US 20180317664A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2018/0317664 A1

(43) Pub. Date: Nov. 8, 2018

MIN et al.

(54) **HEIGHT-ADJUSTABLE BED**

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(21) Appl. No.: **15/772,452**

(22) PCT Filed: **Oct. 28, 2016**

(86) PCT No.: **PCT/KR2016/012299**

§ 371 (c)(1),
(2) Date: **Jul. 2, 2018**

(30) **Foreign Application Priority Data**

Oct. 28, 2015 (KR) ..... 10-2015-0150174

**Publication Classification**

(51) **Int. Cl.**

| | |
|---|---|
| ***A47C 20/04*** | (2006.01) |
| ***A47C 17/16*** | (2006.01) |
| ***A47C 19/04*** | (2006.01) |
| ***A61G 7/012*** | (2006.01) |
| ***A61G 7/015*** | (2006.01) |
| ***A61G 7/018*** | (2006.01) |

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

CPC ..... ***A47C 20/048*** (2013.01); ***A47C 17/163*** (2013.01); ***A61G 7/018*** (2013.01); ***A61G 7/012*** (2013.01); ***A61G 7/015*** (2013.01); ***A47C 19/045*** (2013.01)

(57) **ABSTRACT**

Disclosed is a height-adjustable bed including: a base; a support frame placed on an upper surface of the base; a mattress stably placed on an upper surface of the support frame; and a height adjusting device connected to the support frame and the base to adjust the height and tilt of the support frame, wherein the height adjusting device includes a gas spring or a spring lever to manually adjust the height of the support frame.

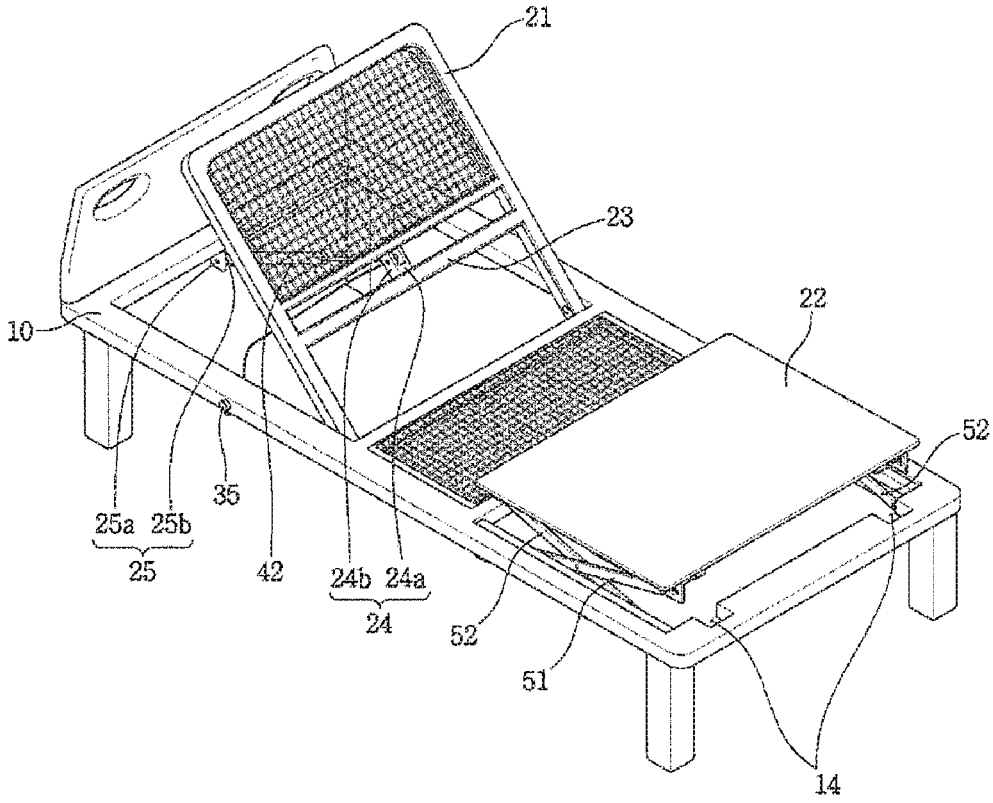


FIG. 1

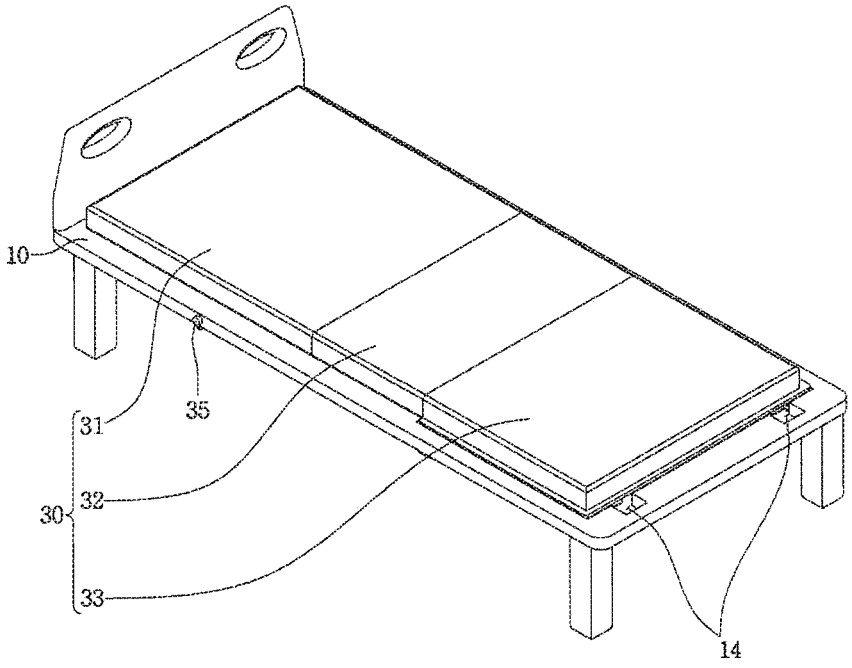


FIG. 2

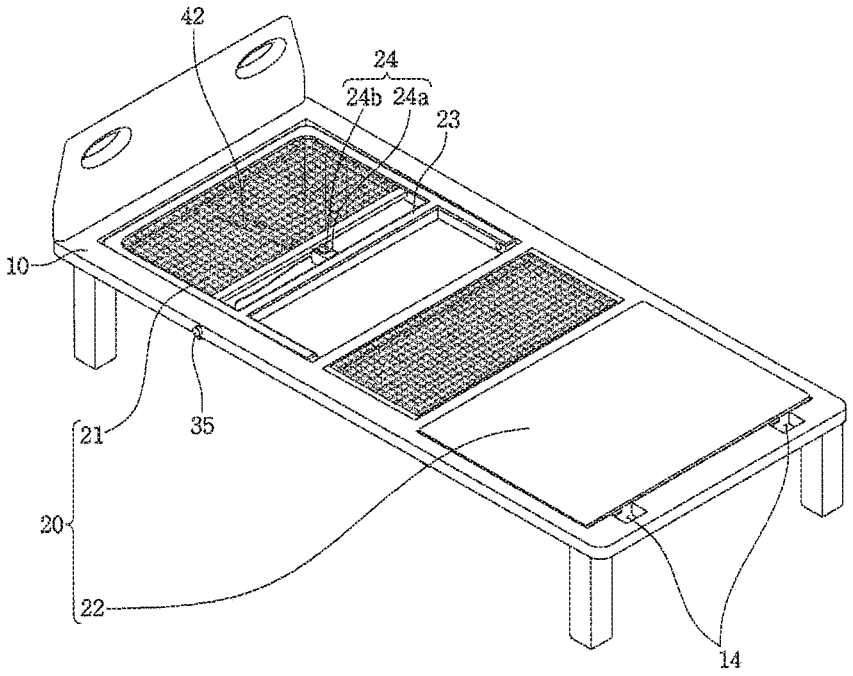


FIG. 3

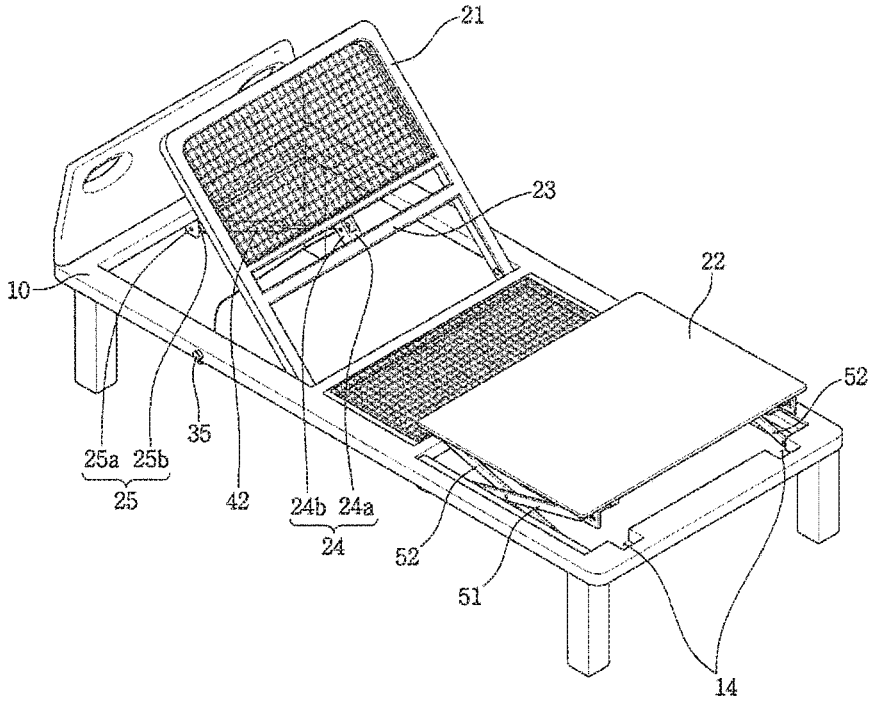


FIG. 4

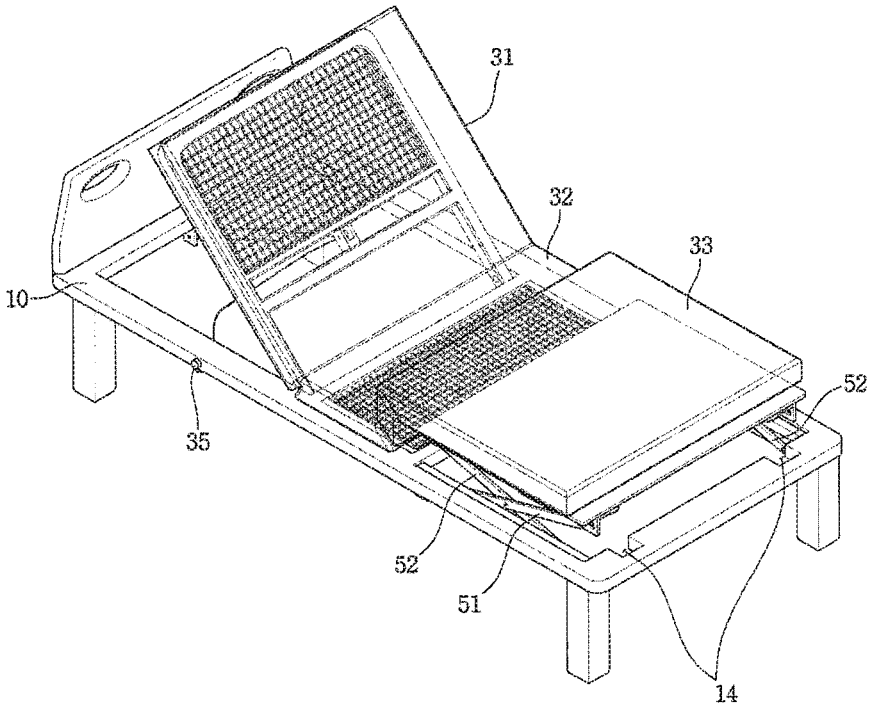


FIG. 5

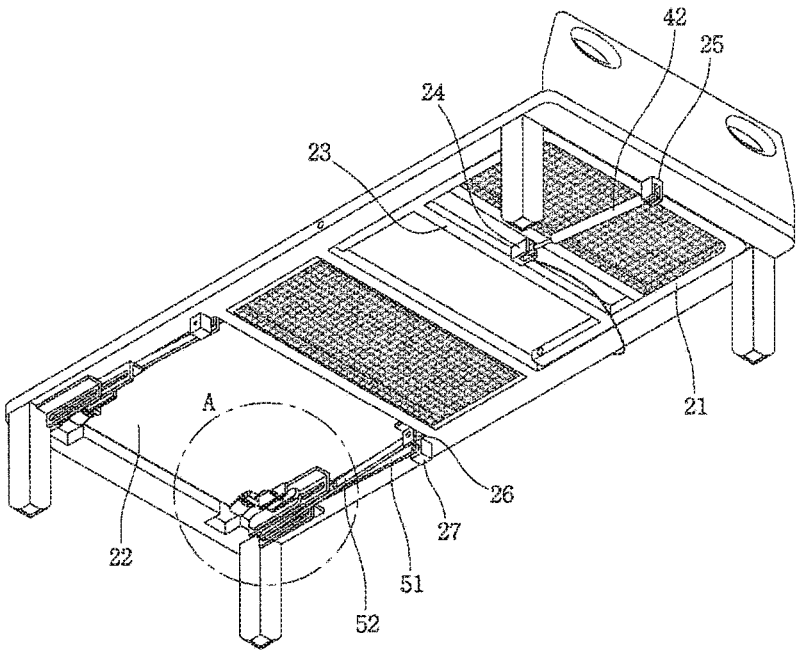


FIG. 6

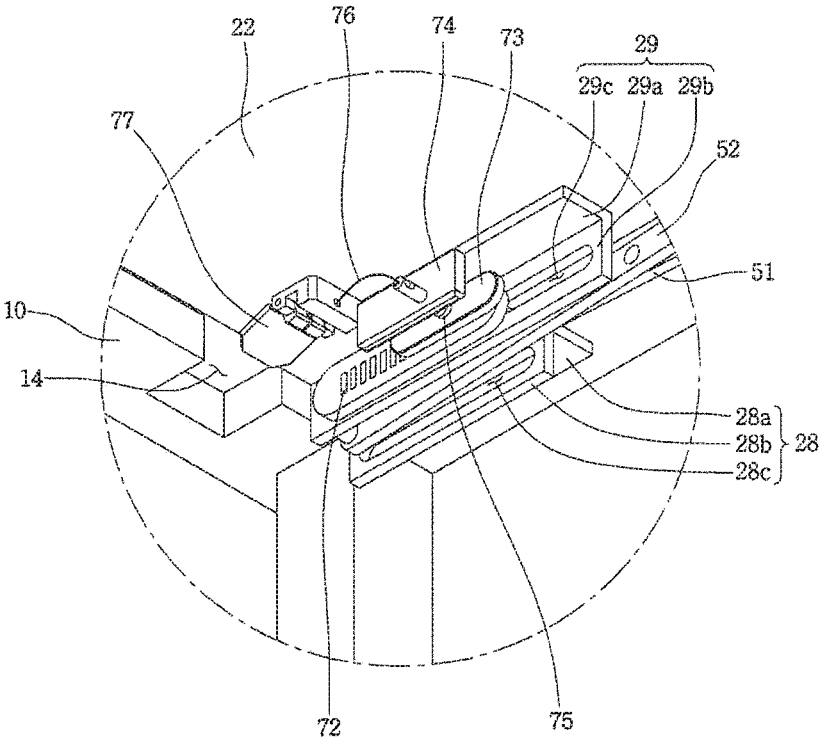


FIG. 7

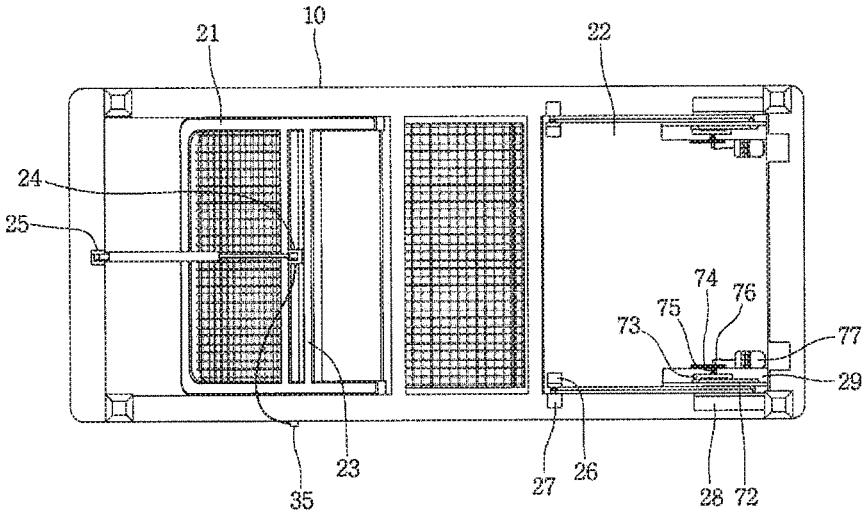


FIG. 8

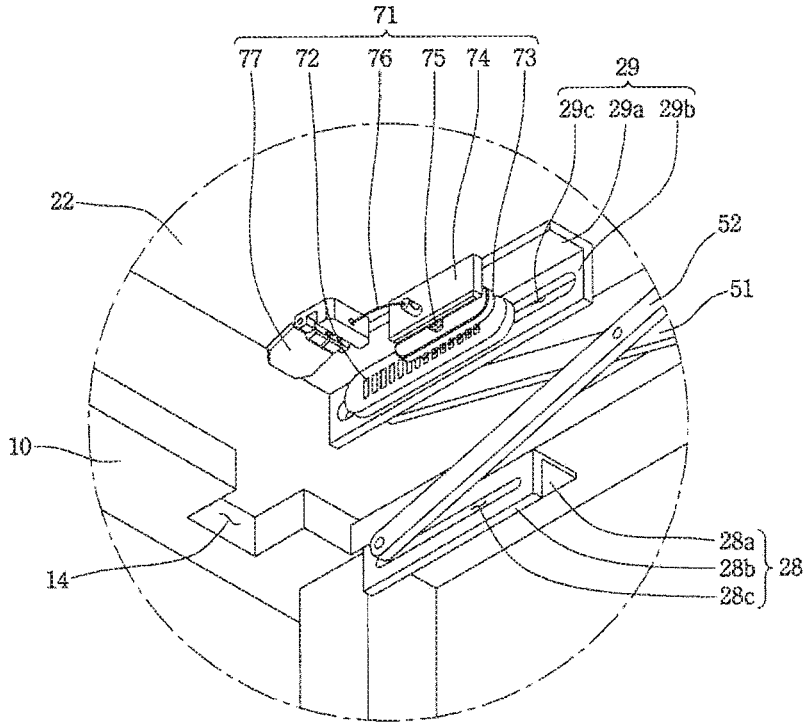


FIG. 9A

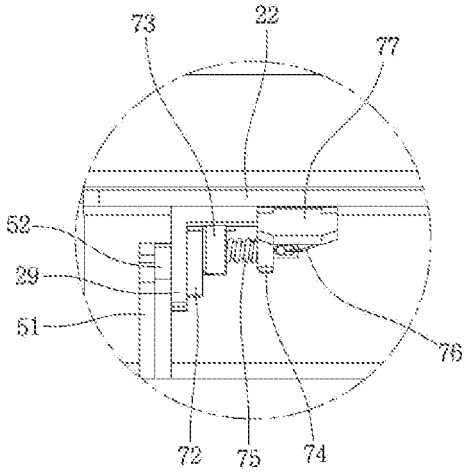



FIG. 9B

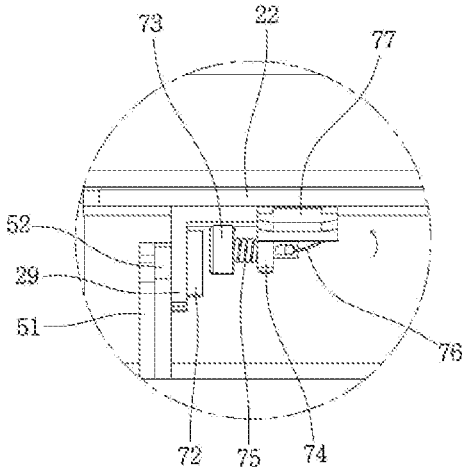


FIG. 10

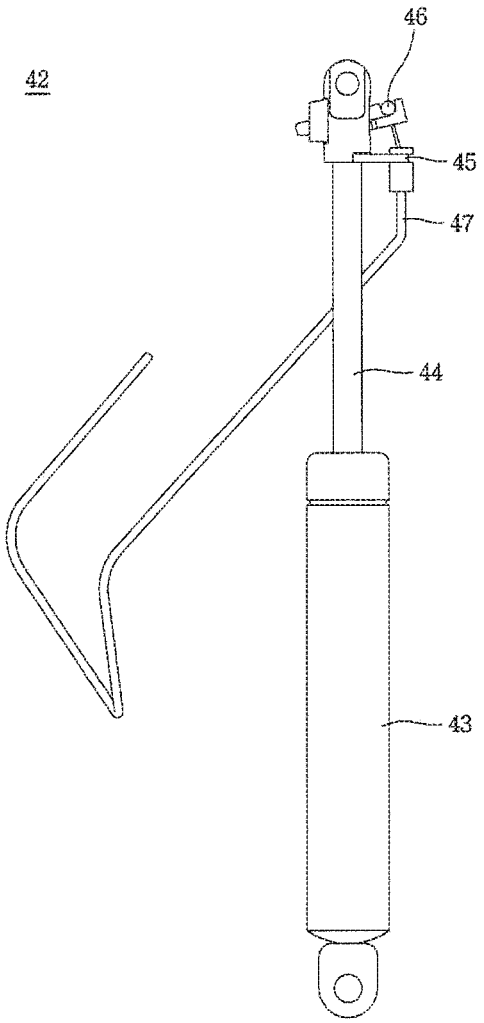


FIG. 11

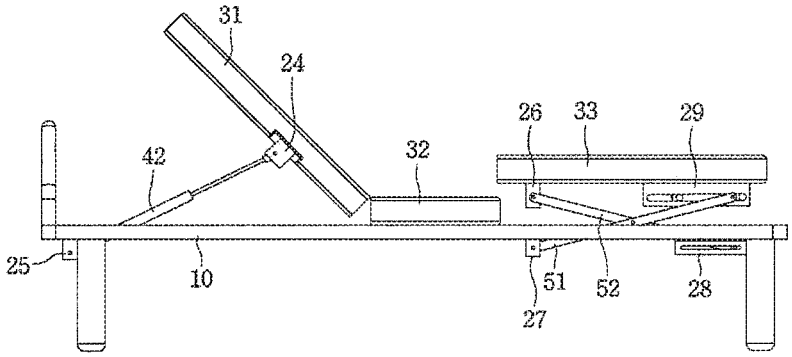



FIG. 12

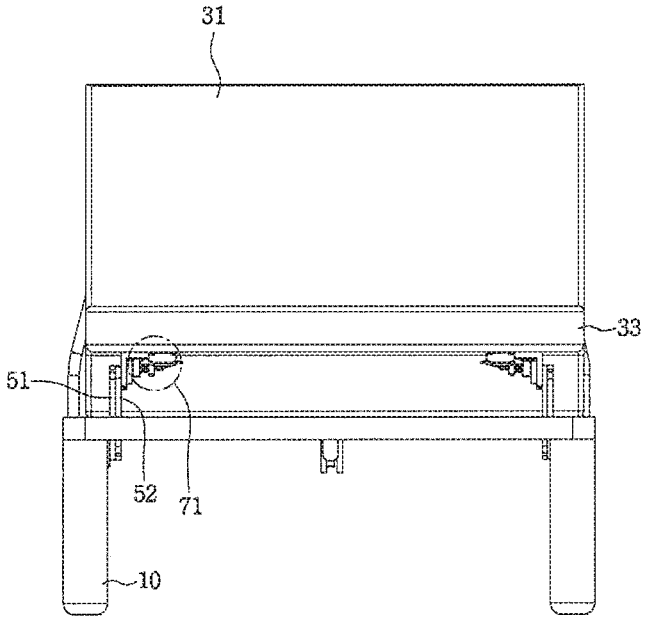


FIG. 13

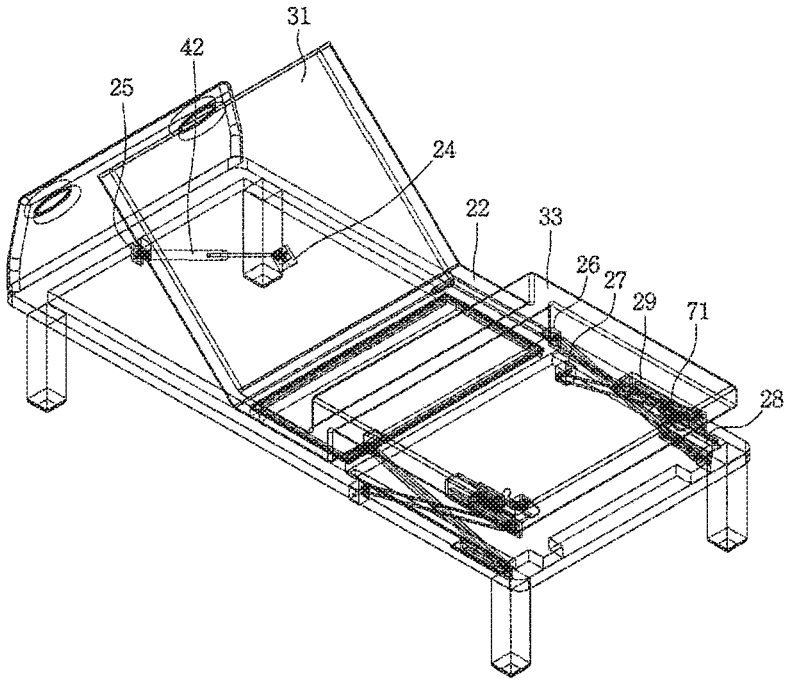


FIG. 14

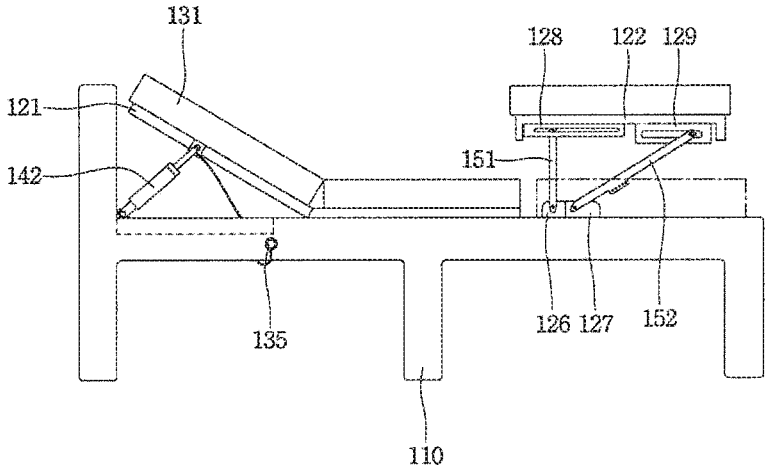


FIG. 15

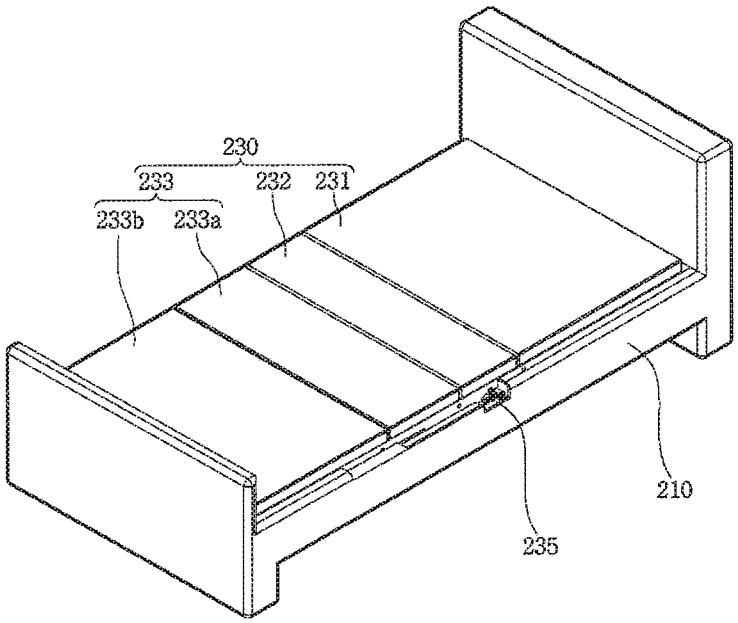


FIG. 16

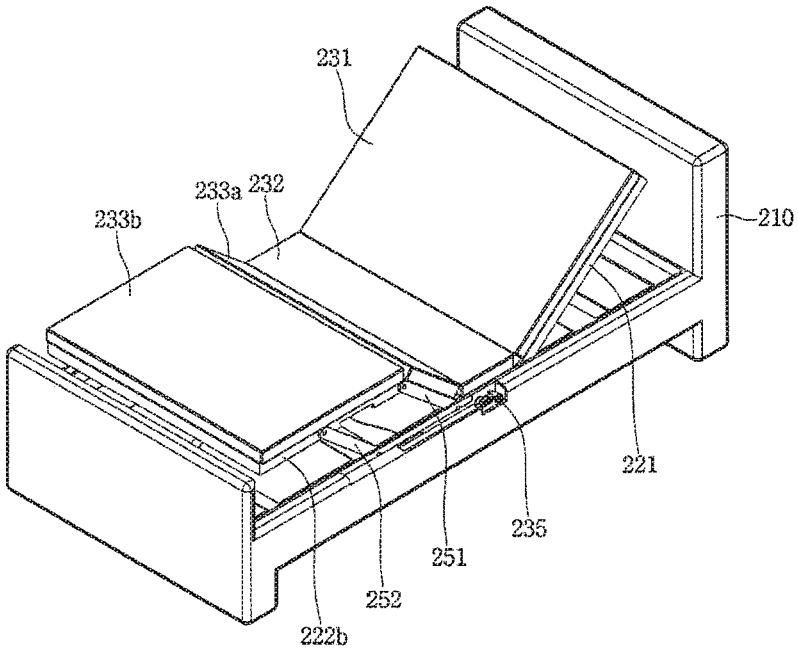


FIG. 17

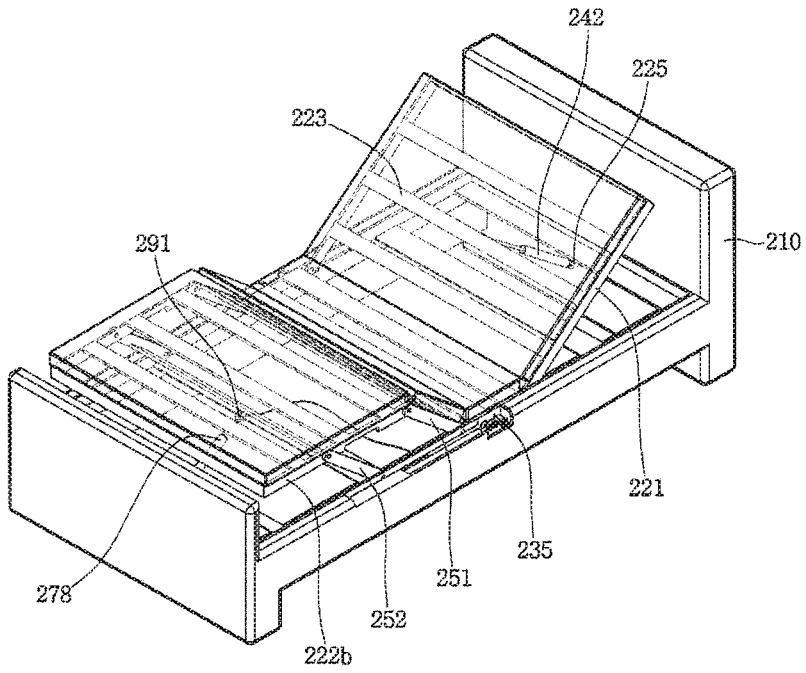


FIG. 18

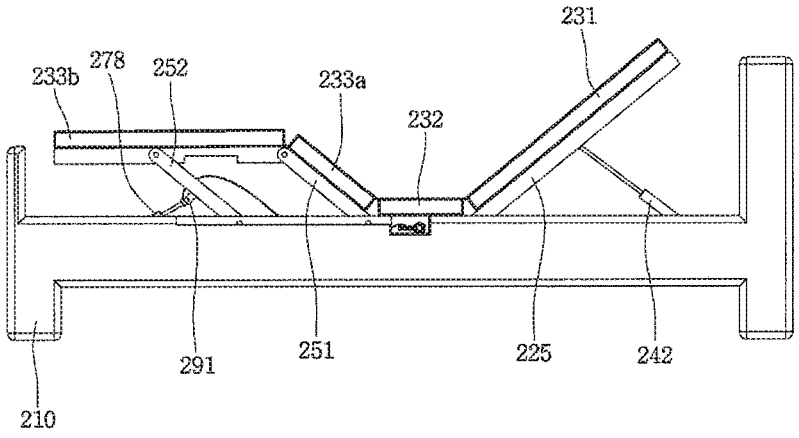


FIG. 19

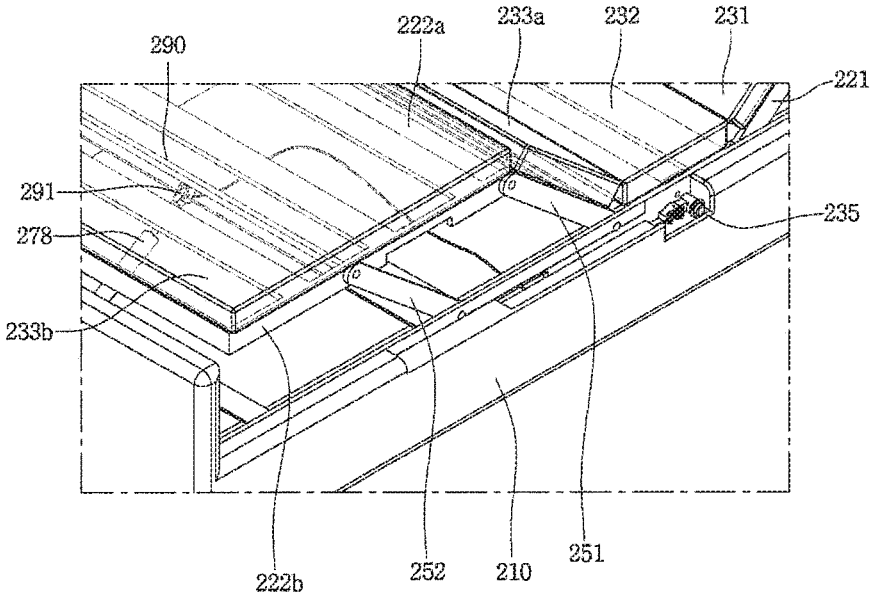
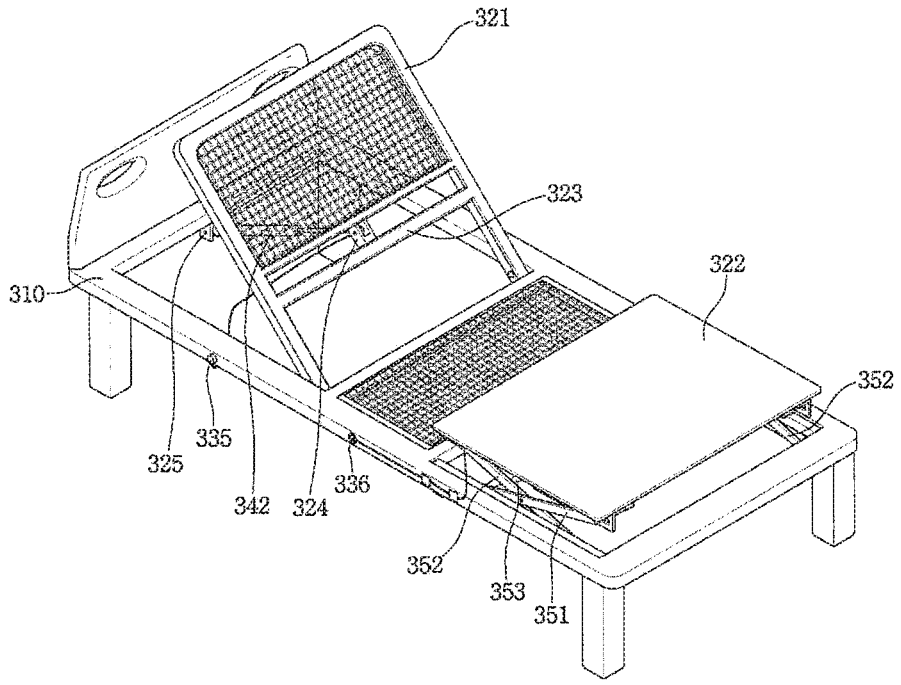


FIG. 20



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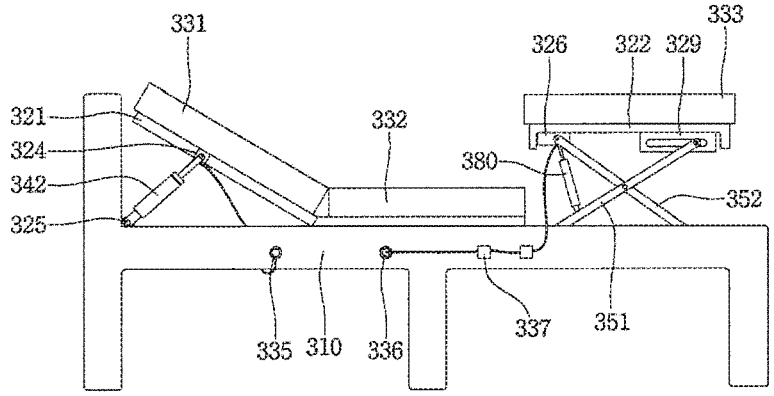
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FIG. 22

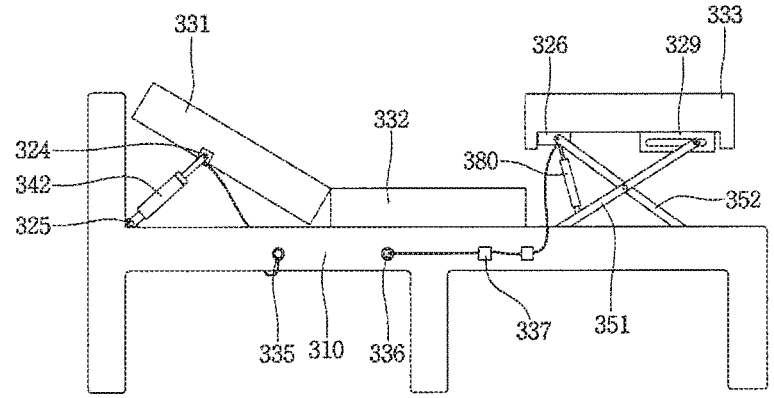
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FIG. 23

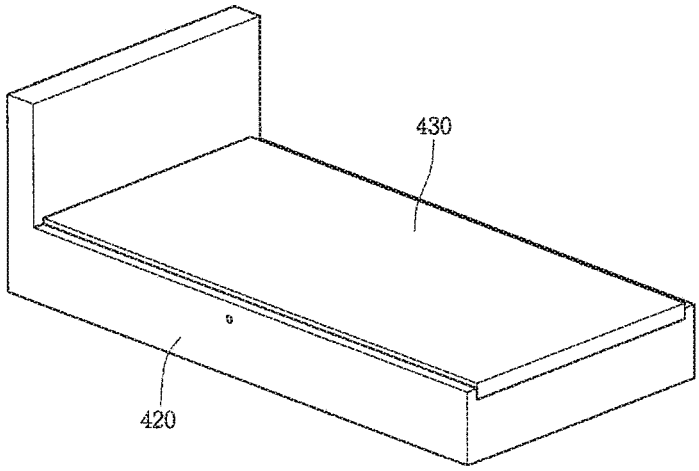



FIG. 24

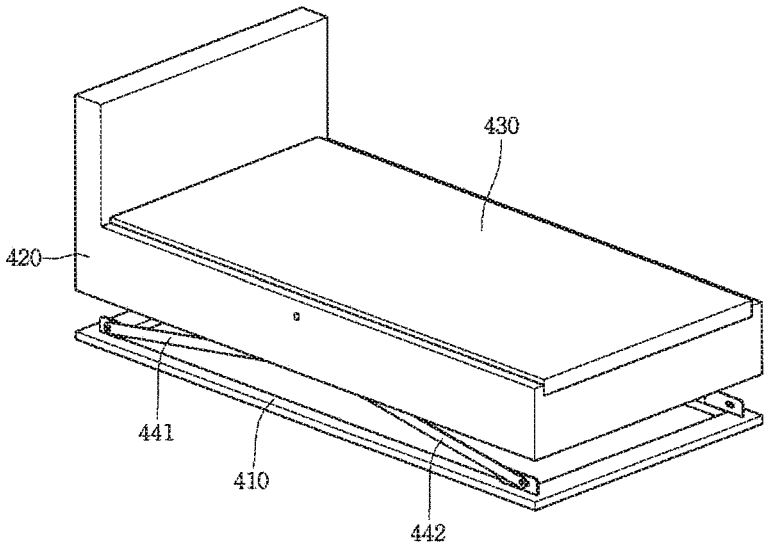
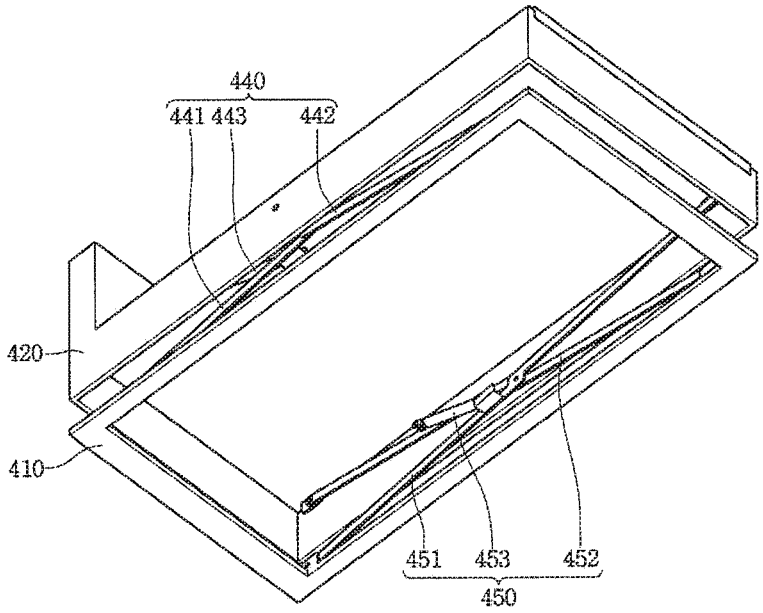


FIG. 25



# HEIGHT-ADJUSTABLE BED

## TECHNICAL FIELD

**[0001]** The present disclosure relates to a height-adjustable bed.

## BACKGROUND ART

**[0002]** In general, homes are equipped with beds to help people comfortably sleep. In the related art, beds have fixed standard heights without a function for adjusting the angle or height of their mattresses.

**[0003]** Therefore, people frequently using beds at home to read books or watch movies in a posture of leaning their back on the headboard of a bed or lying on the bed may have health problems such as a herniated cervical disc or accumulated physically stress. In addition, although users having backache have to lift their lower bodies to some degree for deep sleep, normal beds do not have a function for users to lift their lower bodies, and thus users having backache may not have a good sleep.

**[0004]** In general, hospital beds have a height-adjustment function for transfer of patients or the convenience of patients. However, such hospital beds are configured to be adjusted in mattress height using motors electrically connected thereto. Such electrically connected motor-equipped beds have the following problems.

**[0005]** First, since the mattress of a bed is vertically movable by a motor connected thereto, the supply of electricity is necessary.

**[0006]** That is, an additional external power supply is necessary to supply power, and electricity may be wasted while current flows for supplying electricity.

**[0007]** Secondly, since a motor and a circuit for connection with a power supply source are necessary for constituting a bed, bed manufacturing processes may be complex, and manufacturing costs may high. In addition, selling prices of beds may increase.

**[0008]** The above-described background art is technical information that the inventors had or learned when or while inventing the present invention and may not be publicly known before the filing of the present patent application.

## DESCRIPTION OF EMBODIMENTS

### Technical Problem

**[0009]** The present disclosure is provided to improve the above-described problems.

### Solution to Problem

**[0010]** According to an embodiment of the present disclosure, a height-adjustable bed includes: a base; a support frame placed on an upper surface of the base; a mattress stably placed on an upper surface of the support frame; and a height adjusting device connected to the support frame and the base to adjust the height and tilt of the support frame, wherein the height adjusting device includes a gas spring or a spring lever to manually adjust the height of the support frame.

### Advantageous Effects of Disclosure

**[0011]** The height-adjustable bed of the embodiment of the present disclosure has the following effects.

**[0012]** First, the mattress of the height-adjustable bed may be moved upward and downward using the gas spring or spring lever without electricity.

**[0013]** Secondly, since electricity is not used, electricity is not wasted, and since only the gas spring and the spring lever are used, manufacturing costs may decrease and manufacturing processes may be simple.

**[0014]** Thirdly, since the manufacturing costs and manufacturing processes of the height-adjustable bed are low and simple, the height-adjustable bed may be mass produced with low costs.

## BRIEF DESCRIPTION OF DRAWINGS

**[0015]** FIG. **1** is a perspective view illustrating a bed according to an embodiment of the present disclosure.

**[0016]** FIG. **2** is a perspective view illustrating the bed of FIG. **1** without a mattress, the bed being adjustable in height.

**[0017]** FIG. **3** is a perspective view illustrating a height adjusting operation of the bed of FIG. **2**.

**[0018]** FIG. **4** is a perspective view illustrating a height adjusting operation of the bed of FIG. **1**.

**[0019]** FIG. **5** is a bottom perspective view illustrating a bottom side of the bed of FIG. **1**.

**[0020]** FIG. **6** is an enlarged view illustrating a portion A of FIG. **5**.

**[0021]** FIG. **7** is a bottom view illustrating the bottom side of the bed of FIG. **1**.

**[0022]** FIG. **8** is an enlarged view illustrating the portion A when a spring lever is manipulated for height adjustment.

**[0023]** FIGS. **9**A and **9**B are enlarged views illustrating the portion A from a rear end side of the bed during height adjustment.

**[0024]** FIG. **10** is a side view illustrating a gas spring of the bed of the embodiment of the present disclosure.

**[0025]** FIG. **11** is a side view illustrating the bed of the embodiment of the present disclosure when being used without a support frame.

**[0026]** FIG. **12** is a rear view illustrating the bed of FIG. **11**.

**[0027]** FIG. **13** is a perspective view illustrating the bed of FIG. **11**.

**[0028]** FIG. **14** is a side view illustrating a bed according to a second embodiment of the present disclosure.

**[0029]** FIG. **15** is a perspective view illustrating a bed according to a third embodiment of the present disclosure.

**[0030]** FIG. **16** is a perspective view illustrating a height adjusting operation of the bed of the third embodiment of the present disclosure.

**[0031]** FIG. **17** is a perspective view illustrating the bed of FIG. **13** with a mattress of the bed being transparently illustrated.

**[0032]** FIG. **18** is a side view illustrating the bed FIG. **13**.

**[0033]** FIG. **19** is an enlarged view illustrating a configuration of a lower support frame of the bed of FIG. **13**.

**[0034]** FIG. **20** is a perspective view illustrating a bed according to a fourth embodiment of the present disclosure.

**[0035]** FIG. **21** is a side view illustrating the bed of the fourth embodiment of the present disclosure.

**[0036]** FIG. **22** is a side view illustrating the bed of the fourth embodiment of the present disclosure when being used without a support frame.

**[0037]** FIG. **23** is a perspective view illustrating a height-adjustable bed according to a fifth embodiment of the present disclosure.

**[0038]** FIG. **24** is a perspective view illustrating a height adjusting operation of the height-adjustable bed of the fifth embodiment of the present disclosure.

**[0039]** FIG. **25** is a bottom perspective view illustrating the height-adjustable bed of the fifth embodiment of the present disclosure.

## MODE OF DISCLOSURE

**[0040]** Hereinafter, embodiments of the present disclosure will be described in detail with reference to the accompanying drawings. In the drawings, like reference numerals denote like elements, and overlapping descriptions thereof will be omitted. In the following description, terms ending with "module" and "unit" are used or interchangeably used only for ease of description, and it is not intended to distinguish meanings or functions with the terms. Moreover, in the following descriptions of embodiments, detailed descriptions related to well-known techniques may not be presented in order not to unnecessarily obscure subject matters of the embodiments of the present disclosure. In addition, the accompanying drawings are only for helping easy understanding of the embodiments of the present disclosure and are not for limiting the technical idea of the present disclosure, and it should be understood that modifications, equivalents, and replacements could be made without departing from the technical idea and scope of the present disclosure.

**[0041]** FIG. **1** is a perspective view illustrating a bed according to an embodiment of the present disclosure, and FIG. **2** is a perspective view illustrating the bed of FIG. **1** without a mattress, the bed being adjustable in height. FIG. **3** is a perspective view illustrating a height adjusting operation of the bed of FIG. **2**, FIG. **4** is a perspective view illustrating a height adjusting operation of the bed of FIG. **1**, and FIG. **5** is a bottom perspective view illustrating a bottom side of the bed of FIG. **1**. FIG. **6** is an enlarged view illustrating a portion A of FIG. **5**, FIG. **7** is a bottom view illustrating the bottom side of the bed of FIG. **1**, and FIG. **8** is an enlarged view illustrating the portion A in a height adjustment operation. FIGS. **9**A and **9**B are enlarged views illustrating the portion A from a rear end side of the bed during height adjustment, and FIG. **10** is a side view illustrating a gas spring of the bed of the embodiment of the present disclosure.

**[0042]** Referring to FIGS. **1** to **10**, the bed of the embodiment of the present disclosure may include a base **10**, a mattress **30** placed on an upper portion of the base **10**, a support frame **20** placed between the mattress **30** and the base **10** to support the mattress **30**, and a height adjusting device connecting the support frame **20** and the base **10** to each other and configured to adjust the height and tilt of the support frame **20** for adjusting the height and tilt of the mattress **30**.

**[0043]** The base **10** forms a lower portion of the bed, and a lower surface of the base **10** may be in contact with the ground or floor or may be spaced apart from the ground or floor by a given distance by a plurality of support legs formed on the lower surface of the base **10**. A headboard may be bent from an upper portion of the base **10** in a direction perpendicular to the ground such that a user may lean on the headboard.

**[0044]** The mattress **30** is formed of a mattress material used for general beds and provides a section on which a user may lie. In detail, the mattress **30** may include an upper mattress **31** placed at an upper position of an upper surface of the base **10**, a lower mattress **33** placed at a lower position of the upper surface of the base **10**, and an intermediate mattress **32** placed between the upper mattress **31** and the lower mattress **33**. The upper mattress **31**, the intermediate mattress **32**, and the lower mattress **33** may be separate from each other. When the height of the bed is not adjusted, the upper mattress **31**, the intermediate mattress **32**, and the lower mattress **33** may be arranged in parallel to each other like a single mattress. In addition, the base **10** may include an upper base supporting a lower surface of the upper mattress **31**, an intermediate base supporting the intermediate mattress **32**, and a lower base supporting the lower mattress **33**. The upper mattress **31**, the intermediate mattress **32**, and the lower mattress **33** will be described later in more detail.

**[0045]** The support frame **20** is placed between the mattress **30** and the base **10** to support a lower surface of the mattress **30** and may be adjusted in height when the height adjusting device (**41** and **71**) is manipulated. In detail, the support frame **20** may include: an upper support frame **21** supporting the lower surface of the upper mattress **31** and adjustable in tilt angle by the height adjusting device, an intermediate support frame supporting a lower surface of the intermediate mattress **32**, and a lower support frame **22** supporting a lower surface of the lower mattress **33** and adjustable in height by the height adjusting device. In addition, for ease of description, in the base **10**, the upper base is named as so because the upper support frame **21** is stable placed on the upper base, the intermediate base is named as so because the intermediate support frame is stably placed on the intermediate base, and the lower base is named as so because the lower support frame **22** is stably placed on the lower base.

**[0046]** The height adjusting device may include: an upper height adjusting device **42** connected to upper ends of the upper support frame **21** and the upper base to adjust the tilt of the upper support frame **21**; and a lower height adjusting device **71** connected to a lower surface of the lower support frame **22** to adjust the height of the lower support frame **22**.

**[0047]** In detail, the upper height adjusting device **42** may include an upper gas spring **42**. The upper gas spring **42** may include a cylinder **43** having a hollow tube shape and a piston rod **44** inserted into a hollow portion inside the cylinder **43**. In detail, the length of the upper gas spring **42** is variable as the piston rod **44** vertically reciprocates with respect to the cylinder **43**. That is, gas is injected into the cylinder **43**, and the position of the piston rod **44** is varied by pressure applied from the gas to the piston rod **44**. A gas opening/closing pin **46** for selectively opening or closing internal gas and an opening/closing guide **45** for operating the gas opening/closing pin **46** may be provided on an upper side of the piston rod **44**, and an end of an upper cable **47** may be connected to the opening/closing guide **45**. Therefore, when the upper cable **47** is pulled, gas filled in the upper gas spring **42** may be moved, and thus the piston rod **44** may be vertically moved by pressure of the gas. In addition, when force pulling the upper cable **47** is removed, the position of the piston rod **44** is fixed.

**[0048]** In the present disclosure, an upper button portion **35** is connected to the other end of the upper cable **47**, and as the upper button portion **35** is manipulated, the upper cable **47** may be pulled for length adjustment. However, any length adjusting configuration using the pressure of a gas or

fluid may be applied to the bed of the embodiment of the present disclosure. That is, a hydraulic cylinder or a pneumatic cylinder having a length variable using the pressure of a fluid or air may be used instead of the upper gas spring **42**. Therefore, a detailed description of the upper gas spring **42** will be omitted. The following description will be given for the case in which the upper height adjusting device is the upper gas spring.

**[0049]** Both end portions of an upper coupling shaft **23** are coupled to both lateral surfaces of the upper support frame **21**. A first fixed portion **24** to which an end portion of the upper gas spring **42** is rotatably hinged is formed on the upper coupling shaft **23**. In addition, a second fixed portion **25** to which the other end portion of the upper gas spring **42** is rotatably coupled is formed on an upper end of the upper base.

**[0050]** The first fixed portion **24** may include: a first fixed portion body **24***a* fixed at a middle position of the upper coupling shaft **23**; and a first fixed portion extension **24***b* extending downward from a side of the first fixed portion body **24***a* and including a shaft penetrating the end portion of the upper gas spring **42**.

**[0051]** In addition, the second fixed portion **25** may include: a second fixed portion body **25***a* coupled to a center position of the upper end of the upper base; and a second fixed portion extension **25***b* extending downward from a side of the second fixed portion body **25***a* and including a shaft penetrating the other end portion of the upper gas spring **42**.

**[0052]** In addition, the upper button portion **35** may be attached to a portion of a lateral surface of the upper base for adjusting tension of the upper cable **47** connected to the upper gas spring **42**. In detail, the other end of the upper cable **47** is connected to the upper button portion **35**, and thus if a user pushes the upper button portion **35**, the upper cable **47** is pulled. Thereafter, if the user applies forward force to the upper support frame **21** while pushing the upper button portion **35**, the upper support frame **21** may be rotated forward and stood, and if the upper button portion **35** is released from the pushed state, the upper support frame **21** may be fixed in a state in which the upper support frame **21** is stood at a certain angle. In addition, if the user applies downward force to the upper support frame **21** while pushing the upper button portion **35**, the upper support frame **21** may be returned to an original position thereof.

**[0053]** The lower height adjusting device may include a plurality of connecting members **51** and **52** and height adjusting units **71** to vary the height of the lower support frame **21** and thus to move the lower mattress **33** relative to the lower base. The plurality of connecting members **51** and **52** may be provided respectively on both sides between the lower support frame **21** and the lower base.

**[0054]** More specifically, the plurality of connecting members **51** and **52** may include first connecting members **52** extending from a lower surface of a rear side of the lower support frame **22** toward a lower surface of a front side of the lower base, and second connecting members **51** extending from a lower surface of a front side of the lower support frame **22** toward a lower surface of a rear side of the lower base. The first connecting members **52** and the second connecting members **51** may cross each other between the lower support frame **22** and the lower base and may approximately form an 'X' shape when viewed from a side. To this end, central portions of the first connecting members **52** and the second connecting members **51** may be hinged to each other. In this case, the first and second connecting members **52** and **51** have the same length. If the first and second connecting members **52** and **51** have different lengths, the lower support frame **22** may not be vertically moved in a horizontal posture, but may be vertically reciprocated in a state in which the lower support frame **22** is inclined at an angle.

**[0055]** Ends of the first connecting members **52** are coupled to first coupling portions **26** provided on the lower surface of the front side of the lower support frame **22**, and the other ends of the first connecting members **52** are coupled to first movement frames **28** provided on the lower surface of the rear side of the lower base. The first coupling portions **26** and the first movement frames **28** may be provided on both sides of the lower surface of the lower support frame **22** and both sides of the lower surface of the lower base according to the number of first connecting members **52**.

**[0056]** The first coupling portions **26** include: first horizontal portions having lower surfaces coupled to the lower surface of the front side of the lower support frame **22** using screws or links; and first vertical portions extending downward from sides of the first horizontal portions and coupled to the ends of the first connecting members **52**. The ends of the first connecting members **52** may be rotatably hinged to lateral surfaces of the first vertical portions. That is, the ends of the first connecting members **52** are rotatably coupled to the first vertical portions using hinge pins inserted through the first connecting members **52** and the first vertical portions.

**[0057]** The first movement frames **28** are provided respectively on both sides of the lower surface on the rear side of the lower base. The first movement frames **28** may include: first upper surface portions **28***a* having upper surfaces coupled to the lower surface of the lower base; and first lateral surface portions **28***b* extending downward from sides of the first upper surface portions **28***a*, wherein movement openings **28***c* extend in the first lateral surface portions **28***b* in forward and backward directions. First protrusions are formed on the other ends of the first connecting members **52** so as to be inserted into the movement openings **28***c* and slide in the forward and backward directions along inner surfaces extending in the movement openings **28***c*, and to this end, the first protrusions may be hinged to the movement openings **28***c*.

**[0058]** When the first protrusions formed on the other ends of the first connecting members **52** slide in the forward and backward directions, the slope of the first connecting members **52** is varied, and thus the first coupling portions **26** connected to the ends of the first connecting members **52** are vertically moved such that the lower support frame **22** may be vertically reciprocated with respect to the lower base.

**[0059]** Ends of the second connecting members **51** are coupled to second coupling portions **27** provided on the lower surface of the front side of the lower base, and the other ends of the second connecting members **51** are coupled to second movement frames **29** provided on the lower surface of the rear side of the lower support frame **22**. The second coupling portions **27** and the second movement frames **29** may be provided on both sides of the lower surface of the base and both sides of the lower surface of the lower support frame **22** according to the number of second connecting members **51**.

**[0060]** The second coupling portions **27** include: second horizontal portions having lower surfaces coupled to the lower surface of the front side of the lower base using screws or links; and second vertical portions extending downward from sides of the second horizontal portions and coupled to the ends of the second connecting members **51**. The ends of the second connecting members **51** may be rotatably hinged to lateral surfaces of the second vertical portions. That is, the ends of the second connecting members **51** are rotatably coupled to the second vertical portions using hinge pins inserted through the second connecting members **51** and the second vertical portions.

**[0061]** The second movement frames **29** are provided respectively on both sides of the lower surface on the rear side of the lower support frame **22**. The second movement frames **29** may include: second upper surface portions **29***a* having upper surfaces coupled to the lower surface of the lower support frame **22**; and second lateral surface portions **29***b* extending downward from sides of the second upper surface portions **29***a*, wherein movement openings **29***c* extend in the second lateral surface portions **29***b* in forward and backward directions. Second protrusions are formed on the other ends of the second connecting members **51** so as to be inserted into the movement openings **29***c* and slide in the forward and backward directions along inner surfaces extending in the movement openings **29***c*. The second protrusions may be inserted into the movement openings **29***b*.

**[0062]** The height adjusting units **71** may be connected to the second movement frames **29**. In detail, the height adjusting units **71** may be spring levers **71**. The spring levers **71** may include: movable portions **72** connected to the other ends of the second connecting members **51** and slidable forward and backward along the movement openings while surfaces of the movable portions **72** are brought into contact with or spaced apart from surfaces of the second lateral surface portions; friction portions **73** configured to limit movement of the movable portions **72** when surfaces of the friction portions **73** are brought into contact with the other surfaces of the movable portions **72**; fixed portions **74** having a plate shape and fixed at a distance from the friction portions **73**; elastically deformable springs **75** placed between the friction portions **73** and the fixed portions **74**; lower cables **76** fixed to the other surfaces of the friction portions **73**; and lever portions **77** connected to the lower cables **76** and configured to be moved to adjust tension of the lower cables **76**.

**[0063]** The surfaces of the movable portions **72** may be fixed to ends of the second protrusions formed on the other ends of the second connecting members **51**, and may have areas wider than the areas of the movement openings. In addition, when the second protrusions slide forward or backward in an extension direction of the movement openings, the movable portions **72** may also slide.

**[0064]** The friction portions **73** may reciprocate in directions toward and away from the other surfaces of the movable portions **72** to press or release the other surfaces of the movable portions **72** for limiting movement of the movable portions **72**. In detail, a plurality of protrusions may be formed on the surfaces of the friction portions **73**, and members such as rubber members capable of increasing friction may be coupled to the plurality of protrusions. When the surfaces **73** of the frictional portions press the other surfaces **72** of the movable portions, movement of the movable portions **72** is limited, and thus sliding of the second protrusions are limited, thereby fixing the second connecting members. Furthermore, in this case, a plurality of recesses corresponding to the plurality of protrusions may be formed in the other surfaces of the movable portions **72**.

**[0065]** The fixed portions **74** are fixed to portions of lateral surfaces of the second upper surface portions of the second movement frames **29**, and the springs **75** are fixed to surfaces of the fixed portions **74**, wherein cable insertion openings may be formed in the fixed portions **74** at positions corresponding to positions to which the springs **75** are fixed so as to receive ends of the lower cables **76**.

**[0066]** The springs **75** may be placed between the fixed portions **74** and the friction portions **73** with ends of the springs **75** being fixed to the surfaces of the fixed portions **74** and the other ends of the springs **75** being fixed to the surfaces of the fixed portions **74**, and may be compressed or extended according to the positions of the friction portions **73** varying with tension of the lower cables **76**. In detail, the springs **75** may be elastically deformed according to the distance between the fixed portions **74** and the friction portions **73**.

**[0067]** The ends of the lower cables **76** may be fixed to the other surfaces of the fixed portions **74**, and the other ends of the lower cables **76** may be fixed to the lever portions **77** so that the positions of the fixed portions **74** may be varied according to manipulation of the lever portions **77**. More specifically, when the lower cables **76** are pulled, the friction portions **73** may be spaced apart from the movable portions **72**, and when the lower cables **76** are released, the friction portions **73** may be brought into contact with the movable portions **72** and may limit movement of the movable portions **72**.

**[0068]** The lever portions **77** having a lever shape are respectively coupled to both sides of a rear end of the lower surface of the lower support frame **22** with ends of the lever portions **77** protruding backward from the rear end of the lower support frame **22**, and the other ends of the lower cables **76** are fixed to the other ends of the lever portions **77**, such that tension of the lower cables **76** may be adjusted according to movement of the lever shape of the lever portions **77**. In detail, if upward force is applied to the lever portions **77**, the lower cables **76** may be pulled, and if the force is removed, the lower cables **76** may be released.

**[0069]** The height adjusting units **72** may be provided on both sides of the lower surface of the lower support frame **22** according to the number of first connecting members **52** and second connecting members **51**.

**[0070]** In addition, lever recesses **14** may be formed respectively in both sides of the lower base corresponding to the positions of the lever portions **77** such that a user may easily manipulate the lever portions **77** through the lever recesses **14**.

**[0071]** Operations of the upper mattress **31** and the lower mattress **33** will now be described in detail.

**[0072]** When a user presses the upper button portion **35** to adjust the inclination of the upper mattress **31**, the upper cable **47** is pulled, and the opening/closing guide **45** operates the opening/closing pin **46**, such that gas filled in the upper cylinder **43** may be moved to move the piston rod **44** upward or downward, that is, the length of the gas spring **42** may be varied. That is, the piston rod **44** may move upward, and thus the length of the gas spring **42** may increase. In this case, if the user does not apply any force to the upper mattress **31** while pressing the upper button portion **35**, the upper

mattress **31** is rotated and erected. In order to lay the upper mattress **31** down, the length of the gas spring **42** may be varied to change the inclination of the upper mattress **31** by pressing an upper surface of the upper mattress **31**.

**[0073]** In order to adjust the height of the lower mattress **33**, when a user lifts the lower support frame **22** while pulling the lever portions **77** upward through the lever recesses **14** in a state in which the lower mattress **33** and the intermediate mattress **32** are parallel to each other, the lower cables **76** are pulled, and the friction portions **73** are separated from the movable portions **72**. In this state, the movable portions **72** are moved forward through the movement openings formed in the second movement frames **29**.

**[0074]** When the movable portions **72** are moved forward through the movement openings formed in the second movement frames **29**, the first connecting members **52** hinged to the second connecting members **51** are also moved forward through the movement openings formed in the first movement frames **28**, and the lower support frame **22** is separated upward from lower base owing to the forward movement of the first connecting members **52** and the second connecting members **51**. Accordingly, the lower mattress **33** stably placed on the lower support frame **22** is raised. When the user removes force applied to the lever portions **77** at a proper height, the lower cables **76** are returned to original lengths thereof, and the friction portions **73** press the movable portions **72**, thereby limiting movement of the movable portions **72** and stopping the first connecting members **52** and the second connecting members **51**.

**[0075]** In addition, when a user pushes the lower support frame **22** downward while pulling the lever portions **77** upward so as to lower the lower support frame **22**, the lower cables **76** are pulled, and the friction portions **73** are separated from the movable portions **72**. In this state, the movable portions **72** are moved backward through the movement openings formed in the second movement frames **29**.

**[0076]** When the movable portions **72** are moved backward through the movement openings formed in the second movement frames **29**, the first connecting members **52** hinged to the second connecting members **51** are also moved backward through the movement openings formed in the first movement frames **28**, and thus the lower support frame **22** is stably placed on the lower base owing to the backward movement of the first connecting members **52** and the second connecting members **51**. Thus, the lower mattress **33** stably placed on the lower support frame **22** is lowered.

**[0077]** FIG. **11** is a side view illustrating the bed of the embodiment of the present disclosure when used without the support frame **20**, FIG. **12** is a rear view illustrating the bed of FIG. **11**, and FIG. **13** is a perspective view illustrating the bed of FIG. **11**.

**[0078]** Referring to FIGS. **1** to **13**, the bed of the embodiment of the present disclosure may operate without the structure of the support frame **20**. In this case, when the support frame **20** is removed, the lower surface of the mattress **30** may serve as the support frame **20**. That is, the upper support frame **21**, the intermediate support frame, and the lower support frame **22** may be removed. In detail, when the upper support frame **21** is removed, the upper gas spring **42** may be coupled to the lower surface of the upper mattress **31**. More specifically, the first fixed portion **24** may be fixed to the lower surface of the upper mattress **31**, and the second fixed portion **25** may be coupled to the upper base **10**. In addition, an end of the upper gas spring **42** may be hinged to the first fixed portion **24**, and the other end of the upper gas spring **42** may be hinged to the second fixed portion **25**. In this case, a plate-shaped member for securely fixing the first fixed portion **24** may be fixed to the lower surface of the upper mattress **31**. However, the embodiment is not limited thereto. That is, the first fixed portion **24** may be directly fixed to the lower surface of the upper mattress **31**.

**[0079]** In addition, when the lower support frame **22** is removed, the first connecting members **52** and the second connecting members **51** may be connected to the lower surface of the lower mattress **33**. In detail, the first coupling portions **26** may be coupled to a lower surface of a front side of the lower mattress **33**, and the second movement frames **29** may be coupled to a lower surface of a rear side of the lower mattress **33**. Furthermore, to prevent the first coupling portions **26** and the second movement frames **29** from being exposed to the outside, upwardly-bent recesses may be formed in the lower surface of the lower mattress **33**, and the first coupling portions **26** and the second movement frames **29** may be fixed to the lower surface of the lower mattress **33** in a state in which the first coupling portions **26** and the second movement frames **29** are inserted in the upwardly-bent recesses.

**[0080]** That is, even when the support frame **20** is removed from the bed of the embodiment of the present disclosure, a user may adjust the tilt and height of the mattress **30** to obtain desired purposes and effects.

**[0081]** FIG. **14** is a side view illustrating a bed according to a second embodiment of the present disclosure.

**[0082]** The second embodiment of the present disclosure is the same as the first embodiment except for the configuration of a lower height adjusting device. Therefore, in the following description, only characteristic parts of the second embodiment will be described, and descriptions of the same parts as those in the first embodiment will be substituted with previous descriptions.

**[0083]** Referring to FIGS. **1** to **10** and **14**, the lower height adjusting device of the bed of the second embodiment of the present disclosure may include a plurality of connecting members **151** and **152** and height adjusting units. More specifically, the plurality of connecting members **151** and **152** may include first connecting members **151** extending from a lower surface of a front side of a lower support frame **122** toward a lower surface of a front side of a lower base, and second connecting members **152** extending from a lower surface of a rear side of the lower support frame **122** toward the lower surface of the front side of the lower base. In this case, the second connecting members **152** may be placed behind the first connecting members **151**. The first connecting members **151** and the second connecting members **152** do not cross each other between the lower support frame **122** and the lower base. That is, the first connecting members **151** and the second connecting members **152** do not overlap each other when viewed from a lateral side. That is, the first connecting members **151** and the second connecting members **152** are not coupled to each other.

**[0084]** Ends of the first connecting members **151** are hinged to first coupling portions **126** provided on the lower surface of the front side of the lower base, and the other ends of the first connecting members **151** are hinged to first movement frames **128** provided on the lower surface of the front side of the lower support frame **122**.

**[0085]** In addition, ends of the second connecting members **152** are hinged to second coupling portions **127** provided on rear ends of the first coupling portions **126**, and the other ends of the second connecting members **152** are hinged to second movement frames **129** provided on the lower surface of the rear side of the lower support frame **122**.

**[0086]** The first coupling portions **126** include: first horizontal portions having lower surfaces coupled to an upper surface of the front side of the lower base using screws or links; and first vertical portions extending downward from sides of the first horizontal portions and coupled to the ends of the first connecting members **151**. The ends of the first connecting members **151** are rotatably hinged to lateral surfaces of the first vertical portions. That is, the ends of the first connecting members **151** are rotatably coupled to the first vertical portions using hinge pins inserted through the first connecting members **151** and the first vertical portions.

**[0087]** The first movement frames **128** are provided respectively on both sides of the lower surface of the front side of the lower support frame **122**. The first movement frames **128** may include: first upper surface portions having upper surfaces coupled to the lower surface of the lower base; and first lateral surface portions extending downward from sides of the first upper surface portions, wherein movement openings extend in the first lateral surface portions in forward and backward directions. First protrusions may be formed on the other ends of the first connecting members **151** so as to be inserted into the movement openings of the first movement frames **128** and slide in the forward and backward directions along inner surfaces extending in the movement openings.

**[0088]** When the first protrusions formed on the other ends of the first connecting members **151** slide in the forward and backward directions, the slope of the first connecting members **151** is varied, and thus the lower support frame **122** may be vertically reciprocated with respect to the lower base.

**[0089]** Ends of the second connecting members **152** are coupled to the second coupling portions **127** provided behind the first coupling portions **126**, and the other ends of the second connecting members **152** are coupled to the second movement frames **152** provided on the lower surface of the rear side of the lower support frame **122**. The second coupling portions **127** and the second movement frames **129** may be provided on both sides of the lower surface of the base and both sides of the lower surface of the lower support frame **122** according to the number of second connecting members **152**.

**[0090]** The second coupling portions **127** include: second horizontal portions having lower surfaces that extend from rear ends of the first horizontal portions of the first coupling portions **126** and are coupled to the upper surface of the lower base using screws or links; and second vertical portions extending downward from sides of the second horizontal portions and coupled to the ends of the second connecting members **152**. The ends of the second connecting members **152** are rotatably hinged to lateral surfaces of the second vertical portions. That is, the ends of the second connecting members **152** are rotatably coupled to the second vertical portions using hinge pins inserted through the second connecting members **152** and the second vertical portions.

**[0091]** The second movement frames **129** are provided respectively on both sides of the lower surface of the rear side of the lower support frame **122**. The second movement frames **129** may include: second upper surface portions having upper surfaces coupled to the lower surface of the lower support frame **122**; and second lateral surface portions extending downward from sides of the second upper surface portions, wherein movement openings extend in the second lateral surface portions in the forward and backward directions. Second protrusions are formed on the other ends of the second connecting members **152** so as to be inserted into the movement openings of the second movement frames **129** and slide in the forward and backward directions along inner surfaces extending in the movement openings. The second protrusions may be inserted into the movement openings.

**[0092]** In addition, the first connecting members **151** and the second connecting members **152** may have different lengths because the first connecting members **151** and the second connecting members **152** do not cross each other. In detail, since the first connecting members **151** have a movable range shorter than that of the second connecting members **152**, the first connecting members **151** may be shorter than the second connecting members **152**.

**[0093]** The height adjusting units connected to the second movement frames **129** have the same configuration and operation as those described in the first embodiment, and thus descriptions thereof will be omitted.

**[0094]** That is, in the bed of the first embodiment of the present disclosure, the first connecting members **52** and the second connecting members **51** crossing each other are used to vertically reciprocate the lower support frame **22**. However, in the bed of the second embodiment of the present disclosure, the first connecting members **151** and the second connecting members **152** not crossing each other may be moved to vertically reciprocate the lower support frame **122**.

**[0095]** FIG. **15** is a perspective view illustrating a bed according to a third embodiment of the present disclosure, and FIG. **16** is a perspective view illustrating a height adjusting operation of the bed of the third embodiment of the present disclosure. FIG. **17** is a perspective view illustrating the bed of FIG. **16** with a mattress of the bed being transparently illustrated, FIG. **18** is a side view illustrating the bed FIG. **16**, and FIG. **19** is an enlarged view illustrating a configuration of a lower support frame of the bed of FIG. **16**.

**[0096]** The third embodiment of the present disclosure is the same as the first embodiment except for the configurations and operations of a lower support frame **222**, a lower mattress **233** and a lower height adjusting device. Therefore, in the following description, only characteristic parts of the third embodiment will be described, and descriptions of the same parts as those in the first embodiment will be substituted with previous descriptions and will not be repeated here.

**[0097]** Referring to FIGS. **15** to **19**, the lower support frame **222** of the bed of the third embodiment of the present disclosure may include: a first lower support frame **222***a* placed on an intermediate support frame; and a second lower support frame **222***b* rotatably hinged to both sides of a rear end of the first lower support frame **222***a*.

**[0098]** In addition, the lower mattress **233** may include: a first lower mattress **233***a* stably placed on the first lower support frame **222***a*; and a second lower mattress **233***b* bendable from the first lower mattress **233***a* and separate from the first lower mattress **233***a*, the second lower mattress **233***b* being stably placed on the second lower support frame **222***b*.

**[0099]** The lower height adjusting device may include a lower gas spring **278**, a lower coupling shaft **290**, a third fixed portion **291**, a fourth fixed portion, a plurality of connecting members **251** and **252**, and a lower button portion **235**.

**[0100]** The lower gas spring **278** has the same configuration and operation as the upper gas spring **42** of the bed of the first embodiment, and thus a repeated description thereof will be omitted.

**[0101]** Both end portions of the lower coupling shaft **290** are coupled to centers of both lateral surfaces of the second lower support frame **222***b*. The third fixed portion **291** to which an end portion of the lower gas spring **278** may be rotatably hinged is formed on a center portion of the lower coupling shaft **290**. In addition, the fourth fixed portion to which the other end portion of the lower gas spring **278** may be rotatably coupled is formed on a lower end of a lower base.

**[0102]** The third gas spring coupling portion **291** may include a third fixed portion body fixed to a center portion of the lower coupling shaft **290**, and a third fixed portion extension extending downward from a side of the third fixed portion body and including a shaft inserted through the end portion of the lower gas spring **278**.

**[0103]** In addition, the fourth gas spring coupling portion may include a fourth fixed portion body fixed to a center portion of a rear end of the lower base, and a fourth fixed portion extension extending downward from a side of the fourth fixed portion body and including a shaft inserted through the other end portion of the lower gas spring **278**.

**[0104]** The plurality of connecting members **251** and **252** may be coupled to lateral surfaces of the lower support frame **222** and inner lateral surfaces of the lower base. In detail, the plurality of connecting members **251** and **252** may include: first connecting members **251** having ends hinged to leading ends of lateral surfaces of the lower base and the other ends hinged to rear ends of lateral surfaces of the first lower support frame **222***a*, the first connecting members **251** being parallel to the lateral surfaces of the first lower support frame **222***a*; and second connecting members **252** having ends hinged to center portions of the lateral surfaces of the lower base and the other ends hinged to lateral surfaces of the second lower support frame **222***b*. The first connecting members **251** and the second connecting members **252** may be coupled to both the lateral surfaces of the lower base and the lateral surfaces of the lower support frame **222**. In addition, the first connecting members **251** and the second connecting members **252** may have the same length, and the first connecting members **251** and the second connecting members **252** may be spaced apart from each other in parallel to each other such that the first connecting members **251** and the second connecting members **252** may be equally moved at the same angle.

**[0105]** The lower button portion **235** is placed on a portion of a lateral surface of a base **210** and is connected to a lower cable of the lower gas spring **278** to adjust tension of the lower cable. The lower button portion **235** has the same structure and operation as those of the upper button portion **35** connected to the upper gas spring **42** of the first embodiment, and thus a repeated description thereof will be omitted.

**[0106]** When a user pushes the lower button portion **235**, the length of the lower gas spring **278** is increased by the lower cable. As the lower gas spring **278** is extended, the third fixed portion **291** is pushed upward, and thus the first lower support frame **222***a* and the second lower support frame **222***b* are lifted. In this case, since the first and second connecting members **251** and **252** have the same length, the first connecting members **251** and the second connecting members **252** are lifted at the same angle. Accordingly, the first lower support frame **222***a* connected to the first connecting members **251** may be lifted at the same angle as the angle of the first connecting members **251**, and the second lower support frame **222***b* connected to the rear end of the first lower support frame **222***a* may be lifted in parallel to the ground by the end portion of the lower gas spring **291** and the second connecting members **252**. After the second lower support frame **222***b* is lifted by a desired amount, if the lower button portion **235** is released from the pushed state, the first lower support frame **222***a* and the second lower support frame **222***b* are stopped and fixed. In this case, a user may place his/her thighs on the first lower mattress **233***a* stably placed on the first lower support frame **222***a* and his/her calves on the second lower mattress **233***b* stably placed on the second lower support frame **222***b*.

**[0107]** Furthermore, in this state, if the user pushes downward the first and second lower mattresses **233***a* and **233***b* with his/her lower body while pushing the lower button portion **235**, the first lower support frame **222***a* and the second lower support frame **222***b* are moved downward, and thus the first and second lower mattresses **233***a* and **233***b* are also moved downward to original positions thereof.

**[0108]** FIG. **20** is a perspective view illustrating a bed according to a fourth embodiment of the present disclosure, and FIG. **21** is a side view illustrating the bed of the fourth embodiment of the present disclosure.

**[0109]** The fourth embodiment of the present disclosure is the same as the first embodiment except for the configuration of a lower height adjusting device. Therefore, in the following description, only characteristic parts of the fourth embodiment will be described, and descriptions of the same parts as those in the first embodiment will be substituted with previous descriptions and will not be repeated here.

**[0110]** Referring to FIGS. **15** to **21**, the lower height adjusting device of the bed of the fourth embodiment of the present disclosure may include a plurality of connecting members **351** and **352** and a height adjusting unit **380**, and the height adjusting unit **380** may include at least one lower gas spring **380**.

**[0111]** The configuration of the at least one lower gas spring **380** is the same as the configuration of the upper gas spring **42** of the first embodiment except for coupling structures of both ends of the lower gas spring **380** which are described later.

**[0112]** The plurality of connecting members **351** and **352** are for moving a lower support frame **322** relative to a lower base and may be provided on both sides between the lower support frame **322** and the lower base.

**[0113]** More specifically, the plurality of connecting members **351** and **352** may include: first connecting members **352** extending from a lower surface of a front side of the lower support frame **322** toward a lower surface of a rear side of the lower base; and second connecting members **351** extending from a lower surface of a rear side of the lower support frame **322** toward a lower surface of a front side of the lower base. The first connecting members **352** and the second connecting members **351** may cross each other between the lower support frame **322** and the lower base and may

approximately form an 'X' shape when viewed from a side. To this end, central portions of the first connecting members **352** and the second connecting members **351** may be hinged to each other. In this case, the first and second connecting members **352** and **351** have the same length. If the first and second connecting members **352** and **351** have different lengths, the lower support frame **322** may not be vertically moved in a horizontal posture, but may be vertically reciprocated in a state in which the lower support frame **322** is inclined at an angle.

**[0114]** In addition, both end portions of a lower coupling shaft **353** are coupled to inner lateral surfaces of the second connecting members **351** formed on both sides of a lower mattress **333**. An end portion of the lower gas spring **380** may be rotatably hinged to the lower coupling shaft **353**. This will be described later.

**[0115]** Ends of the first connecting members **352** are coupled to first coupling portions **326** provided on the lower surface of the front side of the lower support frame **322**, and the other ends of the first connecting members **352** are coupled to first movement frames provided on the lower surface of the rear side of the lower base. The first coupling portions **326** and the first movement frames may be provided on both sides of the lower surface of the lower support frame **322** and both sides of the lower surface of the lower base according to the number of first connecting members **352**.

**[0116]** The first coupling portions **326** include: first horizontal portions having lower surfaces coupled to the lower surface of the front side of the lower support frame **322** using screws or links; and first vertical portions extending downward from sides of the first horizontal portions and coupled to the ends of the first connecting members **352**, wherein the ends of the first connecting members **352** may be rotatably hinged to lateral surfaces of the first vertical portions. That is, the ends of the first connecting members **352** may be rotatably coupled to the first vertical portions using hinge pins inserted through the first connecting members **352** and the first vertical portions.

**[0117]** The first movement frames have the same structure as that of the first movement frames **28** of the first embodiment and are provided respectively on both sides of the lower surface on the rear side of the lower base. The first movement frames may include: first upper surface portions having upper surfaces coupled to the lower surface of the lower base; and first lateral surface portions extending downward from sides of the first upper surface portions, wherein movement openings extend in the first lateral surface portions in forward and backward directions. First protrusions are formed on the other ends of the first connecting members **351** so as to be inserted into the movement openings of the first movement frames and slide in the forward and backward directions along inner surfaces extending in the movement openings. The first protrusions may be inserted into the movement openings of the first movement frames.

**[0118]** When the first protrusions formed on the other ends of the first connecting members **352** slide in the forward and backward directions, the slope of the first connecting members **352** are varied, and thus the first coupling portions **326** connected to the ends of the first connecting members **352** are vertically moved such that the lower support frame **322** may be vertically reciprocated with respect to the lower base.

**[0119]** Ends of the second connecting members **351** are coupled to second coupling portions provided on the lower surface of the front side of the lower base, and the other ends of the second connecting members **351** are coupled to second movement frames **329** provided on the lower surface of the rear side of the lower support frame **322**. The second coupling portions and the second movement frames **329** may be provided on both sides of the lower surface of the base and both sides of the lower surface of the lower support frame **322** according to the number of second connecting members **351**.

**[0120]** The second coupling portions have the same configuration as that of the second coupling portions **27** of the first embodiment. That is, the second coupling portions include: second horizontal portions having lower surfaces coupled to the lower surface of the front side of the lower base using screws or links; and second vertical portions extending downward from sides of the second horizontal portions and coupled to the ends of the second connecting members **351**. The ends of the second connecting members **351** are rotatably hinged to lateral surfaces of the second vertical portions. That is, the ends of the second connecting members **351** are rotatably coupled to the second vertical portions using hinge pins inserted through the second connecting members **351** and the second vertical portions.

**[0121]** The second movement frames **329** are provided respectively on both sides of the lower surface on the rear side of the lower support frame **322**. The second movement frames **329** may include: second upper surface portions having upper surfaces coupled to the lower surface of the lower support frame **322**; and second lateral surface portions extending downward from sides of the second upper surface portions, wherein movement openings extend in the second lateral surface portions in the forward and backward directions. Second protrusions are formed on the other ends of the second connecting members **351** so as to be inserted into the movement openings of the second movement frames **329** and slide in the forward and backward directions along inner surfaces extending in the movement openings. The second protrusions may be inserted into the movement openings formed in the second movement frames **329**.

**[0122]** In addition, an end of the at least one lower gas spring **380** may be rotatably hinged to the lower coupling shaft **353**, and the other end of the at least one lower gas spring **380** may be rotatably hinged to a front lower surface of the lower support frame **322**.

**[0123]** In addition, a lower button portion **336** may be connected to an end of a lower cable of the lower gas spring **380**. When a user presses the lower button portion **336**, tension of the lower cable may be adjusted to vary the length of the lower gas spring **380**.

**[0124]** For example, the lower cable may be long such that the lower cable may be hooked on button portion fixing tabs **337** provided on a lateral surface of the lower base. The button portion fixing tabs **337** may have a hook shape bent upward from the lateral surface of the lower base, and the lower cable may be placed on bent portions of the button portion fixing tabs **337** to place the lower button portion **336** on the lateral surface of the lower base.

**[0125]** When a user pushes the lower button portion **336**, the lower cable is pulled, and thus the length of the lower gas spring **380** may be increased. Then, as the first connecting members **352** and the second connecting members **351** slide in the movement openings formed in the first movement

frames and the second movement frames **329**, the lower support frame **322** is lifted from the lower base. That is, the lower mattress **333** placed on an upper portion of the lower support frame **322** is also lifted. In addition, if the user releases the lower button portion **336** at a certain height, the lower cable is released, and thus the length of the lower gas spring **380** is not varied but is fixed.

**[0126]** In this state, if the user pushes the lower mattress **333** downward while pushing the lower button portion **336**, the length of the lower gas cylinder **380** is decreased, and the lower support frame **322** is moved downward, thereby returning the lower mattress **322** to an original position thereof.

**[0127]** FIG. **22** is a side view illustrating the bed of the fourth embodiment of the present disclosure when used without a support frame.

**[0128]** Referring to FIGS. **15** to **22**, the bed of the fourth embodiment of the present disclosure may operate without the support frame **320**. In this case, when the support frame **320** is removed, a lower surface of a mattress **330** may serve as the support frame **320**. That is, an upper support frame **321**, an intermediate support frame, and the lower support frame **322** may be removed. In detail, when the upper support frame **321** is removed, an upper gas spring **342** may be coupled to a lower surface of an upper mattress **331**. More specifically, a first fixed portion **324** may be fixed to the lower surface of the upper mattress **331**, and a second fixed portion **325** may be coupled to an upper base **310**. In addition, an end of the upper gas spring **342** may be hinged to the first fixed portion **324**, and the other end of the upper gas spring **342** may be hinged to the second fixed portion **325**. In this case, a plate-shaped member for securely fixing the first fixed portion **324** may be fixed to the lower surface of the upper mattress **331**. However, the fourth embodiment is not limited thereto. That is, the first fixed portion **324** may be directly fixed to the lower surface of the upper mattress **331**.

**[0129]** In addition, when the lower support frame **322** is removed, the first connecting members **352** and the second connecting members **351** may be connected to a lower surface of the lower mattress **333**. In detail, the first coupling portions **326** may be coupled to a lower surface of a front side of the lower mattress **333**, and the second movement frames **329** may be coupled to a lower surface of a rear side of the lower mattress **333**. Furthermore, to prevent the first coupling portions **326** and the second movement frames **329** from being exposed to the outside, upwardly-bent recesses may be formed in the lower surface of the lower mattress **333**, and the first coupling portions **326** and the second movement frames **329** may be fixed to the lower surface of the lower mattress **333** in a state in which the first coupling portions **26** and the second movement frames **29** are inserted in the upwardly-bent recesses.

**[0130]** In addition, the end of the at least one lower gas spring **380** may be rotatably hinged to the lower coupling shaft **353**, and the other end of the at least one lower gas spring **380** may be rotatably hinged to a front lower surface of the lower mattress **333**.

**[0131]** That is, even when the support frame is removed from the bed of the embodiment of the present disclosure, a user may adjust the tilt and height of the mattress to obtain desired purposes and effects.

**[0132]** FIG. **23** is a perspective view illustrating a height-adjustable bed according to a fifth embodiment of the present disclosure, FIG. **24** is a perspective view illustrating a height adjusting operation of the height-adjustable bed of the fifth embodiment of the present disclosure, and FIG. **25** is a bottom perspective view illustrating the height-adjustable bed of the fifth embodiment of the present disclosure.

**[0133]** Referring to FIGS. **23** to **25**, the height-adjustable bed of the fifth embodiment of the present disclosure may include: a base **410**, a support frame **420** placed on an upper portion of the base **410**; a mattress **430** placed on an upper portion of the support frame **420**; and a height adjusting device placed between the base **410** and the support frame **420** to adjust the height of the mattress **430** with respect to the base **410**.

**[0134]** The height adjusting device may include a first height adjusting device **440** and a second height adjusting device **450** that are provided respectively on both sides of the base **410** and the support frame **420**.

**[0135]** In detail, the first height adjusting device **440** may be placed on sides of the base **410** and the support frame **420** and connected to the base **410** and the support frame **420**. In more detail, the first height adjusting device **440** may include: a first connecting frame **441** having a straight shape and configured to connect a front end portion of a side of the base **410** to a rear end portion of a side of the support frame **420**; and a second connecting frame **442** having a straight shape and configured to connect a rear end portion of the side of the base **410** to a front end portion of the side of the support frame **420**. In addition, the first connecting frame **441** and the second connecting frame **442** may be hinged to each other in an X-shape.

**[0136]** In addition, a first gas spring **443** may be placed between the first connecting frame **441** and the second connecting frame **442**. In detail, a rear end portion of the first gas spring **443** is connected to a center portion of the first connecting frame **441**, and a front end portion of the first gas spring **443** is connected to a portion of the second connecting frame **442** ahead of the center portion of the first connecting frame **441**, such that the first connecting frame **441** and the second connecting frame **442** may be operated according to extension of the first gas spring **443**.

**[0137]** The second height adjusting device **450** may be placed on the other sides of the base **410** and the support frame **420** and connected to the base **410** and the support frame **420**. In more detail, the second height adjusting device **450** may include: a third connecting frame **451** having a straight shape and configured to connect a front end portion of the other side of the base **410** to a rear end portion of the other side of the support frame **420**; and a fourth connecting frame **452** having a straight shape and configured to connect a rear end portion of the other side of the base **410** to a front end portion of the other side of the support frame **420**. In addition, the third connecting frame **451** and the fourth connecting frame **452** may be hinged to each other in an X-shape. In this case, the third connecting frame **451** and the fourth connecting frame **452** may face the first connecting frame **441** and the second connecting frame **442**.

**[0138]** In addition, a second gas spring **453** may be placed between the third connecting frame **451** and the fourth connecting frame **452**. In detail, a rear end portion of the second gas spring **453** is connected to a center portion of the third connecting frame **451**, and a front end portion of the second gas spring **453** is connected to a portion of the fourth connecting frame **452** ahead of the center portion of the third connecting frame **451**, such that the third connecting frame

451 and the fourth connecting frame 452 may be operated according to extension of the second gas spring 453.

[0139] In addition, the first gas spring 443 and the second gas spring 453 may be extended by the same amount, and the height of the mattress 430 stably placed on the support frame 420 may be adjusted with respect to the base 410 by hinge motions of the first, second, third, and fourth connecting frames 441, 442, 451, and 452 according to the extension of the first gas spring 443 and the second gas spring 453.

## INDUSTRIAL APPLICABILITY

[0140] The present disclosure relates to a height-adjustable bed.

1. A height-adjustable bed comprising:
- a base;
- a support frame placed on an upper surface of the base;
- a mattress stably placed on an upper surface of the support frame; and
- a height adjusting device connected to the support frame and the base to adjust a height and tilt of the support frame,
- wherein the height adjusting device comprises at least one gas spring or spring lever, and the height of the support frame is manually adjusted.

2. The height-adjustable bed of claim 1, wherein the mattress comprises an upper mattress and a lower mattress,
- the support frame comprises an upper support frame on which the upper mattress is stably placed and a lower support frame on which the lower mattress is stably placed,
- the base comprises an upper base on which the upper support frame is stably placed and a lower base on which the lower support frame is stably placed, and
- the height adjusting device comprises an upper height adjusting device comprising an upper gas spring configured to adjust a tilt of the upper support frame, and a lower height adjusting device comprising a lower gas spring or spring lever configured to adjust a height of the lower support frame.

3. The height-adjustable bed of claim 2, wherein both end portions of an upper coupling shaft are coupled to both lateral surfaces of the upper support frame,
- an end of the upper gas spring is hinged to the upper coupling shaft, and the other end of the upper gas spring is hinged to a front end of the base, and
- the tilt of the upper support frame is varied according to operation of the upper gas spring.

4. The height-adjustable bed of claim 3, wherein the upper coupling shaft comprises a first fixed portion rotatably coupled to the end of the upper gas spring, and
- the front end of the base comprises a second fixed portion to which the other end of the upper gas spring is rotatably coupled.

5. The height-adjustable bed of claim 4, further comprising an upper button portion placed on a lateral surface of the base and coupled to a cable of the upper gas spring to adjust tension of the cable when a user applies external force.

6. The height-adjustable bed of claim 2, wherein the lower height adjusting device comprises:
- a plurality of spring levers respectively placed on both sides of the lower support frame to adjust a height between the lower support frame and the lower base; and
- a plurality of connecting members connecting both sides of the lower support frame and the lower base to each other, at least one of the plurality of connecting members being coupled to the plurality of spring levers.

7. The height-adjustable bed of claim 6, wherein the plurality of connecting members comprise:
- first connecting members connecting both the sides of the lower support frame and the lower base to each other; and
- second connecting members connected to the plurality of spring levers and connecting both the sides of the lower support frame and the lower base.

8. The height-adjustable bed of claim 7, further comprising:
- first coupling portions provided on a lower surface of a front side of the lower support frame, ends of the first connecting members being hinged to the first coupling portions;
- first movement frames provided on a lower surface of a rear side of the lower base and comprising first movement openings to which the other ends of the first connecting members are coupled in a forward and backward slidable manner;
- second coupling portions provided on a lower surface of a front side of the lower base, ends of the second connecting members being hinged to the second coupling portions; and
- second movement frames provided on a lower surface of a rear side of the lower support frame and comprising second movement openings to which the other ends of the second connecting members are coupled in a forward and backward slidable manner,
- wherein the first connecting members and the second connecting members are connected to each other using rotation shafts.

9. The height-adjustable bed of claim 8, further comprising:
- first coupling portions provided on an upper surface of a front side of the lower base, ends of the first connecting members being hinged to the first coupling portions;
- first movement frames provided on a lower surface of a front side of the lower support frame and comprising first movement openings to which the other ends of the first connecting members are coupled in a forward and backward slidable manner;
- second coupling portions provided on rear ends of the first coupling portions, ends of the second connecting members being hinged to the second coupling portions; and
- second movement frames provided on a lower surface of a rear side of the lower support frame and comprising second movement openings to which the other ends of the second connecting members are coupled in a forward and backward slidable manner,
- wherein the first connecting members and the second connecting members are not coupled to each other.

10. The height-adjustable bed of claim 8, wherein protrusions are formed on the other ends of the second connecting members and inserted through the second movement openings to allow the second connecting members to slide forward and backward,
- the spring levers are connected to ends of the protrusions and are brought into contact with or spaced apart from the second movement frames, and

when the spring levers are in contact with the second movement frames, forward and backward sliding of the protrusions is limitable.

**11**. The height-adjustable bed of claim **10**, wherein the spring levers comprise:

movable portions connected to the ends of the protrusions inserted through the second movement openings and having surfaces capable of being brought into contact with or spaced apart from the second movement frames, the movable portions being movable as the protrusions slide;

friction portions having surfaces configured to press the other surfaces of the movable portions to limit movement of the movable portions by friction;

fixed portions spaced apart from the friction portions by a distance and fixed to the second movement frames, the fixed portions comprising cable insertion openings;

elastically deformable springs placed between the friction portions and the fixed portions;

cables inserted in the cable insertion openings and having ends fixed to the other surfaces of the friction portions; and

lever portions connected to the other ends of the cables and adjusting tension of the cables according to external force applied by a user,

wherein, when a user applies external force to the lever portions, the cables are pulled to compress the springs, and the friction portions release the movable portions to allow the protrusions to slide forward or backward.

**12**. The height-adjustable bed of claim **11**, wherein a plurality of protrusions are formed on the surfaces of the friction portions,

a plurality of recesses corresponding to shapes of the plurality of protrusions are formed in the other surfaces of the movable portions, and

when the surfaces of the fiction portions press the other surfaces of the movable portions, the plurality of protrusions are inserted into the plurality of recesses.

**13**. The height-adjustable bed of claim **2**, wherein the lower height adjusting device comprises:

a plurality of connecting members provided on both sides of the lower support frame to connect the lower support frame to the lower base; and

at least one lower gas spring placed between the lower support frame and the lower base to adjust the height of the lower support frame.

**14**. The height-adjustable bed of claim **13**, further comprising a lower button portion placed on a lateral surface of the base and coupled to a cable of the lower gas spring such that tension of the cable is adjusted when a user applies external force to the lower button portion.

**15**. The height-adjustable bed of claim **13**, wherein both end portions of a lower coupling shaft are coupled to both lateral surfaces of the lower support frame,

an end of the lower gas spring is hinged to the lower coupling shaft, and the other end of the lower gas spring is hinged to a rear end of the base, and

the height of the lower support frame is varied according to operation of the lower gas spring.

**16**. The height-adjustable bed of claim **15**, wherein the lower mattress comprises a first lower mattress and a second lower mattress placed on a rear end of the first lower mattress,

the lower support frame comprises a first lower support frame on which the first lower mattress is stably placed and a second lower support frame on which the second lower mattress is stably placed, the second lower support frame being rotatably hinged to both sides of a rear end of the first lower support frame, and

both the end portions of the lower coupling shaft are coupled to both lateral surfaces of the second lower support frame, and when the lower gas spring is extended, a height of the second lower support frame is adjusted in a state in which the second lower support frame is parallel to ground.

**17**. The height-adjustable bed of claim **16**, wherein the plurality of connecting members comprise:

a first connecting member having an end hinged to a lateral surface of the base and the other end hinged to a lateral surface of the first lower support frame; and

a second connecting member having an end hinged to the lateral surface of the base and the other end hinged to a lateral surface of the second lower support frame,

wherein the first and second connecting members are movable in parallel to each other.

**18**. The height-adjustable bed of claim **13**, wherein the plurality of connecting members comprise:

first connecting members connecting the lower support frame and the lower base to each other; and

second connecting members connected to the first connecting members through rotation shafts and connecting the lower support frame and the lower base to each other,

wherein the lower coupling shaft to which the lower gas spring is connected is placed between the second connecting members provided on both sides of the lower support frame.

**19**. The height-adjustable bed of claim **18**, further comprising:

first coupling portions provided on a lower surface of a front side of the lower support frame, ends of the first connecting members being hinged to the first coupling portions;

first movement frames provided on a lower surface of a rear side of the lower base and comprising first movement openings to which the other ends of the first connecting members are coupled in a forward and backward slidable manner;

second coupling portions provided on a lower surface of a front side of the lower base, ends of the second connecting members being hinged to the second coupling portions; and

second movement frames provided on a lower surface of a rear side of the lower support frame and comprising second movement openings to which the other ends of the second connecting members are coupled in a forward and backward slidable manner.

**20**. A height-adjustable bed comprising:

a base;

a mattress stably placed on an upper surface of the base; and

a height adjusting device connected to the base and the mattress to adjust a height and tilt of the mattress,

wherein the height adjusting device comprises at least one gas spring or spring lever, and the height and tilt of the mattress are manually adjusted.

**21**. The height-adjustable bed of claim **20**, wherein the mattress comprises an upper mattress and a lower mattress,

the base comprises an upper base on which the upper mattress is stably placed and a lower base on which the lower mattress is stably placed, and

the height adjusting device comprises an upper height adjusting device comprising an upper gas spring configured to adjust a tilt of the upper mattress, and a lower height adjusting device comprising a lower gas spring or spring lever configured to adjust a height of the lower mattress.

**22**. The height-adjustable bed of claim **1**, wherein the height adjusting device further comprises:

a first height adjusting device connected to sides of the base and the support frame to adjust a height and tilt of the mattress; and

a second height adjusting device connected to the other sides of the base and the support frame to adjust the height and tilt of the mattress,

wherein the first and second height adjusting devices are adjusted in height by gas springs.

**23**. The height-adjustable bed of claim **22**, wherein the first height adjusting device comprises:

a first connecting frame connecting a front end portion of a side of the base and a rear end portion of a side of the support frame to each other;

a second connecting frame connecting a rear end portion of the side of the base and a front end portion of the side of the support frame to each other; and

a first gas spring placed between the first connecting frame and the second connecting frame,

wherein the first and second connecting frames are connected to each other in an X-shape.

**24**. The height-adjustable bed of claim **23**, wherein the second height adjusting device comprises:

a third connecting frame connecting a front end portion of the other side of the base and a rear end portion of the other side of the support frame to each other;

a fourth connecting frame connecting a rear end portion of the other side of the base and a front end portion of the other side of the support frame to each other; and

a second gas spring placed between the third connecting frame and the fourth connecting frame,

wherein the third and fourth connecting frames are connected to each other in an X-shape.

**25**. The height-adjustable bed of claim **24**, wherein lengths of the first and second gas springs are extended by the same amount.

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