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(71) Applicant: **Nisco Co., Ltd.**
Rugao, Jiangsu (CN)

(72) Inventors:
- **WANG, Wei**
  Rugao, Jiangsu (CN)
- **SUN, Jian**
  Rugao, Jiangsu (CN)
- **XIE, Jian**
  Rugao, Jiangsu (CN)
- **YANG, Qiaoyan**
  Rugao, Jiangsu (CN)
- **SWEETING, Matthew Howard**
  Rugao, Jiangsu (CN)

(74) Representative: **Weickmann & Weickmann PartmbB**
Postfach 860 820
81635 München (DE)

(54) ADJUSTABLE BED SYSTEM HAVING FANS

(57) An adjustable bed system includes a frame structure (110), a back lifting assembly (120) and a leg lifting assembly (130) pivotally connected to the frame structure (110), platforms (33-36) having a plurality of openings, disposed on the frame structure (110) and operably coupled with the back and leg lifting assemblies (120, 130), a mattress (5) having a plurality of through holes and disposed on the platforms so that the plurality of through holes (6) is aligned with the plurality of openings, respectively, and a plurality of fans (4) installed in the plurality of openings of the platforms (33-36) such that each fan (4) is in communication with a respective through hole of the mattress (5) for operably moving air via said through hole into the mattress body and outputting the air from the top surface of the mattress (5). Positions of upper and lower portions of the mattress (5) are adjustable based on operations of the back and leg lifting assemblies (120, 130).

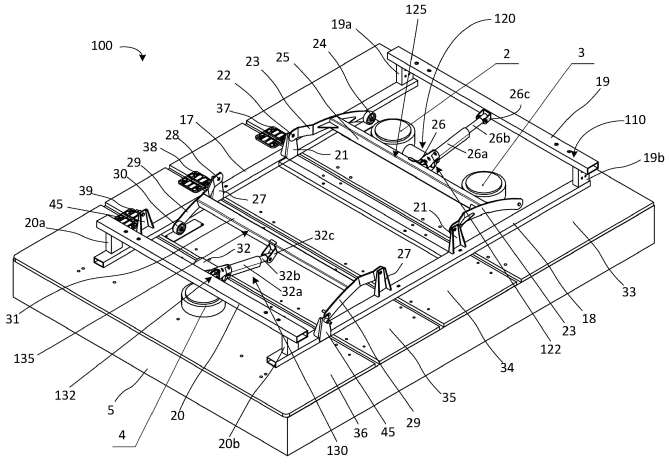


FIG. 1

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Description

CROSS-REFERENCE TO RELATED PATENT APPLICATION

[0001] This application claims priority to and the benefit of U.S. Provisional Patent Application Serial No. 62/790,583 filed January 10, 2019, which is incorporated herein in its entirety by reference.

FIELD OF THE INVENTION

[0002] The invention generally relates to a bed, and more particular to adjustable bed systems with fans.

BACKGROUND OF THE INVENTION

[0003] Sleep is critical for people in every aspect of their lives. Thus, it is beneficial and desirable for people to have a bedding system that is capable of adjusting body positions and bed temperature based on user's sleep preference, so that the user achieves maximum comfort during sleep.

SUMMARY OF THE INVENTION

[0004] In one aspect, the invention relates to an adjustable bed system. In one embodiment, the adjustable bed system includes a frame structure; a back lifting assembly; a leg lifting assembly; a mattress; and a plurality of fans.

[0005] The back lifting assembly comprises a back lifting bracket pivotally connected to the frame structure, and a back lifting actuator pivotally connected between the back lifting bracket and the frame structure for operably driving the back lifting bracket to pivotally move in an upward rotating direction or a downward rotating direction relative to the frame structure.

[0006] The leg lifting assembly comprises a leg lifting bracket pivotally connected to the frame structure, and a leg lifting actuator pivotally connected between the leg lifting bracket and the frame structure for operably driving the leg lifting bracket to pivotally move in an upward rotating direction or a downward rotating direction relative to the frame structure.

[0007] The mattress has a bottom surface, a top surface defining a sleeping surface, a mattress body defined between the bottom surface and the top surface, and a plurality of through holes defined in the mattress body. The mattress is disposed above the frame structure and coupled with the back lifting assembly and the leg lifting assembly such that a upper portion and a lower portion of the mattress are in relation to the back lifting assembly and the leg lifting assembly, respectively, and positions of the upper portion and the lower portion of the mattress are individually and/or coordinately adjustable in accordance with operations of the back lifting assembly and the leg lifting assembly.

[0008] The plurality of fans is coupled with the bottom surface of the mattress. Each fan of the plurality of fans is in communication with a respective through hole of the plurality of through holes of the mattress for operably moving air via said respective through hole into the mattress body and outputting the air from the top surface of the mattress.

[0009] In one embodiment, the frame structure comprises two side rails transversely spaced and longitudinally extended and being parallel to each other; an upper rail being perpendicular to the two side rails and having one end secured to an upper end of the side rail through a first vertical post and the other end secured to an upper end of the side rail through a second vertical post; and a lower rail being perpendicular to the two side rails and having one end secured to a lower end of the side rail through a third vertical post and the other end secured to a lower end of the side rail through a fourth vertical post.

[0010] In one embodiment, the back lifting bracket comprises a middle bar and a pair of swing arms. The pair of swing arms is transversely spaced and longitudinally extended, and rigidly connected to ends of the transversely extending middle bar in an H-shaped form, and each of the pair of swing arms has a first end portion and an opposite, second end portion. The first end portions of the pair of swing arms are pivotally connected to the two side rails of the frame structure, respectively.

[0011] In one embodiment, the back lifting actuator comprises a motor member, an outer tube extending from the motor member, and an activation rod having a first end portion received in the outer tube and an opposite, second end portion. The activation rod is engaged with the motor member and configured to be telescopically movable relative to said outer tube according to a direction of motor rotation.

[0012] In one embodiment, the motor member is pivotally connected to the middle bar of the back lifting bracket, and the second end portion of the activation rod pivotally connected to the upper rail of the frame structure. In another embodiment, the motor member is pivotally connected to the upper rail of the frame structure, and the second end portion of the activation rod pivotally connected to the middle bar of the back lifting bracket.

[0013] In one embodiment, the first end portion of each swing arm is pivotally connected to a vertical post of a respective one of the side rails of the frame structure through a pivot.

[0014] In one embodiment, the swing arms are in an arc-shaped design.

[0015] In one embodiment, the second end portion of at least one of the swing arms is equipped with a back lifting wheel.

[0016] In one embodiment, the leg lifting bracket comprises a middle bar and a pair of swing arms. The pair of swing arms is transversely spaced and longitudinally extended, and rigidly connected to ends of the transversely extending middle bar in an H-shaped form, and each of the pair of swing arms has a first end portion and an

opposite, second end portion. The first end portions of the pair of swing arms are pivotally connected to the two side rails of the frame structure, respectively.

[0017] In one embodiment, the leg lifting actuator comprises a motor member, an outer tube extending from the motor member, and an activation rod having a first end portion received in the outer tube and an opposite, second end portion. The activation rod is engaged with the motor member and configured to be telescopically movable relative to said outer tube according to a direction of motor rotation.

[0018] In one embodiment, the motor member is pivotally connected to the middle bar of the leg lifting bracket, and the second end portion of the activation rod pivotally connected to the lower rail of the frame structure. In another embodiment, the motor member is pivotally connected to the lower rail of the frame structure, and the second end portion of the activation rod pivotally connected to the middle bar of the leg lifting bracket.

[0019] In one embodiment, the first end portion of each swing arm is pivotally connected to a vertical post of a respective one of the side rails of the frame structure through a pivot.

[0020] In one embodiment, the second end portion of at least one of the swing arms is equipped with a leg lifting wheel.

[0021] In one embodiment, the adjustable bed system further includes a plurality of platforms hingedly connected to one another and disposed between the frame structures and the mattress. Positions of at least one or more of the plurality of platforms are adjustable in accordance with operations of the back lifting assembly and the leg lifting assembly.

[0022] In one embodiment, said at least one or more of the plurality of platforms have a plurality of openings that is operably aligned with the plurality of through holes of the mattress, respectively. The plurality of fans is mounted onto said at least one or more platforms such that each of the plurality of openings accommodates a respective fan of the plurality of fans.

[0023] In one embodiment, the plurality of platforms comprises a seat platform mounted on the two side rails of the frame structure; a back platform, a lower side of the back platform being hinged with an upper side of the seat platform through a first hinge, such that the back platform is rotatable about a rotating axis of the first hinge in a back platform forward direction or a back platform backward direction; a thigh platform, an upper side of the thigh platform being hinged with the lower side of the seat platform through a second hinge, such that the thigh platform is rotatable about a rotating axis of the second hinge in a thigh platform forward direction or a thigh platform backward direction; and a leg platform, an upper side of the leg platform being hinged with a lower side of the thigh platform through a third hinge, such that the leg platform is rotatable about a rotating axis of the third hinge.

[0024] In one embodiment, the back platform has two openings, and the leg platform has one opening.

[0025] In one embodiment, the adjustable bed system also includes a controller configured to control operations of the back lifting actuator, the leg lifting actuator and the plurality of fans, respectively, so as to lift individually or cooperatively the back platform, the thigh platform, and the leg platform in desired positions, and to provide air and/or air circulation. The air can be room temperature air, cooling air or heating air.

[0026] In another aspect, the invention relates to another adjustable bed system comprising a frame structure; a back lifting assembly comprising a back lifting bracket pivotally connected to the frame structure, and a back lifting actuator pivotally connected between the back lifting bracket and the frame structure for operably driving the back lifting bracket to pivotally move in an upward rotating direction or a downward rotating direction relative to the frame structure; a leg lifting assembly comprising a leg lifting bracket pivotally connected to the frame structure, and a leg lifting actuator pivotally connected between the leg lifting bracket and the frame structure for operably driving the leg lifting bracket to pivotally move in an upward rotating direction or a downward rotating direction relative to the frame structure; a plurality of platforms hingedly connected to one another and disposed on the frame structures and coupled to the back lifting assembly and the leg lifting assembly, such that positions of at least one or more of the plurality of platforms are adjustable in accordance with operations of the back lifting assembly and the leg lifting assembly. Said at least one or more of the plurality of platforms have a plurality of openings; and a plurality of fans mounted onto said at least one or more platforms such that each of the plurality of openings accommodates a respective fan of the plurality of fans. Each of the plurality of fans is adapted for operably providing air circulation in surrounding of the adjustable bed system. The provided air can be room temperature air, cooling air or heating air.

[0027] In one embodiment, the adjustable bed system further includes a mattress having a bottom surface, a top surface, a mattress body defined between the bottom surface and the top surface, and a plurality of through holes defined in the mattress body. The mattress is disposed on the plurality of platforms such that the plurality of through holes is aligned with the plurality of openings of said at least one or more of the plurality of platforms, a upper portion and a lower portion of the mattress are in relation to the back lifting assembly and the leg lifting assembly, respectively, and positions of the upper portion and the lower portion of the mattress are individually and/or coordinately adjustable in accordance with operations of the back lifting assembly and the leg lifting assembly, and each of the plurality of fans is in communication with a respective through hole of the plurality of through holes of the mattress for operably moving air via said respective through hole into the mattress body and outputting the air from the top surface of the mattress.

[0028] In one embodiment, the frame structure com-

prises two side rails transversely spaced and longitudinally extended and being parallel to each other; an upper rail being perpendicular to the two side rails and having one end secured to an upper end of the side rail through a first vertical post and the other end secured to an upper end of the side rail through a second vertical post; and a lower rail being perpendicular to the two side rails having one end secured to a lower end of the side rail through a third vertical post and the other end secured to a lower end of the side rail through a fourth vertical post. In one embodiment, the back lifting bracket comprises a middle bar and a pair of swing arms. The pair of swing arms is transversely spaced and longitudinally extended, and rigidly connected to ends of the transversely extending middle bar in an H-shaped form, and each of the pair of swing arms has a first end portion and an opposite, second end portion. The first end portions of the pair of swing arms are pivotally connected to the two side rails of the frame structure, respectively.

[0029] In one embodiment, the back lifting actuator comprises a motor member, an outer tube extending from the motor member, and an activation rod having a first end portion received in the outer tube and an opposite, second end portion. The activation rod is engaged with the motor member and configured to be telescopically movable relative to said outer tube according to a direction of motor rotation. In one embodiment, the motor member is pivotally connected to the middle bar of the back lifting bracket, and the second end portion of the activation rod pivotally connected to the upper rail of the frame structure. In another embodiment, the motor member is pivotally connected to the upper rail of the frame structure, and the second end portion of the activation rod pivotally connected to the middle bar of the back lifting bracket.

[0030] In one embodiment, the leg lifting bracket comprises a middle bar and a pair of swing arms. The pair of swing arms is transversely spaced and longitudinally extended, and rigidly connected to ends of the transversely extending middle bar in an H-shaped form, and each of the pair of swing arms has a first end portion and an opposite, second end portion. The first end portions of the pair of swing arms are pivotally connected to the two side rails of the frame structure, respectively.

[0031] In one embodiment, the leg lifting actuator comprises a motor member, an outer tube extending from the motor member, and an activation rod having a first end portion received in the outer tube and an opposite, second end portion. The activation rod is engaged with the motor member and configured to be telescopically movable relative to said outer tube according to a direction of motor rotation. In one embodiment, the motor member is pivotally connected to the middle bar of the leg lifting bracket, and the second end portion of the activation rod pivotally connected to the lower rail of the frame structure. In another embodiment, the motor member is pivotally connected to the lower rail of the frame structure, and the second end portion of the activation rod pivotally connected to the middle bar of the leg lifting bracket.

[0032] In one embodiment, the plurality of platforms comprises a seat platform mounted on the two side rails of the frame structure; a back platform, a lower side of the back platform being hinged with an upper side of the seat platform through a first hinge, such that the back platform is rotatable about a rotating axis of the first hinge in a back platform forward direction or a back platform backward direction; a thigh platform, an upper side of the thigh platform being hinged with the lower side of the seat platform through a second hinge, such that the thigh platform is rotatable about a rotating axis of the second hinge in a thigh platform forward direction or a thigh platform backward direction; and a leg platform, an upper side of the leg platform being hinged with a lower side of the thigh platform through a third hinge, such that the leg platform is rotatable about a rotating axis of the third hinge.

[0033] These and other aspects of the invention will become apparent from the following description of the preferred embodiment taken in conjunction with the following drawings, although variations and modifications therein may be affected without departing from the spirit and scope of the novel concepts of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] The accompanying drawings illustrate one or more embodiments of the invention and, together with the written description, serve to explain the principles of the invention. Wherever possible, the same reference numbers are used throughout the drawings to refer to the same or like elements of an embodiment.

FIG. 1 shows schematically a back perspective view of an adjustable bed system according to one embodiment of the invention.

FIG. 2 shows schematically a front perspective view of the adjustable bed system shown in FIG. 1.

FIG. 3 shows schematically a cross-sectional view of the adjustable bed system shown in FIG. 1.

FIG. 4 shows schematically another cross-sectional view of the adjustable bed system in a lift state shown in FIG. 1.

FIG. 5 shows schematically a front perspective view of the adjustable bed system in a lift state shown in FIG. 1.

FIG. 6 shows schematically a fan according to one embodiment of the invention.

FIG. 7 shows schematically a control system according to one embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0035] The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the

present invention are shown. The present invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like reference numerals refer to like elements throughout.

[0036] The terms used in this specification generally have their ordinary meanings in the art, within the context of the invention, and in the specific context where each term is used. Certain terms that are used to describe the invention are discussed below, or elsewhere in the specification, to provide additional guidance to the practitioner regarding the description of the invention. For convenience, certain terms may be highlighted, for example using italics and/or quotation marks. The use of highlighting and/or capital letters has no influence on the scope and meaning of a term; the scope and meaning of a term are the same, in the same context, whether or not it is highlighted and/or in capital letters. It will be appreciated that the same thing can be said in more than one way. Consequently, alternative language and synonyms may be used for any one or more of the terms discussed herein, nor is any special significance to be placed upon whether or not a term is elaborated or discussed herein. Synonyms for certain terms are provided. A recital of one or more synonyms does not exclude the use of other synonyms. The use of examples anywhere in this specification, including examples of any terms discussed herein, is illustrative only and in no way limits the scope and meaning of the invention or of any exemplified term. Likewise, the invention is not limited to various embodiments given in this specification.

[0037] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise.

[0038] It will be understood that when an element is referred to as being "on," "attached" to, "connected" to, "coupled" with, "contacting," etc., another element, it can be directly on, attached to, connected to, coupled with or contacting the other element or intervening elements may also be present. In contrast, when an element is referred to as being, for example, "directly on," "directly attached" to, "directly connected" to, "directly coupled" with or "directly contacting" another element, there are no intervening elements present. It will also be appreciated by those of skill in the art that references to a structure or feature that is disposed "adjacent" to another feature may have portions that overlap or underlie the adjacent feature.

[0039] It will be understood that, although the terms first, second, third, etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer or section from another element, component, region, layer or section. Thus, a first element, component, region, layer or section discussed below can be termed a second element, component, region, layer or section without departing from the teachings of the present invention.

[0040] Furthermore, relative terms, such as "lower" or "bottom" and "upper" or "top," may be used herein to describe one element's relationship to another element as illustrated in the figures. It will be understood that relative terms are intended to encompass different orientations of the device in addition to the orientation shown in the figures. For example, if the device in one of the figures is turned over, elements described as being on the "lower" side of other elements would then be oriented on the "upper" sides of the other elements. The exemplary term "lower" can, therefore, encompass both an orientation of lower and upper, depending on the particular orientation of the figure. Similarly, if the device in one of the figures is turned over, elements described as "below" or "beneath" other elements would then be oriented "above" the other elements. The exemplary terms "below" or "beneath" can, therefore, encompass both an orientation of above and below.

[0041] It will be further understood that the terms "comprise(s)" and/or "comprising," or "include(s)" and/or "including" or "has (have)" and/or "having" or "contain(s)" and/or "containing" when used in this specification specify the presence of stated features, regions, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, regions, integers, steps, operations, elements, components, and/or groups thereof.

[0042] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the present invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and the present disclosure, and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0043] As used herein, "around," "about," "substantially" or "approximately" shall generally mean within 20 percent, preferably within 10 percent, and more preferably within 5 percent of a given value or range. Numerical quantities given herein are approximate, meaning that the terms "around," "about," "substantially" or "approximately" can be inferred if not expressly stated.

[0044] As used in this specification, the phrase "at least one of A, B, and C" should be construed to mean a logical (A or B or C), using a non-exclusive logical OR. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

[0045] The description below is merely illustrative in

nature and is in no way intended to limit the invention, its application, or uses. The broad teachings of the invention can be implemented in a variety of forms. Therefore, while this invention includes particular examples, the true scope of the invention should not be so limited since other modifications will become apparent upon a study of the drawings, the specification, and the following claims. For purposes of clarity, the same reference numbers will be used in the drawings to identify similar elements. It should be understood that one or more steps within a method may be executed in different order (or concurrently) without altering the principles of the invention.

[0046] The description will be made as to the embodiments of the invention in conjunction with the accompanying drawings in FIGS. 1-7. In accordance with the purposes of this invention, as embodied and broadly described herein, this invention, in one aspect, relates to an adjustable bed system with fans.

[0047] Referring to FIGS. 1-7, and particularly to FIG. 1, the adjustable bed system 100 includes a frame structure 110, a back lifting assembly 120, a leg lifting assembly 130, a plurality of platforms 33-36, a mattress 5, and a plurality of fans 2-4.

[0048] The frame structure 110 comprises two side rails 17 and 18 transversely spaced and longitudinally extended and being parallel to each other; an upper rail 19 being perpendicular to the two side rails 17 and 18 and having one end secured, preferably by welding, to an upper end of the side rail 17 through a first vertical post 19a and the other end secured, preferably by welding, to an upper end of the side rail 18 through a second vertical post 19b; and a lower rail 20 being perpendicular to the two side rails 17 and 18 and having one end secured, preferably by welding, to a lower end of the side rail 17 through a third vertical post 20a and the other end secured, preferably by welding, to a lower end of the side rail 18 through a fourth vertical post 20b. In addition, the frame structure 110 also has a plurality of additional vertical posts 21, 27 and 45 spatial-apart secured, preferably by welding, to the side rails 17 and 18. In addition to the welding means, other securing/connecting means, such as screwing means, mating connections, etc., can also be utilized to practice the invention.

[0049] The back lifting assembly 120 comprises a back lifting bracket 125 pivotally connected to the frame structure 110, and a back lifting actuator 122 pivotally connected between the back lifting bracket 125 and the frame structure 110 for operably driving the back lifting bracket 125 to pivotally move in an upward rotating direction or a downward rotating direction relative to the frame structure 110.

[0050] The back lifting bracket 125 comprises a middle bar 25 and a pair of swing arms 23. The pair of swing arms 23 is transversely spaced and longitudinally extended, and rigidly connected to ends of the transversely extending middle bar 25 in an H-shaped form, and each of the pair of swing arms 23 has a first end portion and an opposite, second end portion. The first end portions of the pair of swing arms 23 are pivotally connected to the two side rails 17 and 18 of the frame structure 110, respectively. In one embodiment, the first end portion of each swing arm 23 is pivotally connected to the vertical post 21 of a respective one of the side rails 17 and 18 of the frame structure 110 through a pivot 22. The second end portion of at least one of the swing arms 23 is equipped with a back lifting wheel 24. In one embodiment, the swing arms 23 are in an arc-shaped design. Other designs of the swing arms 23 can also be utilized to practice the invention.

[0051] The back lifting actuator 122 comprises a motor member 26, an outer tube 26a extending from the motor member 26, and an activation rod 26b having a first end portion received in the outer tube 26a and an opposite, second end portion. The activation rod 26b is engaged with the motor member 26 and configured to be telescopically movable relative to said outer tube 26a according to a direction of motor rotation. In the exemplary embodiment shown in FIG. 1, the motor member 26 is pivotally connected to the middle bar 25 of the back lifting bracket 125, and the second end portion of the activation rod 26b pivotally connected to the upper rail 19 of the frame structure 110 through a bracket 26c mounted to the upper rail 19. In another embodiment, the motor member 26 is pivotally connected to the upper rail 19 of the frame structure 110, and the second end portion of the activation rod 26b pivotally connected to the middle bar 25 of the back lifting bracket 125.

[0052] The leg lifting assembly 130 comprises a leg lifting bracket 135 pivotally connected to the frame structure 110, and a leg lifting actuator 132 pivotally connected between the leg lifting bracket 135 and the frame structure 110 for operably driving the leg lifting bracket 135 to pivotally move in an upward rotating direction or a downward rotating direction relative to the frame structure 110.

[0053] The leg lifting bracket 135 comprises a middle bar 31 and a pair of swing arms 29. The pair of swing arms 29 is transversely spaced and longitudinally extended, and rigidly connected to ends of the transversely extending middle bar 31 in an H-shaped form, and each of the pair of swing arms 29 has a first end portion and an opposite, second end portion. The first end portions of the pair of swing arms 29 are pivotally connected to the two side rails 17 and 18 of the frame structure 110, respectively. In one embodiment, the first end portion of each swing arm 29 is pivotally connected to a vertical post 27 of a respective one of the side rails 17 and 18 of the frame structure 110 through a pivot 28. The second end portion of at least one of the swing arms 29 is equipped with a leg lifting wheel 30.

[0054] The leg lifting actuator 132 comprises a motor member 32, an outer tube 32a extending from the motor member 32, and an activation rod 32b having a first end portion received in the outer tube 32a and an opposite, second end portion. The activation rod 32b is engaged with the motor member 32 and configured to be telescopically movable relative to said outer tube 32a according

to a direction of motor rotation. In the exemplary embodiment shown in FIG. 1, the motor member 32 is pivotally connected to the lower rail 20 of the frame structure 110, and the second end portion of the activation rod 32b pivotally connected to the middle bar 31 of the leg lifting bracket 125 through a bracket 32c mounted to the middle bar 31. In another embodiment, the motor member 32 is pivotally connected to the middle bar 31 of the leg lifting bracket 125, and the second end portion of the activation rod 26b pivotally connected to the lower rail 20 of the frame structure 110.

[0055] In some embodiments, each of the motor members 26 and 32 includes a linear actuator.

[0056] The plurality of platforms 33-36 is hingedly connected to one another and disposed on the frame structures 110 and coupled to the back lifting assembly 120 and the leg lifting assembly 130, such that positions of at least one or more of the plurality of platforms 33-36 are adjustable in accordance with operations of the back lifting assembly 120 and the leg lifting assembly 130. In the exemplary embodiment shown in FIG. 1, the plurality of platforms 33-36 includes a back platform 33, a seat platform 34, a thigh platform 35 and a leg platform 36, arranged in sequence from the upper side (i.e., near the upper rail 20) to the lower side (i.e., near the lower rail 20) of the adjustable bed system 100. The seat platform 34 is mounted on the two side rails 17 and 18 and is fixed. The lower side of the back platform 33 is hinged with the upper side of the seat platform 34 through a first hinge 37. Thus the back platform 33 is capable of rotating about a rotating axis of the first hinge 37 in a back platform forward direction (i.e., from a laid back state to a lift state) or a back platform backward direction (i.e., from a lift state to a laid back state). The upper side of the thigh platform 35 is hinged with the lower side of the seat platform 34 through a second hinge 38. The thigh platform 35 is capable of rotating about a rotating axis of the second hinge 38 in a thigh platform forward direction (i.e., from a laid back state to a lift state) or a thigh platform backward direction (i.e., from a lift state to a laid back state). The upper side of the leg platform 36 is hinged with the lower side of the thigh platform 35 through a third hinge 39. The leg platform 36 is capable of rotating about a rotating axis of the third hinge 39.

[0057] In some embodiments, at least one or more of the plurality of platforms 33-36 have a plurality of openings. In the exemplary embodiment shown in FIG. 1, the back platform 33 has two openings, and the leg platform 36 has one opening. It should be noted that other arrangement of locations of the holes, fans 2-4 and through holes 6 can be employed. For instance, the first of the three holes is located at the back platform 33, the second of the three holes is located at the seat platform 34, and the third of the three holes is located at the leg platform 36. Different arrangements can be employed as desired.

[0058] The plurality of fans 2-4 is mounted onto the platforms 33-36 such that each of the plurality of openings accommodates a respective fan of the plurality of fans 2-4. Each of the plurality of fans 2-4 is adapted for operably providing air circulation in surrounding of the adjustable bed system. The air can be room temperature air, cooling air or heating air.

[0059] The mattress 5 has a bottom surface 5a, a top surface 5b defining a sleeping surface, a mattress body 5c defined between the bottom surface 5a and the top surface 5b, and a plurality of through holes 6 defined in the mattress body 5c (e.g., FIG. 3),. The mattress 5 is disposed on the plurality of platforms 33-36 such that the plurality of through holes 6 is aligned with the plurality of openings of the plurality of platforms 33-36, a upper portion and a lower portion of the mattress 5 are in relation to the back lifting assembly 120 and the leg lifting assembly 130, respectively, and positions of the upper portion and the lower portion of the mattress 5 are individually and/or coordinately adjustable in accordance with operations of the back lifting assembly 120 and the leg lifting assembly 130, and each of the plurality of fans 2-4 is in communication with a respective through hole of the plurality of through holes 6 of the mattress 5 for operably moving air via said respective through hole 6 into the mattress body and outputting the air from the top surface of the mattress 5.

[0060] The controlling system 150 in one embodiment shown in FIG. 7 includes a controller 10 configured to control operations of the back lifting actuator, the leg lifting actuator and the plurality of fans, respectively, so as to lift individually or cooperatively the back platform 33, the thigh platform 35, and the leg platform 36 in desired positions, and to provide air and/or circulation, which can be room temperature air, cooling air or heating air.

[0061] In one embodiment shown in FIG. 5, the adjustable bed system 100 also includes a pair of leg support tubes 47, each leg support tubes 47 having one end pivotally connected to the vertical posts 45 of the frame structure 110 through a pivot 46, and the other end pivotally connected to the leg platform 36. Operably, the pair of leg support tubes 47 support the leg platform 36 when the leg platform 36 is lifted after the thigh platform 35 is lifted.

[0062] In one embodiment shown in FIG. 6, each of the fans 2-4 may include a fan motor assembly 52, a first fan cover 51, a second fan cover 53 and a plurality of mounting members 54. The first fan cover 51 and the second fan cover 54 cover two sides of the fan motor assembly 52 for protection. The plurality of mounting members 54 mount the fan motor assembly 52, the first fan cover 51 and the second fan cover 53 to one of the back platform 33, the seat platform 34, the thigh platform 35 and the leg platform 36 (shown as a plate 50). In one embodiment, the plurality of mounting members 54 are four screws. Each of the fans 2-4 is configured such that in operation, air is flown from the rear side of said fan to the through holes 6 of the mattress 5, then spread through the mattress body 5c and output from the sleeping surface (i.e., the top surface) 5b of the mattress 5, as illustrated by arrows shown in FIGS. 3 and 4. The air can be

room temperature air, cooling air or heating air.

[0063] In one embodiment shown in FIG. 7, the control system 150 includes a control box 10, a power supply 9, a power cord 8, a plurality of connecting cables 13-14, LED lights 15 and USB ports 16. The control box 10 is powered by the power supply 9 which is in turn connected to any power source via the power cord 8. The fans 2-4, the back lifting motor member 26 and the leg lifting motor member 32 are connected to the control box 10 via the plurality of connection cables (e.g., the connecting cable 14). In this way, the user can adjust the bed position and air flow strength of each cooling fan system. Alternatively, LED lights 15 can be employed to indicate the working conditions of the fans 2-4, the back lifting motor 26 and the leg lifting motor 32. For example, when the cooling fan system 4 is working, one of the LED lights 15 is turned on and emits green light. The USB ports 16 are set for interfacing with the control box 10 by the user when needed.

[0064] The foregoing description of the exemplary embodiments of the invention has been presented only for the purposes of illustration and description and is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many modifications and variations are possible in light of the above teaching.

[0065] The embodiments were chosen and described in order to explain the principles of the invention and their practical application so as to enable others skilled in the art to utilize the invention and various embodiments and with various modifications as are suited to the particular use contemplated. Alternative embodiments will become apparent to those skilled in the art to which the invention pertains without departing from its spirit and scope. Accordingly, the scope of the invention is defined by the appended claims rather than the foregoing description and the exemplary embodiments described therein.

[0066] Herewith inter alia the following items are disclosed:

1. An adjustable bed system, comprising:

a frame structure (110);
a back lifting assembly (120) comprising a back lifting bracket (125) pivotally connected to the frame structure (110), and a back lifting actuator (122) pivotally connected between the back lifting bracket (125) and the frame structure (110) for operably driving the back lifting bracket (125) to pivotally move in an upward rotating direction or a downward rotating direction relative to the frame structure (110);
a leg lifting assembly (130) comprising a leg lifting bracket (135) pivotally connected to the frame structure (110), and a leg lifting actuator (132) pivotally connected between the leg lifting bracket (135) and the frame structure (110) for operably driving the leg lifting bracket (135) to pivotally move in an upward rotating direction or a downward rotating direction relative to the frame structure (110);
a mattress (5) having a bottom surface (5a), a top surface (5b) defining a sleeping surface, a mattress body (5c) defined between the bottom surface (5a) and the top surface (5b), and a plurality of through holes (6) defined in the mattress body (5c); wherein the mattress (5) is disposed above the frame structure (110) and coupled with the back lifting assembly (120) and the leg lifting assembly (130) such that a upper portion and a lower portion of the mattress (5) are in relation to the back lifting assembly (120) and the leg lifting assembly (130), respectively, and positions of the upper portion and the lower portion of the mattress (5) are individually and/or coordinately adjustable in accordance with operations of the back lifting assembly (120) and the leg lifting assembly (130); and
a plurality of fans (2)-(4) coupled with the bottom surface of the mattress (5), wherein each fan of the plurality of fans (2)-(4) is in communication with a respective through hole of the plurality of through holes (6) of the mattress (5) for operably moving air via said respective through hole (6) into the mattress body and outputting the air from the top surface of the mattress (5).

2. The adjustable bed system of item 1, further comprising a plurality of platforms (33)-(36) hingedly connected to one another and disposed between the frame structures (110) and the mattress (5), and wherein positions of at least one or more of the plurality of platforms (33)-(36) are adjustable in accordance with operations of the back lifting assembly (120) and the leg lifting assembly (130).

3. The adjustable bed system of item 2, wherein said at least one or more of the plurality of platforms (33)-(36) have a plurality of openings that is operably aligned with the plurality of through holes (6) of the mattress (5), respectively, and wherein the plurality of fans (2)-(4) is mounted onto said at least one or more platforms (33)-(36) such that each of the plurality of openings accommodates a respective fan of the plurality of fans (2)-(4).

4. An adjustable bed system, comprising:

a frame structure (110);
a back lifting assembly (120) comprising a back lifting bracket (125) pivotally connected to the frame structure (110), and a back lifting actuator (122) pivotally connected between the back lifting bracket (125) and the frame structure (110) for operably driving the back lifting bracket (125) to pivotally move in an upward rotating direction or a downward rotating direction relative to the

frame structure (110);
a leg lifting assembly (130) comprising a leg lifting bracket (135) pivotally connected to the frame structure (110), and a leg lifting actuator (132) pivotally connected between the leg lifting bracket (135) and the frame structure (110) for operably driving the leg lifting bracket (135) to pivotally move in an upward rotating direction or a downward rotating direction relative to the frame structure (110);
a plurality of platforms (33)-(36) hingedly connected to one another and disposed on the frame structures (110) and coupled to the back lifting assembly (120) and the leg lifting assembly (130), such that positions of at least one or more of the plurality of platforms (33)-(36) are adjustable in accordance with operations of the back lifting assembly (120) and the leg lifting assembly (130), and wherein said at least one or more of the plurality of platforms (33)-(36) have a plurality of openings; and
a plurality of fans (2)-(4) mounted onto said at least one or more platforms (33)-(36) such that each of the plurality of openings accommodates a respective fan of the plurality of fans (2)-(4), and wherein each of the plurality of fans (2)-(4) is adapted for operably providing air circulation in surrounding of the adjustable bed system.

5. The adjustable bed system of item 4, further comprising a mattress (5) having a bottom surface, a top surface, a mattress body defined between the bottom surface and the top surface, and a plurality of through holes (6) defined in the mattress body; wherein the mattress (5) is disposed on the plurality of platforms (33)-(36) such that the plurality of through holes (6) is aligned with the plurality of openings of said at least one or more of the plurality of platforms (33)-(36), a upper portion and a lower portion of the mattress (5) are in relation to the back lifting assembly (120) and the leg lifting assembly (130), respectively, and positions of the upper portion and the lower portion of the mattress (5) are individually and/or coordinately adjustable in accordance with operations of the back lifting assembly (120) and the leg lifting assembly (130), and each of the plurality of fans (2)-(4) is in communication with a respective through hole of the plurality of through holes (6) of the mattress (5) for operably moving air via said respective through hole (6) into the mattress body and outputting the air from the top surface of the mattress (5).

6. The adjustable bed system of any one of items 1 to 5, wherein the frame structure (110) comprises:

two side rails (17) and (18) transversely spaced and longitudinally extended and being parallel to each other;
an upper rail (19) being perpendicular to the two side rails (17) and (18) and having one end secured to an upper end of the side rail (17) through a first vertical post (19a) and the other end secured to an upper end of the side rail (18) through a second vertical post (19b); and
a lower rail (20) being perpendicular to the two side rails (17) and (18) and having one end secured to a lower end of the side rail (17) through a third vertical post (20a) and the other end secured to a lower end of the side rail (18) through a fourth vertical post (20b).

7. The adjustable bed system of item 6, wherein

the back lifting bracket (125) comprises a middle bar (25) and a pair of swing arms (23), wherein the pair of swing arms (23) is transversely spaced and longitudinally extended, and rigidly connected to ends of the transversely extending middle bar (25) in an H-shaped form, and each of the pair of swing arms (23) has a first end portion and an opposite, second end portion, wherein the first end portions of the pair of swing arms (23) are pivotally connected to the two side rails (17) and (18) of the frame structure (110), respectively; and
the back lifting actuator (122) comprises a motor member (26), an outer tube (26a) extending from the motor member (26), and an activation rod (26b) having a first end portion received in the outer tube (26a) and an opposite, second end portion, wherein the activation rod (26b) is engaged with the motor member (26) and configured to be telescopically movable relative to said outer tube (26a) according to a direction of motor rotation, wherein the motor member (26) is pivotally connected to the middle bar (25) of the back lifting bracket (125), and the second end portion of the activation rod (26b) pivotally connected to the upper rail (19) of the frame structure (110), or wherein the motor member (26) is pivotally connected to the upper rail (19) of the frame structure (110), and the second end portion of the activation rod (26b) pivotally connected to the middle bar (25) of the back lifting bracket (125).

8. The adjustable bed system of item 7, wherein the first end portion of each swing arm (23) is pivotally connected to a vertical post (21) of a respective one of the side rails (17) and (18) of the frame structure (110) through a pivot (22).

9. The adjustable bed system of item 7 or 8, wherein the second end portion of at least one of the swing arms (23) is equipped with a back lifting wheel (24).

10. The adjustable bed system of any one of items 6 to 9, wherein

the leg lifting bracket (135) comprises a middle bar (31) and a pair of swing arms (29), wherein the pair of swing arms (29) is transversely spaced and longitudinally extended, and rigidly connected to ends of the transversely extending middle bar (31) in an H-shaped form, and each of the pair of swing arms (29) has a first end portion and an opposite, second end portion, wherein the first end portions of the pair of swing arms (29) are pivotally connected to the two side rails (17) and (18) of the frame structure (110), respectively; and
the leg lifting actuator (132) comprises a motor member (32), an outer tube (32a) extending from the motor member (32), and an activation rod (32b) having a first end portion received in the outer tube (32a) and an opposite, second end portion, wherein the activation rod (32b) is engaged with the motor member (32) and configured to be telescopically movable relative to said outer tube (32a) according to a direction of motor rotation, wherein the motor member (32) is pivotally connected to the middle bar (31) of the leg lifting bracket (125), and the second end portion of the activation rod (26b) pivotally connected to the lower rail (20) of the frame structure (110), or wherein the motor member (32) is pivotally connected to the lower rail (20) of the frame structure (110), and the second end portion of the activation rod (32b) pivotally connected to the middle bar (31) of the leg lifting bracket (125).

11. The adjustable bed system of item 10, wherein the first end portion of each swing arm (29) is pivotally connected to a vertical post (27) of a respective one of the side rails (17) and (18) of the frame structure (110) through a pivot (28).

12. The adjustable bed system of item 10 or 11, wherein the second end portion of at least one of the swing arms (29) is equipped with a leg lifting wheel 30.

13. The adjustable bed system of any one of items 1 to 12, in any case according to item 2 or 4, wherein the plurality of platforms comprises

a seat platform (34) mounted on the two side rails (17) and (18) of the frame structure (110);
a back platform (33), a lower side of the back platform (33) being hinged with an upper side of the seat platform (34) through a first hinge (37), such that the back platform (33) is rotatable about a rotating axis of the first hinge (37) in a back platform forward direction or a back platform backward direction;
a thigh platform (35), an upper side of the thigh platform (35) being hinged with the lower side of the seat platform (34) through a second hinge (38), such that the thigh platform (35) is rotatable about a rotating axis of the second hinge (38) in a thigh platform forward direction or a thigh platform backward direction; and
a leg platform (36), an upper side of the leg platform (36) being hinged with a lower side of the thigh platform (35) through a third hinge (39), such that the leg platform (36) is rotatable about a rotating axis of the third hinge (39).

14. The adjustable bed system of any one of items 1 to 13, further comprising a controller (10) configured to control operations of the back lifting actuator (122), the leg lifting actuator (132) and the plurality of fans (2)-(4), respectively.

15. An adjustable bed system including a frame structure, a back lifting assembly and a leg lifting assembly pivotally connected to the frame structure, platforms having a plurality of openings, disposed on the frame structure and operably coupled with the back and leg lifting assemblies, a mattress having a plurality of through holes and disposed on the platforms so that the plurality of through holes is aligned with the plurality of openings, respectively, and a plurality of fans installed in the plurality of openings of the platforms such that each fan is in communication with a respective through hole of the mattress for operably moving air via said through hole into the mattress body and outputting the air from the top surface of the mattress, wherein positions of upper and lower portions of the mattress are adjustable based on operations of the back and assemblies.

Claims

1. An adjustable bed system, comprising:

a frame structure (110);
a back lifting assembly (120) comprising a back lifting bracket (125) pivotally connected to the frame structure (110), and a back lifting actuator (122) pivotally connected between the back lifting bracket (125) and the frame structure (110) for operably driving the back lifting bracket (125) to pivotally move in an upward rotating direction or a downward rotating direction relative to the frame structure (110);
a leg lifting assembly (130) comprising a leg lifting bracket (135) pivotally connected to the frame structure (110), and a leg lifting actuator (132) pivotally connected between the leg lifting

bracket (135) and the frame structure (110) for operably driving the leg lifting bracket (135) to pivotally move in an upward rotating direction or a downward rotating direction relative to the frame structure (110);
a plurality of fans (2)-(4) coupled or adapted to be coupled with the bottom surface of a mattress (5) or/and adapted for operably providing air circulation in surrounding of the adjustable bed system.

2. The adjustable bed system of claim 1, further comprising

a mattress (5) having a bottom surface (5a), a top surface (5b) defining a sleeping surface, a mattress body (5c) defined between the bottom surface (5a) and the top surface (5b), and a plurality of through holes (6) defined in the mattress body (5c); wherein the mattress (5) is disposed above the frame structure (110) and coupled with the back lifting assembly (120) and the leg lifting assembly (130) such that a upper portion and a lower portion of the mattress (5) are in relation to the back lifting assembly (120) and the leg lifting assembly (130), respectively, and positions of the upper portion and the lower portion of the mattress (5) are individually and/or coordinately adjustable in accordance with operations of the back lifting assembly (120) and the leg lifting assembly (130);
wherein the plurality of fans (2)-(4) is coupled with the bottom surface of the mattress (5), wherein each fan of the plurality of fans (2)-(4) is in communication with a respective through hole of the plurality of through holes (6) of the mattress (5) for operably moving air via said respective through hole (6) into the mattress body and outputting the air from the top surface of the mattress (5).

3. The adjustable bed system of claim 1 or 2, further comprising a plurality of platforms (33)-(36) hingedly connected to one another and disposed between the frame structures (110) and the mattress (5), and wherein positions of at least one or more of the plurality of platforms (33)-(36) are adjustable in accordance with operations of the back lifting assembly (120) and the leg lifting assembly (130).

4. The adjustable bed system of claim 3, wherein said at least one or more of the plurality of platforms (33)-(36) have a plurality of openings that is operably aligned with the plurality of through holes (6) of the mattress (5), respectively, and wherein the plurality of fans (2)-(4) is mounted onto said at least one or more platforms (33)-(36) such that each of the plurality of openings accommodates a respective fan of the plurality of fans (2)-(4).

5. The adjustable bed system according to any one of claims 1 to 4, comprising:

a/the plurality of platforms (33)-(36) hingedly connected to one another and disposed on the frame structures (110) and coupled to the back lifting assembly (120) and the leg lifting assembly (130), such that positions of at least one or more of the plurality of platforms (33)-(36) are adjustable in accordance with operations of the back lifting assembly (120) and the leg lifting assembly (130), and wherein said at least one or more of the plurality of platforms (33)-(36) have a plurality of openings; and
wherein the plurality of fans (2)-(4) is mounted onto said at least one or more platforms (33)-(36) such that each of the plurality of openings accommodates a respective fan of the plurality of fans (2)-(4), and wherein each of the plurality of fans (2)-(4) is adapted for operably providing air circulation in surrounding of the adjustable bed system.

6. The adjustable bed system of claim 5, further comprising a/the mattress (5) having a bottom surface, a top surface, a mattress body defined between the bottom surface and the top surface, and a plurality of through holes (6) defined in the mattress body; wherein the mattress (5) is disposed on the plurality of platforms (33)-(36) such that the plurality of through holes (6) is aligned with the plurality of openings of said at least one or more of the plurality of platforms (33)-(36), a upper portion and a lower portion of the mattress (5) are in relation to the back lifting assembly (120) and the leg lifting assembly (130), respectively, and positions of the upper portion and the lower portion of the mattress (5) are individually and/or coordinately adjustable in accordance with operations of the back lifting assembly (120) and the leg lifting assembly (130), and each of the plurality of fans (2)-(4) is in communication with a respective through hole of the plurality of through holes (6) of the mattress (5) for operably moving air via said respective through hole (6) into the mattress body and outputting the air from the top surface of the mattress (5).

7. The adjustable bed system of any one of claims 1 to 6, wherein the frame structure (110) comprises:

two side rails (17) and (18) transversely spaced and longitudinally extended and being parallel to each other;
an upper rail (19) being perpendicular to the two side rails (17) and (18) and having one end secured to an upper end of the side rail (17) through

a first vertical post (19a) and the other end secured to an upper end of the side rail (18) through a second vertical post (19b); and
a lower rail (20) being perpendicular to the two side rails (17) and (18) and having one end secured to a lower end of the side rail (17) through a third vertical post (20a) and the other end secured to a lower end of the side rail (18) through a fourth vertical post (20b).

8. The adjustable bed system of claim 7, wherein

the back lifting bracket (125) comprises a middle bar (25) and a pair of swing arms (23), wherein the pair of swing arms (23) is transversely spaced and longitudinally extended, and rigidly connected to ends of the transversely extending middle bar (25) in an H-shaped form, and each of the pair of swing arms (23) has a first end portion and an opposite, second end portion, wherein the first end portions of the pair of swing arms (23) are pivotally connected to the two side rails (17) and (18) of the frame structure (110), respectively; and
the back lifting actuator (122) comprises a motor member (26), an outer tube (26a) extending from the motor member (26), and an activation rod (26b) having a first end portion received in the outer tube (26a) and an opposite, second end portion, wherein the activation rod (26b) is engaged with the motor member (26) and configured to be telescopically movable relative to said outer tube (26a) according to a direction of motor rotation, wherein the motor member (26) is pivotally connected to the middle bar (25) of the back lifting bracket (125), and the second end portion of the activation rod (26b) pivotally connected to the upper rail (19) of the frame structure (110), or wherein the motor member (26) is pivotally connected to the upper rail (19) of the frame structure (110), and the second end portion of the activation rod (26b) pivotally connected to the middle bar (25) of the back lifting bracket (125).

9. The adjustable bed system of claim 8, wherein the first end portion of each swing arm (23) is pivotally connected to a vertical post (21) of a respective one of the side rails (17) and (18) of the frame structure (110) through a pivot (22).

10. The adjustable bed system of claim 8 or 9, wherein the second end portion of at least one of the swing arms (23) is equipped with a back lifting wheel (24).

11. The adjustable bed system of any one of claims 7 to 10, wherein

the leg lifting bracket (135) comprises a middle bar (31) and a pair of swing arms (29), wherein the pair of swing arms (29) is transversely spaced and longitudinally extended, and rigidly connected to ends of the transversely extending middle bar (31) in an H-shaped form, and each of the pair of swing arms (29) has a first end portion and an opposite, second end portion, wherein the first end portions of the pair of swing arms (29) are pivotally connected to the two side rails (17) and (18) of the frame structure (110), respectively; and
the leg lifting actuator (132) comprises a motor member (32), an outer tube (32a) extending from the motor member (32), and an activation rod (32b) having a first end portion received in the outer tube (32a) and an opposite, second end portion, wherein the activation rod (32b) is engaged with the motor member (32) and configured to be telescopically movable relative to said outer tube (32a) according to a direction of motor rotation, wherein the motor member (32) is pivotally connected to the middle bar (31) of the leg lifting bracket (125), and the second end portion of the activation rod (26b) pivotally connected to the lower rail (20) of the frame structure (110), or wherein the motor member (32) is pivotally connected to the lower rail (20) of the frame structure (110), and the second end portion of the activation rod (32b) pivotally connected to the middle bar (31) of the leg lifting bracket (125).

12. The adjustable bed system of claim 11, wherein the first end portion of each swing arm (29) is pivotally connected to a vertical post (27) of a respective one of the side rails (17) and (18) of the frame structure (110) through a pivot (28).

13. The adjustable bed system of claim 11 or 12, wherein the second end portion of at least one of the swing arms (29) is equipped with a leg lifting wheel 30.

14. The adjustable bed system of any one of claims 1 to 14, in any case according to claim 3 or 5, wherein the plurality of platforms comprises

a seat platform (34) mounted on the two side rails (17) and (18) of the frame structure (110);
a back platform (33), a lower side of the back platform (33) being hinged with an upper side of the seat platform (34) through a first hinge (37), such that the back platform (33) is rotatable about a rotating axis of the first hinge (37) in a back platform forward direction or a back platform backward direction;
a thigh platform (35), an upper side of the thigh platform (35) being hinged with the lower side

of the seat platform (34) through a second hinge (38), such that the thigh platform (35) is rotatable about a rotating axis of the second hinge (38) in a thigh platform forward direction or a thigh platform backward direction; and
a leg platform (36), an upper side of the leg platform (36) being hinged with a lower side of the thigh platform (35) through a third hinge (39), such that the leg platform (36) is rotatable about a rotating axis of the third hinge (39).

15. The adjustable bed system of any one of claims 1 to 14, further comprising a controller (10) configured to control operations of the back lifting actuator (122), the leg lifting actuator (132) and the plurality of fans (2)-(4), respectively.

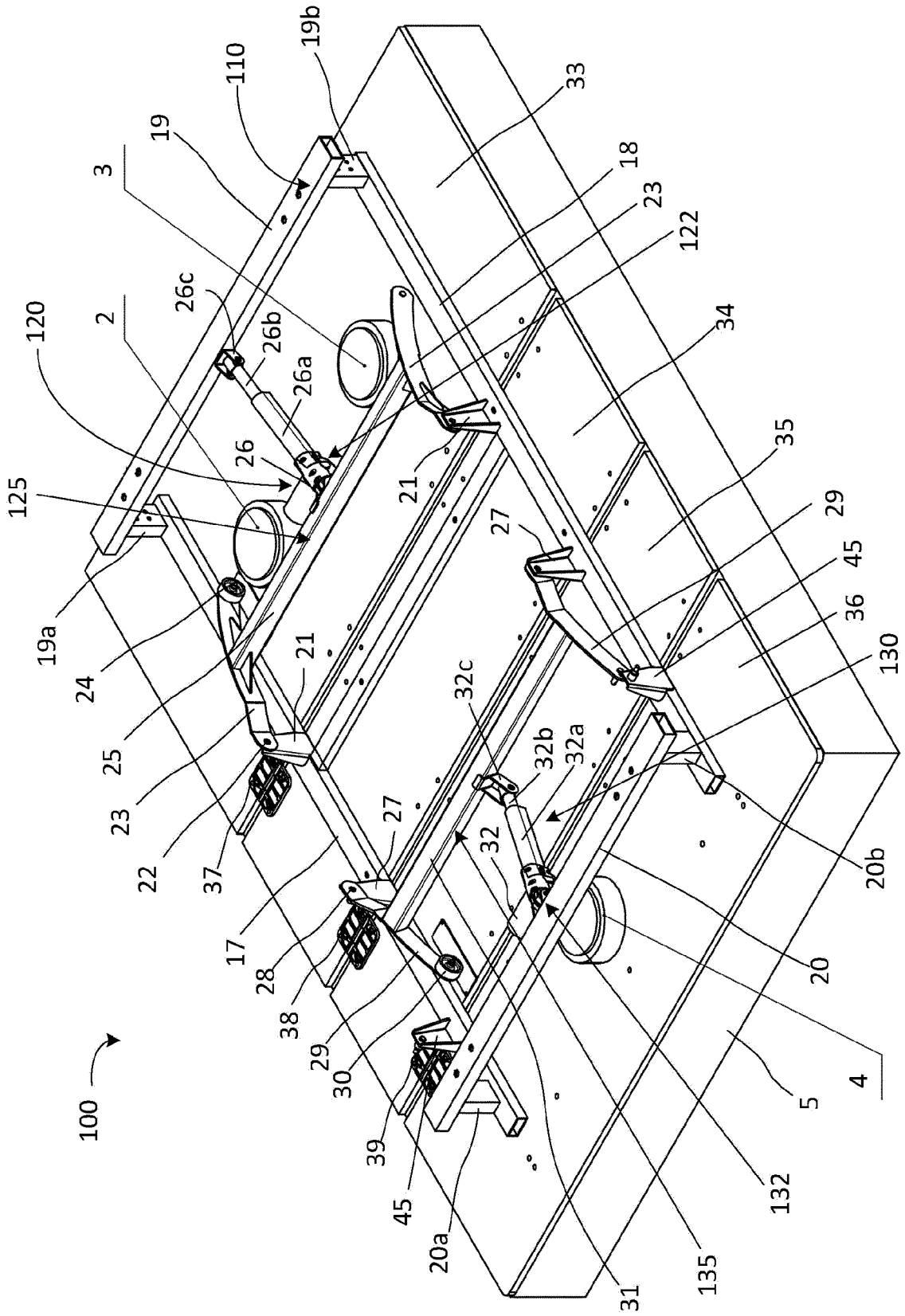

100
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120
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110
19b
33
18
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20b
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FIG. 1

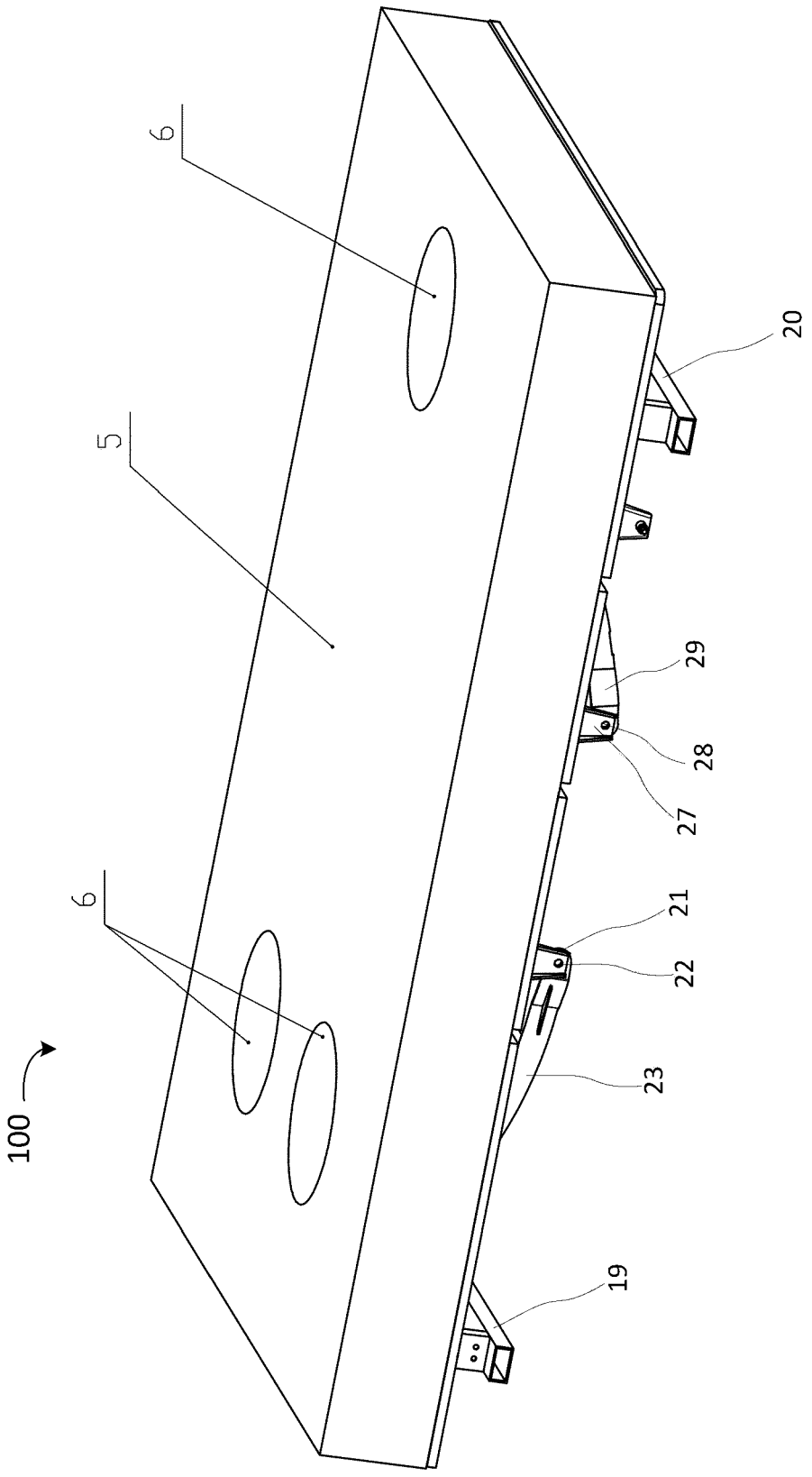


FIG. 2

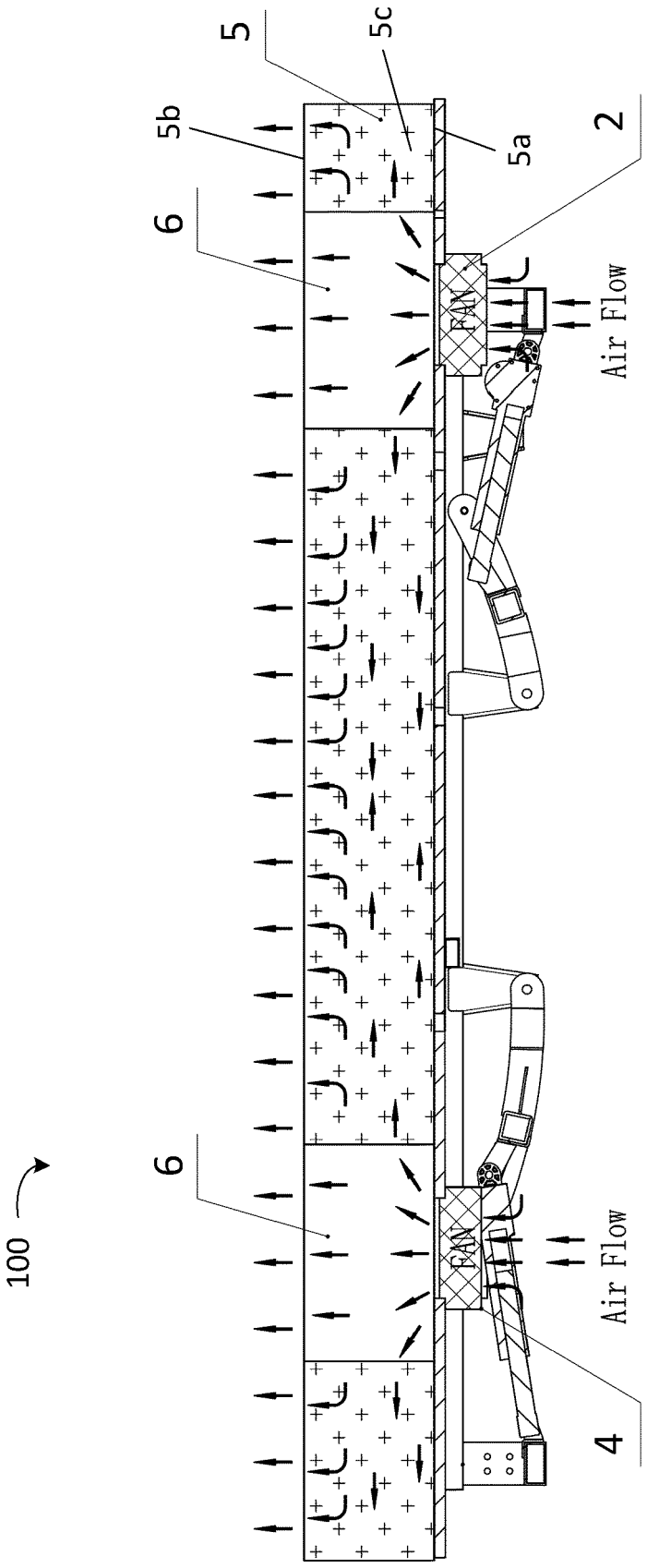


FIG. 3

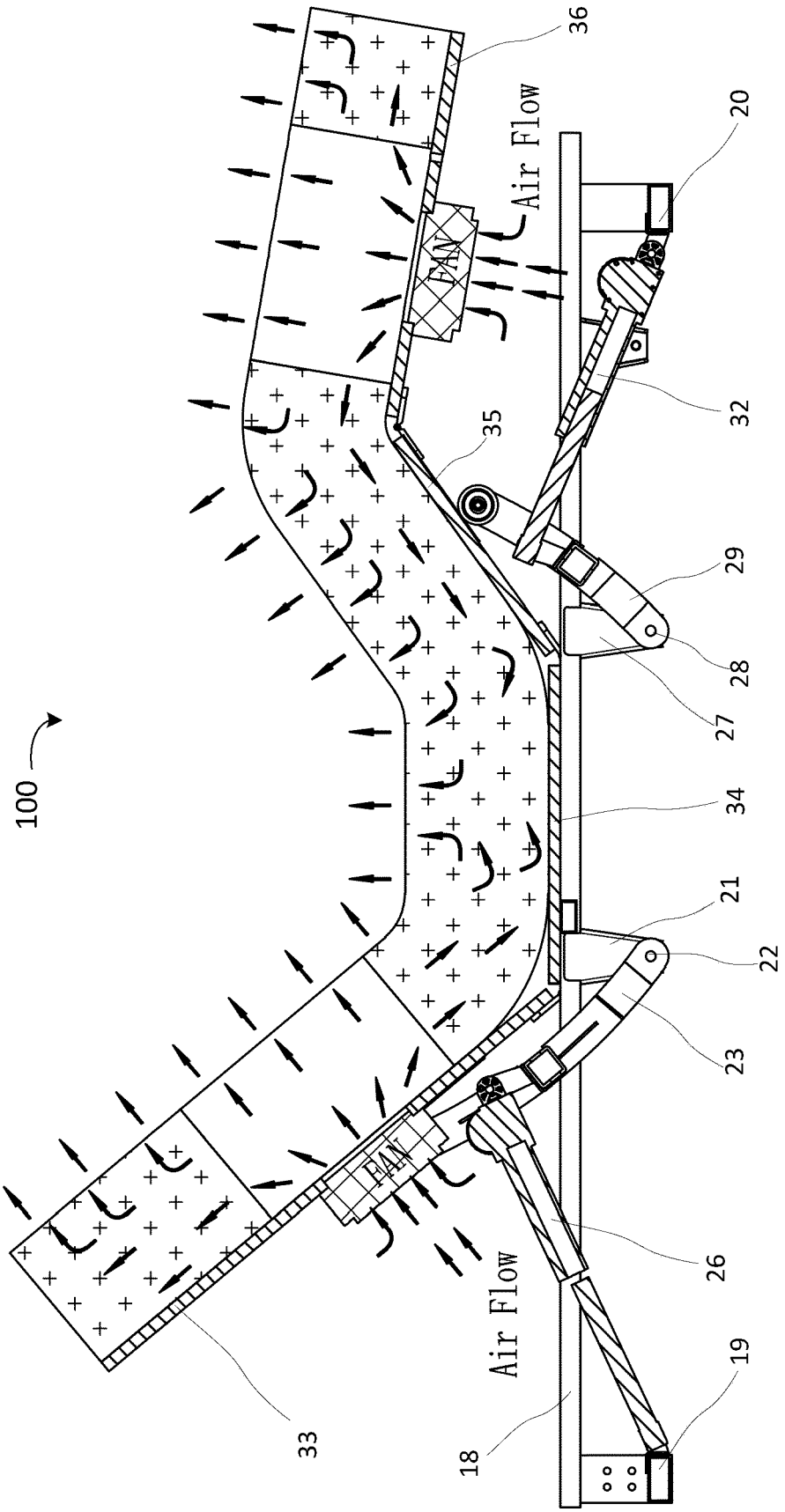

100
36
Air Flow
FAN
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29
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27
34
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23
FAN
26
Air Flow
19
18
33

FIG. 4

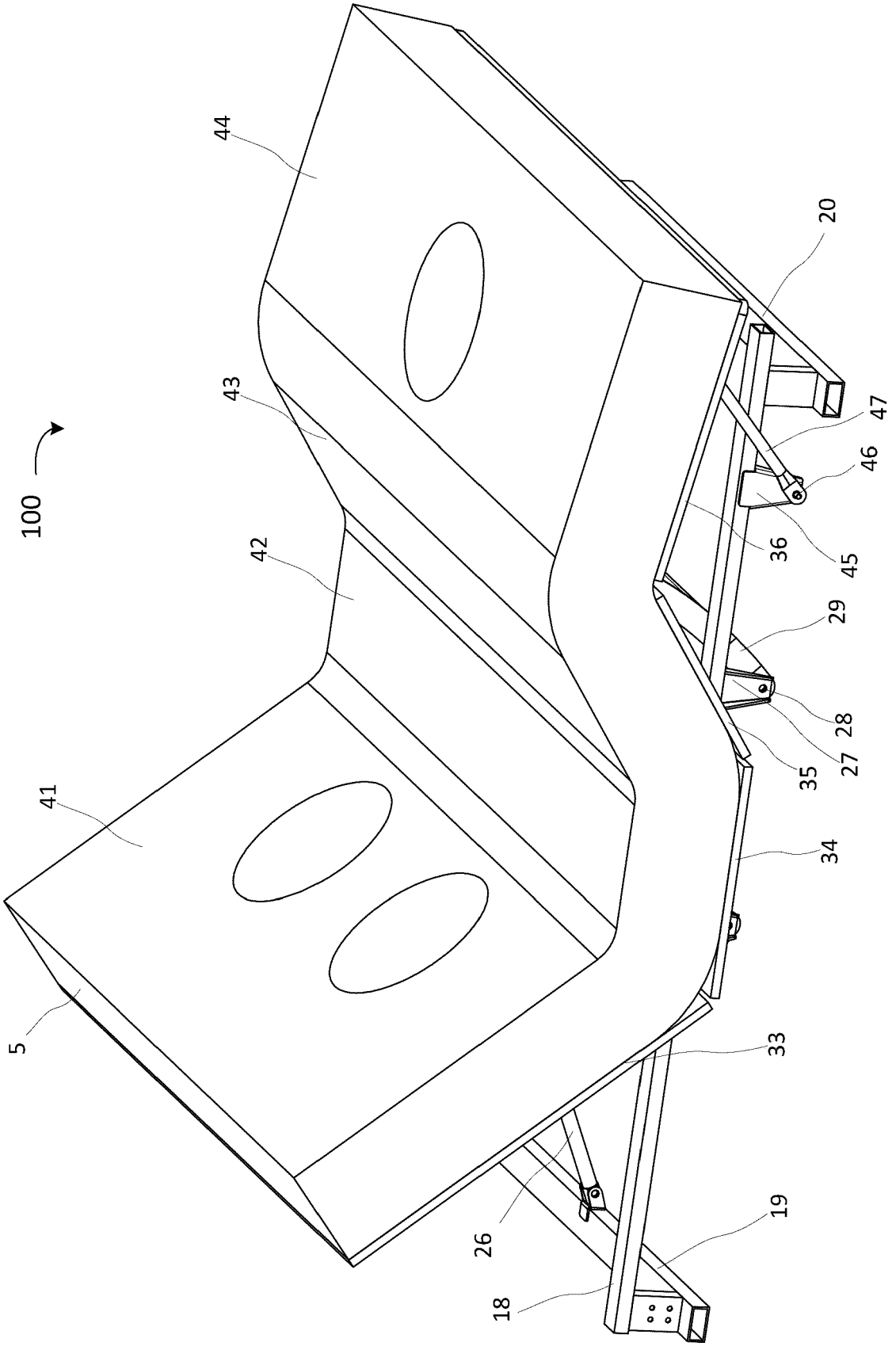


FIG. 5

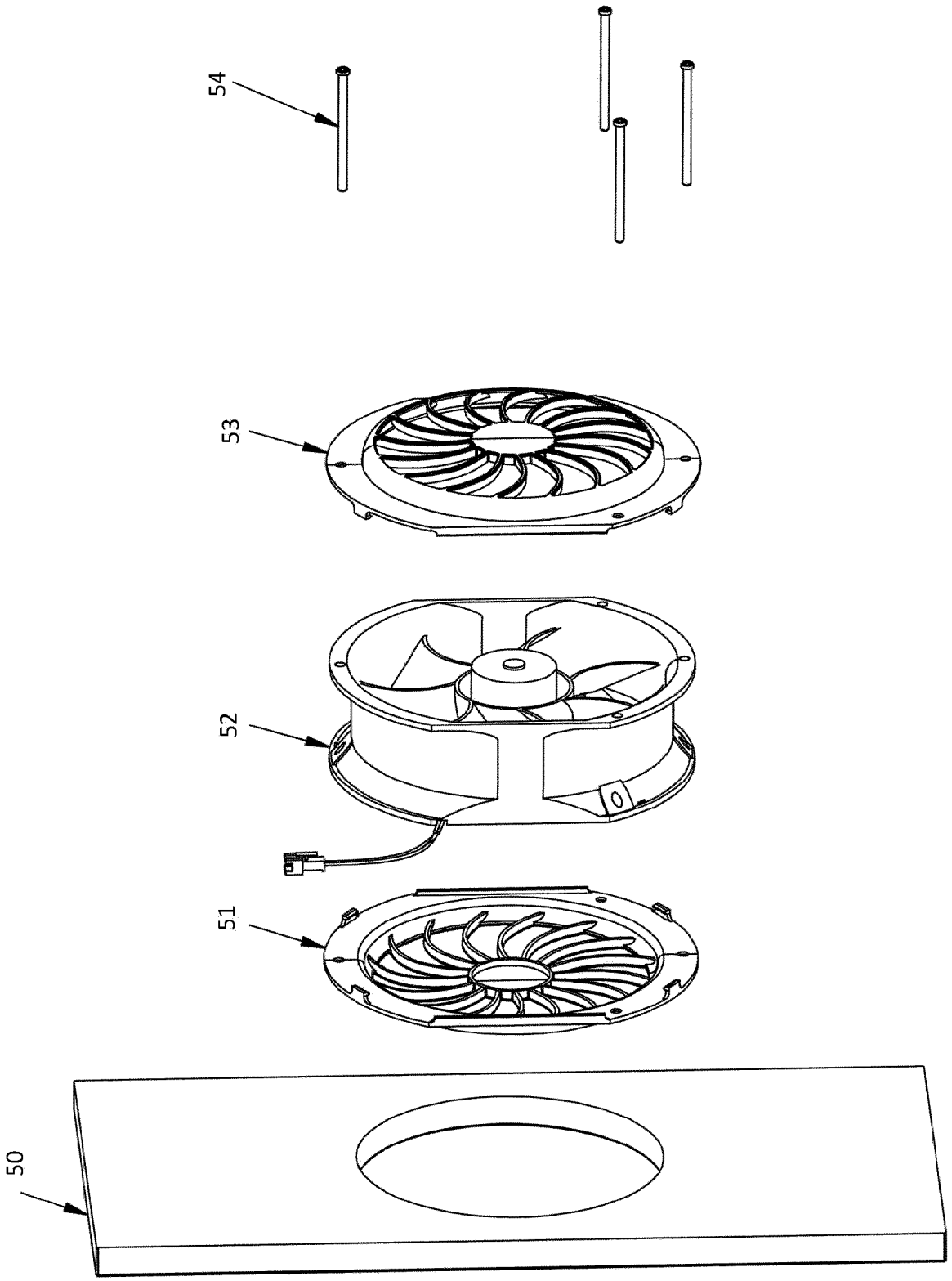


FIG. 6

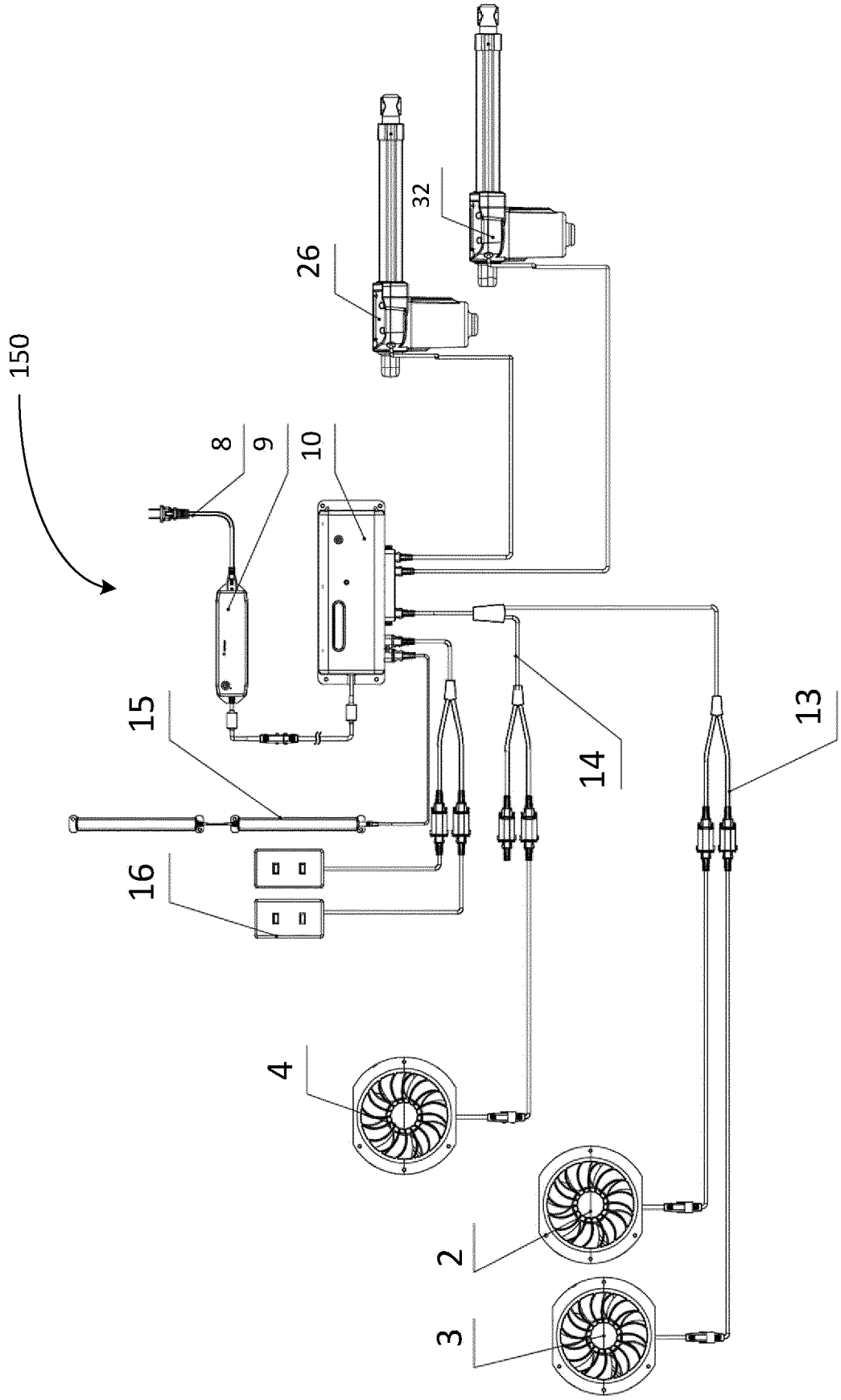


FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 20 15 0858

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2018/110340 A1 (RAWLS-MEEHAN MARTIN B [US] ET AL) 26 April 2018 (2018-04-26) * paragraphs [0036], [0040]; figures 1-5 *	1,3,5, 14,15	INV. A47C20/04 A47C21/04
X	US 2017/360212 A1 (RAWLS-MEEHAN MARTIN B [US]) 21 December 2017 (2017-12-21) * paragraphs [0041], [0046]; figures *	1,3,5,15	

TECHNICAL FIELDS SEARCHED (IPC)
A47C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 February 2020	Kis, Pál

CATEGORY OF CITED DOCUMENTS

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L : document cited for other reasons

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EPO FORM 1503 03.82 (P04C01)

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25-02-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2018110340 A1	26-04-2018	NONE	
US 2017360212 A1	21-12-2017	NONE	

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 62790583 **[0001]**