LEVELING ROBOT

CROSS REFERENCE OF RELATED APPLICATIONS

[0001] The present application claims priority to Chinese patent application No. 201910875830.1, entitled “LEVELING ROBOT", filed on September 17, 2019, the content of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to the field of construction robots, and in particular, to a leveling robot.

BACKGROUND

[0003] At present, there are more and more intelligent robots used in the field of construction. For the leveling robot used in the field of construction in the related technology, its body is prone to tilt during work. At present, the concrete floor leveling equipment on the market are all operated and controlled manually, and no fully automatic leveling equipment has been found.

SUMMARY

[0004] The present disclosure aims to solve at least one of the technical problems existing in the prior art. Therefore, an object of the present disclosure is to propose a leveling robot, which can automatically adjust an angle between a ground of the leveling device and the horizontal plane, so that leveling operations on a base surface may be well performed, and have a good leveling effect.

[0005] In a leveling robot according to the present disclosure, the leveling robot includes a transport vehicle, a control box, a leveling device, a detection device and a

lifting device, and the control box is pivotally arranged on the transport vehicle. The control box and the transport vehicle are pivotally connected via a rotating connecting shaft. The leveling device is connected to a front end of the control box, the leveling device is adapted to level a base surface. The detection device is arranged on the control box to detect levelness information of a bottom surface of the control box, and a bottom surface of the leveling device is parallel to the bottom surface of the control box. The lifting device is arranged between the control box and the leveling device, and the lifting device is adapted to obtain the levelness information, so as to control actions of the leveling device according to the levelness information.

[0006] In a leveling robot according to the present disclosure, the lifting device is provided between the control box and the leveling device, and the rotating connecting shaft is provided between the transport vehicle and the control box, so that the control box may rotate around the rotating connecting shaft when relative positions of the lifting device and the control box in an up-down direction is adjusted by lifting device, and therefore an angle between the bottom surface of the control box and the horizontal plane may be adjusted, and then an angle between the bottom surface of the leveling device and the horizontal plane may be adjusted, thereby the leveling device being capable of performing the leveling operation on the base surface well, and ensuring a good leveling effect of the leveling device.

[0007] In addition, a leveling robot according to the present disclosure may also have the following additional features.

[0008] In the present disclosure, the transport vehicle includes a plurality of traveling wheels and at least one driving motor, and the plurality of traveling wheels and the driving motor are driveably connected.

[0009] In the present disclosure, the rotating connecting shaft is provided adjacent to the front end of the control box.

[0010] In the present disclosure, the leveling device includes a connecting frame, a leveling plate and a vibration motor. The leveling plate is connected to the lifting device via the connecting frame. The lifting device is adapted to obtain the levelness information to control the actions of the leveling plate according to the levelness information. The

vibration motor is provided on the leveling plate.

[0011] In the present disclosure, the lifting device includes a first connecting rod, a second connecting rod and a lifting electric push rod. Two ends of the first connecting rod are hinged to the control box and the connecting frame, respectively. Two ends of the second connecting rod are hinged to the control box and the connecting frame, respectively. The first connecting rod is configured to be parallel to the second connecting rod. An end of the lifting electric push rod is hinged to the control box, and the other end of the lifting electric push rod is hinged to the second connecting rod.

[0012] In the present disclosure, the leveling plate includes a bottom plate, and a side plate circumferentially arranged around the bottom plate, a support plate and a connecting portion. The bottom plate and the side plate together define a groove, a top of which is provided to be open. The support plate is arranged across the groove, the vibration motor is arranged on the support plate, the connecting portion is arranged in the groove, and the connecting frame is connected to the connecting portion. A vibration damper is provided between the connecting portion and an inner wall of the groove.

[0013] In the present disclosure, the leveling robot further includes a rubber sheet, the rubber sheet is arranged on a front end of the leveling plate, and a bottom of the rubber sheet protrudes downward from a bottom surface of the leveling plate.

[0014] In the present disclosure, the leveling robot further includes a scraping device, and the scraping device includes a scraper, a third connecting rod, a fourth connecting rod, a laser receiver and a scraper electric push rod. Two ends of the third connecting rod are hinged to the scraper and the connecting frame, respectively. Two ends of the fourth connecting rod are hinged to the leveling plate and the connecting frame, respectively. The third connecting rod is configured to be parallel to the fourth connecting rod. The laser receiver is provided on the scraper to detect distance information between the scraper and the base surface. An end of the scraper electric push rod is hinged to the connecting frame, and the other end of the scraper electric push rod is hinged to the scraper. The scraper electric push rod is adapted to obtain the distance information to lift the connecting frame.

[0015] In the present disclosure, the scraping device is located on a rear side of the scraper.

[0016] In the present disclosure, the leveling robot further includes an auxiliary support electric push rod telescopically arranged on the control box, and the auxiliary support electric push rod is adapted to be extended and support the control box on the transport vehicle. At least two auxiliary support electric push rods are provided, and the two auxiliary support electric push rods are arranged at intervals in a front-rear direction and located on two sides of the rotating connecting shaft, respectively.

[0017] Some of additional aspects and advantages of the present disclosure will be set forth in the following description and Some of additional aspects and advantages of the present disclosure will be apparent from the following description, or will be learned by practices of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The above and/or additional aspects and advantages of the present disclosure will become apparent and readily understood from the following description of embodiments in conjunction with the accompanying drawings, wherein:

[0019] FIG. 1 is a perspective view of a leveling robot according to the present disclosure;

[0020] FIG. 2 is a front view of the leveling robot according to the present disclosure;

[0021] FIG. 3 is a schematic structural view of a transport vehicle of the leveling robot according to the present disclosure;

[0022] FIG. 4 is a schematic structural view of the leveling robot according to the present disclosure with the transport vehicle and a control box removed.

[0023] List of reference numerals:

[0024] 100: leveling robot;

[0025] 1: transport vehicle; 11: traveling wheel; 12: driving motor; 13: second mounting seat;

[0026] 2: control box; 21: rotating connecting shaft; 22: first mounting seat;

[0027] 3: leveling device; 31: connecting frame; 32: leveling plate; 321: bottom plate; 322: side plate; 323: support plate; 324: connecting portion; 325: vibration damper; 33:

vibration motor;

[0028] 4: lifting device; 41: first connecting rod; 42: second connecting rod; 43: lifting electric push rod;

[0029] 5: scraping device; 51: scraper; 52: third connecting rod; 53: fourth connecting rod; 54: laser receiver; 55: scraper electric push rod;

[0030] 6: rubber sheet;

[0031] 7: auxiliary support electric push rod.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0032] The following describes in detail the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings, the same or similar reference numerals refer to the same or similar elements or elements having the same or similar functions throughout. The embodiments described below with reference to the accompanying drawings are exemplary and are only used to explain the present disclosure, but should not be construed as a limitation on the present disclosure.

[0033] The leveling robot 100 according to an embodiment of the present disclosure is described below with reference to FIGS. 1 to 4.

[0034] As shown in FIGS. 1 to 4, the leveling robot 100 according to an embodiment of the present disclosure includes a transport vehicle 1, a control box 2, a leveling device 3, a detection device and a lifting device 4.

[0035] Specifically, the control box 2 is pivotally arranged on the transport vehicle 1. The control box 2 and the transport vehicle 1 are pivotally connected via a rotating connecting shaft 21, that is, the control box 2 can be matched with and mounted on the transport vehicle 1, and can rotate around the rotating connecting shaft 21 after being matched with and mounted on the transport vehicle 1.

[0036] The leveling device 3 is connected to a front end of the control box 2. The leveling device 3 is adapted to level the base surface, that is, the leveling device 3 can be matched with and connected to the control box 2. When the control box 2 rotates around the rotating connecting shaft 21 relative to the transport vehicle 1, the control box 2 can

drive the leveling device 3 to rotate around the rotating connecting shaft 21. In addition, in a front-rear direction as shown in FIG. 1, the leveling device 3 is provided at the front end of the control box 2 and the leveling device 3 can pre-level the ground to make the base surface relatively flat.

[0037] The detection device (not shown in the drawings) is arranged on the control box 2 to detect levelness information of a bottom surface of the control box 2. A bottom surface of the leveling device 3 is parallel to the bottom surface of the control box 2. The levelness information can refer to information of an angle between the bottom surface of the control box 2 and the horizontal plane. Since the bottom surface of the leveling device 3 is configured to be parallel to the bottom surface of the control box 2, the information of the angle between the bottom surface of the control box 2 and the horizontal plane is information of an angle between the bottom surface of the leveling device and the horizontal plane.

[0038] It can be understood that, due to the uneven base surface, when the transport vehicle 1 moves on the base surface, the bottom surface of the leveling device 3 will not be parallel to the horizontal plane, thereby easily affecting the leveling effect of the leveling robot 100 on the base surface.

[0039] The lifting device 4 is arranged between the control box 2 and the leveling device 3, and the lifting device 4 is adapted to obtain the levelness information to control actions of the leveling device 3 according to the levelness information, that is, during the moving process of the leveling robot 100, and when an angle is formed between the bottom surface of the leveling device 3 and the horizontal plane, the lifting device 4 may drive the leveling device 3, such that a position of the leveling device 3 relative to the control box 2 in an up-down direction is changed. After the position of the leveling device 3 is changed, the control box 2 can rotate around the rotating connecting shaft 21, such that the angle between the bottom surface of the control box 2 and the horizontal plane may be adjusted. By adjusting the angle between the bottom surface of the control box 2 and the horizontal plane, the angle between the bottom surface of the leveling device 3 and the horizontal plane may be adjusted. Therefore, the leveling device 3 is capable of performing a good leveling operation on the base surface, and the leveling effects of the leveling device 3 can

be ensured.

[0040] Therefore, in the leveling robot 100 according to an embodiment of the present disclosure, the lifting device 4 is provided between the control box 2 and the leveling device 3, and the rotating connecting shaft 21 is provided between the transport vehicle 1 and the control box 2, so that when the relative positions of the lifting device 4 and the control box 2 in the up-down direction is adjusted, the control box 2 may rotate around the rotating connecting shaft 21. Therefore, the angle between the bottom surface of the control box 2 and the horizontal plane may be adjusted, and further the angle between the bottom surface of the leveling device 3 and the horizontal plane may be adjusted, such that the leveling device 3 is capable of performing a good leveling operation on the base surface, and the leveling effects of the leveling device 3 can be ensured.

[0041] In a specific example as shown in FIG. 1, the control box 2 generally has a shape of cube, and the detection device is arranged on the bottom surface of the control box 2 to detect the angle between the bottom surface of the control box 2 and the horizontal plane. Further, the detection device may be an inclination sensor, which can well detect the angle between the bottom surface of the control box 2 and the horizontal plane.

[0042] Alternatively, as shown in FIG. 1 and FIG. 2, a first mounting seat 22 is formed on a side of the control box 2 facing the transport vehicle 1, and a second mounting seat 13 is formed on a side of the transport vehicle 1 facing the control box 2. Each of the first mounting seat 22 and the second mounting seat 13 is provided with a mounting hole adapted to be matched with the rotating connecting shaft 21, such that the rotating connecting shaft 21 may be well mounted between the control box 2 and the transport vehicle 1 via the first mounting seat 22 and the second mounting seat 13.

[0043] Further, a projection of the second mounting seat 13 on a plane defined by a straight line in the front-rear direction and a straight line in the up-down direction as shown in FIG.1 generally has a shape of triangular, and the mounting hole is formed on the top of the second mounting seat 13. In this way, the rotation of the control box 2 relative to the transport vehicle 1 around the rotating connecting shaft 21 can be facilitated.

[0044] Further, the first mounting seat 22 is adjacent to a left end and a right end of the bottom surface of the control box 2 and extends in the front-rear direction. Therefore,

after the first mounting seat 22 and the second mounting seat 13 are connected by the rotating connecting shaft 21, the first mounting seat 22 can support the control box 2 well and so that the control box 2 rotate around the rotating connecting shaft 21 well.

[0045] In some embodiments of the present disclosure, the transport vehicle 1 includes a plurality of traveling wheels 11 and at least one driving motor 12, and the plurality of traveling wheels 11 and the driving motor 12 are rotatably connected, that is, there may be a plurality of traveling wheels 11. The plurality here can refer to two or more than two. There may be one or a plurality of driving motors 12. In an example, one driving motor 12 may be provided, that is, one driving motor 12 can drive a plurality of traveling wheels 11 to rotate, such that the transport vehicle 1 can move. In another example, two driving motors 12 and four traveling wheels 11 may be provided, and each driving motor 12 may drive two traveling wheels to rotate. Of course, it can be understood that the number of and a corresponding relationship between the traveling wheels 11 and the driving motors 12 can be arranged according to the size, the shape and the model of the leveling robot 100, which is not limited here.

[0046] Further, each traveling wheel 11 of the transport vehicle 1 can be driven by the driving motor 12, such that each traveling wheel 11 can be a driving wheel of the transport vehicle 1, thereby making the transport vehicle 1 to move well on the base surface.

[0047] In some embodiments of the present disclosure, the rotating connecting shaft 21 is arranged adjacent to the front end of the control box 2. For example, as shown in FIG. 1 and FIG. 2, in the up-down direction, the rotating connecting shaft 21 is arranged between the control box 2 and the transport vehicle; and in a left-right direction, the rotating connecting shaft 21 is adjacent to the connection joint between the control box 2 and the leveling device 3, thus, when the position of the leveling device 3 relative to the control box 2 is changed, the control box 2 can rotate around the rotating connecting shaft 21 well.

[0048] In some embodiments of the present disclosure, the leveling device 3 includes a connecting frame 31, a leveling plate 32 and a vibration motor 33.

[0049] Specifically, the leveling plate 32 is connected to the lifting device 4 via the connecting frame 31, and the lifting device 4 is adapted to obtain the levelness information

to control the actions of the leveling plate 32 according to the levelness information. That is, the connecting frame 31 is arranged between the leveling plate 32 and the lifting devices 4. The connecting frame 31 facilitates the match of the leveling plate 32 with the lifting device 4. After the leveling plate 32 is matched with the lifting device 4, the lifting device 4 can adjust position information of the leveling plate 32 relative to the control box 2 according to the levelness information.

[0050] The vibration motor 33 is provided on the leveling plate 32, that is, the vibration motor 33 can generate vibration and transmit the vibration to the leveling plate 32, and the base surface can be leveled by the vibration of the leveling plate 32.

[0051] In some embodiments of the present disclosure, the lifting device 4 includes a first connecting rod 41, a second connecting rod 42 and a lifting electric push rod 43.

[0052] Specifically, as shown in FIGS. 1 to 4, two ends of the first connecting rod 41 are hinged to the control box 2 and the connecting frame 31, respectively, and two ends of the second connecting rod 42 are hinged to the control box 2 and the connecting frame 31, respectively. That is, an end of the first connecting rod 41 is hinged to the control box 2, and the other end of the first connecting rod 41 is hinged to the connecting frame 31; and an end of the second connecting rod 42 is hinged to the control box 2, and the other end of the second connecting rod 42 is hinged to the connecting frame 31. Thus, the first connecting rod 41, the second connecting rod 42, the connecting frame 31 and the control box 2 can define a quadrilateral mechanism, and two adjacent sides of the quadrilateral mechanism can rotate relative to each other. Please refer to FIGS. 2 and 4.

[0053] Alternatively, the first connecting rod 41 is configured to be parallel to the second connecting rod 42. Further, the first connecting rod 41 and the second connecting rod 42 are configured to have equal lengths, and thus, the first connecting rod 41, the second connecting rod 42, the connecting frame 31 and the vehicle body can define a parallelogram mechanism.

[0054] An end of the lifting electric push rod 43 is hinged to the control box 2 and the other end of the lifting electric push rod 43is hinged to the second connecting rod 42. As shown in FIGS. 2 and 4, an end of the lifting electric push rod 43 can be hinged to the control box 2, and the other end of the lifting electric push rod 43 can be hinged to the

second connecting rod 42. When the lifting electric push rod 43 is extended, that is, the lifting electric push rod 43 can be extended toward a front-down direction as shown in FIG. 1, and the second connecting rod 42 can rotate clockwise in the plane defined by a straight line in the up-down direction and a straight line in the front-rear direction shown in FIG. 1, so that the second connecting rod 42 can drive the connecting frame 31 to move downward, and the downward movement of the connecting frame 31 can drive the leveling plate 32 moves downward. When the lifting electric push rod 43 is retracted, that is, the lifting electric push rod 43 is retracted to a rear-up direction as shown in FIG. 1, the second connecting rod 42 rotates counterclockwise on the plane defined by the straight line in the up-down direction and the straight line in the front-rear direction shown in FIG. 1. At the same time, the second connecting rod 42 can drive the connecting frame 31 to move upward, and the upward movement of the connecting frame 31 can drive the leveling plate 32 to move upward. Thus, the telescopic action of the lifting electric push rod 43 can make the lifting electric push rod 43 drive the leveling plate 32 to move upward and downward, such that the control box 2 can rotate around the rotating connecting shaft 21, an angle between the bottom surface of the control box 2 and the horizontal plane can be adjusted, and an angle between the bottom surface of the leveling plate 32 and the horizontal plane can be adjusted, so as to level the base surface well.

[0055] In some embodiments of the present disclosure, the leveling plate 32 includes a bottom plate 321, a side plate 322, a support plate 323 and a connecting portion 324. Specifically, as shown in FIG. 4, the side plate 322 is circumferentially arranged around the bottom plate 321. The bottom plate 321 and the side plate 322 together define an groove, a top of which is provided to be open. The support plate 323 is arranged across the groove, and the vibration motor 33 is provided on the support plate 323. Thus, the vibration motor 33 can be well assembled on the leveling plate 32 via the support plate 32 arranged across the groove.

[0056] The connecting portion 324 is provided in the groove, and the connecting frame 31 is connected to the connecting portion 324. A vibration damper 325 is arranged between the connecting portion 324 and an inner wall of the groove, such that the connecting frame 31 can be well matched with the leveling plate 32 via providing the connecting portion 324

on the leveling plate. After the connecting frame 31 is matched with the leveling plate 32, the vibration damper 325 arranged between the connecting portion 324 and the inner wall of the groove can reduce the transmission of the vibration generated by the vibration motor 33 to the connecting frame 31, thereby reducing the impact of the vibration on other structures of the leveling robot 100.

[0057] Alternatively, the leveling robot 100 further includes a rubber sheet 6, the rubber sheet 6 is arranged on a front end of the levelling plate 32 and a bottom of the rubber sheet 6 protrudes downward from the bottom surface of the levelling plate 32. Further, in the example shown in FIG. 1, two rubber sheets 6 are arranged on the front side of the leveling plate 32, and the two rubber sheets 6 are arranged on a left end and a right end of a front side of the leveling plate 32, respectively. For the convenience of description, the rubber sheet 6 on the left side is called first rubber sheet, and a left side of the first rubber sheet protrudes from a left side surface of the leveling plate 32; and the rubber sheet 6 on the right side is called second rubber sheet, and a right side of the second rubber sheet protrudes from the right side of the leveling plate 32. Thus, when the leveling plate 32 performs the leveling operation on the base surface, the first rubber sheet and the second rubber sheet can smooth the base surface on the left side and the right sides of the leveling plate 32, thereby the effects of leveling operation of the leveling device 3 can be improved.

[0058] In some embodiments of the present disclosure, the scraping device 5 includes a scraper 51, a third connecting rod 52, a fourth connecting rod 53, a laser receiver 54 and a scraper electric push rod 55.

[0059] Specifically, two ends of the third connecting rod 52 are hinged to the scraper 51 and the connecting frame 31, respectively, two ends of the fourth connecting rod 53 are hinged to the scraper 51 and the connecting frame 31, respectively, and the third connecting rod 52 is configured to be parallel to the fourth connecting rod 53. As shown in FIGS. 1 to 4, an end of the third connecting rod 52 is hinged to the scraper 51, and the other end of the third connecting rod 52 is also hinged to the connecting frame 31. An end of the fourth connecting rod 53 is hinged to the scraper 51, and the other end of the fourth connecting rod 53 is also hinged to the connecting frame 31. Alternatively, the third connecting rod 52 and the fourth connecting rod 53 are configured to be parallel and of equal length. Thus,

the third connecting rod 52, the fourth connecting rod 53, the scraper 51 and the connecting frame 31 can define a parallelogram mechanism. In the parallelogram mechanism, two adjacent sides can rotate relative to each other. Thus, the parallelogram mechanism can limit the movement of the scraper 51, such that the scraper 51 can move stably.

[0060] An end of the scraper electric push rod 55 is hinged to the connecting frame 31, and the other end of the scraper electric push rod 55 is hinged to the scraper 5. For example, as shown in FIG. 1 to FIG. 4 , the scraper electric push rod 55 is generally arranged in the left-right direction, and the scraper electric push rod 55 is arranged between the connecting frame 31 and the scraper 51, so that the scraper electric push rod 55 can drive the scraper 51 to move in the up-down direction. During the movement of the scraper 51 in the up-down direction, the parallelogram mechanism can make the movement of the scraper 51 more stable. Further, the leveling device 3 can perform the leveling operation on the base surface with the scraper 51, so as to further improve the effect of the leveling operation of the leveling device 3 on the base surface.

[0061] In an example, as shown in FIGS. 1 to 4, the leveling robot 100 further includes a detection device, and the detection device further includes a laser receiver 54 and a mounting rod for laser receiver. The leveling robot 100 may be provided with two laser receivers 54 and two mounting rods for laser receiver. The two mounting rods for laser receiver are connected to the left and right ends of the scraper 51, respectively via the connecting frame 31, and the two laser receivers 54 are arranged on the two mounting rods for laser receiver, respectively. A positional relationship of the left and right ends of the scraper 51 and the base surface can be continuously detected by the laser receiver 54, and fed back to a control unit. The control unit can control the scraper electric push rod 55 according to the feedback information from the laser receiver 54, such that the plane where the scraper 51 is located is kept parallel to the base surface, so as to improve the effect of scraping.

[0062] Alternatively, two scraper electric push rods 55 may be provided, and the two scraper electric push rods 55 may be provided at two ends of the scraper 51, respectively, that is, the laser receivers 54 may be arranged in one-to-one correspondence with the scraper electric push rods 55. Therefore, the laser receiver 54 obtains the position

information of the scraper 51, such that the leveling robot 100 can drive the corresponding scraper electric push rod 55 to adjust the distance between the scraper 51 and the base surface at this position with high accuracy.

[0063] Of course, it can be understood that the detection device can also be provided with three or more than three laser receivers 54 to further detect the distance between the scraper 51 and the base surface. Three or more than three scraper electric push rods 55 may also be provided to adjust the distance between the scraper 51 and the base surface well. Further, the laser receivers 54 may be arranged in one-to-one correspondence with the scraper electric push rods 55, or may not be arranged in one-to-one correspondence with the scraper electric push rods 55, which may be configured according to the actual working environment, the model and size of the leveling robot 100, etc. specifically, and is not limited here.

[0064] Alternatively, the scraping device 5 is located on a rear side of the leveling plate 32, that is to say, the leveling robot 100 can first perform the leveling operation on the base surface. The vibration exerted by the leveling device 3 on the base surface can not only make the base surface relatively soft to facilitate the scraping operation of the scraping device 5, but also make slurry materials on the base surface more evenly mixed to help improve the effects of the scraping operation of the scraping device 5.

[0065] In some embodiments of the present disclosure, the leveling robot 100 further includes an auxiliary support electric push rod 7 telescopically provided on the control box 2, and the auxiliary support electric push rod 7 is adapted to be extended and support the control box 2 on the transport vehicle 1. At least two auxiliary support electric push rods 7 are provided, and the two auxiliary support electric push rods 7 are arranged at intervals in the front-rear direction and are located on two sides of the rotating connecting shaft 21, respectively.

[0066] For example, as shown in FIG. 1 and FIG. 2, two auxiliary support electric push rods 7 are provided, and the two auxiliary support electric push rods 7 are arranged at intervals in the front-rear direction and are located on two sides of the rotating connecting shaft 21, respectively. Thus, when there is no need for the leveling device 3 to perform the leveling operation on the base surface, or during the turning process of the transport vehicle

1, the two auxiliary electric push rods can be extended and abut on the transport vehicle 1, respectively. Thus, two auxiliary electric push rods supported between the transport vehicle 1 and the electric control box, and located on two sides of the rotating connecting shaft 21 keep the electric control box stationary relative to the transport vehicle 1, so that the electric control box can stably follow the transport vehicle 1 to walk or turn, and therefore the leveling device 3 can stably follow the transport vehicle 1 to walk or turn.

[0067] Of course, it can be understood that three or more than three auxiliary support electric push rods 7 may also be provided. The number and the arrangement of the auxiliary support rods can be arranged according to the size, model, etc. of the leveling robot 100, which are not limited here.

[0068] Other structures and operations of the leveling robot 100 according to an embodiment of the present disclosure are known to those of ordinary skill in the art, and will not be described in detail here.

[0069] In the description of this specification, description with reference to the terms "some embodiments", "Alternatively", "further," or "some examples", etc., means that the particular specific features, structures, materials, or characteristics described in connection with the embodiment or example are included in at least one embodiment or example of the present disclosure. In this specification, schematic representations of the aforementioned terms do not necessarily refer to the same embodiment or example. Furthermore, the particular features, structures, materials or characteristics described may be combined in any suitable manner in any one or more embodiments or examples.

[0070] Although the embodiments of the present disclosure have been shown and described, it should be understood by those of ordinary skill in the art that various changes, modifications, substitutions and alterations can be made in these embodiments without departing from the principles and spirit of the present disclosure. The scope of the present disclosure is defined by the claims and their equivalents.

CLAIMS

1. A leveling robot, comprising:

a transport vehicle;

a control box pivotally arranged on the transport vehicle, wherein the control box and the transport vehicle are pivotally connected via a rotating connecting shaft;

a leveling device connected to a front end of the control box, wherein the leveling device is adapted to level a base surface;

a detection device arranged on the control box to detect levelness information of a bottom surface of the control box, wherein a bottom surface of the leveling device is configured to be parallel to the bottom surface of the control box;

a lifting device arranged between the control box and the leveling device, wherein the lifting device is adapted to obtain the levelness information to control action of the leveling device according to the levelness information.

2. The leveling robot of claim 1, wherein the transport vehicle comprises a plurality of traveling wheels and at least one driving motor, and the plurality of the traveling wheels are driveably connected to the driving motor.

3. The leveling robot of claim 1, wherein the rotating connecting shaft is arranged adjacent to the front end of the control box.

4. The leveling robot of claim 1, wherein the leveling device comprises:

a connecting frame;

a leveling plate connected to the lifting device via the connecting frame, wherein the lifting device is adapted to obtain the levelness information to control the action of the leveling plate according to the levelness information;

a vibration motor arranged on the leveling plate.

5. The leveling robot of claim 4, wherein the lifting device comprises:

a first connecting rod, wherein two ends of the first connecting rod are hinged to the control box and the connecting frame, respectively;

a second connecting rod, wherein two ends of the second connecting rod are hinged to the control box and the connecting frame, respectively, and the first connecting rod is configured to be parallel to the second connecting rod;

a lifting electric push rod, wherein an end of the lifting electric push rod is hinged to the control box, and the other end of the lifting electric push rod is hinged to the second connecting rod.

6. The leveling robot of claim 4, wherein the leveling plate comprises:

a bottom plate and a side plate circumferentially arranged around the bottom plate, wherein the bottom plate and the side plate together define an groove, a top of which is provided to be open;

a support plate arranged across the groove, wherein the vibration motor is arranged on the support plate;

a connecting portion provided in the groove, wherein the connecting frame is connected to the connecting portion, and a vibration damper is provided between the connecting portion and an inner wall of the groove.

7. The leveling robot of claim 4, further comprising a rubber sheet, wherein the rubber sheet is arranged on a front end of the leveling plate and a bottom of the rubber sheet protrudes downward from a bottom surface of the leveling plate.

8. The leveling robot of claim 4, further comprising a scraping device, the scraping device comprising:

a scraper;

a third connecting rod, wherein two ends of the third connecting rod are hinged to the scraper and the connecting frame, respectively;

a fourth connecting rod, wherein two ends of the fourth connecting rod are hinged to the scraper and the connecting frame, respectively, and the third connecting rod is configured to be parallel to the fourth connecting rod;

a laser receiver provided on the scraper to detect distance information between the scraper and the base surface;

a scraper electric push rod, wherein an end of the scraper electric push rod is hinged to the connecting frame, the other end of the scraper electric push rod is hinged to the scraper, and the scraper electric push rod is adapted to obtain the distance information to lift the connecting frame.

9. The leveling robot of claim 8, wherein the scraping device is located on a rear side of the leveling plate.

10. The leveling robot of claim 1, further comprising an auxiliary support electric push rod telescopically arranged on the control box, wherein the auxiliary support electric push rod is adapted to be extended and support the control box on the transport vehicle, wherein at least two auxiliary support electric push rods are provided, and the two auxiliary support electric push rods are arranged at intervals in a front-rear direction and are located at two sides of the rotating connecting shaft, respectively.