and wherein the rectangular frame further includes a linkage assembly operable to articulate one or more articulating sections from a planar configuration to a non-planar configuration and vice versa. The particular rectangular frame, the linkage assembly, and the one or more articulating sections are not intended to be limited. Exemplary rectangular frames and the one or more articulating sections are disclosed in U.S. Pat. Nos. 7,992,240, and 10,638,851, incorporated by reference herein in its entireties.

[0021] To assist with ingress and egress, the interactive articulating bedding system can further include adjustable support legs as will be described below for varying a height of the foundation relative to ground such as is disclosed in US Pat. Pub. No. 2019/0059601, which is incorporated herein by reference in its entirety. Each adjustable support leg can be independently adjusted or two or more can be simultaneously adjusted. For example, the support legs extending along a selective length of the bedding system between the head end and the foot end of the bedding system can be simultaneously lowered to minimize the height of the mattress surface to ground level, which can increase ease in getting on as well as off the mattress since some mattress assemblies can have the mattress surface at a height relative to ground level well in excess of thirty inches. Moreover, by selectively lowering a length of bedding system relative to the other side, the added tilt relative to the other side can help the individual move to the side edge.

[0022] Referring now to FIGS. **1-2**, there is shown a perspective view of an exemplary adjustable mattress foundation **10** in accordance with the present disclosure that can be utilized in the interactive articulating bedding system. The adjustable mattress foundation **10** is not intended to be limiting. A mattress having similar length and width dimensions is typically provided on the adjustable foundation to define the articulating bedding system.

[0023] As is typical for adjustable mattress foundations, the adjustable foundation **10** is movable between a fully horizontal planar position as shown in FIG. **1** and a non-planar configuration position as shown in FIG. **2**. The different non-planar configurations are typically defined by ahead and back section **12**, a leg and foot section **16**, and an intermediate seat section **14** therebetween, wherein the head and back section **12** and the leg and foot section **16** can articulate, i.e., elevate, relative to the intermediate seat section **14**. The different sections, **12**, **14**, and **16** collectively form a mattress support surface upon which a mattress (not shown) is disposed. In the illustrated inclined position shown in FIG. **2**, which is exemplary and not intended to be limiting, the head and back section **12** and the leg and foot section **16** are shown elevated relative to the intermediate seat section **14**. However, the adjustable foundation can include independent inclination/declination of the head and back section relative to the leg and foot section. An operator or user may lie prone on a mattress disposed on the adjustable mattress foundation **10** in its fully horizontal position, in the fully inclined position, or in any position therebetween. The adjustable mattress foundation **10** generally includes a rectangular shaped foundation frame **18**, which supports and elevates the head and back section **12** and the leg and foot section **16**, and the intermediate seat section **14**, relative to ground.

[0024] The head and back section **12** is typically formed of a single panel **20** whereas the intermediate seat section **14** as

well as the leg and foot section **16** can be formed of two panels **22**, **24** and **26**, **28**, respectively, as shown more clearly in FIG. **2**. Panel **20** of the head section **12** is hingedly connected via hinges **30** to lower panel **24** of the intermediate seat section **14** at one end thereof. Likewise, the leg and foot section **16** includes panel **26** hingedly connected at one end via hinges **32** to panel **22** of the intermediate seat section **14** and at another end to panel **26** of the leg and foot section **16** via hinges **34**, wherein panels **22**, **24** of the intermediate seat section **14** are in a sliding relationship to selectively increase or decrease length of the intermediate section upon inclination or declination of the head section **12** and/or the leg and foot section **16**. In the intermediate section **14**, panel **22** is an upper panel and panel **24** is the lower panel. Additionally, panels **26** and **28** of the leg and foot section **18** are hingedly connected to one another via hinges **34**.

[0025] The different sections **12**, **14**, and **16** are supported on a generally rectangular foundation frame **18**, which includes a motorized linkage assembly (not shown) operable to selectively articulate the sections **12** and **16** relative to section **14** of the mattress support surface. The linkage assembly is not intended to be limited and can include one or more linear actuators to effect independent articulation of the different sections. An exemplary linkage assembly and adjustable foundation is described in U.S. Pat. Nos. 5,870,784, and 10,278,512, incorporated herein by reference in their entireties.

[0026] As shown more clearly in FIG. **3**, the generally rectangular foundation, frame **18** generally includes upper and lower side frame members **40**, **42** respectively, and upper and lower transverse frame members **44**, **46**, respectively. Respective ends of the upper and lower side frame members **40**, **42** and the upper and lower transverse frame members **44**, **46** are coupled to a corner bracket **48** to define the generally rectangular shape of the foundation frame **18**. Adjustable support legs **60** (shown in FIG. **3**) are coupled to the corner brackets **48** at each corner of the foundation for elevating the foundation **18** relative to ground.

[0027] A motion activated lighting system **50** is coupled to one or more of the members **40**, **42**, **44**, and **46** and configured to illuminate the area around the interactive bedding system in the event the individual leaves the bedding system when the lighting is insufficient. The motion activated lighting system **50** can include LED lighting **52** and one or more motion sensors **54** coupled to the adjustable foundation frame **18** configured to activate the LED lighting upon detection of movement at about ground, level, which is indicative of movement of an individual into and from the bedding system. The LED lighting **52** can be adjusted to project light underneath the bedding system and illuminate a pathway within the sleeping environment such as illuminating a pathway towards an adjacent bathroom or doorway. The motion activated lighting system **50** can further include a photosensor (not shown) to activate the lighting system only during times associated with poor lighting within the environment of the interactive articulating bedding system.

[0028] The adjustable foundation **10** includes adjustable support legs **60** for varying a height of the foundation relative to ground. The support legs **60** are configured to provide automatic adjustment. As shown more clearly in FIG. **4-6**, an outer tubular member **80** is fastened to a corner bracket **48**. An inner tubular member **82** is fixedly attached at one end to the outer tubular member **80** and is non-movable relative to the outer tubular member **80**. The inner tubular member **82** includes an endcap **86** at the other end. A linear actuator **84** is disposed within an interior region of and is fixedly attached to the outer tubular member **80**. A portion of the linear actuator **84** extends into the interior region of the inner tubular member **82** and is coupled to the end cap **86**, which includes an aperture **87**.

[0029] The linear actuator can be a motorized mechanical linear force actuator and, generally includes a cover tube **90** and motor **91** coupled thereto disposed within the outer tubular member **80**. The linear actuator **84** further includes an extension tube **92** slidably engaged with the cover tube **82** and actuated by the motor **91**. A caster (not shown) may be disposed at a distal end of the extension tube.

[0030] FIGS. **5** and **6** depict the adjustable leg **60** in the retracted and extended positions, wherein the extent of the extended position can be varied to provide a desired clearance height for the foundation at that particular support leg. The extension tube **92** has a diameter equal to the aperture **87** in the end, cap **86**. As previously described, all or individual support legs can be connected to a controller (not shown) to adjust the clearance height of the foundation. For example, two of the support legs along the longitudinal length of the foundation **18** can be retracted to provide easier ingress/egress from/to the bedding system.

[0031] As shown in FIG. **7**, the articulating bedding system **100** includes a sleep diagnostic system generally includes a plurality of sensors **102** disposed below the sleeping surface within the mattress **120**, the interface between the mattress **120** and the adjustable foundation **110** and/or within the adjustable foundation **110**. The sensors **102** are configured to measure at least one sleep condition such as heart rate, oxygen levels, blood pressure, respiration, and the like and provide output data signals indicative of these sleep conditions.

[0032] A data acquisition device and a processor can be coupled to the adjustable foundation frame, e.g., data acquisition device **104** and processor **106** shown in FIG. **3**, receives signals from the sensors **102** and stores a sleep characteristic representative of the sensor based upon these received signals. In some embodiments, the sleep processor may be external to the bed/mattress, and the sensors may communicate with the sleep processor either directly, if the individual sensors are directly linked to the sleep processor, or through a data acquisition device.

[0033] In one or more embodiments, the data acquisition device **104** can be integrated with the processor **106** as one unit, which can be in communication with a user interface, and/or a network interface. The network interface connects the processor to a communications network, such as the internet, which can be in direct communication with third party such as caretaker, health provider, or other family member and/or a social network.

[0034] Turing now to FIG. **8**, the various sensors generate output signals within the interactive articulating beddings as shown in block **200**. These output signal are provided to the data acquisition device through a wired or wireless connection, e.g., BLUETOOTH, ZIGBEE, WIFI, and the like as shown in block **210**. The data acquisition device may process the received signals, for example through analog-to-digital conversion, domain transform, filtering, or any other signal processing technique or a combination thereof for further processing by the processor as shown in block **220**. Each sensor may be in communication with its own

dedicated data acquisition device, or there may be a single data acquisition device for receiving signals from all sensors. In some embodiments, there may be a data acquisition device for each type of sensor, e.g., a weight data acquisition device for receiving signals from all weight sensors.

[0035] The data acquisition device may communicate the received data signals to the processor through a wired or wireless connection. The processor may include microcontrollers and microprocessors programmed to receive data from the sensors, and determine whether the data exceeds or falls below certain thresholds associated with a particular sleep condition based on the received data, e.g., heart rate above or below certain thresholds, low oxygen levels, and the like. The processor may include a central processing unit (CPU), a memory, and an interconnect bus (not shown). The CPU may include a single microprocessor or a plurality of microprocessors for configuring the sleep processor as a multi-processor system. The memory may include a main memory and a read-only memory. The sleep processor and/or the sleep database may include mass storage devices having, for example, various disk drives, tape drives, FLASH drives, etc. The main memory may include dynamic random-access memory (DRAM) and high-speed cache memory. During operation, the main memory may store at least portions of instructions and data for execution by a CPU. In certain embodiments, the sleep processor may include circuitry for an analog-to-digital converter and/or a digital-to-analog converter. The analog-to-digital converter circuitry may convert analog signals received at the sensors to digital signals for further processing by the sleep processor. In some embodiments, the data acquisition device and sleep processor may be coupled to a general-purpose computer system such as those used as servers, workstations, personal computers, network terminals, and the like.

[0036] The sleep processor may also be connected to a network interface for data communications as shown in block **230**. The network interface may be a modem, a network card, serial port, bus adapter, or any other suitable data communications mechanism for communicating with one or more local or remote systems. The network interface may provide a relatively high-speed link to a network, such as the Internet. The communication link to the network may be, for example, optical, wired, or wireless (e.g., via satellite, cellular, or WiFi network). Alternatively, the sleep processor may include a mainframe or other type of host computer system capable of communications via the network. The sleep processor may communicate with third parties, such as a healthcare provider and/or a social network via the network. In some embodiments, the sleep processor may communicate using an infrared connection, a BLUETOOTH protocol, or any other suitable wireless communication protocol. The sleep processor may also include suitable input/output ports or use the interconnect bus for interconnection with other components, such as user interface.

[0037] Additional sleep characteristics that may be measured by appropriate sensors of the type generally known in the art may be a length of time in bed, a sleep start time, a sleep end time, sleep state, or a measurement of moving. Likewise, the sensors may be configured to measure movement, pressure, weight, stress/strain, temperature, humidity, light, noise, heart rate, breathing, blood oxygenation, blood pressure, time in bed, total time slept, and/or other suitable parameters related to sleep and sleep quality. In some embodiments, one or more of the above parameters may not be directly measured, but rather derived from other measured parameters and/or vital signs (including initial vital signs). Sensors may be any conventional sensor used to measure any of the above parameters, such as weight sensors, temperature sensors, humidity sensors, microphone/noise sensors, accelerometers, and/or other suitable sensors. In some embodiments, the sensors may be configured as substantially planar sensors. In these embodiments, the sensors may be disposed within or on the foundation and/or the mattress. The sensors may be distributed along one or more major or sleeping surfaces of the mattress and/or the foundation. For example, noise sensors may be distributed primarily along the head and/or foot (i.e., where the head or foot of an individual sleeping on mattress assembly would most likely be disposed), and weight sensors may be distributed along the length of the mattress assembly, where a sleeping individual would most likely lie. In other embodiments, sensors may be distributed evenly across one or more of the surfaces of the mattress and/or the foundation. In yet other embodiments, sensors may be disposed on or in other bedclothes, such as sheets, comforters, blankets, quilts, pillows, and/or pillow covers.

[0038] In some embodiments, the sensors may be flexible. For example, the sensors may comprise flexible membrane sensors fabricated on a flexible support of plastic or any other suitable, flexible substrate. In certain embodiments, the sensors may include flexible, metallic conductors and/or sensing elements. Incorporating flexible sensors into bedding may improve the comfort of the bedding. However, in some embodiments, conventional, non-flexible sensors may be incorporated into the articulating bedding system. In these embodiments, the sensors may be disposed beneath one or more mattress layers, or the sensors may be small enough to avoid significant discomfort, or the sensors may be disposed within the adjustable foundation. In some embodiments, one or more of the sensors are wearable.

[0039] The network interface is coupled to a communications network as shown in block **240**, which can the processed information to a third party as shown in block **250**. The information may be in the form of alerts should the at least one health condition be lower or exceed a predefined threshold. Additionally, the alert may be forwarded to emergency services should the at least one health condition be indicative of a life-threatening health issue. Also, the communications network can be configured to provide remote access by the third party to historical data or instantaneous data as may be desired by the third party to insure wellness of the individual using the interactive articulating bedding system. In this manner, the third party, which can be a family member, can be provided with information that the individual is safe and is not in need of immediate attention or the alternative, that the individual needs immediate attention.

[0040] In one or more embodiments, a process for ingress/egress from interactive articulating bedding system including the adjustable support legs can include synchronization of two or more of the adjustable support legs so as to lower a height of the mattress. In this manner, ingress as well as egress can be easily facilitated. For example, the adjustable legs along a longitudinal length of the foundation located at corners of the head section and the foot section, e.g., right-hand side or left-hand side or both, can be lowered to facilitate facile ingress and egress to/from the mattress. Once the user is situated on the mattress, the adjustable legs can

be raised to provide the mattress in a horizontal position relative to ground or can be maintained at that position until such time the user decides to access the mattress.

[0041] Additionally, a process for preventing bed sores can include programming the processor to periodically articulate the mattress and/or adjust the adjustable support legs to reposition or encourage repositioning of an individual on the mattress. For example, the adjustable support legs can be lowered along a length of the interactive bedding assembly relative to the other side resulting in a tilt to the mattress surface, which can be used to encourage repositioning as well as make it less strenuous to effect repositioning.

[0042] Although specific embodiments of the disclosure have been described, one of ordinary skill in the art will recognize that numerous other modifications and alternative embodiments are within the scope of the disclosure. For example, any of the functionality and/or processing capabilities described with respect to a particular system, system component, device, or device component may be performed by any other system, device, or component. Further, while various illustrative implementations and architectures have been described in accordance with embodiments of the disclosure, one of ordinary skill in the art will appreciate that numerous other modifications to the illustrative implementations and architectures described herein are also within the scope of this disclosure. In addition, it should be appreciated that any operation, element, component, data, or the like described herein as being based on another operation, element, component, data, or the like may be additionally based on one or more other operations, elements, components, data, or the like. Accordingly, the phrase "based on," or variants thereof, should be interpreted as "based at least in part on."

[0043] The present disclosure may be a system, a method, apparatus, and/or a computer program product. The computer program product may include a computer readable storage medium (or media) having computer readable program instructions thereon for causing a processor to carry out aspects of the present disclosure.

[0044] The computer readable storage medium can be a tangible device that can retain and store instructions for use by an instruction execution device. The computer readable storage medium may be, for example, but is not limited to, an electronic storage device, a magnetic storage device, an optical storage device, an electromagnetic storage device, a semiconductor storage device, or any suitable combination of the foregoing. A non-exhaustive list of more specific examples of the computer readable storage medium includes the following: a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), a static random access memory (SRAM), a portable compact disc read-only memory (CD-ROM), a digital versatile disk (DVD), a memory stick, a floppy disk, a mechanically encoded device such as punch-cards or raised structures in a groove having instructions recorded thereon, and any suitable combination of the foregoing. A computer readable storage medium, as used herein, is not to be construed as being transitory signals per se, such as radio waves or other freely propagating electromagnetic waves, electromagnetic waves propagating through a waveguide or other transmission media (e.g., light pulses passing through a fiber-optic cable), or electrical signals transmitted through a wire.

[0045] Computer readable program instructions described herein can be downloaded to respective computing/processing devices from a computer readable storage medium or to an external computer or external storage device via a network, for example, the Internet, a local area network, a wide area network and/or a wireless network. The network may comprise copper transmission cables, optical transmission fibers, wireless transmission, routers, firewalls, switches, gateway computers and/or edge servers. A network adapter card or network interface in each computing/processing device receives computer readable program instructions from the network and forwards the computer readable program instructions for storage in a computer readable storage medium within the respective computing/processing device.

[0046] Computer readable program instructions for carrying out operations of the present disclosure may be assembler instructions, instruction-set-architecture (ISA) instructions, machine instructions, machine dependent instructions, microcode, firmware instructions, state-setting data, or either source code or object code written in any combination of one or more programming languages, including an object oriented programming language such as Smalltalk, C++ or the like, and conventional procedural programming languages, such as the "C" programming language or similar programming languages. The computer readable program instructions may execute entirely on the user's computer, partly on the user's computer, as a stand-alone software package, partly on the user's computer and partly on a remote computer or entirely on the remote computer or server. In the latter scenario, the remote computer may be connected to the user's computer through any type of network, including a local area network (LAN) or a wide area network (WAN), or the connection may be made to an external computer (for example, through the Internet using an Internet Service Provider). In some embodiments, electronic circuitry including, for example, programmable logic circuitry, field-programmable gate arrays (FPGA), or programmable logic arrays (PLA) may execute the computer readable program instructions by utilizing state information of the computer readable program instructions to personalize the electronic circuitry, in order to perform aspects of the present disclosure.

[0047] Aspects of the present disclosure are described herein with reference to flowchart illustrations and/or block diagrams of methods, apparatus (systems), and computer program products according to embodiments of the invention. It will be understood that each block of the flowchart illustrations and/or block diagrams, and combinations of blocks in the flowchart illustrations and/or block diagrams, can be implemented by computer readable program instructions.

[0048] These computer readable program instructions may be provided to a processor of a general-purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks. These computer readable program instructions may also be stored

in a computer readable storage medium that can direct a computer, a programmable data processing apparatus, and/or other devices to function in a particular manner, such that the computer readable storage medium having instructions stored therein comprises an article of manufacture including instructions which implement aspects of the function/act specified in the flowchart and/or block diagram block or blocks.

[0049] The computer readable program instructions may also be loaded onto a computer, other programmable data processing apparatus, or other device to cause a series of operational steps to be performed on the computer, other programmable apparatus or other device to produce a computer implemented process, such that the instructions which execute on the computer, other programmable apparatus, or other device implement the functions/acts specified in the flowchart and/or block diagram block or blocks.

[0050] The block diagrams in the Figures illustrate the architecture, functionality, and operation of possible implementations of systems, methods, apparatus, and computer program products according to various embodiments of the present disclosure. In this regard, each block in the flowchart or block diagrams may represent a module, segment, or portion of instructions, which comprises one or more executable instructions for implementing the specified logical function(s). In some alternative implementations, the functions noted in the block may occur out of the order noted in the figures. For example, two blocks shown in succession may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved. It will also be noted that each block of the block diagrams and/or flowchart illustration, and combinations of blocks in the block diagrams and/or flowchart illustration, can be implemented by special purpose hardware-based systems that perform the specified functions or acts or carry out combinations of special purpose hardware and computer instructions.

[0051] The descriptions of the various embodiments of the present techniques have been presented for purposes of illustration but are not intended to be exhaustive or limited to the embodiments disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the described embodiments. The terminology used herein was chosen to best explain the principles of the embodiments, the practical application or technical improvement over technologies found in the marketplace, or to enable others of ordinary skill in the art to understand the embodiments disclosed herein. Additionally, while various embodiments of the disclosure have been described, it is to be understood that the exemplary embodiment(s) may include only some of the described exemplary aspects. Accordingly, the disclosure is not to be seen as limited by the foregoing description but is only limited by the scope of the appended claims.

What is claimed is:

1. An interactive articulating bedding system configured for caring comfort of an individual comprising:

a mattress;

an adjustable foundation supporting the mattress comprising a linkage assembly operable to articulate one or more surfaces of the foundation from a planar configuration to a non-planar configuration, height adjustable legs, and motion activated lights coupled to a rigid member of the adjustable foundation;

sleep diagnostics comprising a plurality of sensors at different locations within the articulating bedding system configured to measure at least one health condition comprising heart rate, respiration rate, blood pressure, and/or oxygen level and provide output signals indicative of the at least one health condition; and

a data acquisition device configured to receive the output signals from the sleep diagnostics, wherein the data acquisition device includes a processor and a network interface, wherein the processor is configured to communicate with the articulating bedding system to adjust a height of one or more of the height adjustable legs upon a command; automatically and periodically articulate the adjustable foundation to reposition the individual on the mattress, and process the output signals to determine whether the output signals are below or above a threshold, and wherein the network interface is configured to receive processed information from the processor and communicate the processed information with a third party related to the at least one health condition.

2. The interactive articulating bedding system of claim **1**, wherein the third party is a caretaker.

3. The interactive articulating bedding system of claim **2**, wherein the processed information comprises alerts indicative of at least one of the health conditions being below or above a threshold value.

4. The interactive articulating bedding system of claim **2**, wherein the processed information comprises values associated with the at least one of the health conditions being monitored to the third party.

5. The interactive articulating bedding system of claim **2**, wherein the processed information comprises a history of values over a period of time associated with the at least one of the health conditions being monitored to the third party.

6. The interactive articulating bedding system of claim **3** further comprising communicating the processed information with emergency services when the processed information is indicative of at least one of the health conditions being below or above the threshold value.

7. A process for monitoring at least one health condition while an individual is sleeping, the process comprising:

providing an interactive articulating bedding system comprising a mattress, an adjustable foundation supporting the mattress, a sleep diagnostic system including a plurality of sensors at different locations within the interactive articulating bedding system configured to measure at least one health condition comprising heart rate, breathing rate, blood pressure, and/or oxygen level and provide output signals indicative of the at least one health condition to a data acquisition device including a processor, and a network interface for communicating processed information to a third party; wherein the adjustable foundation comprises a linkage assembly operable to articulate one or more surfaces of the adjustable foundation from a planar configuration to a non-planar configuration, height adjustable legs, and motion activated lights coupled to a rigid member of the adjustable foundation;

detecting ingress and egress from the interactive bedding system and illuminating an area about the adjustable foundation with the motion activated lights;

adjusting a height of a sleeping surface of the mattress relative to ground by adjusting a height of one or more of the height adjustable legs upon a command;

automatically and periodically articulating the adjustable foundation to reposition the individual on the mattress; and

communicating processed information related to the at least one health condition from the processor via the network interface to a third party.

8. The process of claim **7**, wherein adjusting the height of the sleeping surface of the mattress relative to ground by adjusting the height of one or more of the height adjustable legs comprises simultaneously lowering two of the height adjustable legs along a length dimension to provide ingress or egress to the interactive articulating bedding system.

9. The process of claim **7**, wherein illuminating the area about the adjustable foundation with the motion activated lights comprises illuminating a pathway.

10. The process of claim **7**, wherein the third party is a caretaker and the process further comprises providing an alert to the third party when the at least one health condition is lower than or exceeds a predetermined threshold.

11. The process of claim **10** further comprising notifying emergency services in addition to notifying the third party.

12. The process of claim **7**, wherein the processed information comprises values associated with the at least one of the health conditions being monitored to the third party.

13. The process of claim **7**, wherein the processed information comprises a history of values over a period of time associated with the at least one of the health conditions being monitored to the third party.

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