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(54) **INTERACTIVE POWERED BEDDING SYSTEMS FOR CHILDREN**

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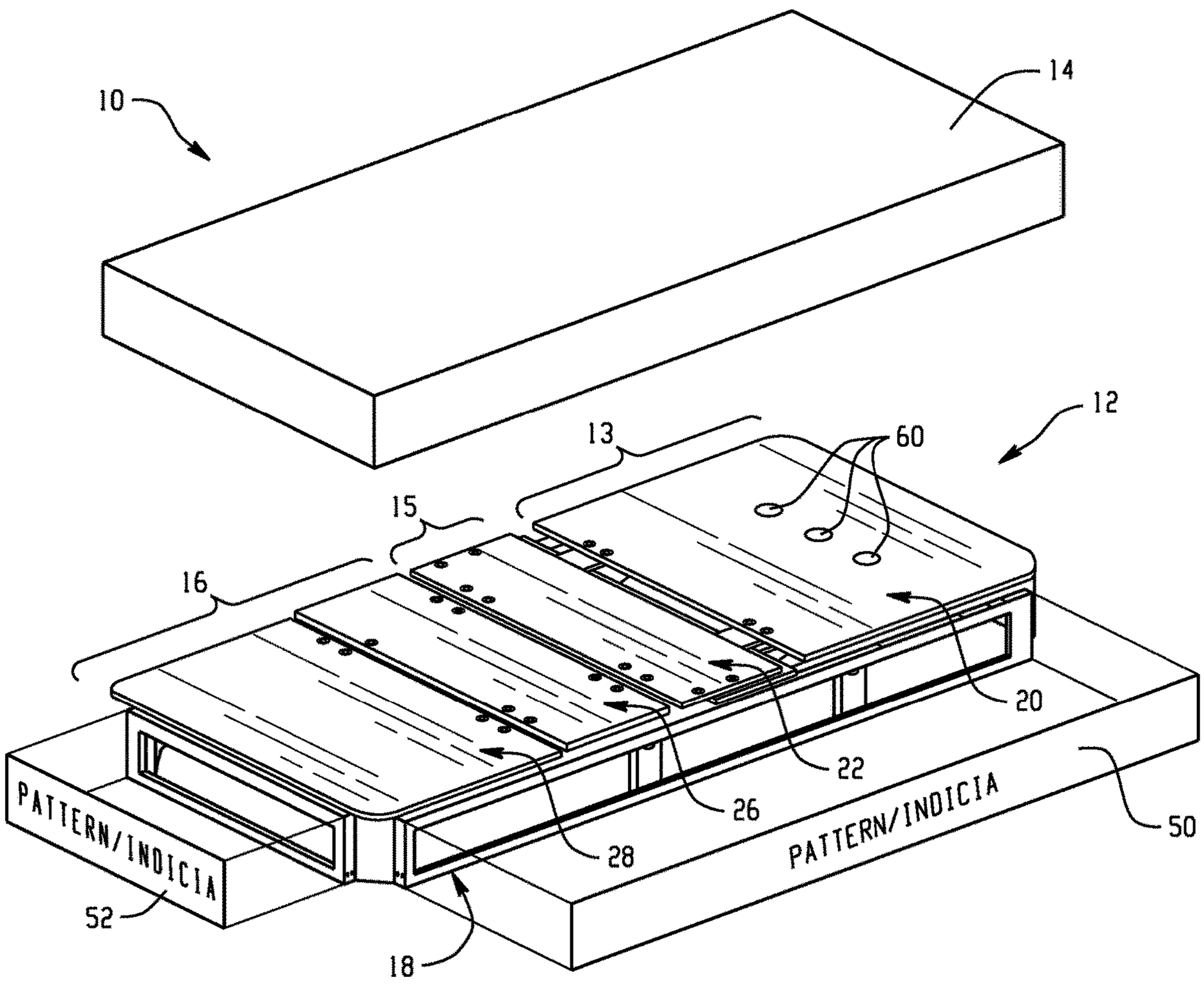
(57) **ABSTRACT**

Interactive bedding systems for a child and processes of use include a mattress and a foundation supporting the mattress. The interactive bedding system can be dynamically adjusted to the child's individuality and age. The bedding system includes a control unit configured to automatically adjust articulating sections in the foundation, the one or more color-changeable lighting units, the one or more sound speakers, and the vibrating units upon detection of a sleep condition, and automatically detect a presence or an absence of the child on the articulating bedding system at a predetermined range of time and notifying a third party in the absence of the child during the predetermined range of time.



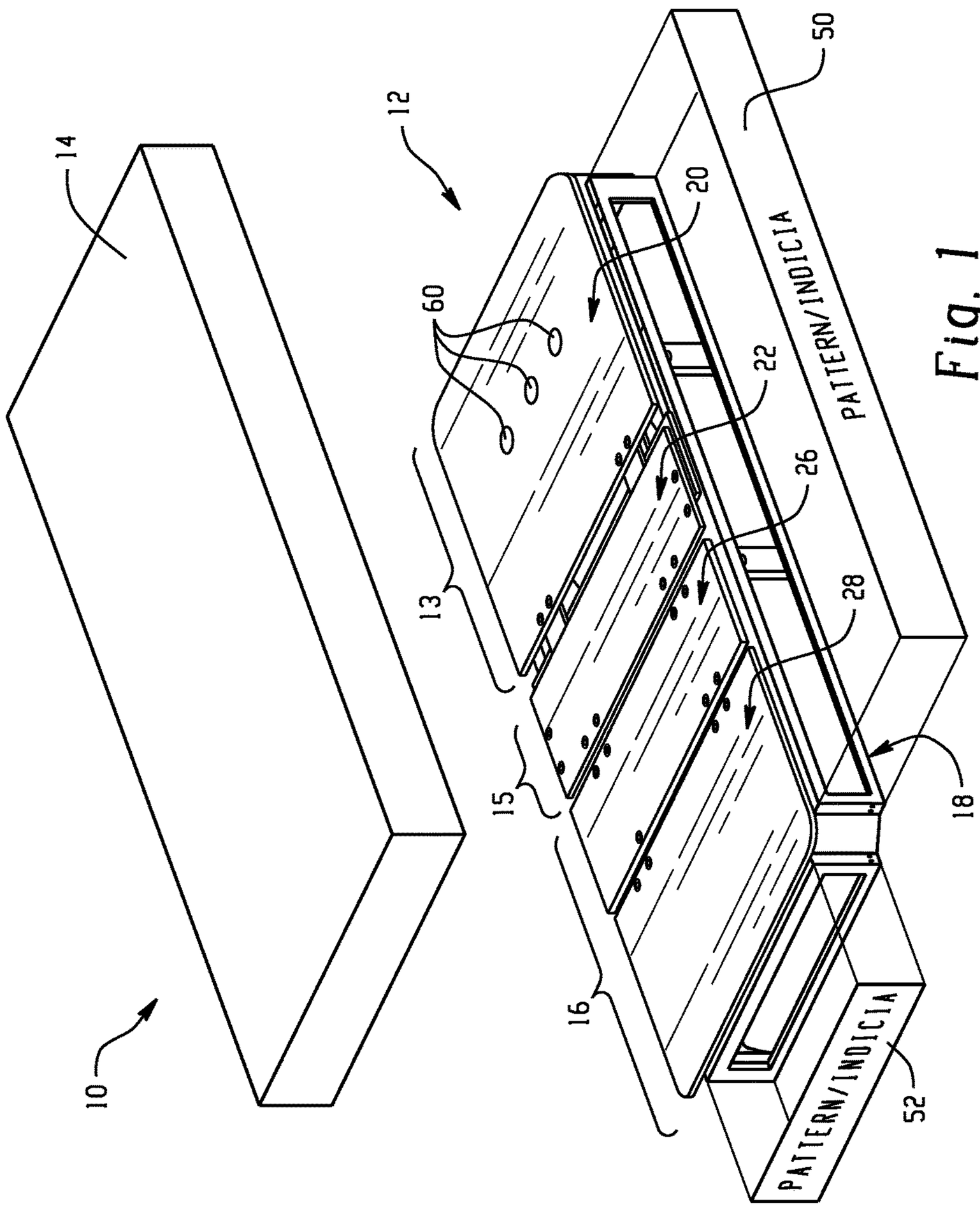

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Fig. 1

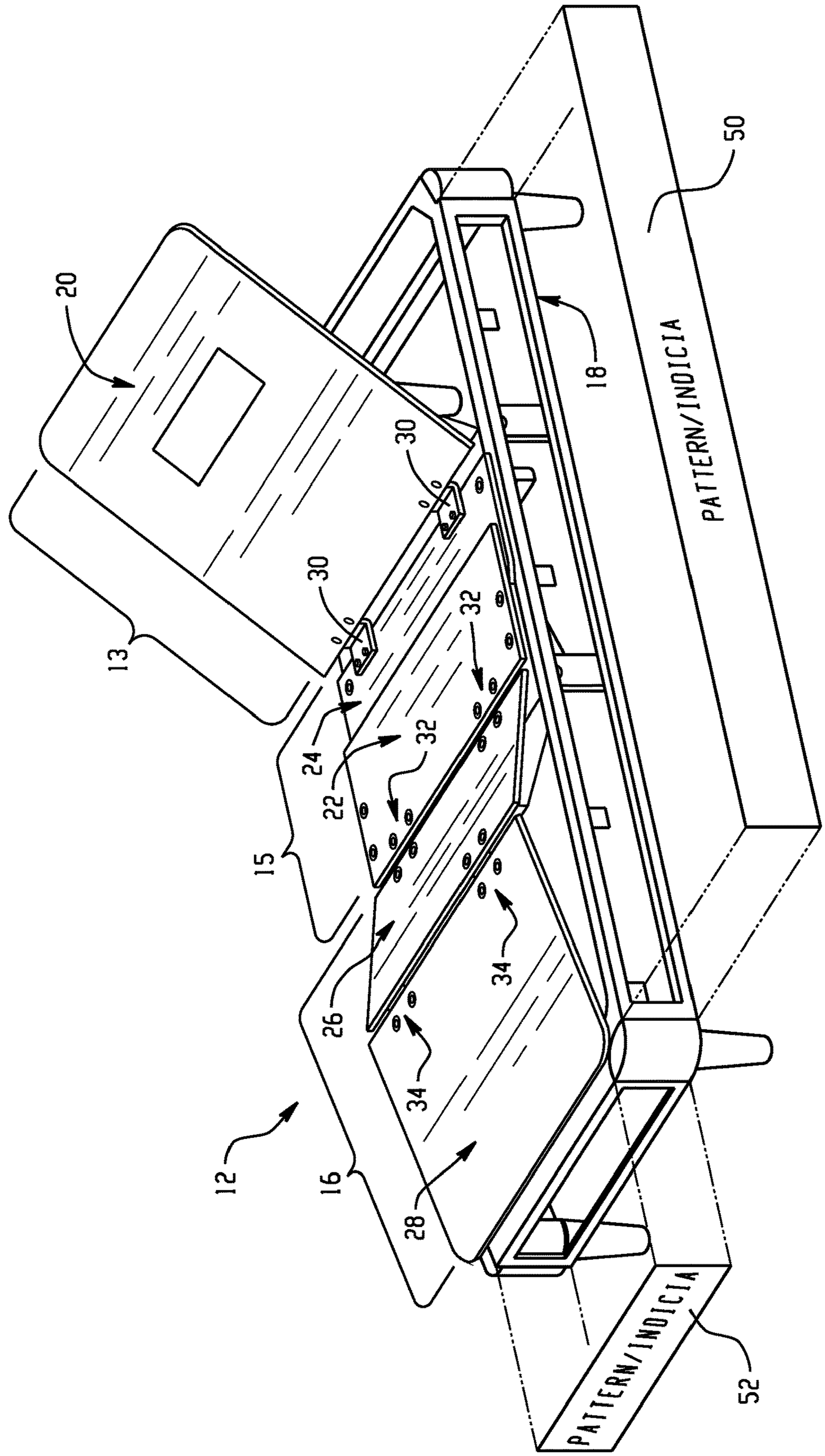
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Fig. 2

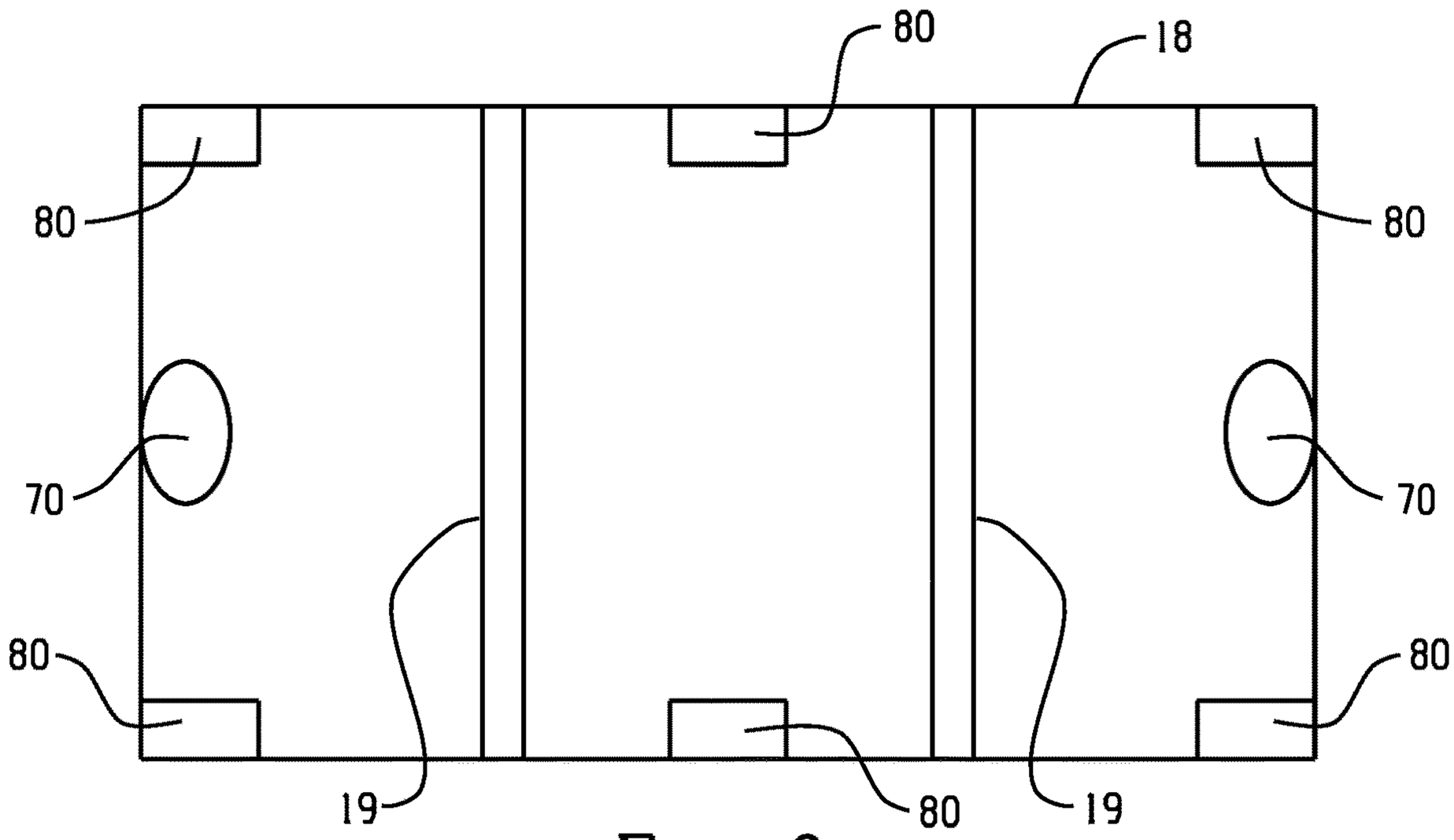

Fig. 3

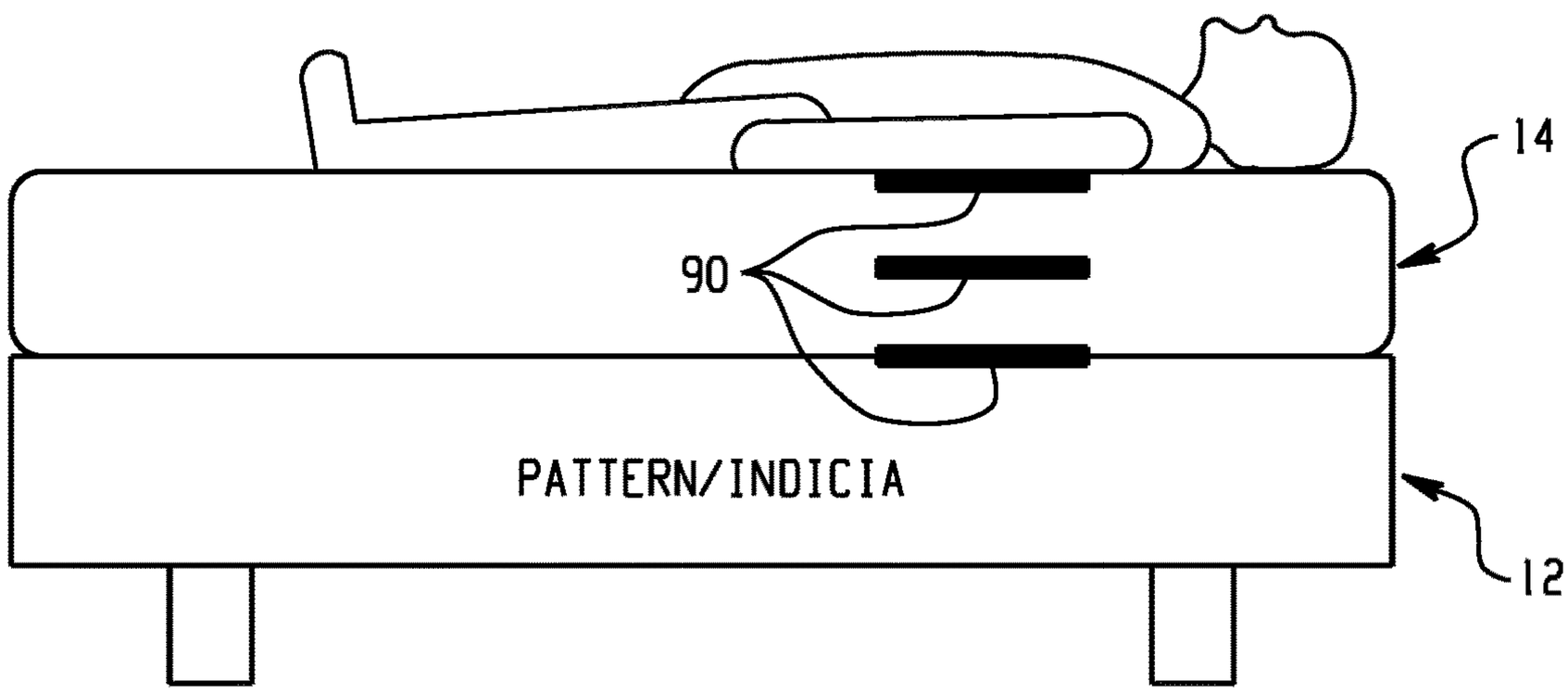

Fig. 4

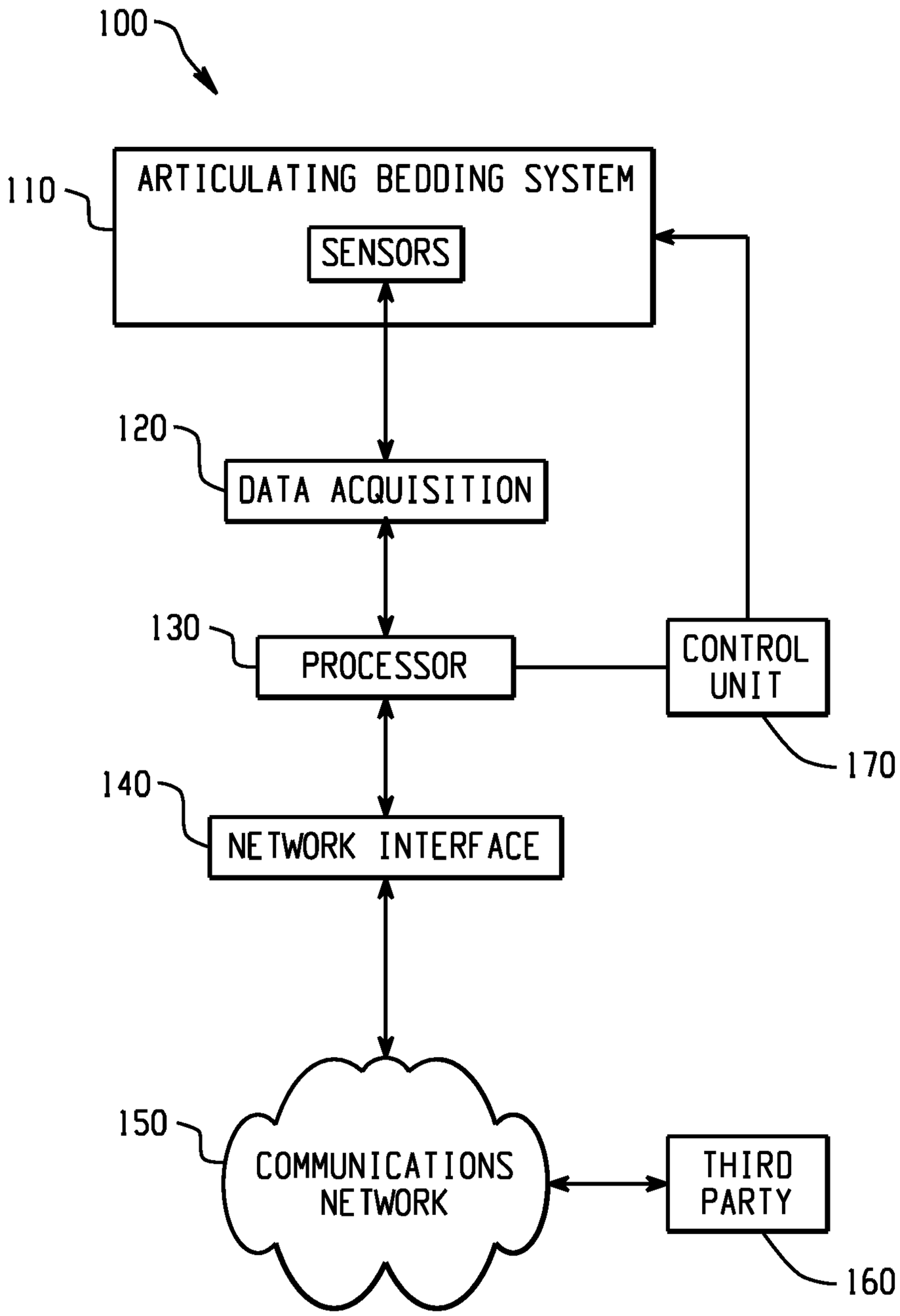
100
110
ARTICULATING BEDDING SYSTEM
SENSORS
120
DATA ACQUISITION
130
PROCESSOR
CONTROL UNIT
170
140
NETWORK INTERFACE
150
COMMUNICATIONS NETWORK
THIRD PARTY
160

Fig. 5

INTERACTIVE POWERED BEDDING SYSTEMS FOR CHILDREN

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 powered bedding systems and, more specifically, to interactive powered bedding systems for children that can be dynamically adjusted to the child's individuality and age.

[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 a 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 posses 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 powered bedding system for a child is provided and configured to dynamically adjust to a child's individuality and age. In one or more embodiments, the interactive powered bedding system for a child includes a mattress; and a foundation including a rectangular frame and optionally one or more articulating sections mounted to the rectangular frame configured to support the mattress, wherein the rectangular frame includes a head end, a foot end, and sidewalls extending from the head end to the foot end, and removable border panels about a perimeter of the rectangular frame including a pattern and/or indicia. The rectangular frame can include a linkage assembly operable to articulate one or more of the articulating sections from a planar configuration to a non-planar configuration. A plurality of sensors is positioned below a sleeping surface of the interactive bedding system and configured to measure at least one sleep condition and provide output signals. Coupled to the rectangular frame are one or more color-changeable lighting units; and one or more sound speakers coupled to the rectangular frame. Vibrating units are coupled to the foundation. A control unit is configured to automatically activate one or more of the different components integrated into the powered bedding system, e.g., activate the one or more color-changeable lighting units, articulate the mattress, activate the one or more sound speakers to play music, alerts, or instructions, activating the vibrating units upon detection of a sleep condition, and/or automatically detecting a presence or an absence of the child on the powered bedding system at a predetermined range of time and notifying a third party in the absence of the child during the predetermined range of time.

[0006] In one or more embodiments, a process for operating an interactive powered bedding system for a child includes providing an interactive bedding system comprising a mattress; and a foundation supporting the mattress, wherein the interactive bedding system is configured with a plurality of sensors below a sleeping surface of the interactive bedding system configured to measure at least one sleep condition and provide output signals, one or more color-changeable lighting units coupled to the rectangular frame, one or more sound speakers coupled to the rectangular frame, vibrating units coupled to the foundation, and a control unit; and automatically adjusting the one or more color-changeable lighting units, the one or more sound speakers, and the vibrating units upon detection of a sleep condition, and automatically detect a presence or an absence of the child on the interactive bedding system at a predetermined range of time and notifying a third party in the absence of the child during the predetermined range of time.

[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 an exploded perspective view of an interactive articulating bedding system for a child in a planar configuration according to one or more embodiments of the present disclosure;

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

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

[0012] FIG. **4** is a side view of an interactive articulating bedding system for a child according to one or more embodiments of the present disclosure; and

[0013] FIG. **5** is a block diagram of an interactive articulating bedding system, according to one or more embodiments of the present disclosure.

[0014] These and other advantages and features will become more apparent from the following description taken in conjunction with the drawings.

DETAILED DESCRIPTION

[0015] Disclosed herein are interactive powered bedding systems for children that can be programmed by a caretaker, e.g., a parent, babysitter, health care provider or the like to dynamically adjust the articulating bedding system for the child's individuality and age. Moreover, with the exception of the articulating components, the other components are modular and can be added or removed from the bedding system when desired. The interactive powered bedding systems generally include a mattress and a foundation such as an articulating foundation supporting the mattress. As will be described in greater detail herein, the interactive powered bedding systems are configured to encourage a child to remain on the mattress during bedtime by providing an interactive system that automatically adjusts to promote healthy sleep habits. Advantageously, the interactive bedding systems can be configured to provide third party notification in the event the child leaves the bedding system during a predetermined range of time, e.g., bedtime, naptime, or the like, that the caretaker can preset. The interactive bedding systems can also be configured to activate one or more integrated system accessories such as underbed nightlights upon detection of the child's absence during bedtime such as may occur should the child need to use a restroom, for example.

[0016] Reference will now be made to interactive articulating bedding systems although it should be apparent that the articulating foundation is intended to be optional. Interactive articulating bedding systems generally include 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.

[0017] The mattresses utilized in the interactive bedding systems are also 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.

[0018] The interactive bedding systems for children generally include modular accessories including one or more color-changeable lighting units coupled to the rectangular frame and/or the one or more articulating sections and oriented to project light toward a ground level; one or more sound speakers coupled to the rectangular frame and/or the one or more articulating sections to play music, stories, white noise, or the like; vibrating units coupled to one or more of the more articulating sections; and a control unit configured to receive output signals from one or more sensors within the articulating bedding system and communicate these output signals to the bedding system upon detection of a condition, e.g., a sleep condition such as a predetermined bed time, sleep state, or the like, by automatically articulating one or more of the articulating sections; and/or automatically vibrating the vibratory units; and/or automatically adjusting a color of the lighting based on sleep or wake status of the child, and/or automatically adjusting speaker volume and selection of emitted sound from the one or more speakers, wherein an external sound device wirelessly communicates with a network interface communicating with the one or more speakers to provide stories, songs, music, white noise, instructions, or the like; and/or automatically detecting the presence or the absence of the child on the articulating bedding system and notifying a third party in the absence of the child. Detection of the presence or absence of the child can further include activating the one or more lighting units upon detection of the child's absence from the bedding system so as to function as a nightlight, for example. By way of example, the color changing lights can be red colored to indicate absence from the bedding system so as to provide notice to the child that this is unacceptable behavior or green indicating the child's presence. The lights can fade out once a sleep state is detected.

[0019] The rectangular frame, whether it be an articulating foundation or not, can also be configured to receive customized border panels that are removably attached thereto, which can feature outwardly facing patterns and/or indicia that is age appropriate and specifically selected for the child. For example, the outwardly facing patterns can include the child's favorite caricatures and/or include phrases that hold special meaning. The removable border panels can be replaced with more appropriate patterns/indicia as the child ages extending the attraction of the powered bedding system to the child. The presence of the removable border panels attracts and encourages the child to use and remain on the interactive powered bedding system at a predetermined time such as during sleep time or nap time, for example.

[0020] The interactive powered bedding systems can include multiple sensors for detecting various parameters to provide output signals indicative of at least one sleep condition, which can be used to automatically adjust the articulating bedding system. For example, sensors can be used to detect an early sleep stage associated with the child and automatically change the powered bedding system from a non-planar configuration to a planar configuration; reduce sound levels or provide white noise, provide a rhythmic vibration using the vibrating units or the like. The sensors can be placed at locations on and/or within the mattress and/or adjustable foundation suitable for detection of a desired parameter to be measured that is associated with the child. Exemplary sensors can be used to detect movement, weight, heart rate, breathing, humidity, temperature, or the like. These types of sensors are generally known in the art.

[0021] Referring now to FIGS. **1-2**, there are shown an exploded perspective view of an exemplary interactive articulating bedding system **10** configured for a child including an adjustable mattress foundation **12** and mattress **14** thereon in accordance with the present disclosure. The

interactive bedding system **10** is not intended to be limited to any particular adjustable foundation **12** or mattress **13**. The mattress **14** is configured to have similar length and width dimensions to the adjustable foundation **12** to define the articulating bedding system, which is generally rectangular shaped. The mattress **14** can be secured to the adjustable foundation in any manner generally known in the art, e.g., through the use of book and loop fasteners, metal rails, and the like.

[0022] As is typical for adjustable mattress foundations, the adjustable mattress foundation **12** includes one or more sections that are movable between a planar configuration as shown in FIG. **1** to a non-planar configuration as shown in FIG. **2**. The non-planar configurations are typically defined by a head and back section **13**, a leg and foot section **16**, and an intermediate seat section **15** therebetween, wherein the head and back section **13** and the leg and foot section **16** can articulate, i.e., elevate, relative to the intermediate seat section **15**. The different sections, **13**, **15**, and **16** collectively form the mattress support surface upon which the mattress **14** shown in FIG. **1** overlies. In the illustrated non-planar configuration position shown in FIG. **2**, which is exemplary and not intended to be limiting, both the head and back section **13** and portions of the leg and foot section **16** are shown simultaneously elevated relative to the intermediate seat section **15**. However, suitable adjustable foundations can include independent inclination/declination of the head and back section relative to the leg and foot section. A child may lie prone on the mattress **14** disposed on the adjustable mattress foundation **12** in its fully horizontal planar configuration, in the fully inclined non-planar configuration, or in any position therebetween. As noted above, the adjustable mattress foundation **12** generally includes a rectangular shaped foundation frame **18**, which supports and elevates the head and back section **13** and the leg and foot section **16**, and the intermediate seat section **15**, relative to ground.

[0023] The head and back section **13** is typically formed of a single panel **20** whereas the intermediate seat section **15** as well as the leg and foot section **16** can be formed of multiple panels, e.g., intermediate seat panels **22**, **24** and leg and foot panels **26**, **28**, respectively, as shown more clearly in FIG. **2**. Panel **20** of the head section **13** is connected via hinges **30** to lower panel **24** of the intermediate seat section **15** at one end thereof. Likewise, the leg and foot section **16** includes panel **26** connected at one end via hinges **32** to panel **22** of the intermediate seat section **15** 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 **15** are in a sliding relationship to selectively increase or decrease length of the intermediate seat section upon inclination or declination of the head section **13** and/or the leg and foot section **16** in the intermediate section **15**, panel **22** is an upper panel and panel **24** is the lower panel. Additionally, panels **26** and **28** of the leg and foot section **1168** are hingedly connected to one another via hinges **34**.

[0024] The different sections **13**, **15**, and **16** are supported on the rectangular foundation frame **18**, which further includes a motorized linkage assembly (not shown) operable to selectively articulate the sections **13** and **16** relative to the intermediate seat section **15** 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. Exemplary linkage assemblies and adjustable foundations are described in U.S. Pat. Nos. 5,870,784, 10,638,851 and 10,278,512, incorporated herein by reference in their entireties.

[0025] The rectangular frame can further include removable decorative border panels **50** and **52**, which can include a pattern and/or indicia. The panels **50**, **52** can be removably secured to the rectangular frame **18** about the entire perimeter or portions thereof. A shown, panel **50** is attached along a length dimension of one side of the rectangular frame and panel **52** is positioned along a width dimension corresponding to a foot end of the rectangular frame. Attachment is not intended to be limited and can be effected using any mechanical attachment such as hook and loop fasteners, nut and bolt fasteners, clips, or the like.

[0026] In one or more embodiments, the bedding system **10** includes one or more vibratory units **60** attached to one or more of the panels such as the head panel **13** as shown in FIG. **1**. Each vibratory unit **60** generally includes a variable speed motor with a shat and an eccentric weight attached to the shaft causing the motor to vibrate when in use. The frequency of the vibrations produced within the foundation may be controlled by varying the speed of each motor. The amplitude of the vibration may be controlled by re-positioning the eccentric weight. Operation of the individual vibrating units thusly imparts a resonating effect to the overlying mattress and to the child reclining upon the mattress. By varying the frequencies of the vibratory impulses and the level of resonance, a person may recline upon the mattress for its comforting effects or, alternatively, be slowly lulled to sleep. Alternatively, the one or more vibrating units can be integrated into the mattress (not shown). In these embodiments, a separate power source can be used or the vibratory units can be battery operated.

[0027] Turning now to FIG. **3**, a bottom plan view of the rectangular frame **18** is shown without the linkage assembly. The rectangular frame **18** typically incudes one or more cross members **19**, two of which are shown, for stability and for coupling with the linkage assembly. Speakers **70** and color changeable lighting units **80** are coupled to the rectangular frame **18**. The locations and configuration of the speakers and color changing lighting units are not intended to be limited. Generally, the color changing lights are oriented to project light towards the ground.

[0028] In FIG. **4**, a cross sectional view of the interactive articulating bedding system **10** is shown including a plurality of sensors **90**. As shown, the sensors **90** are positioned generally corresponding to a lumbar region of a child **92** prone on the mattress **14** although it should be apparent the sensors can be positioned anywhere within the bedding system **10**. The sensors can be mounted to the rectangular frame **18** of the adjustable foundation **12** or components thereof; intermediate the mattress **14** and the adjustable foundation; within the mattress **14**; and/or proximate to the sleeping surface of the mattress **14**. The sensors are not intended to be limited to any particular type or types. Sensors **90** 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. The sensors can be used to determine a sleep condition and provide output data signals to a control unit that is indicative of the sleep condition. For example, weight or stress/strain sensors may be used to monitor a child's sleeping position and/or movements during sleep.

[0029] Turning now to FIG. **5**, a block diagram of an exemplary operating system **100** is shown for controlling the interactive articulating bedding system **10**. The system **100** generally includes generating output signals from sensors **110** to the control unit **170**, which may also communicate with a data acquisition device **120** that communicates with processor **130**. The processor **130** can be in communication with a sleep database, a user interface, and/or a network interface **140**. The processor can be programmed by a caretaker to provide the interactive articulating bedding systems with a variety of functions. For example, the caretaker can program the interactive articulating bedding system to play lullabies, songs, or a bedtime story that fades into white noise or turns off completely upon detection by the sensors that the child has fallen asleep. Likewise, colored lighting can be activated to indicate sleeping time or serve as a night light. A specific color can be repeatedly projected each bedtime for example, to indicate to the child that it is sleeping time. Additionally, a predetermined sleeping time can be entered to cause the adjustable foundation to articulate from anon-planar configuration to a planar configuration. Still further, the bedding system processor can be programmed to actuate the vibrating units, which along with white noise emitted from the speakers can be configured to provide repeatable oscillations to encourage sleepiness. Parental or caretaker control can be used to program the different articulating positions and experiences the child occupant can enjoy so as to provide healthy sleep habits. For example, the color changing lights can turn to red if the child leaves the bedding system during a predetermined sleep time along with the speaker providing a message indicating that it is sleep time and to return to the bedding system. In the event the child does not return promptly, the bedding system can provide the caretaker and/or parent with appropriate notification via the network interface **140** and communications network **150**, e g., wirelessly, to send a message to the caretakers control device, e.g., tablet, phone, computer, or the like.

[0030] The data acquisition device **120** can be configured to receive electronic output signals from the sensors **120** through a wired or wireless connection. e.g., BLUETOOTH, ZIGBEE, WIFI, etc. The data acquisition device **120** may then process the received output 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 sleep processor. 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.

[0031] The data acquisition device **120** may communicate the received data signals to the sleep processor **130** through a wired or wireless connection. The sleep processor **130** may include microcontrollers and microprocessors programmed to receive data from the sensors, and determine sleep parameters based on the received data, which can be sent to the control unit **170** to trigger an action such as activating the color changing lights to a specific color. In particular, the sleep processor **130** 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 **130** 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 sleep processor **130** may include general purpose computer systems used as servers, workstations, personal computers, network terminals, and the like.

[0032] The sleep processor **130** can be connected to the network interface **140** for data communications. The network interface **140** 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 **140** 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 **130** may include a mainframe or other type of host computer system capable of communications via the network. The network interface may communicate with third parties, such as a caretaker or emergency services 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 **130** may also include suitable input/output ports or use the interconnect bus for interconnection with other components, such as user interface.

[0033] The sleep characteristic measured by the sensors may be a length of time in bed, a sleep start time, a sleep end time, a measurement of respiration, sleep state, or a measurement of moving. For example, 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). As previously discussed, the sensors may be distributed along one or more major or sleeping surfaces of the mattress and/or the foundation. For example, weight sensors may be distributed along the length of the articulating bedding system, where a sleeping child 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 adjustable foundation.

[0034] In some embodiments, the sensors may be flexible. For example, the sensors may include 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.

[0035] Still further, the color-changeable light source can be configured to emit a light at an intensity and color based on the end user settings. The light source is not intended to be limited and can include light emitting diodes, halogen sources, incandescent sources, and the like. The light source can be activated to serve as a nightlight, provide certain colors at certain intensities and durations, or a fade out to signal and encourage the child that it is time to sleep.

[0036] The articulating bedding system can be configured to assume multiple configurations with multiple settings by programming a control unit **170**. The control unit **170** is configured to communicate with the bedding assembly and to control the bedding assembly to assume a selected configuration and/or response with selected settings in in accordance with user or vendor inputs in response to a predefined event. In some embodiments, the control unit can be configured with a parental control to allow the parent to set the positions and experiences the child may have so as to encourage sleepiness at a particular time. Additionally, the parental control can be configured to provide notifications when the child exits the bedding system.

[0037] 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."

[0038] 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.

[0039] 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.

[0040] 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.

[0041] 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.

[0042] 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.

[0043] 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.

[0044] 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.

[0045] 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.

[0046] 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 bedding system for a child comprising:

a mattress;

a foundation supporting the mattress;

a plurality of sensors below a sleeping surface of the interactive bedding system configured to measure at least one sleep condition and provide output signals;

one or more color-changeable lighting units coupled to the rectangular frame;

one or more sound speakers coupled to the rectangular frame;

vibrating units coupled to foundation; and

a control unit configured to automatically actuate the one or more color-changeable lighting units, the one or more sound speakers, and the vibrating units upon detection of a sleep condition, and automatically detect a presence or an absence of the child on the interactive bedding system at a predetermined range of time and notifying a third party in the absence of the child during the predetermined range of time.

2. The interactive bedding system of claim **1**, wherein the control unit is configured to activate the color changeable lighting units upon the absence of a child from the bedding system.

3. The interactive bedding system of claim **1**, wherein automatically adjusting lighting from the one or more color-changeable lighting units to fade upon detection of the sleep condition.

4. The interactive bedding system of claim **1**, wherein the third party is a caretaker or a parent.

5. The interactive bedding system of claim **1**, wherein the foundation comprises 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 comprises a linkage assembly operable to articulate one or more of the articulating sections from a planar configuration to a non-planar configuration; and wherein the control unit is configured to automatically adjust the articulating sections upon detection of the sleep condition to provide a non-planar configuration.

6. The interactive bedding system of claim **1** further comprising removable border panels about a perimeter of the rectangular frame comprising a pattern and/or indicia,

7. The interactive bedding system of claim **1**, wherein the control unit is configured to automatically adjust the vibrating units to provide a repeating pattern.

8. The interactive bedding system of claim **1**, wherein the control unit is configured to automatically adjust the one or more speakers to emit white noise upon detection of the sleep condition.

9. The interactive bedding system of claim **1**, wherein the control unit is configured to automatically discontinue sound emission from the one or more speakers upon detection of the sleep condition.

10. The interactive bedding system of claim **1**, wherein the plurality of sensors is configured to measure at least one of movement, pressure, weight, and time in bed.

11. A process for operating an interactive bedding system for a child, the process comprising:

providing an interactive bedding system comprising a mattress; and a foundation supporting the mattress, wherein the interactive bedding system is configured with a plurality of sensors below a sleeping surface of the interactive bedding system configured to measure at least one sleep condition and provide output signals, one or more color-changeable lighting units coupled to the rectangular frame, one or more sound speakers coupled to the rectangular frame, vibrating units coupled to the foundation, and a control unit; and

automatically adjusting the one or more color-changeable lighting units, the one or more sound speakers, and the vibrating units upon detection of a sleep condition, and automatically detect a presence or an absence of the child on the interactive bedding system at a predetermined range of time and notifying a third party in the absence of the child during the predetermined range of time.

12. The process of claim **11**, wherein the interactive bedding system further comprises removable border panels about a perimeter of the rectangular frame comprising a pattern and/or indicia, and the process further comprises periodically changing the removable border panels to provide a different pattern and/or indicia.

13. The process of claim **11**, wherein automatically adjusting the vibrating units comprises providing a repeating pattern prior to detection of the sleep condition.

14. The process of claim **11**, wherein the foundation comprises 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 comprises a linkage assembly operable to articulate one or more of the articulating sections from a planar configuration to a non-planar configuration; and the process further comprises automatically adjusting the articulating sections to a planar configuration upon detection of the sleep condition.

15. The process of claim **11**, wherein automatically adjusting the one or more speakers comprises playing a song or music prior to detecting the sleep condition followed by playing white noise upon detecting the sleep condition.

16. The process of claim **11**, wherein automatically adjusting the one or more speakers comprises playing a song or music prior to detecting the sleep condition followed by discontinuing sound emission upon detecting the sleep condition.

17. The process of claim **11**, wherein automatically adjusting the color changing lighting units comprises changing color to a different color upon detection of the sleep condition and the absence of the child from the bedding system.

18. The process of claim **11**, wherein the third party is a caretaker or a parent.

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