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(54) **ELECTRIC BALANCE SCOOTER**  
ELEKTRISCHER GLEICHGEWICHTSROLLER  
TROTINETTE À ÉQUILIBRE ÉLECTRIQUE

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**Description**

## BACKGROUND OF THE INVENTION

## Field of the Invention

**[0001]** The present invention relates to an electric balance two-wheeled vehicle, of which two platforms for carrying people can rotate relative to each other to drive.

## Description of the Related Art

**[0002]** An electric balance vehicle is also known as a somatosensory vehicle or a sensor controlled vehicle. The operating principle thereof is mainly established on a basic principle called "dynamic stabilization", the change of car attitudes is detected by a gyroscope and an acceleration sensor inside the vehicle body, and a motor is accurately driven by a servo control system to adjust correspondingly, in order to keep the balance of the system.

**[0003]** The existing electric balance vehicle generally has an operating rod. A user stands on a foot platform of the balance vehicle to operate the operating rod so as to advance, retreat, and stop, and this control is also known as "manual control". The foot platform of the existing balance vehicle is generally a flat plate, and the foot platform is always kept in a horizontal state during use and cannot rotate relatively. Therefore, the user cannot control the balance vehicle merely through the feet. US 20130238231 discloses a two-wheel, self-balancing personal vehicle having independently movable foot placement sections. The user can independently control movement of each platform section by the magnitude and direction of tilt the user induces in a given platform section.

## BRIEF SUMMARY OF THE INVENTION

**[0004]** In order to overcome at least one defect in the prior art, the present invention provides an electric balance vehicle.

**[0005]** To achieve the above objective, the present invention provides an electric balance vehicle including a top cover, a bottom cover, an inner cover, a rotating mechanism, two wheels, two hub motors, a plurality of sensors, a power supply, and a controller. The top cover includes a first top cover and a second top cover disposed symmetrically and rotatable relative to each other. The bottom cover is fixed to the top cover, and the bottom cover includes a first bottom cover and a second bottom cover disposed symmetrically and rotatable relative to each other. The inner cover is fixed between the top cover and the bottom cover, and the inner cover includes a first inner cover and a second inner cover disposed symmetrically and rotatable relative to each other. The rotating mechanism is fixed between the first inner cover and the second inner cover. The two wheels are rotatably fixed

at two sides of the inner cover, respectively. The two hub motors are fixed in the two wheels, respectively. The plurality of sensors is disposed between the bottom cover and the inner cover, respectively. The power supply is fixed between the first bottom cover and the first inner cover. The controller is fixed between the second bottom cover and the second inner cover. The controller is electrically connected with the plurality of sensors, the power supply, and the hub motors, and the controller controls the hub motors to drive the corresponding wheels to rotate according to sensing signals transmitted by the sensors.

**[0006]** According to one embodiment of the invention, the electric balance vehicle may further include two pedals fixed to the top cover and the inner cover.

**[0007]** According to one embodiment of the invention, the pedals may have mutually separated friction strips disposed on upper surfaces of the pedals.

**[0008]** According to one embodiment of the invention, the first top cover and the second top cover may have hollow spaces, respectively, the first inner cover and the second inner cover may have recesses at positions corresponding to the hollow spaces, respectively, and the hollow spaces may be combined with the recesses to form pedal cavities for contacting the pedals.

**[0009]** According to one embodiment of the invention, the rotating mechanism may include two bearings, a shaft sleeve, and two snap springs, the two snap springs, the two bearings may be fixed to the first inner cover and the second inner cover, respectively, and the shaft sleeve may be fixed inside the two bearings and may be fixed to the inner cover via the two snap springs.

**[0010]** According to one embodiment of the invention, the inner cover may have a cylindrical barrel, and the bearings and the shaft sleeve may be installed in the barrel via the snap springs.

**[0011]** According to one embodiment of the invention, the electric balance vehicle may further include a decorative lamp disposed at the bottom cover.

**[0012]** According to one embodiment of the invention, the top cover may further include two indicating screens electrically connected with the controller. One indicating screen may display a remaining capacity of the power supply, and the other indicating screen may display a working state of the electric balance vehicle.

**[0013]** According to one embodiment of the invention, the sensor may include a gyroscope, an acceleration sensor, and an inductive switch, the inductive switch may sense whether a user stands on the electric balance vehicle so as to be on or off, the controller may receive the sensing signal of the inductive switch to control the hub motors to work or to stop, and the controller may receive the sensing signals of the acceleration sensor and the gyroscope to control the hub motors to change a state or to keep the state.

**[0014]** According to one embodiment of the invention, the inductive switch may be an infrared photoelectric sensor.

**[0015]** According to one embodiment of the invention, the electric balance vehicle may further include a charging interface disposed at the bottom cover.

**[0016]** According to one embodiment of the invention, the electric balance vehicle may further include an interface cover covering the charging interface.

**[0017]** According to one embodiment of the invention, the electric balance vehicle may further include a limiting shaft disposed between the first inner cover and the second inner cover, and the length of the limiting shaft in the second inner cover may be larger than the length of the limiting shaft in the first inner cover.

**[0018]** According to one embodiment of the invention, the top cover may have two arc-shaped projections, and the two arc-shaped projections may be located above the two wheels and may cover a part of the wheels, respectively.

**[0019]** According to one embodiment of the invention, the width of the arc-shaped projections may be larger than the width of the wheels.

**[0020]** According to one embodiment of the invention, the top cover and the bottom cover may be made of plastic, and the inner cover may be made of aluminum alloy.

**[0021]** According to one embodiment of the invention, the electric balance vehicle may further include a remote controller, and the controller may receive a control signal sent by the remote controller.

**[0022]** According to one embodiment of the invention, the controller may have a storage unit and a correction unit, the storage unit may store an initial balance state of the electric balance vehicle, and the correction unit may correct a current balance state of the electric balance vehicle.

**[0023]** In summary, according to the invention, the inner cover is uniquely disposed between the top cover and the bottom cover of the electric balance vehicle, such that the entire structure of the electric balance vehicle is firmer, and electronic elements inside the vehicle body are protected at the same time. Further, a space for fixing the electronic elements is formed between the inner cover and the bottom cover, such that the electronic elements are installed more compactly. The power supply and the controller are disposed in two parts of the vehicle body, respectively. Therefore, one power supply and one controller can control the two hub motors simultaneously, the assembly is easier, the wiring is more convenient, and more space is saved. Meanwhile, the weights on both sides of the vehicle body are better balanced thus to improve the self-balance of the vehicle body. According to the present invention, the wheels are located at the left and right edges of the vehicle body. Thus, the wheels with larger sizes can be used. Compared with the existing balance vehicle with wheels installed at the bottom of the bottom cover, the electric balance vehicle has considerable movement distance and speed advantages. Further, the hub motors are adopted in the present invention, and the motors are directly installed in the wheels. Accordingly, the structure of the electric balance

vehicle is more compact. Compared with the balance vehicle singly installed with a motor, more space is saved and the entire device is more compact.

**[0024]** These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims, and accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

### **[0025]**

FIG. 1 is a sectional view showing an electric balance vehicle according to a first embodiment of the present invention;

FIG. 2 is an exploded schematic diagram showing the electric balance vehicle according to the first embodiment of the invention;

FIG. 3 is a schematic diagram showing the electric balance vehicle according to the first embodiment of the invention;

FIG. 4 is a schematic diagram showing the electric balance vehicle at another angle according to the first embodiment of the invention;

FIG. 5 is a partial functional block diagram of the electric balance vehicle according to the first embodiment of the invention; and

FIG. 6 is a schematic diagram showing an electric balance vehicle according to a second embodiment of the invention.

## DETAILED DESCRIPTION OF THE INVENTION

**[0026]** Please refer to FIG. 1 to FIG. 5 together. An electric balance vehicle 100 in this embodiment includes a top cover 1, an inner cover 2, a bottom cover 3, two hub motors 4, two wheels 50, a rotating mechanism 60, a plurality of sensors 80, a power supply 81, and a controller 82.

**[0027]** The top cover 1 includes a first top cover 11 and a second top cover 12, and the first top cover 11 and the second top cover 12 are disposed symmetrically and rotatable relative to each other. When the electric balance vehicle 100 is in a using state, the top cover 1 is located at the top. The first top cover 11 may be a left top cover, and the second top cover 12 may be a right top cover. However, the invention is not limited thereto. When the electric balance vehicle 100 is rotated 180 degrees horizontally, the first top cover 11 becomes the right top cover, and the second top cover 12 becomes the left top cover.

**[0028]** The shapes of the first top cover 11 and the second top cover 12 are basically the same, and the first

top cover 11 and the second top cover 12 can rotate relative to each other under the action of the rotating mechanism 60. The inward parts of the first top cover 11 and the second top cover 12 are connected to form an X shape, and two indicating screens 13 are disposed at the inner ends. The indicating screens 13 are electrically connected with the controller 82, wherein one of the indicating screens 13 can display a remaining capacity of the power supply 81, and the other indicating screen 13 can display a working state of the electric balance vehicle 100. In actual application, a transparent outer cover 14 is disposed on each indicating screen 13 for protecting the indicating screen 13 and facilitating reading for a user. The indicating screen 13 displaying the working state can display different icons (for example, a battery icon and the like) according to different modes of the electric balance vehicle 100, for example, a low speed mode, a high speed mode, a normal system state, a locked state and the like, thereby enabling the user to intuitively and clearly understand the working state of the electric balance vehicle 100.

**[0029]** In the embodiment, outward parts of the first top cover 11 and the second top cover 12 have arc-shaped projections 15, respectively, and the two arc-shaped projections 15 are located above the two wheels 50 and cover a part of the wheels 50, respectively. In the first embodiment, the width W1 of each of the arc-shaped projections 15 is larger than the width W2 of each of the wheels 50. The arc-shaped projections 15 completely cover the tops of the wheels 50. Due to this arrangement, the arc-shaped projections 15 can effectively block muddy water splashed when the wheels 50 walk. Meanwhile, a hanging object (for example, an overlong waistband of the clothes of the user) is prevented from being accidentally rolled into the wheels in a moving process to cause possible injury of the user, so that the safety of the electric balance vehicle 100 is improved. However, the invention is not limited thereto. In other embodiments, the arc-shaped projections 15 can be designed to be narrow at two ends and wide in the middle.

**[0030]** The bottom cover 3 is fixed to the top cover 1. In actual application, the top cover 1 and the bottom cover 3 can be fixed together by screws. In the present invention, the top cover 1, the inner cover 2, and the bottom cover 3 jointly form the framework of the electric balance vehicle 100, and after the top cover 1 and the bottom cover 3 are fixed together, the inner cover 2 is covered inside the vehicle body and is not exposed. When the electric balance vehicle 100 is in the using state, the bottom cover 3 is located at the bottom.

**[0031]** The bottom cover 3 includes a first bottom cover 31 and a second bottom cover 32, and the first bottom cover 31 and the second bottom cover 32 are disposed symmetrically and rotatable relative to each other. The shapes of the first bottom cover 31 and the second bottom cover 32 are basically the same, and the first bottom cover 31 and the second bottom cover 32 can rotate relative to each other under the action of the rotating mechanism

60. The inward parts of the first bottom cover 31 and the second bottom cover 32 are connected to form an X shape. Similarly, the first bottom cover 31 may be a left bottom cover, and the second bottom cover 32 may be a right bottom cover. When the electric balance vehicle 100 is rotated 180 degrees horizontally, the first bottom cover 31 becomes the right bottom cover, and the second bottom cover 32 becomes the left bottom cover.

**[0032]** In the embodiment, the bottom cover 3 has two decorative lamps 33 for increasing the beautiful appearance and playing an illumination role at the same time. The shells of the decorative lamps 33 may be transparent for transmitting light. In actual application, the decorative lamps 33 may be electrically connected with the controller 82, so that the decorative lamps 33 can reflect a driving state of the electric balance vehicle 100 to remind surrounding people, thereby improving the using safety. For example, when the electric balance vehicle 100 advances, the decorative lamps 33 may stay lit; when the electric balance vehicle 100 retreats, the decorative lamps 33 may flash; when the electric balance vehicle 100 turns left, the decorative lamp 33 at the left side may flash or stay lit, and the decorative lamp 33 at the right side may be off; when the electric balance vehicle 100 turns right, the decorative lamp 33 at the right side may flash or stay lit, and the decorative lamp 33 at the left side may be off. The lighting states of the decorative lamps 33 are not limited in the invention.

**[0033]** The inner cover 2 is fixed between the top cover 1 and the bottom cover 3. The inner cover 2 includes a first inner cover 21 and a second inner cover 22, and the first inner cover 21 and the second inner cover 22 are disposed symmetrically and rotatable relative to each other. The shapes of the first inner cover 21 and the second inner cover 22 are basically the same, and the first inner cover 21 and the second inner cover 22 can rotate relative to each other under the action of the rotating mechanism 60. The rotating mechanism 60 may be installed in the middle of the inner cover 2, and the longitudinally installed hub motors 4 are fixed to the left and right edges. In the embodiment, the first inner cover 21 and the second inner cover 22 are interconnected to form an entirety. However, the invention is not limited thereto. In other embodiments, the first inner cover 21 and the second inner cover 22 may be mutually separated and independent components. Similarly, the first inner cover 21 may be a left inner cover, and the second inner cover 22 may be a right inner cover. When the electric balance vehicle 100 is rotated 180 degrees horizontally, the first inner cover 21 becomes the right inner cover, and the second inner cover 22 becomes the left right cover.

**[0034]** In the embodiment, the electric balance vehicle 100 further includes two pedals 5, and the pedals 5 are fixed to the top cover 1 and the inner cover 2. To enable the user to stand more stably in the moving process, mutually separated friction strips 51 are disposed on the upper surface of each pedal 5 of the balance vehicle 100 in the embodiment to increase the friction force.

**[0035]** To fix the pedals 5 and reduce the volume of the balance vehicle 100, the first top cover 11 and the second top cover 12 have hollow spaces 16, respectively, the first inner cover 21 and the second inner cover 22 have recesses 23 at positions corresponding to the hollow spaces 16, respectively, and the hollow spaces 16 and the recesses 23 are mutually combined to form pedal cavities (not shown in FIG. 2) for containing the pedals 5. In actual application, the hollow spaces 16 are penetrated in the top cover 1, the recesses 23 are not penetrated in the inner cover 2, and the shapes of the hollow spaces 16 and the recesses 23 are matched with the shapes of the pedals 5. The pedal cavities are containing spaces having bottom surfaces and side walls formed after the combination of the hollow spaces 16 with the recesses 23.

**[0036]** When in use, the pedals 5 directly carry the user. The inner cover 2 is used as the internal framework of the entire balance vehicle 100 to indirectly bear the weight of the user transferred by the pedals 5, thereby preventing electronic elements between the inner cover 2 and the bottom cover 3 from being extruded by the weight of the user. Therefore, the entire electric balance vehicle 100 is firmer and stronger, and the electronic elements therein are protected, such that the balance vehicle 100 operates more stably and has longer service life. Preferably, the inner cover 2 is made of aluminum alloy. Thus, the strength is higher, and the structure is more stable. The top cover 1 and the bottom cover 3 are made of plastic, so that the weight of the entire vehicle body is reduced, the processes, such as spray coating, coloring and so on, are conveniently carried out on the appearance of the vehicle body, and antifouling and waterproof functions are achieved. Since the conventional electric balance vehicle does not include the inner cover 2, the internal electronic elements directly bear the weight of the user, and due to the shaking generated during the driving process of the conventional balance vehicle, an automatic power off situation is easy to occur, and the user is easy to fall down during driving. The electric balance vehicle 100 in the present invention has solved this technical problem.

**[0037]** The rotating mechanism 60 is fixed between the first inner cover 21 and the second inner cover 22. In the first embodiment, the rotating mechanism 60 includes two bearings 61, a shaft sleeve 62, and two snap springs 63. The two bearings 61 are fixed to the inner ends of the first inner cover 21 and the second inner cover 22, respectively. The shaft sleeve 62 is fixed inside the two bearings 61 and is fixed to the inner cover 2 via the two snap springs 63. Thus, the left and right inner covers of the inner cover 2 can rotate under the cooperation of the rotating mechanism 60. Due to the arrangement of the rotating mechanism 60, the two parts of the vehicle body of the electric balance vehicle 100 can rotate freely and relatively.

**[0038]** To install the rotating mechanism 60, a cylindrical barrel 24 may be designed at the inward ends of the

first inner cover 21 and the second inner cover 22, and the bearings 61 and the shaft sleeve 62 are installed in the barrel 24 via the snap springs 63 from outside to inside. In order to limit an overlarge relative rotation angle between the first inner cover 21 and the second inner cover 22, the electric balance vehicle 100 further includes a limiting shaft 7, and the length of the limiting shaft 7 in the second inner cover 22 is larger than the length of the limiting shaft 7 in the first inner cover 21. In the embodiment, the limiting shaft 7 is located between the inward ends of the first inner cover 21 and the second inner cover 22.

**[0039]** The two wheels 50 are rotatably fixed at two sides of the inner cover 2, respectively, and the two hub motors 4 are fixed in the two wheels 50, respectively. The hub motor 4 is also called in-wheel motor, wherein power, transmission, and braking devices are incorporated into a hub, so that a large quantity of transmission components can be omitted, the structure of the balance vehicle can be simpler, a better space utilization rate can be obtained, and the transmission efficiency can be improved at the same time. Since the hub motor 4 have the characteristic of independently driving a single wheel, differential steering similar to a crawler-type vehicle can be achieved by different rotating speeds and even by inversion of the left and right wheels 50, so that the turning radius of the vehicle can be greatly reduced, and in-situ steering can be nearly achieved under a particular condition.

**[0040]** The plurality of sensors 80 are disposed between the bottom cover 3 and the inner cover 2. In detail, a half of the sensors 80 are disposed between the first bottom cover 31 and the first inner cover 21, and the other half of the sensors 80 are disposed between the second bottom cover 32 and the second inner cover 22. The power supply 81 is fixed between the first bottom cover 31 and the first inner cover 21. The controller 82 is fixed between the second bottom cover 32 and the second inner cover 22. In the present invention, only one power supply 81 and one controller 82 are required to simultaneously control the two hub motors 4, so that the assembling is easier, the wiring is more convenient, and the repairing of the sold electric balance vehicle 100 returned to the factory is more convenient. Moreover, the power supply 81 and the controller 82 are disposed in two half parts of the vehicle body, respectively. Thus, more space is saved, and the structure of the entire vehicle body is more compact. An electric wire connecting the power supply 81 and the controller 82 and the electric wires connecting the controller 82 and the hub motors 4 can penetrate through the joint of the two half parts of the vehicle body, that is the electric wires penetrate from the left half part (or the right half part) of the vehicle body to the right half part (or the left half part).

**[0041]** In the embodiment, the sensors 80 include a gyroscope 83, an inductive switch 84, and an acceleration sensor 85. In actual application, to modularize the internal elements of the entire device, the acceleration

sensor 85 and the gyroscope 83 are disposed on the same circuit board. Due to a visual angle, only the front surface of the circuit board can be seen in FIG. 2, and the acceleration sensor 85 and the gyroscope 83 (indicated by dotted lines in FIG. 2) are disposed on the back surface of the circuit board in actual application. The controller 82 is electrically connected with the plurality of sensors 80, the power supply 81, and the hub motors 4, and the controller 82 controls the hub motors 4 to drive the corresponding wheels 50 to rotate according to sensing signals transmitted by the sensors 80.

**[0042]** The inductive switch 84 senses whether the user stands on the electric balance vehicle 100 so as to be on or off, the controller 82 receives the sensing signal (i.e., the on or off signal) of the inductive switch 84 to control the hub motors 4 to work or to stop, and the controller 82 receives the sensing signals of the acceleration sensor 85 and the gyroscope 83 to control the hub motors 4 to change the state or to keep the state. In the first embodiment, the inductive switch 84 is an infrared photoelectric sensor. However, the invention is not limited thereto. In other embodiments, the inductive switch 84 may be a microwave inductive switch, an ultrasonic inductive switch, or any other inductive switches capable of achieving the same function. In the embodiment, the electric balance vehicle 100 further includes a blocking element 86. When the user stamps on the pedals 5, the blocking element 86 will block an infrared induction area of the infrared photoelectric sensor, and thus the infrared photoelectric sensor is started. The controller 82 receives a starting signal sent by the inductive switch 84, thereby driving the hub motors 4 to work.

**[0043]** The wheels of the balance vehicle in the prior art start rotating automatically once the balance vehicle is enabled, so that the user cannot easily stand on the balance vehicle. When the user gets off from the balance vehicle, the wheels do not stop rotating, and the entire wheels stop rotating only after the power switch is turned off. Thus, a very huge potential risk exists, and the using is very inconvenient. When the electric balance vehicle 100 in the embodiment is enabled, the hub motors 4 do not work, while the wheels 50 are driven by sensing whether the user stands on the pedals 5, thereby avoiding the blind rotating situation of the balance vehicle in the prior art and greatly improving the using safety. On the other hand, the electric balance vehicle 100 in the embodiment achieves automatic balance after sensing the stamping instead of balancing once the power supply is turned on, so that the safety of the vehicle body can be guaranteed, the rotation of the vehicle body is little to avoid the problem in the prior art that automatic balance is achieved once the power supply is turned on to cause a wrong balance point of the vehicle body and the vehicle body rotates to result in unbalance of the user.

**[0044]** The acceleration sensor 85 and the gyroscope 83 detect the motion state of the balance vehicle 100 together, for example, the acceleration, the angular speed and the like of the balance vehicle 100. The con-

troller 82 drives the hub motors 4 according to the sensing signals transmitted by the acceleration sensor 85 and the gyroscope 83, thereby determining to change the direction or the speed of the balance vehicle 100 or not.

5 The detection technology of the acceleration sensor 85 and the gyroscope 83 is conventional and will not be described herein for a concise purpose.

**[0045]** In the embodiment, the electric balance vehicle 100 further includes a U-shaped fixing element 9. The sensors 80 and the blocking element 86 are fixed to the U-shaped fixing element 9, in order to achieve modularized installation of the electronic elements of the entire device to facilitate the assembly, wiring and the subsequent maintenance.

10 **[0046]** In practice, the user drives a part or two parts of the vehicle body to twist by forces of the feet, in order to drive the sensors 80 to send the sensing signals to the controller 82. The controller 82 drives the hub motors 4 to operate according to an internal control program, to enable the user to turn, advance or retreat, so that "foot control" is achieved, the use is more convenient, and the control is more flexible.

**[0047]** How the controller 82 in the present invention controls the balance vehicle to achieve a self-balancing state and controls the wheels 50 to advance, retreat or turn belongs to the prior art, and will not be described herein for a concise purpose. Specific reference can refer to currently disclosed balance vehicle control methods and control technologies adopted by balance vehicle production enterprises. For example, the Chinese patent application No. 201320050547.3, entitled BALANCE CONTROL DEVICE FOR INTELLIGENT BALANCING VEHICLE AND INTELLIGENT BALANCING VEHICLE, wherein the control device may be the controller 82 in the embodiment. Or, for example, the Chinese patent application No. 201220367045.9, entitled CIRCUIT CONTROL DEVICE FOR CONTROLLING BALANCING VEHICLE MOTOR BY USING CPLD. Certainly, in actual application, other control devices and control methods can also be selected, for example, the control method described in the Chinese patent application No. 201310516158.X, entitled CONTROL METHOD FOR TWO-WHEELED SELF-BALANCING VEHICLE.

**[0048]** In the embodiment, the electric balance vehicle 100 further includes a charging interface 87, and the charging interface 87 is disposed at the bottom cover 3. Specifically, the charging interface 87 is disposed at the outer side of the bottom cover 3 for charging the power supply 81 conveniently.

50 **[0049]** In the embodiment, the controller 82 has a storage unit 821 and a correction unit 822, the storage unit 821 stores an initial balance state of the electric balance vehicle 100, and the correction unit 822 corrects a current balance state of the electric balance vehicle 100. Specifically, after the electric balance vehicle 100 is delivered out of the factory, the data when the vehicle body is placed horizontally is recorded in the storage unit 821. After the electric balance vehicle 100 is used for a period

of time, due to external environments, such as temperature and so on, and using situations such as shaking, the sensors 80 of the electric balance vehicle 100 may deviate to a certain extent, so that the horizontal reference value of the electric balance vehicle 100 will change correspondingly. At that time, if the horizontal data adopted when leaving the factory is still adopted, the electric balance vehicle 100 is controlled inaccurately. After long term use, accidents may happen. A correction program is stored in the correction unit 822 in the embodiment. When the correction program is operated, the electric balance vehicle 100 detects the real-time conditions of the sensors 80 and judges and compares the real-time conditions with the initial horizontal data, so as to determine whether to overwrite the original data for resetting. By setting the correction program, the control accuracy and the service life of the electric balance vehicle 100 are greatly improved, and the problem in the prior art that the flexibility and the accuracy of the balance vehicle decline after the balance vehicle is used for a period of time is solved.

**[0050]** FIG. 6 is a schematic diagram showing an electric balance vehicle according to a second embodiment of the invention. Please refer to FIG. 6. The only difference between the electric balance vehicle 200 in the second embodiment and the electric balance vehicle 100 in the first embodiment lies in that the electric balance vehicle 200 further includes a remote controller 210, and the controller receives a control signal sent by the remote controller 210. Remote control of the electric balance vehicle 200 can be achieved by the remote controller 210. A startup button and a correction button and the like can be disposed on the remote controller 210. However, the invention is not limited thereto. The electric balance vehicle 200 further includes an interface cover 220, and the interface cover 220 covers the charging interface. The interface cover 220 can prevent muddy water splashed by operating the electric balance vehicle 200 from polluting the charging interface and even entering the vehicle body.

**[0051]** In summary, according to the invention, the inner cover is uniquely disposed between the top cover and the bottom cover of the electric balance vehicle, such that the entire structure of the electric balance vehicle is firmer, and the electronic elements inside the vehicle body are protected at the same time. Further, the space for fixing the electronic elements is formed between the inner cover and the bottom cover, such that the electronic elements are installed more compactly. The power supply and the controller are disposed in two parts of the vehicle body, respectively. Therefore, one power supply and one controller can control the two hub motors simultaneously, the assembly is easier, the wiring is more convenient, and more space is saved. Meanwhile, the weights on both sides of the vehicle body are better balanced thus to improve the self-balance of the vehicle body. According to the present invention, the wheels are located at the left and right edges of the vehicle body.

Thus, the wheels with larger sizes can be used. Compared with the existing balance vehicle with wheels installed at the bottom of the bottom cover, the electric balance vehicle has considerable movement distance and speed advantages. Further, the hub motors are adopted in the present invention, and the motors are directly installed in the wheels. Accordingly, the structure of the electric balance vehicle is more compact. Compared with the balance vehicle singly installed with a motor, more space is saved and the entire device is more compact.

**[0052]** Although the present invention has been described in considerable detail with reference to certain preferred embodiments thereof, the disclosure is not for limiting the scope of the invention. Persons having ordinary skill in the art may make various modifications and changes without departing from the scope and spirit of the invention. Therefore, the scope of the appended claims should not be limited to the description of the preferred embodiments described above.

## Claims

1. An electric balance vehicle (100; 200), comprising:
  - a top cover (1) comprising a first top cover (11) and a second top cover (12) disposed symmetrically and rotatable relative to each other;
  - a bottom cover (3) fixed to the top cover (1), the bottom cover (3) comprising a first bottom cover (31) and a second bottom cover (32) disposed symmetrically and rotatable relative to each other; **characterized in that,**
  - an inner cover (2) fixed between the top cover (1) and the bottom cover (3), the inner cover (2) comprising a first inner cover (21) and a second inner cover (22) disposed symmetrically and rotatable relative to each other;
  - a rotating mechanism (60) fixed between the first inner cover (21) and the second inner cover (22);
  - two wheels (50) rotatably fixed at two sides of the inner cover (2), respectively;
  - two hub motors (4) fixed in the two wheels (50), respectively;
  - a plurality of sensors (80) disposed between the bottom cover (3) and the inner cover (2);
  - a power supply (81) fixed between the first bottom cover (31) and the first inner cover (21); and
  - a controller (82) fixed between the second bottom cover (32) and the second inner cover (22), wherein the controller (82) is electrically connected with the plurality of sensors (80), the power supply (81), and the hub motors (4), and the controller (82) controls the hub motors (4) to drive the corresponding wheels (50) to rotate according to sensing signals transmitted by the sensors (80).

2. The electric balance vehicle (100; 200) according to claim 1, further comprising two pedals (5), wherein the pedals (5) are fixed to the top cover (1) and the inner cover (2).
3. The electric balance vehicle (100; 200) according to claim 2, wherein the pedals (5) have mutually separated friction strips (51) disposed on upper surfaces of the pedals (5).
4. The electric balance vehicle (100; 200) according to claim 2, wherein the first top cover (11) and the second top cover (12) have hollow spaces (16), respectively, the first inner cover (21) and the second inner cover (22) have recesses (23) at positions corresponding to the hollow spaces (16), respectively, and the hollow spaces (16) are combined with the recesses (23) to form pedal cavities for containing the pedals (5).
5. The electric balance vehicle (100; 200) according to any of claims 1-4, wherein the rotating mechanism (60) comprises two bearings (61), a shaft sleeve (62), and two snap springs (63), the two bearings (61) are fixed to the first inner cover (21) and the second inner cover (22), respectively, and the shaft sleeve (62) is fixed inside the two bearings (61) and is fixed to the inner cover (2) via the two snap springs (63).
6. The electric balance vehicle (100; 200) according to any of claims 1-5, further comprising a decorative lamp (33) disposed at the bottom cover (3).
7. The electric balance vehicle (100; 200) according to any of claims 1-6, wherein the top cover (1) further includes two indicating screens (13) electrically connected with the controller (82), one indicating screen (13) displays a remaining capacity of the power supply (81), and the other indicating screen (13) displays a working state of the electric balance vehicle (100; 200).
8. The electric balance vehicle (100; 200) according to any of claims 1-7, wherein the sensor (80) comprises a gyroscope (83), an acceleration sensor (85), and an inductive switch (84), the inductive switch (84) senses whether a user stands on the electric balance vehicle (100; 200) so as to be on or off, the controller (82) receives the sensing signal of the inductive switch (84) to control the hub motors (4) to work or to stop, and the controller (82) receives the sensing signals of the acceleration sensor (85) and the gyroscope (83) to control the hub motors (4) to change a state or to keep the state.
9. The electric balance vehicle (100; 200) according to any of claims 1-8, further comprising a charging in-

terface (87) disposed at the bottom cover (3).

10. The electric balance vehicle (200) according to claim 9, further comprising an interface cover (220), wherein the interface cover (220) covers the charging interface (87).
11. The electric balance vehicle (100; 200) according to any of claims 1-10, further comprising a limiting shaft (7) disposed between the first inner cover (21) and the second inner cover (22), wherein the length of the limiting shaft (7) in the second inner cover (22) is larger than the length of the limiting shaft (7) in the first inner cover (21).
12. The electric balance vehicle (100; 200) according to any of claims 1-11, wherein the top cover (1) has two arc-shaped projections (15), the two arc-shaped projections (15) are located above the two wheels (50) and cover a part of the wheels (50), respectively, and the width of the arc-shaped projections (15) is larger than the width of the wheels (50).
13. The electric balance vehicle (100; 200) according to any of claims 1-12, wherein the top cover (1) and the bottom cover (3) are made of plastic, and the inner cover (2) is made of aluminum alloy.
14. The electric balance vehicle (200) according to any of claims 1-13, further comprising a remote controller (210), wherein the controller (82) receives a control signal sent by the remote controller (210).
15. The electric balance vehicle (100; 200) according to any of claims 1-14, wherein the controller (82) has a storage unit (821) and a correction unit (822), the storage unit (821) stores an initial balance state of the electric balance vehicle (100; 200), and the correction unit (822) corrects a current balance state of the electric balance vehicle (100; 200).

#### Patentansprüche

1. Elektrisches Balance-Fahrzeug (100; 200) umfassend:
  - eine obere Abdeckung (1), die eine erste Abdeckung (11) und eine zweite Abdeckung (12) umfasst, die symmetrisch und relativ zueinander drehbar angeordnet sind;
  - eine untere Abdeckung (3), die an der oberen Abdeckung (1) befestigt ist, wobei die untere Abdeckung (3) eine erste untere Abdeckung (31) und eine zweite untere Abdeckung (32) umfasst, die symmetrisch und relativ zueinander drehbar angeordnet sind; **gekennzeichnet durch**
  - eine innere Abdeckung (2), die zwischen der

- oberen Abdeckung (1) und der unteren Abdeckung (3) befestigt ist, wobei die erste innere Abdeckung (2) eine erste innere Abdeckung (21) und eine zweite innere Abdeckung (22) umfasst, die symmetrisch und relativ zueinander drehbar angeordnet sind;  
einen Drehmechanismus (60), der zwischen der ersten inneren Abdeckung (21) und der zweiten inneren Abdeckung (22) befestigt ist;  
zwei Räder (50), die jeweils drehbar an den beiden Seiten der inneren Abdeckung (2) befestigt sind;  
zwei Nabenmotoren (4), die jeweils in den beiden Rädern (50) befestigt sind;  
eine Vielzahl von Sensoren (80), die zwischen der unteren Abdeckung (3) und der inneren Abdeckung (2) angeordnet sind;  
eine Stromquelle (81), die zwischen der ersten unteren Abdeckung (31) und der ersten inneren Abdeckung (21) befestigt ist; und  
ein Steuergerät (82), das zwischen der zweiten unteren Abdeckung (32) und der zweiten inneren Abdeckung (22) befestigt ist, wobei das Steuergerät (82) elektrisch mit der Vielzahl von Sensoren (80), der Stromquelle (81) und den Nabenmotoren (4) verbunden ist, und das Steuergerät (82) in Übereinstimmung mit den durch die Sensoren (80) übertragenen Erfassungssignale die Nabenmotoren (4) steuert, um die entsprechenden Räder (50) anzutreiben.
2. Elektrisches Balance-Fahrzeug (100; 200) nach Anspruch 1, ferner zwei Pedale (5) umfassend, wobei die Pedale (5) an der oberen Abdeckung (1) und der inneren Abdeckung (2) befestigt sind.
  3. Elektrisches Balance-Fahrzeug (100; 200) nach Anspruch 2, wobei die Pedale (5) auf der Oberfläche der Pedale (5) angeordnete, voneinander getrennte Anti-Rutsch-Streifen (51) aufweisen.
  4. Elektrisches Balance-Fahrzeug (100; 200) nach Anspruch 2, wobei die erste obere Abdeckung (11) und die zweite obere Abdeckung (12) jeweils Hohlräume (16) aufweisen, die erste innere Abdeckung (21) und die zweite innere Abdeckung (22) jeweils Aussparungen (23) an Stellen aufweisen, die den Hohlräumen (16) entsprechen, und die Hohlräume (16) mit den Aussparungen (23) kombiniert werden, um die Pedalhohlräume für die Aufnahme der Pedale (5) zu bilden.
  5. Elektrisches Balance-Fahrzeug (100; 200) nach einem der Ansprüche 1-4, wobei der Drehmechanismus (60) zwei Lager (61), eine Wellenhülse (62), und zwei Rastfedern (63) umfasst, wobei die beiden Lager (61) an der ersten inneren Abdeckung (21) bzw. der zweiten inneren Abdeckung (22) befestigt sind, und die Wellenhülse (62) in den beiden Lagern (61) befestigt ist und mithilfe der beiden Rastfedern (63) an der inneren Abdeckung (2) befestigt ist.
  - 5 6. Elektrisches Balance-Fahrzeug (100; 200) nach einem der Ansprüche 1-5, ferner eine an der unteren Abdeckung (3) angeordnete dekorative Leuchte (33) umfassend.
  - 10 7. Elektrisches Balance-Fahrzeug (100; 200) nach einem der Ansprüche 1-6, wobei die obere Abdeckung (1) ferner zwei Anzeigebildschirme (13) beinhaltet, die elektrisch mit dem Steuergerät (82) verbunden sind, wobei ein Anzeigebildschirm (13) eine verbleibende Kapazität der Stromversorgung (81) anzeigt, und der andere Anzeigebildschirm (13) einen Betriebszustand des elektrischen Balance-Fahrzeugs (100; 200) anzeigt.
  - 15 8. Elektrisches Balance-Fahrzeug (100; 200) nach einem der Ansprüche 1-7, wobei der Sensor (80) ein Gyroskop (83), einen Beschleunigungssensor (85), und einen Induktionsschalter (84) umfasst, wobei der Induktionsschalter (84) erfasst, ob der Benutzer auf dem elektrischen Balance-Fahrzeug (100; 200) steht, sodass dieses ein oder ausgeschaltet ist, das Steuergerät (82) das Erfassungssignal des Induktionsschalters (84) empfängt, um zu steuern, ob die Nabenmotoren (4) laufen oder zum Stillstand kommen, und wobei das Steuergerät (82) die Erfassungssignale des Beschleunigungssensors (85) und des Gyroskops (83) empfängt, um die Nabenmotoren (4) zu steuern, einen Zustand zu ändern oder den Zustand beizubehalten.
  - 20 9. Elektrisches Balance-Fahrzeug (100; 200) nach einem der Ansprüche 1-8, ferner eine an der unteren Abdeckung (3) angeordnete Ladeschnittstelle (87) umfassend.
  - 25 10. Elektrisches Balance-Fahrzeug (200) nach Anspruch 9, ferner eine Schnittstellenabdeckung (220) umfassend, wobei die Schnittstellenabdeckung (220) die Ladeschnittstelle (87) abdeckt.
  - 30 11. Elektrisches Balance-Fahrzeug (100; 200) nach einem der Ansprüche 1-10, ferner eine zwischen der ersten inneren Abdeckung (21) und der zweiten inneren Abdeckung (22) angeordnete Anschlagwelle (7) umfassend, wobei die Länge der Anschlagwelle (7) in der zweiten inneren Abdeckung (22) größer ist als die Länge der Anschlagwelle (7) in der inneren Abdeckung (21).
  - 35 12. Elektrisches Balance-Fahrzeug (100; 200) nach einem der Ansprüche 1-11, wobei die obere Abdeckung (1) zwei bogenförmige Vorsprünge (15) aufweist, wobei sich die zwei bogenförmigen Vorsprün-

ge (15) jeweils über den beiden Rädern (50) befinden und einen Teil der Räder (50) abdecken, und die Breite der bogenförmigen Vorsprünge (15) größer ist als die Breite der Räder (50).

13. Elektrisches Balance-Fahrzeug (100; 200) nach einem der Ansprüche 1-12, wobei die obere Abdeckung (1) und die untere Abdeckung (3) aus Kunststoff hergestellt sind und die innere Abdeckung (2) aus Aluminiumlegierung hergestellt ist.

14. Elektrisches Balance-Fahrzeug (200) nach einem der Ansprüche 1-13, ferner eine Fernbedienung (210) umfassend, wobei das Steuergerät (82) ein von der Fernbedienung (210) gesendetes Steuersignal empfängt.

15. Elektrisches Balance-Fahrzeug (100; 200) nach einem der Ansprüche 1-14, wobei das Steuergerät (82) eine Speichereinheit (821) und eine Korrektur-einheit (822) aufweist, wobei die Speichereinheit (821) einen Ausgangsbalancezustand des elektrischen Balance-Fahrzeugs (100; 200) speichert, und die Korrektur-einheit (822) einen aktuellen Balancezustand des elektrischen Balance-Fahrzeugs (100; 200) korrigiert.

## Revendications

1. Véhicule à équilibrage électrique (100 ; 200) comprenant :

un couvercle supérieur (1) comprenant un premier couvercle supérieur (11) et un second couvercle supérieur (12), disposés symétriquement et rotatifs l'un par rapport à l'autre ;

un couvercle inférieur (3) fixé au couvercle supérieur (1), le couvercle inférieur (3) comprenant un premier couvercle inférieur (31) et un second couvercle inférieur (32), disposés symétriquement et rotatifs l'un par rapport à l'autre ; **caractérisé en ce que :**

un couvercle intérieur (2) est fixé entre le couvercle supérieur (1) et le couvercle inférieur (3), le couvercle intérieur (2) comprenant un premier couvercle intérieur (21) et un second couvercle intérieur (22) disposés symétriquement et rotatifs l'un par rapport à l'autre ;

un mécanisme de rotation (60) fixé entre le premier couvercle intérieur (21) et le second couvercle intérieur (22) ;

deux roues (50) fixées de manière rotative sur les deux côtés du couvercle interne (2), respectivement ;

deux moteurs de moyeu (4) fixés dans les

deux roues (50), respectivement ;

une pluralité de capteurs (80) disposés entre le couvercle inférieur (3) et le couvercle intérieur (2) ;

une alimentation électrique (81) fixée entre le premier couvercle inférieur (31) et le premier couvercle intérieur (21) ; et

un contrôleur (82) fixé entre le second couvercle inférieur (32) et le second couvercle intérieur (22), le contrôleur (82) étant connecté électriquement à la pluralité de capteurs (80), l'alimentation électrique (81), et les moteurs de moyeu (4), et le contrôleur (82) commandant les moteurs de moyeu (4) pour entraîner les roues correspondantes (50) en rotation en fonction des signaux de détection transmis par les capteurs (80).

2. Véhicule à équilibrage électrique (100 ; 200) selon la revendication 1, comprenant en outre deux pédales (5), dans lequel les pédales (5) sont fixées au couvercle supérieur (1) et au couvercle intérieur (2).

3. Véhicule à équilibrage électrique (100 ; 200) selon la revendication 2, dans lequel les pédales (5) ont des bandes de frottement mutuellement séparées (51) disposées sur les surfaces supérieures des pédales (5).

4. Véhicule à équilibrage électrique (100 ; 200) selon la revendication 2, dans lequel le premier couvercle supérieur (11) et le second couvercle supérieur (12) comportent des espaces creux (16), respectivement, le premier couvercle intérieur (21) et le second couvercle intérieur (22) présentent des évidements (23) au niveau de positions correspondant aux espaces creux (16), respectivement, et les espaces creux (16) sont combinés avec les évidements (23) pour former des cavités de pédales destinées à contenir les pédales (5).

5. Véhicule à équilibrage électrique (100 ; 200) selon l'une quelconque des revendications 1 à 4, dans lequel le mécanisme de rotation (60) comprend deux paliers (61), un manchon d'arbre (62) et deux ressorts à encliquetage (63), les deux paliers (61) étant fixés au premier couvercle intérieur (21) et au second couvercle intérieur (22), respectivement, et le manchon d'arbre (62) est fixé à l'intérieur des deux paliers (61) et est fixé sur le couvercle intérieur (2) par l'intermédiaire des deux ressorts à encliquetage (63).

6. Véhicule à équilibrage électrique (100 ; 200) selon l'une quelconque des revendications 1 à 5, comprenant en outre une lampe décorative (33) disposée au niveau du couvercle inférieur (3).

7. Véhicule à équilibrage électrique (100 ; 200) selon

- l'une quelconque des revendications 1 à 6, dans lequel le couvercle supérieur (1) inclut en outre deux écrans d'affichage (13) connectés électriquement au contrôleur (82), un écran d'affichage (13) affichant une capacité restante de l'alimentation électrique (81), et l'autre écran d'affichage (13) affichant un état de fonctionnement du véhicule à équilibrage électrique (100 ; 200).
8. Véhicule à équilibrage électrique (100 ; 200) selon l'une quelconque des revendications 1 à 7, dans lequel le capteur (80) comprend un gyroscope (83), un capteur d'accélération (85) et un commutateur inductif (84), le commutateur inductif (84) détectant si un utilisateur se trouve sur le véhicule à équilibrage électrique (100 ; 200) de manière à être allumé ou éteint, le contrôleur (82) recevant le signal de détection du commutateur inductif (84) pour commander les moteurs de moyeu (4) pour fonctionner ou pour s'arrêter, et le contrôleur (82) recevant les signaux de détection du capteur d'accélération (85) et du gyroscope (83) pour commander les moteurs de moyeu (4) pour changer un état ou conserver l'état.
9. Véhicule à équilibrage électrique (100 ; 200) selon l'une quelconque des revendications 1 à 8, comprenant en outre une interface de chargement (87) disposée au niveau du couvercle inférieur (3).
10. Véhicule à équilibrage électrique (200) selon la revendication 9, comprenant en outre un couvercle d'interface (220), dans lequel le couvercle d'interface (220) recouvre l'interface de chargement (87).
11. Véhicule à équilibrage électrique (100 ; 200) selon l'une quelconque des revendications 1 à 10, comprenant en outre un arbre de limitation (7) disposé entre le premier couvercle intérieur (21) et le second couvercle intérieur (22), dans lequel la longueur de l'arbre de limitation (7) dans le second couvercle intérieur (22) est supérieure à la longueur de l'arbre de limitation (7) dans le premier couvercle intérieur (21).
12. Véhicule à équilibrage électrique (100 ; 200) selon l'une quelconque des revendications 1 à 11, dans lequel le couvercle supérieur (1) possède deux saillies en forme d'arc (15), les deux saillies en forme d'arc (15) étant situées au-dessus des deux roues (50) et couvrent une partie des roues (50), respectivement, et la largeur des saillies en forme d'arc (15) étant supérieure à la largeur des roues (50).
13. Véhicule à équilibrage électrique (100 ; 200) selon l'une quelconque des revendications 1 à 12, dans lequel le couvercle supérieur (1) et le couvercle inférieur (3) sont en plastique, et le couvercle intérieur (2) est en alliage d'aluminium.
14. Véhicule à équilibrage électrique (200) selon l'une quelconque des revendications 1 à 13, comprenant en outre une télécommande (210), dans lequel le contrôleur (82) reçoit un signal de commande envoyé par la télécommande (210).
15. Véhicule à équilibrage électrique (100 ; 200) selon l'une quelconque des revendications 1 à 14, dans lequel le contrôleur (82) possède une unité de stockage (821) et une unité de correction (822), l'unité de stockage (821) mémorisant un état d'équilibre initial du véhicule à équilibrage électrique (100 ; 200), et l'unité de correction (822) corrigeant un état d'équilibre actuel du véhicule à équilibrage électrique (100 ; 200).

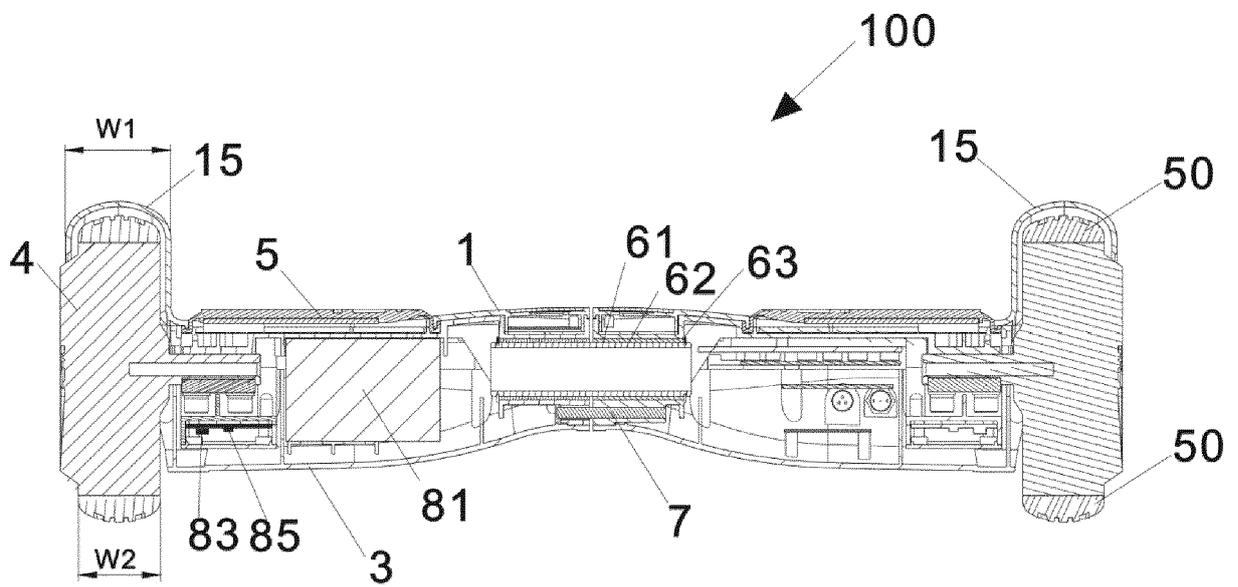


FIG. 1

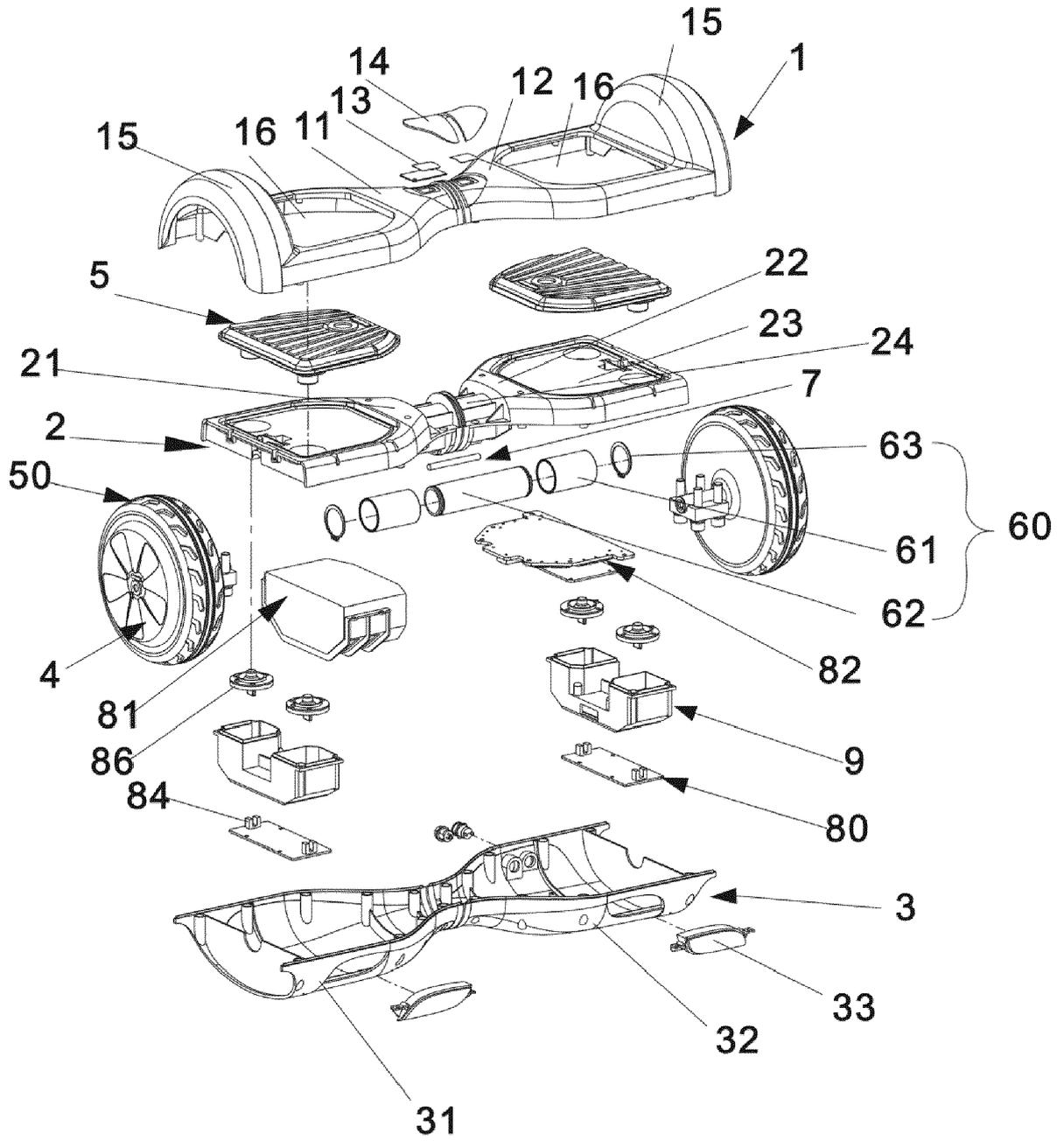


FIG. 2

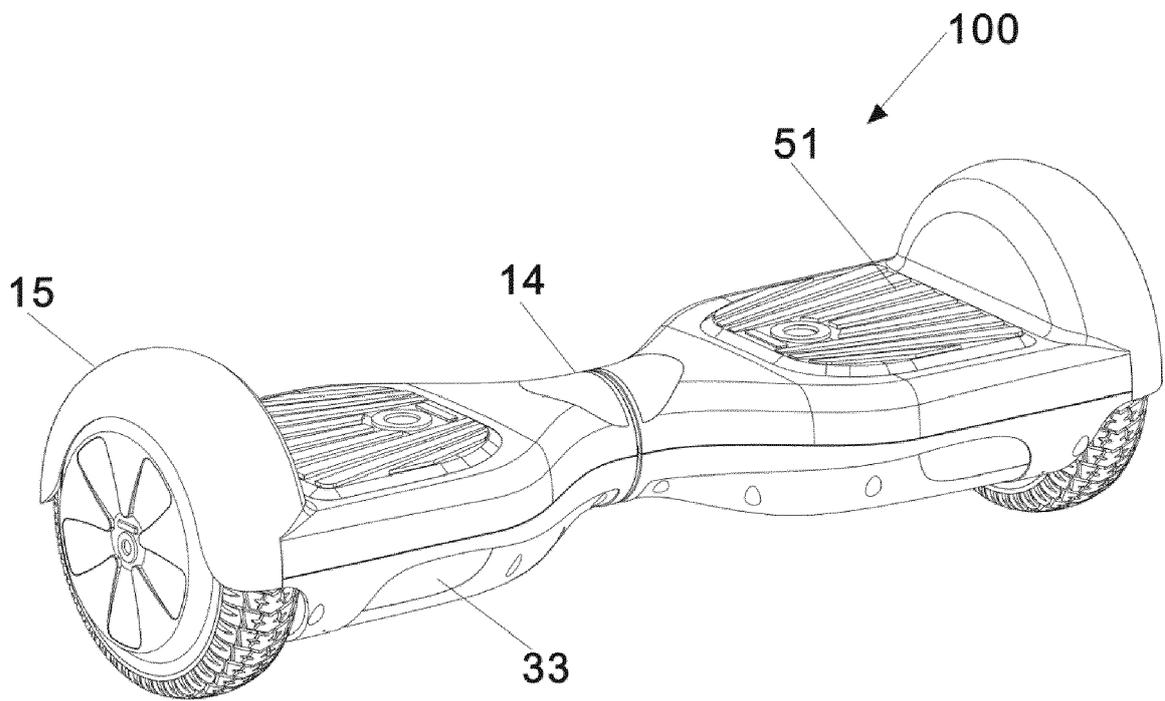


FIG. 3

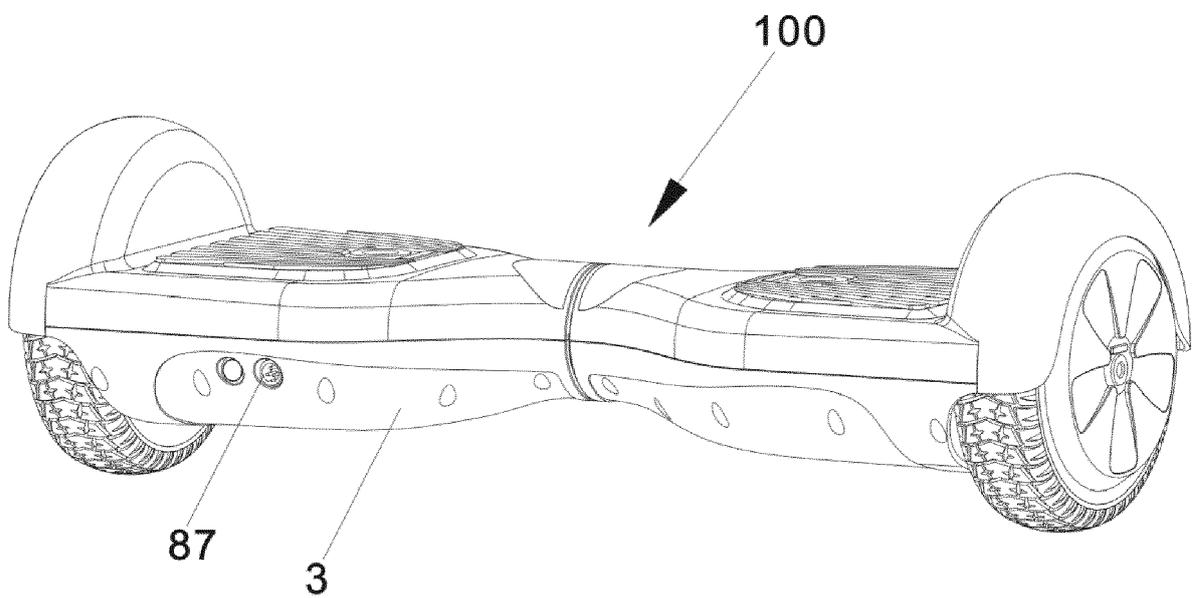


FIG. 4

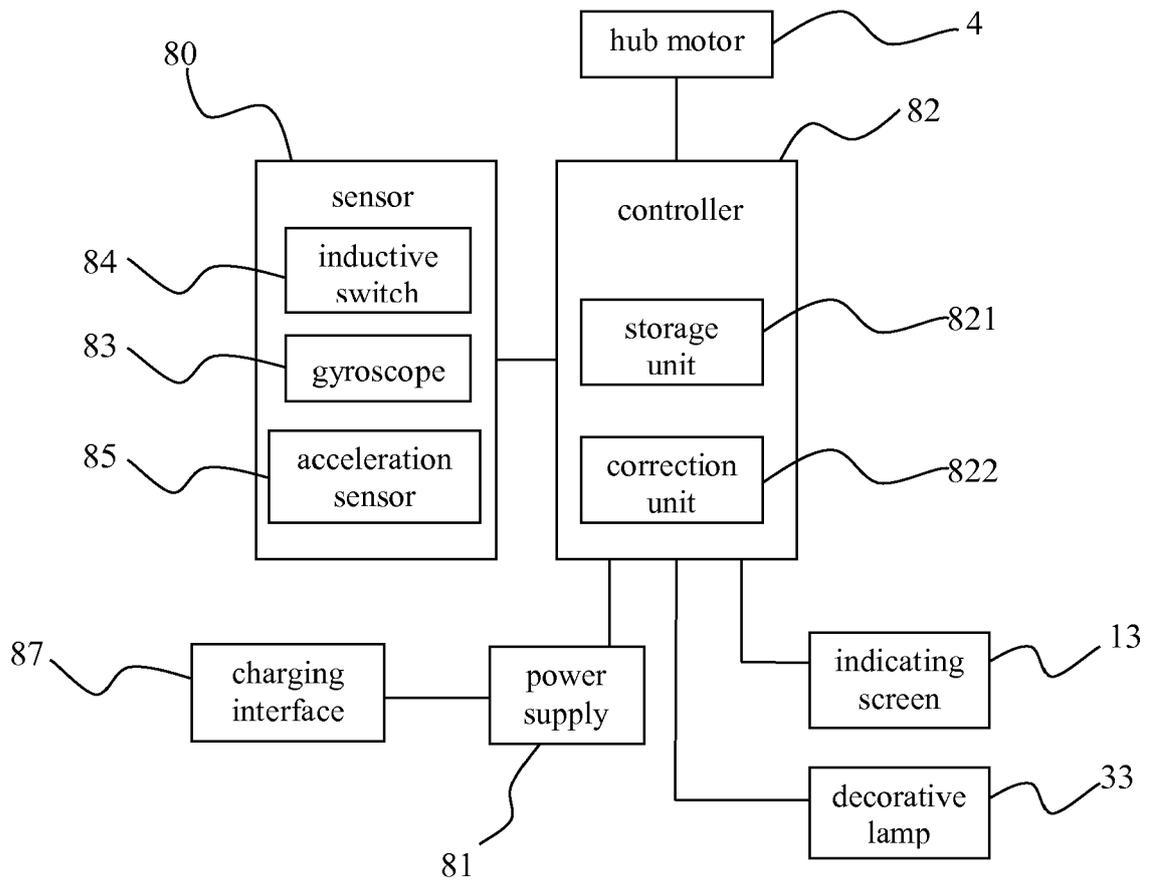


FIG. 5

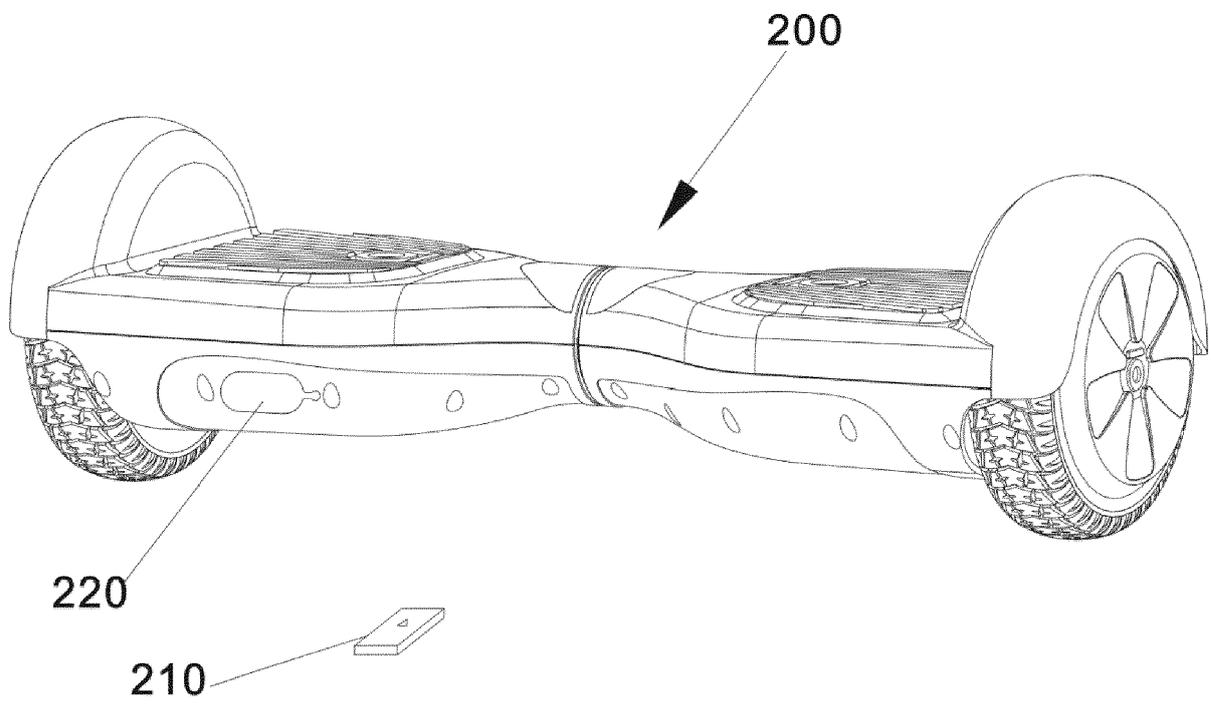


FIG. 6

**REFERENCES CITED IN THE DESCRIPTION**

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