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Inflatable product and built-in air pump assembly

Abstract

An air pump assembly includes; a main air pump in a chamber; and an air pressure adjustment assembly including: a housing in the chamber; a flexible board defining a first chamber on a first side of the board and a second chamber on a second side of the board, the first chamber in fluid communication with an inflatable chamber of the inflatable product, and the second chamber in fluid communication with an exterior of the inflatable product. The adjustment assembly further includes: an adjusting device including a positioning component and an elastic member on the second side of the board, the elastic member disposed between the positioning component and the board, and a position of one end of the elastic member defined by the positioning component; and a driving device coupled to the positioning component to thereby drive the positioning component to move relative to the housing.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION
(1) This application claims priority from Chinese Application CN202320491328.2, filed Mar. 14, 2023 in China, the disclosure of which is incorporated herein by reference in its entirety.
BACKGROUND
1. Field
(2) Example embodiments relate to inflatable products, and, more particularly, to a built-in air pump assembly and an inflatable product comprising the built-in air pump assembly.
2. Description of Related Art
(3) Inflation or deflation of inflatable products is usually achieved by means of an air pump. For ease of use, some inflatable products are equipped with built-in air pump assemblies, with main body portions of the built-in air pump assemblies located in inflatable chambers of the inflatable

products, and panels of the built-in air pump assemblies assembled on walls of the inflatable chambers. Typically, a user may operate a panel of an air pump, so that the air pump sucks air from the outside and inflates the inflatable chamber, or the air pump sucks air from the inflatable chamber and expels it to the outside.

(4) The material of an inflatable product may become stretched over a period of time, causing air pressure in the inflatable chamber of the inflatable product to drop. Taking an inflatable mattress as an example, the mattress may be suitable for use upon initial inflation, but after a period of time, due to a stretching of the material of the mattress, the air pressure may drop and the mattress may become too soft.

SUMMARY

(5) Example embodiments may address at least the above problems and/or disadvantages and other disadvantages not described above. Also, example embodiments are not required to overcome the disadvantages described above, and may not overcome any of the problems described above.

(6) One or more example embodiments described herein may provide an inflatable product and a built-in air pump assembly in which it is convenient for a user to adjust inflation pressure of the inflatable product, such that internal air pressure of the inflatable product.

(7) According to an aspect of an example embodiment, a built-in air pump assembly comprises: a casing defining an accommodating chamber; a main air pump disposed in the accommodating chamber; an air pressure adjustment assembly comprising: a housing disposed in the accommodating chamber; a flexible board defining a first chamber within the housing on a first side of the flexible board and a second chamber within the housing on a second side of the flexible board, wherein the first chamber is in fluid communication with an inflatable chamber, and the second chamber is in fluid communication with an exterior of the inflatable chamber; and an adjusting device comprising: a positioning component disposed on the second side of the flexible board, and an elastic member disposed between the positioning component and the flexible board, wherein one end of the elastic member is defined by the positioning component; and a driving device coupled to the positioning component and configured to drive the positioning component to move relative to the housing to thereby adjust the distance between the positioning component and the flexible board.

(8) The built-in air pump assembly may further comprise: a panel; wherein the driving device comprises: a knob coupled to the positioning component and axially moveable with respect to the panel such that axial movement of the knob triggers a start switch configured to initiate one of inflation and deflation of the inflatable chamber; and a reset spring disposed arranged between the knob and the panel and configured to axially reset the knob.

(9) The built-in air pump assembly may further comprise: a panel; wherein the driving device comprises: a knob disposed on the panel and coupled to the positioning component; a button axially moveable with respect to the knob such that axial movement of the button triggers trigger a start switch for initiating one of inflation and deflation of the inflatable chamber; and a reset spring disposed between the button and the panel and configured to axially reset the button.

(10) The adjusting device may further comprise: a linkage component disposed between the positioning component and the flexible board and abutting against the flexible board, wherein the elastic member comprises a first end abutting against the positioning component and a second end abutting against the linkage component; the driving device further comprises a transmission component fixedly connected to the knob and comprising a clamping rib; and the positioning component comprises clamping teeth coupled to the clamping rib.

(11) The knob may comprise first teeth; and the driving device may further comprise a transmission gear comprising second teeth coupled both to the first teeth and to the positioning component.

(12) The air pressure adjustment assembly may further comprise a switch assembly fixed to the housing and comprising the start switch and at least one stop switch configured to stop one of inflating and deflating of the inflatable chamber, and the linkage component may comprise at least

one contact corresponding to the stop switch, the linkage component moving correspondingly with the at least one contact according to a change in internal air pressure of the inflatable chamber and thereby configured to trigger the corresponding stop switch.
(13) The air pressure adjustment assembly may comprise: a first wire connected to a first conductive element, wherein the first conductive element fixed to the positioning component; a second wire connected to the elastic member; and a third wire connected to a second conductive element, wherein the second conductive element is fixed to the flexible board; wherein the elastic member is electrically conductive, and the first conductive element and the elastic member are alternately in contact with the second conductive element and separated from the second conductive element according to a change in an internal air pressure of the inflatable chamber, such that the first wire and the second wire are correspondingly alternately electrically connected with the third wire and disconnected from the third wire.
(14) The positioning component may comprise an external thread; the housing may comprise a threaded cavity comprising an internal thread that corresponds to the external thread and thereby enables the positioning component to move axially in the threaded cavity by means of rotation; and the elastic member may be a spring compressed between the positioning component and the linkage component.
(15) The built-in air pump assembly may further comprise an air replenishing pump disposed in the accommodating chamber.
(16) The built-in air pump assembly may further comprise: a central control unit disposed in the accommodating chamber and electrically connected to each of the main air pump, the air replenishing pump, and the air pressure adjustment assembly.
(17) The casing may further comprise an air port, wherein the accommodating chamber is in fluid communication with the inflatable chamber via the air port; and the built-in air pump assembly may further comprise: a reversing core axially rotatably disposed in a guide holder, whereby forming an airflow channel; an air valve corresponding to the air port; and an air valve actuator abutting against an end of the reversing core, the air valve actuator configured to alternately open and close in response to a rotation of the reversing core.
(18) According to an aspect of another example embodiment, a built-in air pump assembly, comprises: a casing defining an accommodating chamber therein; an air pressure adjustment assembly comprising: a housing disposed in the accommodating chamber; a flexible dividing assembly defining a first chamber within the housing on a first side of the flexible dividing assembly and a second chamber, isolated from the first chamber, within the housing on a second side of the flexible dividing assembly, wherein the first chamber is in fluid communication with an inflatable chamber, and the second chamber is in fluid communication with an exterior of the inflatable chamber; and an adjusting device arranged on the second side of the flexible dividing assembly, the adjusting device comprising: a positioning component, a first conductive element comprising a first end fixed to the positioning component, and an elastic member comprising a first end fixed to the positioning component; and a driving device configured to adjust a distance between the positioning component and the flexible dividing assembly.
(19) The elastic member may be electrically conductive, a second end of the first conductive element may be alternately disconnected from a second end of the elastic member and in electrical communication with the second end of the elastic member by means of the flexible dividing assembly.
(20) When the elastic member is in an uncompressed state, a first distance between the second end of the elastic member and the flexible dividing assembly may be smaller than a second distance between the first conductive element and the flexible dividing assembly.
(21) According to an aspect of another example embodiment, an inflatable product may comprise a built-in air pump assembly as described with respect to one of the above example embodiments.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The above and/or other aspects will become apparent and more readily appreciated from the following description of example embodiments, taken in conjunction with the accompanying drawings, in which:

(2) FIG. **1** is a perspective view of a built-in air pump assembly according to a first example embodiment;

(3) FIG. **2** is an internal structural diagram of the built-in air pump assembly of FIG. **1**;

(4) FIG. **3** is an exploded view of the built-in air pump assembly of FIG. **1**;

(5) FIG. **4** is a cross-sectional view of the built-in air pump assembly of FIG. **1**;

(6) FIG. **5** is a perspective view of a main air pump of a built-in air pump assembly according to an example embodiment;

(7) FIG. **6** is an exploded view of a main air pump of a built-in air pump assembly according to an example embodiment;

(8) FIG. **7** is a perspective view of a reversing core of an air channel switching device of the main air pump of FIG. **6**;

(9) FIG. **7***a* is an exploded view of the air channel switching device of the main air pump of FIG. **6** in an inflated state;

(10) FIG. **7***b* is an exploded view of the air channel switching device of the main air pump of FIG. **6** in a deflated state;

(11) FIG. **7***c* is an exploded view of the air channel switching device of the main air pump of FIG. **6** in a stopped state;

(12) FIG. **7***d* is a cross-sectional view of a built-in air pump assembly at an air channel switching device;

(13) FIG. **8** is an exploded view of an air valve of a built-in air pump assembly;

(14) FIG. **9***a* is a cross-sectional view of the air valve of FIG. **8** in a closed state;

(15) FIG. **9***b* is a cross-sectional view of the air valve of FIG. **8** in an open state;

(16) FIG. **10***a* is a schematic diagram of a built-in air pump assembly in an inflated state;

(17) FIG. **10***b* is a schematic diagram of a built-in air pump assembly in a deflated state;

(18) FIG. **10***c* is a partial enlarged view at the air valve of FIG. **10***a;*

(19) FIG. **11** is a schematic diagram of connection between an air pressure adjustment assembly and a panel of the built-in air pump assembly of FIG. **1** according to an example embodiment;

(20) FIG. **12** is an exploded view of the air pressure adjustment assembly of FIG. **11**;

(21) FIG. **13** is a perspective view of the air pressure adjustment assembly of FIG. **11**;

(22) FIG. **14** is a cross-sectional view of the air pressure adjustment assembly of FIG. **11**;

(23) FIG. **15** is a schematic diagram of connection between an air pressure adjustment assembly and a panel of the built-in air pump assembly of FIG. **1** according to an example embodiment;

(24) FIG. **16** is a perspective view of the air pressure adjustment assembly of FIG. **15**;

(25) FIG. **17** is an exploded view of the air pressure adjustment assembly of FIG. **15**;

(26) FIG. **18***a* is a cross-sectional view of the air pressure adjustment assembly of FIG. **15** in an inflated or deflated state;

(27) FIG. **18***b* is a cross-sectional view of the air pressure adjustment assembly of FIG. **15** in a completely inflated state;

(28) FIG. **18***c* is a cross-sectional view of the air pressure adjustment assembly of FIG. **15** in a completely deflated state;

(29) FIG. **19** is a cross-sectional view of the air pressure adjustment assembly of FIG. **15** in an inflated or deflated state according to another example embodiment;

(30) FIG. **20** is an exploded view of connection between a driving device and a panel of the built-in

air pump assembly of FIG. **1** according to an example embodiment;
(31) FIG. **21** is a perspective view of the panel of the driving device of FIG. **20**;
(32) FIG. **22***a* is a front view of the driving device of FIG. **20** with a knob pressed down;
(33) FIG. **22***b* is a cross-sectional view of the driving device of FIG. **20** with a knob pressed down;
(34) FIG. **23***a* is a front view of the driving device of FIG. **20** with a knob popped up;
(35) FIG. **23***b* is a cross-sectional view of the driving device of FIG. **20** with a knob popped up;
(36) FIG. **24** is an exploded view of connection between a driving device and a panel of the built-in air pump assembly of FIG. **1** according to an example embodiment;
(37) FIG. **25** is a perspective view of a knob of the driving device of FIG. **24**;
(38) FIG. **26** is a front view of the connection between the driving device and the panel of FIG. **24**;
(39) FIG. **27***a* is a cross-sectional view of the driving device of FIG. **24** with a button popped up;
(40) FIG. **27***b* is a cross-sectional view of the driving device of FIG. **24** with a button pressed down;
(41) FIG. **28** is an exploded view of connection between a driving device and a panel of the built-in air pump assembly of FIG. **1** according to an example embodiment;
(42) FIG. **29***a* is a perspective view of the driving device of FIG. **1** with a button pressed down;
(43) FIG. **29***b* is a perspective view of the driving device of FIG. **1** with a button popped up; and
(44) FIG. **30** is a perspective view of an inflatable mattress with a built-in air pump assembly, according to an example embodiment.
DETAILED DESCRIPTION
(45) Reference will now be made in detail to example embodiments which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. In this regard, the example embodiments may have different forms and may not be construed as being limited to the descriptions set forth herein.
(46) It will be understood that the terms “include,” “including”, “comprise, and/or “comprising,” when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.
(47) It will be further 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 may 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.
(48) As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items. Expressions such as “at least one of,” when preceding a list of elements, modify the entire list of elements and do not modify the individual elements of the list.
(49) Various terms are used to refer to particular system components. Different companies may refer to a component by different names—this document does not intend to distinguish between components that differ in name but not function.
(50) Matters of these example embodiments that are obvious to those of ordinary skill in the technical field to which these example embodiments pertain may not be described here in detail.
(51) It is noted that directional expressions such as “up,” “down,” “left,” and “right” are not absolute, but relative. The directional expressions are appropriate when various components are arranged as shown in the figures, but should change accordingly when positions of the various components in the figures change.
(52) In addition, in this text, unless otherwise explicitly defined or limited, the terms “assembled,” “connected,” and the like should be construed in a broad sense. For example, the connection may be a fixed connection, a detachable connection, or an integral connection, may be a mechanical connection or an electrical connection; and may be a direct connection, an indirect connection, or related by some actions. For those skilled in the art, the specific meaning of the above terms herein

would have been understood according to specific circumstances.

(53) As shown in FIGS. **1** to **3**, a built-in air pump assembly **100** according to an example embodiment comprises: a main air pump **1**, an air replenishing pump **2**, an air pressure adjustment assembly **3**, a driving device **4**, a central control unit **5**, a casing **6**, a panel **7**, and a protective cover **8**.

(54) The main air pump **1** is configured to inflate an inflatable product (for example, an inflatable mattress) or to expel air from such an inflatable product. The air replenishing pump **2** is configured to refill the inflatable product. The air pressure adjustment assembly **3** is in communication with the inflatable product to detect an internal air pressure value of the inflatable product. The driving device **4** is arranged on the panel **7** and is coupled to the air pressure adjustment assembly **3**. The central control unit **5** is electrically connected to each of the main air pump **1**, the air replenishing pump **2**, and the air pressure adjustment assembly **3**. The casing **6** is provided with an opening **61** covered by the panel **7**; the casing **6** and the panel **7** jointly define an accommodating chamber **62**; and the main air pump **1**, the air replenishing pump **2**, the air pressure adjustment assembly **3**, and the central control unit **5** are all arranged in the accommodating chamber **62**.

(55) The built-in air pump assembly **100** according to an example embodiment can adjust and set the required internal air pressure value of the inflatable product in response to rotation of the driving device **4**, and then initiate the main air pump **1** of the built-in air pump assembly **100** in response to the driving device **4** being pressed down and released. Regardless of whether the inflatable product is currently inflated, i.e., full of air, or deflated, the built-in air pump assembly **100** can perform automatic detection of the air pressure and can inflate or deflate the inflatable product to reach a preset pressure value. In a case in which material of the inflatable product is stretched and the air pressure drops to a certain extent, the air pressure adjustment assembly **3** sends a signal to the central control unit **5** to activate the air replenishing pump **2**, and the air replenishing pump **2** starts to refill automatically. Likewise, in a case in which the pressure in the inflatable product, refilled, reaches the user-preset air pressure value, the air pressure adjustment assembly **3** sends a signal to the central control unit **5** to switch off the air replenishing pump **2**.

(56) The built-in air pump assembly **100** may be further provided with a deflation key **72** electrically connected to the central control unit **5**. After a user clicks the deflation key **72**, the central control unit **5** controls the main air pump to deflate the inflatable product to be in a state convenient for storage, and then the central control unit **5** automatically controls the main air pump **1** to stop.

(57) As shown in FIGS. **4** to **6**, the main air pump **1** comprises a blade cover **11**, a guide holder **12**, a reversing drive assembly **13**, an optional microswitch **14**, a reversing core **15**, an air valve actuator **16**, an air valve actuator seal ring **19**, and a main motor **17**. The reversing drive assembly **13** comprises a reversing motor **131** and an optional gearbox **132**, and one or more transmission gears (not shown) installed in the gearbox **132**. The reversing core **15** is axially rotatably arranged in the guide holder **12**, and the guide holder **12** and the reversing core **15** jointly constitute an air channel switching device **110**. The blade cover **11** and the guide holder **12** jointly divide the accommodating chamber **62** into a driving chamber **621** and a blade chamber **622**, the driving chamber **621** being in communication with an external space of the built-in air pump assembly **100**. It can be understood that according to one or more example embodiments, the blade cover **11** and the guide holder **12** may be integrally formed. The blade cover **11** comprises an upper blade cover **111** and a lower blade cover **112**, the lower blade cover **112** being provided with a through hole **1121**. An impeller **18** is arranged in the blade cover **11**. The main motor **17** is electrically connected to the central control unit **5**. A rotating shaft of the main motor **17** passes through the through hole **1121** to be connected to the impeller **18**. The gearbox **132** (and one or more transmission gears therein) is optional for transmitting a torque of the reversing motor **131** to the reversing core **15** by driving teeth **158** arranged on a side of the reversing core **15**, such that the reversing core **15** can be rotated in the guide holder **12**. The air valve actuator **16** is configured to move in the guide holder

12 along an axis A. When the reversing core **15** rotates toward a position for the built-in air pump assembly **100** to inflate and deflate, the air valve actuator **16** is ejected to the right (i.e., in a direction away from the accommodating chamber **62**), and the air channel switching device **110** allows an air chamber to be in fluid communication with the accommodating chamber **62**; and when the reversing core **15** rotates toward a position for the built-in air pump assembly **100** to stop inflating and deflating, the air valve actuator **16** retracts to the left (i.e., in a direction toward the inside of the accommodating chamber **62**), and the air channel switching device **110** isolates the air chamber from the accommodating chamber **62**.

(58) As described above, the air valve actuator **16** is configured to move axially in response to rotation of the reversing core **15**. As shown in FIGS. **7***a* to **7***c*, the air valve actuator **16** has a tubular portion **162** extending to the side where the guide holder **12** is located. An edge of an end of the tubular portion **162** is provided with a working portion **163** arranged axially obliquely with respect to the air valve actuator **16**. The tubular portion **162** is nested in a groove **156** at an end of the reversing core **15** to avoid potential wobbling, which can also greatly reduce wind pressure loss caused by airflow flowing out of a gap between the reversing core **15** and the air valve actuator **16**. Referring to FIG. **7***d*, an outer cylindrical wall **156***a* and an inner cylindrical wall **156***b* that are coaxial are formed at the end of the reversing core **15**, the cylindrical walls **156***a* and **156***b* defining the groove **156** described above. To match the working portion **163**, one or more bumps **157** is/are arranged in the groove **156**, each bump **157** being in contact with a working portion **163**. Where the air valve actuator **16** and the reversing core **15** rotate relative to each other, each bump **157** slides along the corresponding working portion **163**, so that the air valve actuator **16** and the reversing core **15** move axially relative to each other. Meanwhile, the rotation of the air valve actuator **16** around an axis is limited relative to the guide holder **12**. For example, the air valve actuator **16** is nested in the guide holder **12**, and an outer contour of the air valve actuator **16** and an inner wall contour of the guide holder **12** cooperate to limit the rotation of the air valve actuator **16** relative to the guide holder **12**. Optionally, referring to FIG. **7***a*, the air valve actuator **16** has a substantially circular outer contour projection, and the periphery of the air valve actuator **16** is provided with a plurality of protrusions **161**. An inner wall of the guide holder **12** is provided with a plurality of guide grooves **125** that match the plurality of protrusions **161**, so that the air valve actuator **16** can slide along the plurality of guide grooves. Thus, when the reversing core **15** rotates in the guide holder **12**, the air valve actuator **16** is correspondingly driven to slide relative to the guide holder **12**. As an alternative solution, the air valve actuator **16** may have an outer contour projection of another shape (which is for example, but not limited to, substantially oval, triangular, square or rectangular), and the inner wall of the guide holder **12** correspondingly has the inner wall contour that matches the outer contour of the air valve actuator **16** to restrain the rotation of the air valve actuator **16** around an axis.

(59) It can be understood that the positions of the bumps **157** and of the working portion **163** may be interchanged in other example embodiments, i.e., the bumps **157** may be optionally arranged on the air valve actuator **16** while the working portion **163** is correspondingly arranged in the groove **156**. It can also be understood that the groove **156** is optional, for example, in other example embodiments, the inner cylindrical wall **156***b* may be omitted.

(60) A tube wall of the guide holder **12** is provided with a first opening **121** and a second opening **122** that are in communication with the driving chamber **621**, a third opening **123** in communication with the blade chamber **622**, and a fourth opening **124** in communication with the blade cover **11**. As shown in FIG. **7**, the reversing core **15** comprises an air channel **150** and a recess **155**. A first opening **151** of the reversing core **15** is provided at the top of the reversing core **15**, a second opening **152** of the reversing core **15** is provided in a side wall of the reversing core **15**, and a third opening **1541** and a fourth opening **1542** of the reversing core **15** are provided at the bottom of the reversing core **15**. The first opening **151**, the second opening **152** and the third opening **1541** of the reversing core **15** are in communication with the air channel **150**, and the

fourth opening **1542** is in communication with the recess **155**. The first opening **151** is in fluid communication with an inflatable chamber **1002** of the inflatable product by means of the air valve actuator **16**. By means of rotating the reversing core **15**, the corresponding relationship between a wall surface of the reversing core **15** and the opening on the guide holder **12** is changed, achieving the purpose of switching airflow channels.

(61) As shown in FIGS. **7***a* and **10***a*, when the built-in air pump assembly **100** is to be inflated, the reversing core **15** is rotated to a position in which the second opening **122** of the guide holder **12** is blocked and closed by a tube wall of the reversing core **15**, and the first opening **121**, the third opening **123**, and the fourth opening **124** of the guide holder **12** are opened. The first opening **121** and the third opening **123** of the guide holder **12** are in communication with each other via the recess **155**. The fourth opening **124** of the guide holder **12** is aligned with the third opening **1541** of the reversing core **15**, while the air valve actuator **16** is ejected to the right to open the air channel **150**. An outside gas enters the driving chamber **621** via a first air port **71** on the panel **7**, enters the blade chamber **622** via the first opening **121** of the guide holder **12**, the recess **155**, and the third opening **123** in sequence, and then enters the blade cover **11** via the through hole **1121**. The gas, pressurized by the impeller **18**, enters the air channel **150** of the reversing core **15** via the fourth opening **124** of the guide holder **12**, and enters the inside of the inflatable product via the first opening **151** of the reversing core **15** and a second air port **63** of the casing **6** in sequence. In this way, the inflatable product P is inflated.

(62) As shown in FIGS. **7***b* and **10***b*, when the inflatable product is to be deflated by means of the built-in air pump assembly **100**, the reversing core **15** is rotated to a position in which the first opening **121** of the guide holder **12** is blocked and closed by the tube wall of the reversing core **15**, and the second opening **122**, the third opening **123**, and the fourth opening **124** of the guide holder **12** are opened. The third opening **123** of the guide holder **12** is aligned with the second opening **152** (as shown in FIG. **7**) of the reversing core **15**, the fourth opening **124** of the guide holder **12** is aligned with the fourth opening **1542** of the reversing core **15**, and the fourth opening **124** of the guide holder **12** is in communication with the second opening **122** by means of the recess **155**. The air valve actuator **16** is ejected to the right to open the air channel **150**. The gas in the inflatable product enters the air channel **150** via the second air port **63** of the casing **6** and the first opening **151** of the reversing core **15**, enters the blade chamber **622** via the second opening **152** of the reversing core **15**, and the third opening **123** of the guide holder **12**, and then enters the blade cover **11** via the through hole **1121**. The gas, pressurized by the impeller **18**, enters the recess **155** via the fourth opening **124** of the guide holder **12** and the fourth opening **1542** of the reversing core **15**, then enters the driving chamber **621** via the second opening **122** of the guide holder **12**, and is expelled from the first air port **71** to the outside.

(63) As shown in FIG. **7***c*, when the inflating or deflating of the inflatable product is to be stopped, the reversing core **15** is rotated to a position in which the third opening **123** of the guide holder **12** is blocked and closed by the tube wall of the reversing core **15**, and at the same time, the air valve actuator **16** retracts toward the inside of the guide holder **12** to close the air channel **150**. The end of the reversing core **15** is provided with a bulge **153**. A stop signal is sent to the central control unit **5** in response to the bulge **153** triggering the microswitch **14**, so as to stop driving the reversing motor **131**. The gas referenced herein may be, but is not limited to, air.

(64) The air replenishing pump **2** is provided with an air supply pipe **21** in communication with the driving chamber **621**. Where the air replenishing pump **2** performs refilling, the outside gas enters the driving chamber **621** via the first air port **71** of the panel **7**, and the gas, pressurized by the air replenishing pump, enters the inside of the inflatable product via an air outlet (not shown in the figures) of the air replenishing pump **2**. Optionally, a vibration absorbing material (such as, but not limited to, a cotton fiber, a polyester fiber and other fillers) wrapping part or all of the air replenishing pump **2** is arranged in the accommodating chamber **62** to reduce vibration of the air replenishing pump **2** when the air replenishing pump **2** is in operation. The air replenishing pump **2**

may optionally be an air pump with low noise and correspondingly low output power.

(65) As shown in FIGS. **1** to **3**, the central control unit **5** comprises a control circuit board **51**, a circuit board mount **52** fixing the control circuit board **51** in the accommodating chamber **62**. The panel **7** comprises a power cord cover plate **73**, the circuit board mount **5** and the power cord cover plate **73** defining a power cord placement cavity **623** (as shown in FIG. **4**). The central control unit **5** is programmed to send, according to the internal air pressure value of the inflatable product detected by the air pressure adjustment assembly **3** and a preset inflation air pressure value, a start signal or a stop signal to the main air pump **1** or the air replenishing pump **2** to initiate or stop the main air pump **1** or the air replenishing pump **2**. The central control unit **5** comprises, for example, one or more microprocessors arranged on a printed circuit board (PCB).

(66) The panel **7** is fixedly connected to the casing **6** and covers at least a part of the opening **61**, and preferably the panel **7** covers the entire opening **61**. The panel **7** is provided with a first air port **71**, and the built-in air pump assembly **100** is in fluid communication with the outside via the first air port **71**. A side face of the casing **6** is provided with a second air port **63** (the second air port **63** is covered by the protective cover **8** in FIGS. **1** to **3**), and the built-in air pump assembly **100** is in fluid communication with the inflatable chamber **1002** of the inflatable product via the second air port **63**. The first air port **71** is in fluid communication with the second air port **63** via the accommodating chamber **62**.

(67) As shown in FIGS. **8** to **9***b*, the side face of the casing **6** is further provided with an air valve **83** corresponding to the second air port **63**, and a support member **86** is arranged at the second air port **63**; and a support member through-hole **861** is formed in the center of the support member **86**, a valve stem **831** of the air valve **83** passes through the support member through-hole **861**, and the air valve **83** is movable in a length direction of the valve stem **831**. The air valve actuator **16** cooperates with the air valve **83** to control a fluid channel between the gas-filled air chamber and the accommodating chamber **62**. A first end **832** of the valve stem **831** is connected to a limit member **85**. A second end of the valve stem **831** is provided with a valve head **833**, the valve head **833** having a diameter greater than the diameter of the valve stem **831**, and the periphery of the valve head **833** being sleeved with a seal ring **82**. The first end **832** of the valve stem **831** extends to the air valve actuator **16**. A spring **84**, with opposite ends abutting against the support member **86** and the limit member **85**, is sleeved around the outer side of the valve stem **831**. The spring **84** and the limit member **85** are both located inside the casing **6**, and the valve head **833** is located outside the casing **6**. In other words, the limit member **85** and the spring **84** bias the air valve **83** toward a closed position.

(68) As shown in FIGS. **10***a* to **10***c*, the air valve actuator **16** abuts against the right end of the reversing core **15**, and causes the air valve **83** to be opened or closed in response to a rotation of the reversing core **15**. The end of the valve stem **831** abuts against a central portion **164** of the air valve actuator **16**. Thus, in addition to biasing the air valve **83** toward the closed position, the spring **84** pushes the air valve actuator **16** to keep the working portion **163** of the air valve actuator **16** in contact with one or more bumps **157** on the reversing core **15**. When the built-in air pump assembly is switched to the inflated state, the reversing core **15** is driven to rotate relative to the guide holder **12**. Accordingly, the working portion **163** of the air valve actuator **16** slides relative to the bump **157**, such that the air valve actuator **16** is pushed to slide toward the side where the air valve **83** is located. The air valve actuator **16** further pushes the valve stem **831** (and the valve head **833**) to slide until the air valve **83** opens the second air port **63**, and the accommodating chamber **62** is in fluid communication with the inside of the inflatable product via the second air port **63**, thereby allowing the gas to flow through the second air port **63**, such that the air pump can inflate or deflate the inflatable product. The gas flow directions during inflation and deflation are indicated by arrows in FIGS. **10***a* and **10***b*, respectively. According to another example aspect, when the built-in air pump assembly is switched to a stopped state, the reversing core **15** is driven to rotate relative to the guide holder **12**. Accordingly, the working portion **163** of the air valve actuator **16** slides

relative to the bump **157**, and the spring **84** applies pressure to the central portion **164** of the air valve actuator **16** by means of the valve stem **831**, such that the air valve actuator **16** is pushed to slide away from the side where the air valve **83** is located until the air valve **83** closes the second air port **63**, thereby interrupting the fluid communication between the accommodating chamber **62** and the inside of the inflatable product.

(69) In an example embodiment shown in FIGS. **10***a* to **10***c*, the spring **84** is a compression spring. It can be understood, however, that in one or more alternate example embodiments, the spring **84** may be replaced with elastic components (such as, but not limited to, an extension spring and a torsion spring) in other forms, the elastic components biasing the air valve **83** toward the closed position.

(70) The working principle of an air valve control system is described in detail above based on FIGS. **7** to **10***c*. The air valve control system comprises the reversing core **15**, the air valve actuator **16**, and the air valve **83** as described above. In response to the rotation of the reversing core **15**, the air valve actuator **16** pushes the air valve **83** to move. The air valve control system may further comprise the reversing drive assembly **13** as described above. It can be understood that the air valve control system may be used in conjunction with, but is not limited to, the built-in air pump assembly **100** in the example embodiments described above.

(71) Optionally, the side face of the casing **6** may further comprise the protective cover **8**. The protective cover **8** can protect the air valve **83**, and can also prevent the wall of the inflatable product or a tensioning member in the inflatable product from being adsorbed onto the air valve **83**, thereby avoiding the operation (especially a deflating operation of the inflatable product) of the built-in air pump assembly from being affected.

(72) As shown in FIGS. **11** and **12**, the air pressure adjustment assembly **3** comprises a housing **36**, a flexible board **37**, and an adjusting device **38**. The flexible board **37** is optionally made of silicone rubber or other elastic materials. The flexible board **37** divides the internal space of the housing **36** into a first chamber **3611** and a second chamber **3621**. The first chamber **3611** is in fluid communication with the inside of the inflatable product via an air intake pipe **3612**, and the second chamber **3621** is in fluid communication with the outside of the inflatable product. The adjusting device **38** comprises a positioning component **381**, an elastic member **382**, and a linkage component **383**. The elastic member **382** is arranged between the positioning component **381** and the linkage component **383**, and the linkage component **383** is arranged between the positioning component **381** and the flexible board **37** and abuts against the flexible board **37** from the side at which the second chamber **3621** is located. The position of the upper end of the elastic member **382** is defined by the positioning component **381**, for example, the upper end of the elastic member **382** abuts against the positioning component **381** or is embedded into the positioning component **381**. The lower end of the elastic member **382** abuts against the linkage component **383**.

(73) The driving device **4** is coupled to the positioning component **381** for driving the positioning component **381** to move relative to the housing **36** to adjust the distance between the positioning component **381** and the flexible board **37**. For example, the positioning component **381** may be driven to move relative to the housing **36** along its axis of rotation.

(74) Detailed structures of the air pressure adjustment assembly **3** and the driving device **4**, according to one or more example embodiments, are described below with reference to FIGS. **11** to **28***b*.

(75) FIGS. **11** to **14** show an example embodiment of the air pressure adjustment assembly **3**.

(76) The air pressure adjustment assembly **3** is a mechanical air pressure sensor, and the air pressure adjustment assembly **3** is arranged in the driving chamber **621**. The housing **36** of the air pressure adjustment assembly **3** comprises a first housing **361** and a second housing **362** located above the first housing **361**. The flexible board **37** may be at least partially located in the first housing **361** and the second housing **362**. A connecting member **31** is arranged below the flexible board **37**, and a screw **321** passes sequentially through holes in the centers of the connecting

member **31** and the flexible board **37** to fix the connecting member **31** and the flexible board **37** to the linkage component **383**. According to one or more example embodiments, in the air pressure adjustment assembly **3**, when the first housing **361** and the second housing **362** are assembled together, a part of the flexible board **37** (for example, the periphery of the flexible board **37**) may be sandwiched between the first housing **361** and the second housing **362** and may correspondingly forms a seal. The flexible board **37** defines a first chamber **3611** and a second chamber **3621** in the housing **36**. The internal space of the housing **36** is in communication with the air chamber of the inflatable product via the air intake pipe **3612**. For example, the first chamber **3611** is in communication with the air chamber of the inflatable product. The first chamber **3611** is located in an area substantially defined by the flexible board **37** and the second housing **362**, and the second chamber **3621** is located in an area substantially defined by the flexible board **37** and the first housing **361**.

(77) When the air pressure in the inflatable product rises, the air pressure in the first chamber **3611** correspondingly rises and acts on the flexible board **37** to push the flexible board **37** toward the second housing **362**. Correspondingly, flexible board **37** pushes the linkage component **383** to move together; and when the air pressure in the inflatable product drops, the air pressure in the first chamber **3611** drops at the same time, and under the action of the elastic member **382**, the linkage component **383** pushes the flexible board **37** to move toward the first housing **361**.

(78) As shown in FIG. **12**, an external thread **3811** is provided at the lower end of the positioning component **381**, the second housing **362** is provided with a threaded cavity **3621**, and an inner wall of the threaded cavity **3621** is provided with an internal thread **3622** that matches the external thread **3811**, so that the positioning component **381** can move axially in the threaded cavity **3621** along an axis Z when the positioning component rotates along the axis. The elastic member **382** may be sleeved around the linkage component **383**, and as the positioning component **381** is located at different positions, the elastic member **382** can apply different degrees of acting force onto the positioning component **381**. Accordingly, the positioning component **381** is located at different positions along the axis Z, so that the flexible board **37** and the linkage component **383** are subjected to different degrees of mechanical resistance. The positioning component **381** may also be provided with positioning teeth **3813**, and the second housing **362** may be provided with pawls **3623** that match the positioning teeth **3813** to prevent the positioning component **381** from rotating freely.

(79) As shown in FIG. **14**, the air pressure adjustment assembly **3** further comprises a switch assembly **33** fixedly arranged on the housing **36**. The switch assembly **33** comprises a start switch **331** and at least one stop switch which is configured for stopping the main air pump **1**. The linkage component **383** comprises at least one contact that matches the stop switch. According to the change in internal air pressure of the inflatable product, the linkage component **383** moves correspondingly with the at least one contact and triggers the corresponding stop switch by each contact. For example, the at least one stop switch comprises a first stop switch **332** and a second stop switch **333**.

(80) The first stop switch **332** is provided with a first contact point **3321**, and the second stop switch **333** is provided with a second contact point **3331**. The linkage component **383** is provided with a first contact **3831** and a second contact **3832**. When the built-in air pump assembly **100** is in operation, the change in internal air pressure of the inflatable product allows the flexible board **37** and the linkage component **383** to move along the axis Z. If the linkage component **383** reaches a specific position along the axis Z, the contact of the linkage component **383** may be in contact with the contact point of the first stop switch **332** or the second stop switch **333** to activate the first stop switch **332** or the second stop switch **333** and to send corresponding control signals. Rotation of the positioning component **381** can change the internal air pressure of the inflatable product required for activating the first stop switch **332** or the second stop switch **333**. The first contact **3831** of the linkage component **383** may be aligned with the first contact point **3321** of the first stop switch **332**

in the moving direction of the linkage component **383**, i.e., aligned in the direction parallel to the axis Z, so that the linkage component **383** can accurately trigger the first stop switch **332**. Similarly, the second contact **3832** of the linkage component **383** may also be aligned with the second contact point **3331** of the second stop switch **333** in the direction parallel to the axis Z, so that the linkage component **383** can accurately trigger the second stop switch **333**.
(81) For the first stop switch **332**, when the inflatable product is inflated until the internal air pressure reaches a preset value, in the orientation shown in the figure, the first contact **3831** of the linkage component **383** rises to be in contact with the first contact point **3321** of the first stop switch **332**, and the central control unit **5** controls, upon detecting an electrical signal sent by the first stop switch **332**, the air pumps to stop refilling/inflating. When triggered for the first time, the central control unit **5** controls the main air pump **1** to stop inflating, and when subsequently triggered (for example, after the air pressure in the inflatable product drops, or the air pressure has already reached a target air pressure when power is just turned on), the central control unit **5** controls the air replenishing pump **2** to stop refilling.
(82) For the second stop switch **333**, when the internal air pressure gradually drops as the inflatable product is deflated, in the orientation shown in the figure, the second contact **3832** of the linkage component **383** correspondingly gradually descends to be in contact with the second contact point **3331** of the second stop switch **333**, and the central control unit **5** controls, upon detecting an electrical signal sent by the second stop switch **333**, the main air pump **1** to stop deflating.
(83) Example working states of the central control unit **5** are listed as below: a1. detecting in real time whether the first stop switch **332** is closed when the main air pump **1** is working to inflate the inflatable product; and determining, if the first stop switch **332** is closed, that inflation of the inflatable product is finished, and switching off the main air pump **1** to stop inflating the inflatable product; b1. Standing by after the main air pump **1** finishes inflating the inflatable product, and detecting, at preset time intervals, whether the first stop switch **332** is open; determining, if the first stop switch **332** is open, that the inflatable product is under pressure, and initiating the air replenishing pump **2** to refill the inflatable product; c1. Detecting, in real time, whether the first stop switch **332** is closed when the air replenishing pump **2** is working to inflate the inflatable product; and determining, if the first stop switch **332** is closed, that refilling of the inflatable product is finished, and switching off the air replenishing pump **2** to stop refilling the inflatable product; and d1. Detecting, in real time, whether the second stop switch **333** is closed when the main air pump **1** is working to deflate the inflatable product; and determining, if the second stop switch **333** is closed, that deflation of the inflatable product is finished, and switching off the main air pump **1** to stop deflating the inflatable product.
(84) The central control unit **5** can switch between the above-mentioned states b1 and c1 when the inflatable product is in a normal use state.
(85) Furthermore, a washer **34** is may be arranged between the elastic member **382** and the linkage component **383** for isolating the lower end of the elastic member **382** from the linkage component **383** to prevent the elastic member **382** from getting stuck between the positioning component **381** and the linkage component **383** and thus to avoid unsmooth rotation. The elastic member **382** may be a coil spring compressed between the positioning component **381** and the linkage component **383**.
(86) It can be understood that the second stop switch **333** and the second contact **3832** are optional. In other words, in other example embodiments, the central control unit **5** only detects whether refilling or inflation of the inflatable product is finished, and controls, if refilling or inflation is finished, the built-in air pump assembly **100** to stop refilling or inflating the inflatable product. Accordingly, the central control unit **5** may not be in the working state d1 described above.
(87) FIGS. **15** to **18***c* show another example embodiment of the air pressure adjustment assembly **3**.
(88) As shown in FIG. **17**, compared with an above-described embodiment of the air pressure adjustment assembly **3**, the air pressure adjustment assembly **3** according to this example

embodiment comprises a first wire **301**, a second wire **302**, and a third wire **303**. The elastic member **382** is electrically conductive. The air pressure adjustment assembly **3** comprises a flexible dividing assembly **340**. A part of the flexible dividing assembly **340** (for example, a periphery thereof) is sandwiched between the first housing **361** and the second housing **362** and correspondingly forms a seal. The flexible dividing assembly **340** divides the internal space of the housing **36** into a first chamber **3611** and a second chamber **3621**. The first chamber **3611** is in fluid communication with the inside of the inflatable product via the air intake pipe **3612**, and the second chamber **3621** is in fluid communication with the outside of the inflatable product. The adjusting device further comprises a first conductive element **341**, the first conductive element **341** being arranged on the side of the second chamber **3621** relative to the flexible dividing assembly **340**. The upper end of the first conductive element **341** and the upper end of the elastic member **382** are respectively fixed to the positioning component **381**. The lower end of the first conductive element **341** is disconnected from or in electrical communication with the flexible dividing assembly **340**.

(89) The flexible dividing assembly **340** is configured to: electrically connect the elastic member **382** to the first conductive element **341** when the flexible dividing assembly **340** is in contact with both of the elastic member **382** and the first conductive element **341**. The distance between one end of the elastic member **382** and the flexible dividing assembly **340** is smaller than the distance between the first conductive element **341** and the flexible dividing assembly **340** when the elastic member **382** freely extends.

(90) The driving device **4** is configured to adjust the distance between the positioning component **381** and the flexible dividing assembly **340**.

(91) The flexible dividing assembly **340** may comprise a flexible board **37** and a second conductive element **342**. The second conductive element **342** is attached to a side, facing the first conductive element **341**, of the flexible board **37**. Alternatively, the second conductive element **342** may be embedded onto the flexible board **37**. The first wire **301** is connected to the first conductive element **341**, the second wire **302** is connected to the elastic member **382**, and the third wire **303** is connected to the second conductive element **342**. The first conductive element **341**, the second conductive element **342** and the elastic member **382** may each be made from a material (for example, metal) with excellent electrical conductivity, such as copper, aluminum, nickel, cadmium, silver or an alloy thereof. In order to make the first conductive element **341**, the second conductive element **342**, and the elastic member **382** achieve required mechanical properties, they may be made from different materials. The first conductive element **341** and the elastic member **382** are in contact with or separated from the second conductive element **342** according to a change in internal air pressure of the inflatable product, such that the first wire **301** and the second wire **302** are electrically connected with or disconnected from the third wire **303**, respectively. The central control unit **5** determines the current state of the inflatable product according to these electrical connections and disconnections and may generate corresponding control signals. The first conductive element **341** may be a metal sheet fixed to (for example, at least partially embedded into) the positioning component **381**, the second conductive element **342** may be a metal plate or block, and the elastic member **382** may be fixedly arranged on the second housing **362**. The first conductive element **341** moves along with the positioning component **381**, so that the distance between the first conductive element **341** and the flexible dividing assembly **340** (and the second conductive element **342**) can be adjusted by means of the driving device **4**. The further the first conductive element **341** is from the second conductive element **342**, the greater the compression of the elastic member **382** is required to bring the first conductive element **341** and the second conductive element **342** into contact and to stop inflating the inflatable product. In this way, the driving device **4** may be configured to adjust the preset inflation air pressure of the inflatable product.

(92) It can be understood that according to one or more alternate example embodiments, the first conductive element **341** and the elastic member **382** may be mounted in a manner different from

that described above. In the orientation of FIG. **17**, the upper end of the elastic member **382** is fixed to (for example, at least partially embedded into) the positioning component **381**, while the first conductive element **341** is fixed to the second housing **362**. The further the upper end of the elastic member **382** is from the second conductive element **342**, the greater the compression of the elastic member **382** is required to bring the first conductive element **341** and the second conductive element **342** into contact and to stop inflating the inflatable product. In this way, the driving device **4** may be configured to adjust the preset inflation air pressure of the inflatable product.

(93) Similarly, it can be understood that according to one or more alternate example embodiments, the flexible dividing assembly **340** may comprise a flexible board **37** that is electrically conductive. The electrically conductive flexible board **37** is made of a material with good electrical conductivity (for example, metal, or silicone rubber doped with an electrically conductive material). Accordingly, the second conductive element **342** may be omitted. This example embodiment differs from the previous example embodiment in that the third wire **303** is connected to the electrically conductive flexible board **37**. The first conductive element **341** and the elastic member **382** are in contact with or separated from the electrically conductive flexible board **37**, according to the change in the internal air pressure of the inflatable product, so that the first wire **301** and the second wire **302** are electrically connected with or disconnected from the third wire **303**.

(94) As shown in FIGS. **18***a* to **18***c*, for example, the flexible dividing assembly **340** comprises the flexible board **37** and the second conductive element **342**. The first conductive element **341** is snapped into the positioning component **381** by a connecting member **3411** and moves vertically with the positioning component **381**. A boss **3624** is provided at the bottom of the second housing **362**, the upper end of the elastic member **382** being snapped on and fixed to the boss **3624**. The first conductive element **341** may be provided with a first contact point **3411** near the second conductive element **342**, while the second conductive element **342** may be provided with a second contact point **3421** near the first conductive element **341**. The change in the internal air pressure of the inflatable product causes the flexible board **37** and the second conductive element **342** to move along the axis Z. Accordingly, the second conductive element **342** may: (1) be separated from both of the elastic member **382** and the first conductive element **341**, such that the second wire **302** and the third wire **303** are disconnected and the first wire **301** and the third wire **303** are disconnected; (2) be in contact with the elastic member **382** but separated from the first conductive element **341**, such that the second wire **302** and the third wire **303** are electrically connected but the first wire **301** and the third wire **303** are disconnected; or (3) be in contact with both of the elastic member **382** and the first conductive element **341**, such that the third wire **303** is electrically connected with the first wire **301** and the second wire **302**, wherein the first conductive element **341** and the second conductive element **342** are electrically connected by the contact between the first contact point **3411** and the second contact point **3421** described above.

(95) It can be understood that when the flexible dividing assembly **340** comprises the electrically conductive flexible board **37**, accordingly, the change in the internal air pressure of the inflatable product causes the flexible board **37** to move along the axis Z. The electrically conductive flexible board **37** may: (1) be separated from both of the elastic member **382** and the first conductive element **341**, such that the second wire **302** and the third wire **303** are disconnected and the first wire **301** and the third wire **303** are disconnected; (2) be in contact with the elastic member **382** but separated from the first conductive element **341**, such that the second wire **302** and the third wire **303** are electrically connected but the first wire **301** and the third wire **303** are disconnected; or (3) be in contact with both of the elastic member **382** and the first conductive element **341**, such that the third wire **303** is electrically connected with the first wire **301** and the second wire **302**.

(96) The central control unit **5** detects the electrical connections and disconnections between the third wire **303** and the first wire **301** and the second wire **302**, and sends corresponding control signals to the main air pump **1** according to these electrical connections and disconnections to

control the main air pump **1** to work or stop. For ease of understanding, example working states of the central control unit **5** are listed as below: a2. Detecting in real time whether the first wire **301** and the third wire **303** are electrically connected when the main air pump **1** works to inflate the inflatable product; and determining, if the first wire **301** and the third wire **303** are electrically connected, that inflation of the inflatable product is finished, and switching off the main air pump **1** to stop inflating the inflatable product; b2. Standing by after the main air pump **1** finishes inflating the inflatable product, and detecting at preset time intervals whether the first wire **301** and the third wire **303** are electrically connected; and determining, if the first wire **301** and the third wire **303** are not electrically connected, that the inflatable product is under pressure, and switching on the air replenishing pump **2** to refill the inflatable product; c2. Detecting in real time whether the first wire **301** and the third wire **303** are electrically connected when the air replenishing pump **2** works to inflate the inflatable product; and determining, if the first wire **301** and the third wire **303** are electrically connected, that refilling of the inflatable product is finished, and switching off the air replenishing pump **2** to stop refilling the inflatable product; and d2. Detecting in real time whether the second wire **302** and the third wire **303** are electrically connected when the main air pump **1** works to deflate the inflatable product; and determining, if the second wire **302** and the third wire **303** are not electrically connected, that deflation of the inflatable product is finished, and switching off the main air pump **1** to stop deflating the inflatable product.

(97) The central control unit **5** can switch between the above-mentioned state b2 and state c2 when the inflatable product is in a normal use state.

(98) It can be understood that according to one or more alternate example embodiments, one of the first contact point **3411** and the second contact point **3421** may be omitted, or both of the first contact point **3411** and the second contact point **3421** may be omitted.

(99) An example process in which the central control unit **5** controls the working state of the main air pump is described below.

(100) Referring to FIG. **18***a*, when the built-in air pump assembly **100** is in an inflation state, the first conductive element **341** and the flexible dividing assembly **340** are separated, and the elastic member **382** and the flexible dividing assembly **340** are either in contact with or separated from each other. For example, when the user just takes out the inflatable product from a product package, there is almost no air in the air chamber of the inflatable product. The air pressure difference between two sides of the flexible board **37** allows the flexible dividing assembly **340** to be away from the first conductive element **341**, and the flexible dividing assembly **340** is separated from the elastic member **382**. For example, when the inflatable product has been inflated with a certain amount of air, the flexible dividing assembly **340** and the first conductive element **341** are separated by the air pressure difference between the two sides of the flexible board **37**, but the flexible dividing assembly **340** is in contact with the elastic member **382**.

(101) Regardless of whether the elastic member **382** and the flexible dividing assembly **340** are in contact with or separated from each other when the built-in air pump assembly **100** enters the inflation state, the flexible dividing assembly **340** moves toward the first conductive element **341** as the air pressure inside the inflatable product increases. When the flexible dividing assembly **340** is finally in contact with both of the first conductive element **341** and the elastic member **382**, the first wire **301** and the second wire **302** are electrically connected with the third wire **303**, as shown in FIG. **18***b*. The central control unit **5** determines that inflation of the inflatable product is finished, and controls the main air pump **1** to stop.

(102) Still referring to FIG. **18***a*, if the built-in air pump assembly **100** is in a deflation state, the first conductive element **341** is separated from the flexible dividing assembly **340**, while the elastic member **382** and the flexible dividing assembly **340** are either in contact with or separated from each other. As the air pressure inside the inflatable product decreases, the flexible dividing assembly **340** moves away from the first conductive element **341**. When the flexible dividing assembly **340** is finally separated from both of the first conductive element **341** and the elastic

member **382**, the first wire **301** and the second wire **302** are both disconnected from the third wire **303**, as shown in FIG. **18***c*. The central control unit **5** determines that deflation of the inflatable product is finished, and controls the main air pump **1** to stop.

(103) It can be understood that the second wire **302** described above may be optional. In other words, according to one or more other example embodiments, the central control unit **5** may only detect whether refilling or inflation of the inflatable product is finished, and control, if refilling or inflation is finished, the built-in air pump assembly **100** to stop refilling or inflating the inflatable product. Accordingly, the elastic member **382** may be either electrically conductive or insulating, while the central control unit **5** may not be in the above-mentioned working state d2.

(104) FIG. **19** illustrates another example embodiment of the air pressure adjustment assembly **3**. The air pressure adjustment assembly **3** may further comprise a microswitch **39** for indicating completion of deflation of the inflatable product, the microswitch **39** being electrically connected to the central control unit **5**. When deflation of the inflatable product is finished and the air pressure inside the inflatable product drops, the air pressure inside the first chamber **3611** drops synchronously, and the flexible board **37** moves toward the first housing **361** under the action of the elastic member **382** to trigger the microswitch **39**. Upon detecting that the microswitch **39** is triggered, the central control unit **5** controls the main air pump **1** to stop. It can be understood that the microswitch **39** described above is optional. In other words, according to one or more alternate example embodiments, the central control unit **5** only detects whether refilling or inflation of the inflatable product is finished, and controls, if refilling or inflation is finished, the built-in air pump assembly **100** to stop refilling or inflating the inflatable product.

(105) FIGS. **20** to **23***b* illustrate an example embodiment of the driving device **4**.

(106) As shown in FIG. **20**, the driving device **4** comprises: a knob **401**, a first reset spring **41**, a transmission component **42**, and a start switch triggering element **43**. The knob **401** is coupled to the positioning component **381** and is configured to drive the positioning component **381** to rotate axially, and the knob **401** is axially movably arranged on the panel **7** to trigger the start switch **331** for initiating the air pump to inflate or deflate the inflatable product. By means of moving the knob **401** to a preset position, the start switch **331** for initiating the main air pump **1** is triggered.

(107) The first reset spring **41**, with the upper end abutting against a lower surface of the knob **401** and the lower end abutting against an upper surface of the panel **7**, is arranged between the knob **401** and the panel **7**.

(108) As shown in FIGS. **20** and **21**, the lower surface of the knob **401** is provided with an arc-shaped groove **4011**, and the upper end of the transmission component **42** is provided with an arc-shaped bulge **423** that matches the arc-shaped groove **4011**, so that the arc-shaped bulge **423** may be snapped into the arc-shaped groove **4011**. The lower surface of the knob **401** is further provided with a first connecting shaft **4012**, the transmission component **42** is further provided with a shaft cavity **424** that matches the first connecting shaft **4012**, and the first connecting shaft **4012** penetrates the shaft cavity **424** and is fixed by a first screw **461**. Thus, the transmission component **42** is coaxially and fixedly connected to the knob **401** and rotates synchronously with the knob **401**. The upper end of the transmission component **42** is nested in the first reset spring **41**.

(109) A clamping rib **421** is further arranged on the transmission component **42**, and the upper end of the positioning component **381** is provided with clamping teeth **3812** (as shown in FIG. **12**) that match the clamping rib **421**, so that the positioning component **381** can rotate synchronously with the transmission component **42**.

(110) The start switch triggering element **43** abuts beneath the transmission component **42** and comprises a limit groove **432** provided with a through hole **4321**. A lower surface of the panel **7** is provided with a downwardly extending guide post **73**, and the through hole **4321** matches the guide post **73** such that at least a portion of the panel **7** is sleeved around the start switch triggering element **43**, and the start switch triggering element **43** can move axially along the guide post **73**. The start switch triggering element **43** is further provided with a bulge **431**, the bulge **431** being

configured to trigger the start switch **331** of the air pressure adjustment assembly **3**.
(111) When the knob **401** is pressed down, the start switch triggering element **43** is pushed downwards to cause the bulge **431** to trigger the start switch **331** for starting the main air pump, at which time the first reset spring **41** is compressed. When the pressing force applied on the knob **401** disappears, the knob **401** can be restored to its initial position by the elastic force of the first reset spring **41**.
(112) The driving device **4** may further comprise a spring anti-torque gasket **47** arranged between the spring and the knob **401**. The spring anti-torque gasket **47** is provided with first anti-torque teeth **471**, and the upper side of the panel **7** is provided with first convex teeth **741** that match the first anti-torque teeth **471**. The transmission component **42** is provided with second anti-torque teeth **422**, and the lower side of the panel **7** is provided with second convex teeth **742** that match the second anti-torque teeth **422**. When the transmission component **42** is not pressed down, the second anti-torque teeth **422** engage with the second convex teeth **742**, so that the transmission component **42** is non-rotatable relative to the panel **7**; and when the transmission component **42** is pressed down, the second anti-torque teeth **422** disengage from the second convex teeth **742**, and the transmission component **42** is rotatable relative to the panel **7**. At this time, the first anti-torque teeth **471** of the spring anti-torque gasket **47** engage with the first convex teeth **741**, so that the spring anti-torque gasket **47** may not rotate with the knob **401** when the knob **401** rotates, and the spring anti-torque gasket **47** is fixed relative to the panel **7**, thus preventing the first reset spring **41** from rotating with the knob **401** and hence avoiding affecting rotation of the knob **401** per se.
(113) FIGS. **24** to **27***b* illustrate another example embodiment of the driving device **4**.
(114) The driving device **4** comprises a button **402** arranged on the knob **401**, the button **402** moving toward the accommodating chamber **62** to trigger the start switch **331** for starting the air pump to inflate or deflate the inflatable product. The knob **401** is configured to be rotated to preset a pressure value of the air pump, but is axially fixed relative to the panel **7**.
(115) The knob **401** is provided with an arc-shaped bulge **4013**, and an outer wall of the transmission component **42** is provided with an arc-shaped groove **425** that matches the arc-shaped bulge **4013**, so that the transmission component **42** can rotate synchronously with the knob **401**.
(116) The button **402** is provided with a second connecting shaft **4014**, and the transmission component **42** is provided with a shaft cavity **424** that matches the second connecting shaft **4014** to allow the second connecting shaft **4014** to penetrate the shaft cavity **424**.
(117) The driving device **4** further comprises a second reset spring **45**, the second reset spring **45** being arranged between the button **402** and the panel **7** to reset the start switch triggering element **43** after the force that the button **402** applies on the start switch triggering element **43** disappears. More particularly, the panel **7** is further provided with at least one guide post **73**, the number of the guide posts **73** being the same as the number of second reset springs **45**. The start switch triggering element **43** abuts beneath the transmission component **42** and sleeves the corresponding guide post **73** via one or more through holes **4321** to be vertically movable along the guide post **73**. Each second reset spring **45** sleeves a corresponding guide post **73** and is fixed by a second screw **462**. Each second screw **462** is provided with a flange **4621** having a diameter greater than the aperture of the corresponding through hole **4321**. The upper end of the second reset spring **45** abuts against a lower surface of the limit groove **432** of the start switch triggering element **43**, and the lower end of the second reset spring **45** abuts against the flange **4621** of the second screw **462**. In the embodiment shown in FIG. **24**, the panel **7** is provided with two guide posts **73**. It can be understood that according to one or more alternate example embodiments, the panel **7** may be provided with only one guide post **73** or with at least three guide posts **73**.
(118) When the button **402** is pressed down, the transmission component **42** and the start switch triggering element **43** move downwards synchronously, and the second reset spring **45** is compressed until the start switch triggering element **43** triggers the start switch **331**. When the pressing force applied on the button **402** disappears, the second reset spring **45** pushes upwards the

start switch triggering element **43**, the transmission component **42** and the button **402** to return to their initial positions.
(119) FIGS. **28** to **29***b* illustrate another example embodiment of the driving device **4**.
(120) Compared with the previously-described example embodiment of the driving device **4**, the driving device **4** according to this example embodiment comprises a transmission gear **48**, the transmission gear **48** being fixed to the panel **7** by a third screw **463** and being able to rotate axially relative to the third screw **463**. The knob **401** is fixedly provided with first teeth **4011** distributed in the circumferential direction, and the transmission gear **48** is provided with second teeth **481** distributed in the circumferential direction. The second teeth **481** engage with the first teeth **4011** and also engage with the clamping teeth **3812** of the positioning component **381**. Therefore, the knob **401** can rotate to drive the transmission gear **48** to rotate, wherein the knob **401** and the transmission gear **48** rotate in opposite directions; and on the other hand, the transmission gear **48** can rotate to drive the positioning component **381** to rotate, wherein the transmission gear **48** and the positioning component **381** rotate in opposite directions. Therefore, the knob **401** rotates to drive the positioning component **381** to rotate in the same direction. The positioning component **381** that is rotating moves axially in the threaded cavity **3621** of the housing **36** along the axis Z. In this way, the first wire **301**, the second wire **302** and the third wire **303** may be conveniently extracted between the knob **401** and the positioning component **381**. In other words, the knob **401** and the positioning component **381** are separated from each other and coupled by a transmission mechanism (for example, the transmission gear **48**), such that the knob **401** can drive the positioning component **381** to rotate. Meanwhile, by adjusting a gear ratio of the knob **401** to the transmission gear **48** and/or a gear ratio of the transmission gear **48** to the positioning component **381**, the user can make the positioning component **381** rotate for a greater or smaller number of turns by rotating the knob **401** by one turn. The transmission mechanism in the example embodiment shown in FIGS. **28** to **29***b* is provided with only one transmission gear **48**. It can be understood, however, that according to one or more alternate example embodiments, the transmission mechanism may comprise a transmission gear set, for example, at least two transmission gears **48** constitute the transmission gear set, and the knob **401** drives, by means of the transmission gear set, the positioning component **381** to rotate. It can also be understood that the knob **401** can optionally drive, by means of other known transmission mechanisms, the positioning component **381** to rotate. For example, the transmission mechanism may comprise, but is not limited to, a pulley transmission mechanism.
(121) When the button **402** is pressed down, the start switch triggering element **43** moves downwards synchronously, and the second reset spring **45** is compressed until the start switch triggering element **43** triggers the start switch **331**. When the pressing force applied on the button **402** disappears, the second reset spring **45** pushes upwards the start switch triggering element **43**, the transmission component **42** and the button **402** to return to their initial positions.
(122) It can be understood that the built-in air pump assembly described above is applicable to a wide variety of inflatable products, so that a user can adjust, by adjusting the knob **401**, the internal air pressure of the inflatable product when inflation is finished. For example, the built-in air pump assembly is applicable to, but is not limited to, an inflatable mattress, an inflatable sofa or an inflatable toy.
(123) Referring to FIG. **30**, taking a built-in air pump assembly **100** for an inflatable mattress **1000** as an example, the built-in air pump assembly **100** is arranged in the inflatable mattress **1000** and is in fluid communication with an inflatable chamber **1002** of the inflatable mattress **1000**. A side wall **1001** of the inflatable mattress **1000** is provided with a panel **7** of the built-in air pump assembly **100**. By rotating a driving device **4** on the panel **7**, the user can make the built-in air pump assembly **100** suck air from the outside and inflate the inflatable chamber **1002**, or make the built-in air pump assembly **100** suck a gas from the inflatable chamber **1002** and expel the gas to an external atmosphere.

(124) It may be understood that the example embodiments described herein may be considered in a descriptive sense only and not for purposes of limitation. Descriptions of features or aspects within each example embodiment may be considered as available for other similar features or aspects in other example embodiments.
(125) While example embodiments have been described with reference to the figures, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope as defined by the following claims.

Claims

1. An inflatable product having a built-in air pump assembly and an inflatable chamber, the built-in air pump assembly comprising: a casing defining an accommodating chamber; a main air pump disposed in the accommodating chamber; an air pressure adjustment assembly comprising: a housing disposed in the accommodating chamber; a flexible board dividing an interior of the housing into a first chamber in fluid communication with the inflatable chamber and a second chamber in fluid communication with an exterior of the inflatable chamber; an adjusting device comprising: a positioning component disposed in the second chamber; and an electrically conductive elastic member disposed between the positioning component and the flexible board, one end of the elastic member being restrained by the positioning component; and a driving device coupled to the positioning component and configured to drive the positioning component to move relative to the housing to thereby adjust the distance between the positioning component and the flexible board; a first conductive element fixed to the positioning component; and a second conductive element fixed to the flexible board; wherein the first conductive element and the elastic member are, in response to a change in an internal air pressure of the inflatable chamber, moved into contact with the second conductive element and separated from the second conductive element.
2. The inflatable product according to claim 1, further comprising: a panel; wherein the driving device comprises: a knob coupled to the positioning component and axially moveable with respect to the panel such that axial movement of the knob triggers a start switch configured to initiate one of inflation and deflation of the inflatable chamber; and a reset spring disposed between the knob and the panel and configured to axially reset the knob.
3. The inflatable product according to claim 1, further comprising: a panel; wherein the driving device comprises: a knob disposed on the panel and coupled to the positioning component; a button axially moveable with respect to the knob such that axial movement of the button triggers a start switch for initiating one of inflation and deflation of the inflatable chamber; and a reset spring disposed between the button and the panel and configured to axially reset the button.
4. The inflatable product according to claim 2 wherein: the adjusting device further comprises: a linkage component disposed between the positioning component and the flexible board and abutting against the flexible board, wherein the elastic member comprises a first end abutting against the positioning component and a second end abutting against the linkage component; the driving device further comprises a transmission component fixedly connected to the knob and comprising a clamping rib; and the positioning component comprises clamping teeth coupled to the clamping rib.
5. The inflatable product according to claim 3, wherein: the knob comprises first teeth; and the driving device further comprises a transmission gear comprising second teeth coupled both to the first teeth and to the positioning component.
6. The inflatable product according to claim 2, wherein: the adjusting device further comprises a linkage component disposed between the positioning component and the flexible board and abutting against the flexible board, wherein the elastic member comprises a first end abutting against the positioning component and a second end abutting against the linkage component; the air

pressure adjustment assembly further comprises a switch assembly fixed to the housing and comprising the start switch and at least one stop switch configured to stop one of inflating and deflating of the inflatable chamber; and the linkage component comprises at least one contact corresponding to the stop switch, the linkage component moving correspondingly with the at least one contact according to a change in internal air pressure of the inflatable chamber and thereby configured to trigger the corresponding stop switch.

7. The inflatable product according to claim 2, wherein: the air pressure adjustment assembly comprises: a first wire connected to the first conductive element; and a second wire connected to the second conductive element; wherein the first wire is alternatively electrically connected to the second wire in response to the connectivity between the first conductive element and the second conductive element.

8. The inflatable product according to claim 1, wherein: the adjusting device further comprises a linkage component disposed between the positioning component and the flexible board and abutting against the flexible board, wherein the elastic member comprises a first end abutting against the positioning component and a second end abutting against the linkage component; the positioning component comprises an external thread; the housing comprises a threaded cavity comprising an internal thread that corresponds to the external thread and thereby enables the positioning component to move axially in the threaded cavity by means of rotation; and the elastic member is a spring compressed between the positioning component and the linkage component.

9. The inflatable product according to claim 1, wherein: the built-in air pump assembly further comprises an air replenishing pump disposed in the accommodating chamber.

10. The inflatable product according to claim 9, further comprising: a central control unit disposed in the accommodating chamber and electrically connected to each of the main air pump, the air replenishing pump, and the air pressure adjustment assembly.

11. The inflatable product according to claim 1, wherein: the casing further comprises an air port, wherein the accommodating chamber is in fluid communication with the inflatable chamber via the air port; and the built-in air pump assembly further comprises: a reversing core axially rotatably disposed in a guide holder, thereby forming an airflow channel; an air valve corresponding to the air port; and an air valve actuator abutting against an end of the reversing core, the air valve actuator configured to alternately open and close in response to a rotation of the reversing core.

12. An inflatable product having an inflatable chamber and a built-in air pump assembly, the built-in air pump assembly comprising: a casing defining an accommodating chamber therein; an air pressure adjustment assembly comprising: a housing disposed in the accommodating chamber; a flexible dividing assembly dividing an interior of the housing into a first chamber on a first side of the flexible dividing assembly and a second chamber on a second side of the flexible dividing assembly, the first chamber being in fluid communication with the inflatable chamber, and the second chamber is in fluid communication with an exterior of the inflatable chamber; and an adjusting device arranged on the second side of the flexible dividing assembly, the adjusting device comprising: a positioning component, a first conductive element comprising a first end fixed to the positioning component, and an electrically conductive elastic member comprising a first end fixed to the positioning component; and a driving device configured to adjust a distance between the positioning component and the flexible dividing assembly; wherein a second end of the first conductive element is alternately disconnected from a second end of the elastic member and in electrical communication with the second end of the elastic member by means of the flexible dividing assembly.

13. The inflatable product according to claim 12, wherein: when the elastic member is in an uncompressed state, a first distance between the second end of the elastic member and the flexible dividing assembly is smaller than a second distance between the first conductive element and the flexible dividing assembly.

14. An inflatable product comprising: a built in air pump comprising: a casing defining an

accommodating chamber; a main air pump disposed in the accommodating chamber; and an air pressure adjustment assembly comprising: a first wire; a second wire; a housing disposed in the accommodating chamber; a flexible board dividing an interior of the housing into a first chamber in fluid communication with the inflatable chamber and a second chamber in fluid communication with an exterior of the inflatable chamber; and an adjusting device comprising: a positioning component disposed in the second chamber; a first conductive element fixed to the positioning element; a second conductive element fixed to the flexible board; and an electrically conductive elastic member disposed between the positioning component and the flexible board, one end of the elastic member being restrained by the positioning component; wherein the first wire of the air pressure adjustment assembly is connected to the first conductive element, the second wire of the air pressure adjustment assembly is connected to the second conductive element, and the first wire is alternatively electrically connected to the second wire in response to the connectivity between the first conductive element and the second conductive element.

15. The inflatable product of claim 14, wherein the adjusting device further comprises a driving device coupled to the positioning component and configured to drive the positioning component to move relative to the housing to thereby adjust the distance between the positioning component and the flexible board.

16. The inflatable product of claim 14, wherein the first conductive element and the elastic member are in contact with the second conductive element or separated from the second conductive element in response to a change in an internal air pressure of the inflatable chamber.

17. The inflatable product of claim 14, wherein, when the elastic member is in an uncompressed state, a first distance between the at least one end of the elastic member and the flexible board is smaller than a second distance between the first conductive element and the flexible board.

18. The inflatable product of claim 1, further comprising a vibration absorbing material wrapped around the main air pump, such that the vibration absorbing material is positioned between the main air pump and the accommodating chamber.