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(54) **BATTERY QUICK-CHANGE SYSTEM OF
ELECTRIC PASSENGER CAR CHASSIS
BASED ON THE CARTESIAN COORDINATE
ROBOT**

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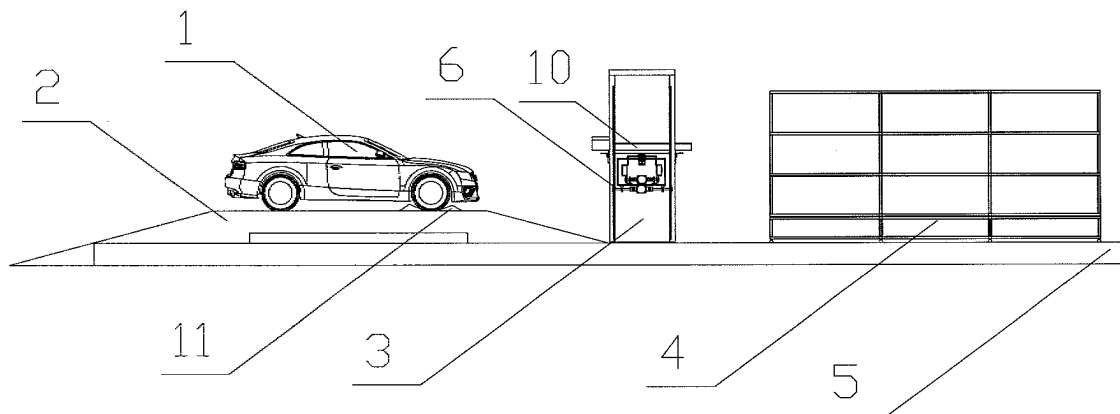
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(57)

ABSTRACT

One type of battery quick-change system of electric passenger car chassis based on the Cartesian coordinate robot, including electric changing platform, and this platform, quick-change robot and charging rack along the same straight line; the quick-change robot comprises the battery tray and the Cartesian coordinate robot of four degrees of freedom, the Cartesian coordinate robot is associated with the X-axis driving motor, the Y-axis driving motor, the Z-axis up-down motor, the battery tray is connected with the R-axis driving motor; each of driving motors is connected with the corresponding encoder, and each of encoders is connected to the corresponding drive; there are equipped with a distance measuring sensor on the battery tray, and the corresponding limit switches on the both ends of each two-track rack; the drive, each limit switch and the distance measuring sensor of each driving motor are connected with the control system.



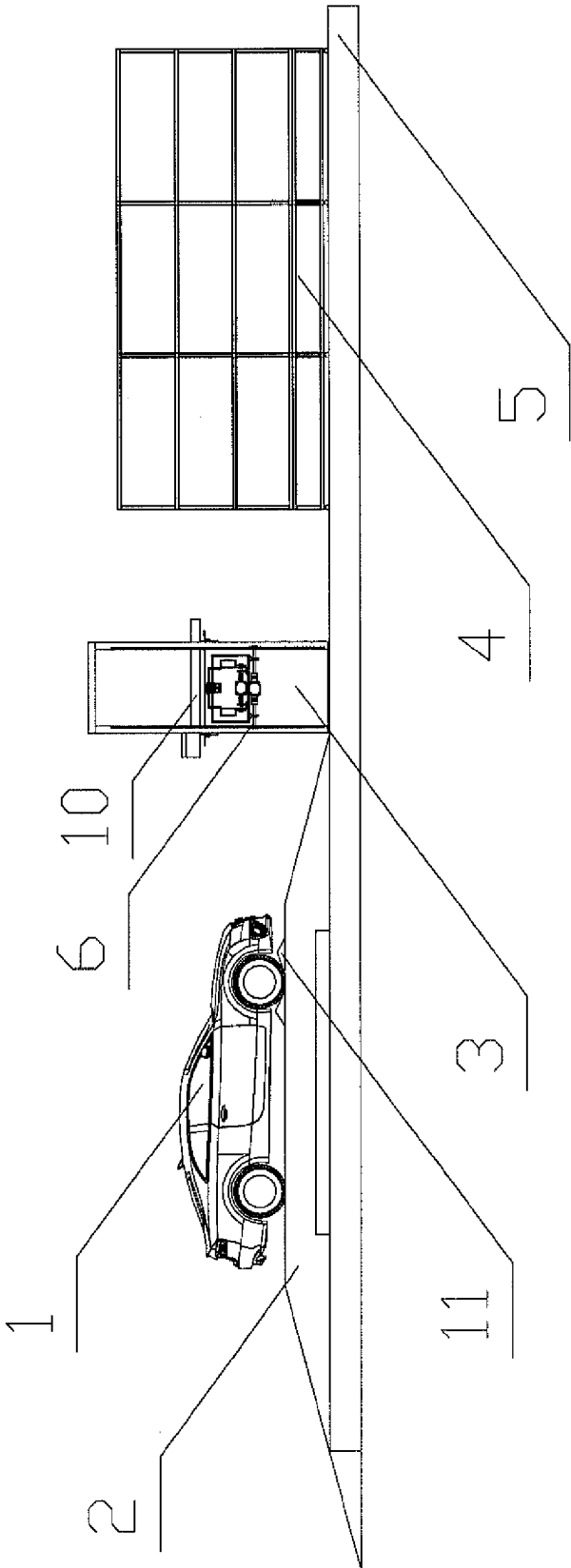


Figure 1

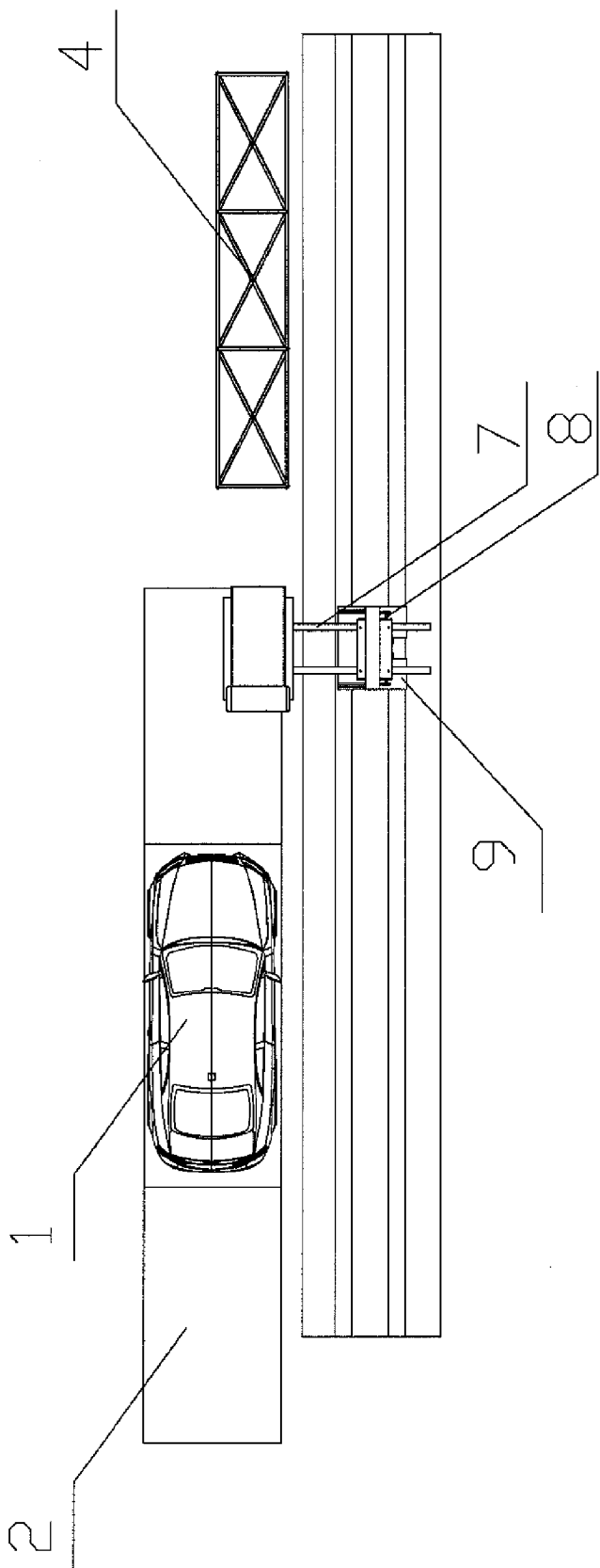


Figure 2

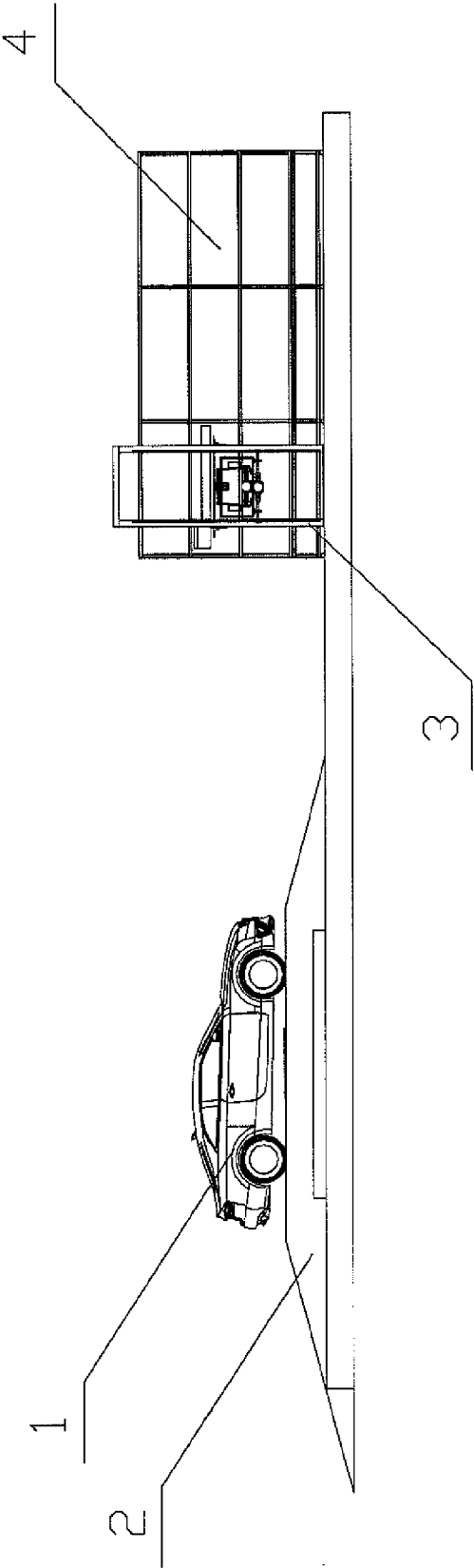


Figure 3

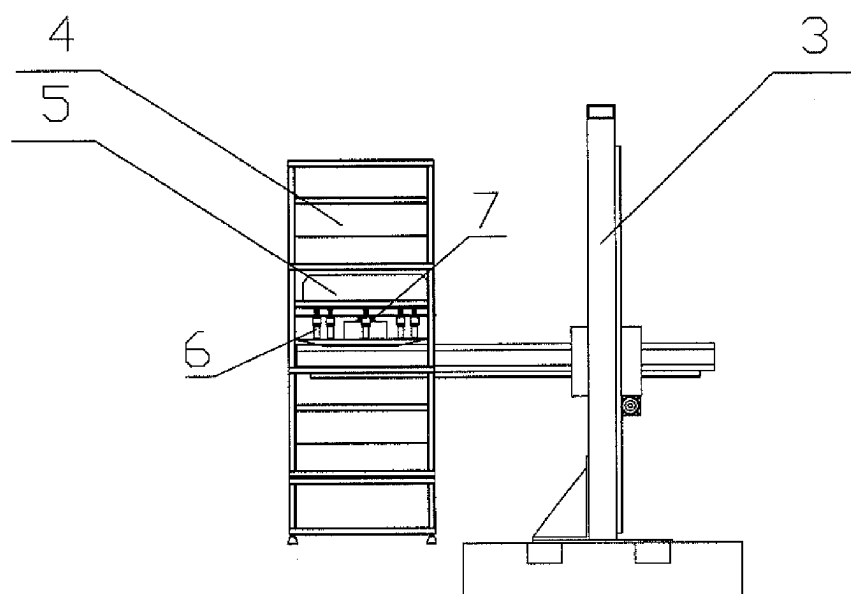


Figure 4

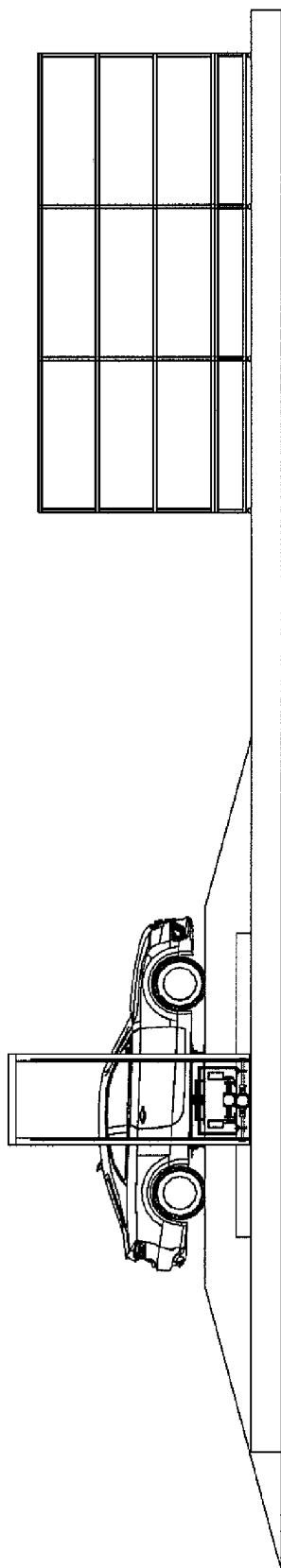


Figure 5

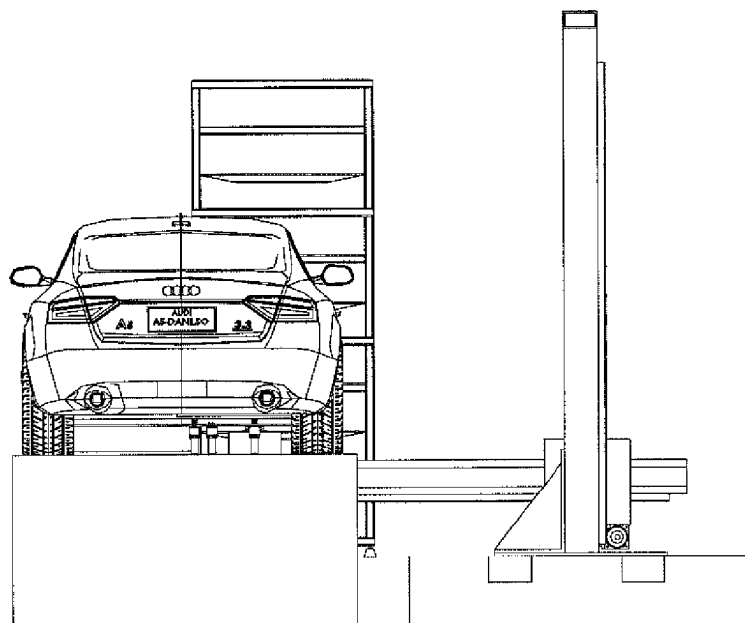


Figure 6

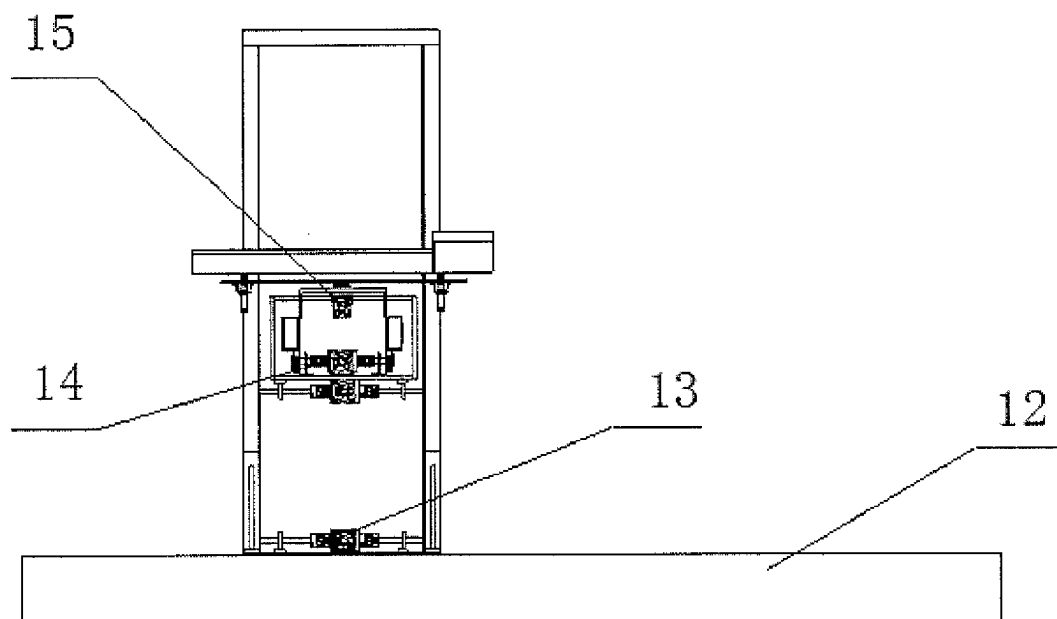


Figure 7

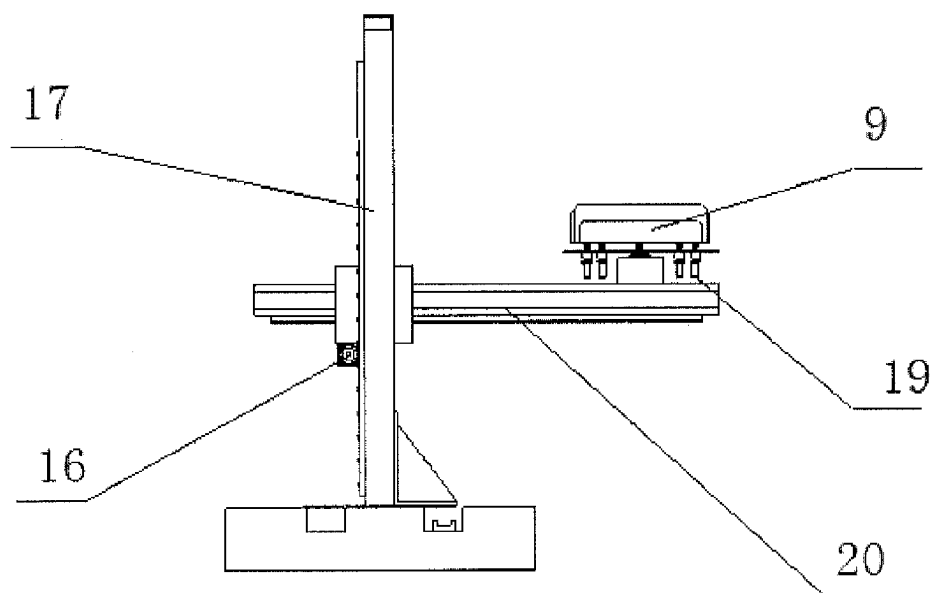


Figure 8

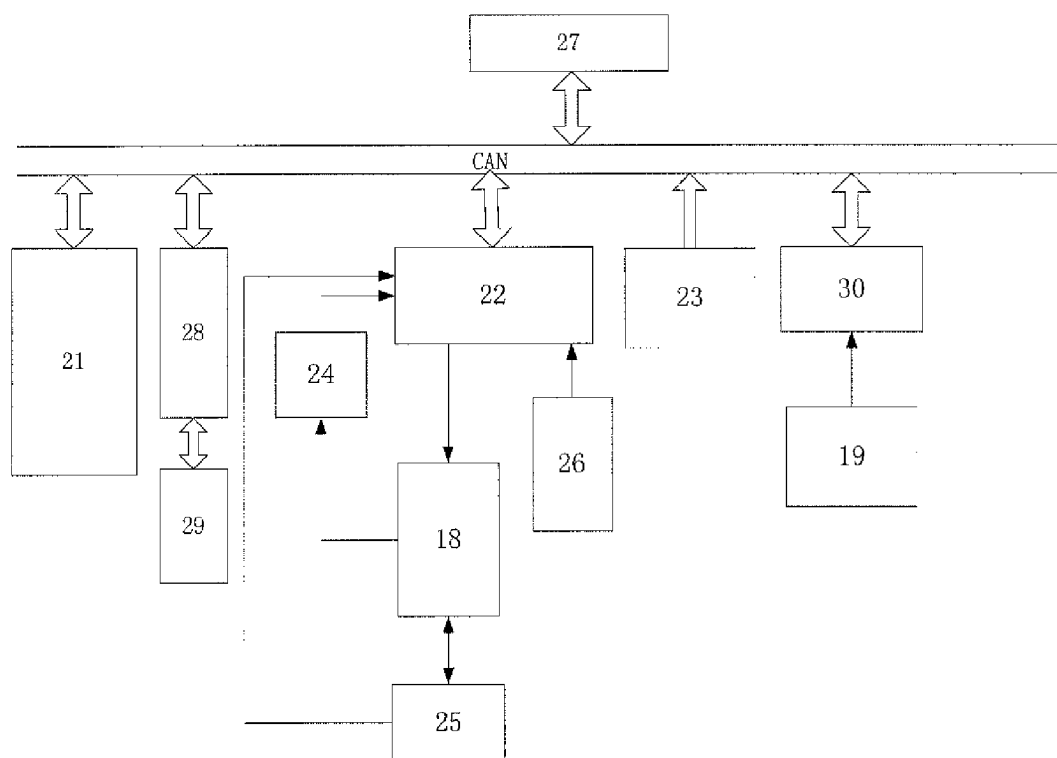


Figure 9

BATTERY QUICK-CHANGE SYSTEM OF ELECTRIC PASSENGER CAR CHASSIS BASED ON THE CARTESIAN COORDINATE ROBOT

FIELD OF TECHNOLOGY

[0001] This invention relates to a robot control system for batteries of electric vehicles changing, especially involving the battery quick-change system of electric passenger car chassis based on the Cartesian coordinate robot which can change the battery of electric passenger car chassis automatically and quickly.

BACKGROUND TECHNOLOGY

[0002] With the world's energy and environmental problems getting worse, the electrical energy as a clean energy source is widely used in automotive field, which provides a broad space of application for electric vehicles. However, due to the limitation of current battery energy density, the mileage range of electric vehicles is generally between one hundred to two hundred kilometers, which is far less endurance mileage of conventional cars. Therefore, whether we can quickly provide energy supplies to cars directly affects the popularization and application of electric vehicles. Charging the battery takes a few hours to complete, and fast charge can impact the lifetime of the battery, at the same time, a single battery is very heavy, which is not conducive to replace it manually. In response to this problem, researching robot for being able to replace the battery quickly is the only effective way to solve the rapid supply of vehicle energy.

[0003] There are mainly two energy supply methods, battery charging and electricity changing for existing electric vehicles. There are lots of insufficient of charging mode, mainly comprising full charge taking a long time; charging equipments needing to be combined with long-term parking position, the layout of charging facilities being out of flexibility; outdoor charge can not be made in a cold climate of the northern winter; the batteries have no unified maintenance and management, which impacts the recycling lifetime of the batteries, compared with these, the electricity changing way is provided with many significant advantages, for example, supplying energy fast (rapid electricity supply), less impact on battery life, easy to achieve commercialization, etc., which have obtained multi-recognition from electric vehicle manufacturers, battery manufacturers and charge operators and so on.

[0004] In the context of intensive introduction of the policies of Chinese new energy automobile industry, the filling electricity station market of the domestic electric vehicles has started rapidly, and automatic electricity changing technology has matured for electric buses, sanitation trucks and other models. But being subject to the constraints of the related technologies and the development of the industry maturity, the automatic electricity changing technology of electric passenger vehicles is still at the exploratory stage of development. In this case, the development of service network for the intelligent filling electricity of electric passenger vehicles must rely on the innovation of electricity changing technology to really promote the healthy and sustainable development of the electric vehicle industry.

[0005] Patent for an invention which Patent No. of the State Intellectual Property Office in China is CN101559758A discloses a quick-change system which serves to support the

chassis battery. This system is unable to achieve the automatic changing of the battery because this system only consists of interconnecting members between the battery and the vehicle, and does not have any positioning and guiding devices. Patent for an invention which Patent No. is CN201784595U discloses an automatic changing system of the battery for electric vehicles, comprising the vehicle positioning platform, lifting equipment, etc., due to the positioning platform of this system can only locate the vehicles in the front and rear direction, if there has an angle (the chassis is tilted to a certain angle) between the chassis of electric vehicle for changing and the horizontal, when the lifting equipment is lifting battery box which will cause excessive lifting or lifting without in place, so that there will be potential security risks for the vehicle after electricity changing. Meanwhile, this system has proposed a changing method of the chassis battery and a method using an inclined plane pin to position the battery, but the error of this method used to position the battery in purely mechanical manner is large, and there is no information feedback, which is easy to damage the battery. Secondly, the system does not have the function of automatic battery identification.

[0006] Therefore, it needs to develop a control system and a control method allowing the automatic identification of the battery and accurate positioning between the battery and the vehicle chassis to achieve the fast, accurate and secure energy supplies of the electric vehicles, thereby contributing to the promotion and application of the electric cars.

SUMMARY OF THE INVENTION

[0007] The purpose of this invention is to overcome these shortcomings, and provide a battery quick-change system of electric passenger car chassis based on the Cartesian coordinate robot, automatic positioning for the electric vehicles can be achieved by electric changing platform, and also the quick-change robot can help to achieve the dismantlement and installation of the battery quickly and accurately, thereby providing a convenient, fast and economic way of battery replacement for filling electricity station of electric passenger cars, which makes up for the lack of taking a long time to charge the vehicle, greatly improves the traveling mileage of the electric vehicles, and makes it possible for endurable travelling of the electric vehicles, and also can adjust the posture of the battery, identify the battery automatically and replace the battery of the vehicle quickly, accurately and safely to achieve the control of the Cartesian coordinate robot in three directions, to correct and position the battery with small angle and make information interaction between the main control systems.

[0008] In order to achieve the above contents, this invention employs the following technical solutions:

[0009] A battery quick-change system of electric passenger car chassis based on the Cartesian coordinate robot wherein comprises electric changing platform, and this platform, quick-change robot and charging rack along the same straight line; the said quick-change robot comprises battery tray and the Cartesian coordinate robot of four degrees of freedom, the said Cartesian coordinate robot comprises X-axis linear positioning system, Z-axis up-down platform, Y-axis telescopic platform and R-axis angle correction system; the X-axis linear positioning system comprises X-axis two-track rack, the Z-axis up-down platform comprises Y-axis two-track rack, and the R-axis angle correction system comprises R-axis driving motor; the both ends of X-axis two-track rack extend

to the electric changing platform and charging rack respectively; the Z-axis two-track rack is connected with the X-axis two-track rack vertically and movably, and the Y-axis two-track rack is mounted on the Z-axis two-track rack vertically and movably; cooperatively, the X-axis driving motor is provided on X-axis two-track rack, the Y-axis driving motor on Y-axis two-track rack, the Z-axis up-down motor on Z-axis two-track rack, and the battery tray connected with the R-axis driving motor is provided on Y-axis two-track rack; each of driving motors is connected with the corresponding encoder, and each of encoders is connected to the corresponding drive; there are equipped with a distance measuring sensor on the battery tray, and the corresponding limit switches on the both ends of each two-track rack; the drive, each limit switch and the distance measuring sensor of each driving motor are connected with the control system.

[0010] The said X-axis driving motor, the Y-axis driving motor, the Z-axis up-down motor and the R-axis driving motor are all stepping motor, on which are respectively equipped with gears in conjunction with the corresponding two-track racks.

[0011] The said X-axis driving motor and Z-axis up-down motor move in a way of linkage, and only when the X-axis driving motor and the Z-axis up-down motor reach the set position, the Y-axis driving motor can take its movement, only the Y-axis driving motor moves to the specified position, the R-axis driving motor can be in motion.

[0012] Between the said X-axis two-track rack and the Z-axis two-track rack, the Z-axis two-track rack and the Y-axis two-track rack are respectively and vertically in connection with each other through the slider.

[0013] The said control system comprises a host computer, the motion control module connected with the host computer, the battery management module, the battery identification module, the detection module of battery position; wherein said motion control module comprises a PLC controller and a operating handle; the PLC controller is connected to the each limit switch and also to the corresponding encoder through each drive; at the same time, the PLC controller is also connected with the emergency stop switch; the PLC controller is in communication with the host computer via the CAN Bus; the said operating handle is connected with the host computer; the said detection module of battery position is in connection with the distance measuring sensor.

[0014] The said battery identification module is connected with the RFID Reader.

[0015] The said distance measuring sensor is actually laser distance measuring sensor, which is connected with the host computer through the detection module of battery position via the CAN Bus.

[0016] The said detection module of battery position is actually two DMP sensors, which are mounted on the battery tray to cooperate with the reflective device provided on the battery charging station.

[0017] The said host computer is in connection with the battery management module, the PLC controller, the battery identification module, the detection module of battery position and the operating handle via the CAN Bus.

[0018] The said electric changing platform is equipped with stop bit in V-shaped for electric changing vehicles.

[0019] The electric changing platform of this invention provides a working platform which can carry a weight of 2.5 tons for the replacement of the chassis battery of the electric passenger car. The electric changing platform is of metal welded

structure, there is a leveling device between the platform and ground. The platform is equipped with the function of automatic front and rear positioning to the vehicle, and there has been designed a V-shaped stop bit in the front of the platform, after the front wheel of the vehicle moves into the V-shaped stop bit, the vehicle stops automatically in the middle of the V-shaped stop bit by its own gravity. The electric changing platform has a detection device (Card Reader) for the vehicle that can determine if there are any vehicles driving into. When the vehicle needing for electric changing drives into the electric changing platform, the Card Reader can read the RFID (Radio Frequency Identification Devices) installed in the front of the vehicle to detect the presence of the vehicle, the control system sends the information of the presence or absence of a vehicle to the quick-change robot and background monitoring system through the Bus in real time.

[0020] The quick-change robot of this invention comprises the battery tray and the Cartesian coordinate robot of four degrees of freedom. Wherein the Cartesian coordinate robot of four degrees of freedom is able to move in the three directions of X, Y, Z and rotate in the R-axis of the battery tray with small angle. The movement in the three directions of X, Y, Z is like a servo motor to drive the gear shaft at both ends, so that to achieve the translation of the corresponding direction via the synchronous rotation of the gear on the corresponding two-track rack.

[0021] The control system comprises: the host computer, battery management system (BMS), motion control system. This motion control system comprises: Siemens S7-300-315 PLC controller, each limit switch, operating handle, each servo motor.

[0022] In addition, the host computer is also connected with the detection module of the battery position, laser distance measuring sensor, DMP sensor, RFID tag, etc.

[0023] The battery management system (BMS) communicates with each battery via the CAN Bus. The host computer makes information interaction with the main controller, Siemens S7-300-315 PLC controller through the CAN Bus. The battery management system submits the information of the battery to the monitoring system of the host computer via the CAN Bus, the monitoring system of the host computer is installed with RFID tag reader by reading the RFID tag on the battery to make sure the information such as the power of each battery.

[0024] The limit switch is installed on both ends of each two-track rack. Wherein the X-axis driving motor and Z-axis up-down motor move in a way of linkage, and only when the X-axis driving motor and the Z-axis up-down motor reach the set position, the Y-axis driving motor can take its movement, only the Y-axis driving motor moves to the specified position, the R-axis driving motor can be in motion.

[0025] The operating handle can demonstrate the coordinates to the robot, by demonstrating to read all encoders of motors, record the current coordinate value and upload to the control system of the host computer for storage.

[0026] The motion control system can detect the position and angle of removing a battery relative to the battery tray, and make the local storage. When removing a fully charged battery from the battery charging station, the motion control system can adjust and recover the posture of the battery according to the data stored in.

[0027] The robot has two DMP sensors mounted on, when picking up and placing the battery relative to the battery charging station, firstly, it needs to make preliminary posi-

tioning in accordance with the coordinate value of the demonstrating storage, secondly, two DMP sensors take positioning for the reflective device provided on the battery charging station, and then for a second confirmation, only the confirmations in twice are both error-free, the robot manipulator can pick up and place the battery.

[0028] Each battery is affixed with a unique REID identification, and the Reader is installed on the battery tray. When the position where the quick-change robot can pick up the battery is determined, the Card Reader will read the identification of the battery to make local verifying and provide a confirmation message to the background monitoring system.

[0029] The battery charging rack provides a reliable storage position for the battery of the electric passenger car, and achieves automatic charging operation of the battery by means of auxiliary mechanism. The battery charging rack is of metal welded structure, and a storage position serves as an independent unit, which connects to each other by bolts.

[0030] The operating procedures of the said control system include the following steps:

[0031] After a vehicle drives into V-shaped stop bit of a electric changing platform, the electric changing platform will report the presence of the vehicle to the background monitoring system which will send work instruction to the quick-change robot via the Bus after receiving the report information;

[0032] The quick-change robot moves quickly to the bottom of the chassis of the electric changing vehicle for implementing the action of removing the battery through the position control function of the position control module;

[0033] Detect the position of removing the battery, and record the relevant data;

[0034] The quick-change robot moves from the bottom of the vehicle chassis and drops to a safe position;

[0035] Adjust the position of the battery to a correct placement;

[0036] The quick-change robot moves to the specified position (empty) of the battery charging rack, and detects to determine the position (by the DMP sensor);

[0037] Put the battery on the charging rack, and make identification (by the RFID Card Reader), then upload to the background monitoring system, after that the quick-change robot exits;

[0038] In accordance with the instruction of the background monitoring system, the quick-change robot moves to the specified position (fully charged battery) of the battery charging rack, and detects to determine the position (by the DMP sensor) and battery identity (by the RFID Card Reader);

[0039] After confirming without any error, take down the battery from the charging rack, after that the quick-change robot exits;

[0040] The quick-change robot drops to a safe position, and makes lateral movement to the front of the vehicle chassis;

[0041] Adjust the position of the battery to a certain angle suitable for installation (by R-axis angle correction system and the memory information of removed battery earlier);

[0042] The battery tray of the quick-change robot moves to the bottom of the vehicle chassis, and installs the battery to the vehicle;

[0043] The quick-change robot leaves from the bottom of the vehicle chassis, returns to the safe position and waits for the next work instruction.

[0044] The workflow of the quick-change robot of this invention is as follows:

[0045] After the system is powered on, the reset instruction is issued by the host computer, after all directions of the robot trigger the limit switch, the robot moves for null seeking, and the host computer records the current position as the origin of the coordinates of the robot movement.

[0046] Removing the battery: when the vehicle safely stops at the electric changing platform, the quick-change robot according to the coordinate point demonstrated accurately extends the battery tray to the bottom of the battery, the Z-axis up-down motor moves upward until triggering the limit switch mounted on the robot manipulator. At this time, the robot manipulator releases, removes the battery, detects the position and angle of the battery relative to itself by three laser distance measuring sensors, and conducts the local storage.

[0047] Placing the battery: the PLC controller accepts the empty charging station label issued by the host computer and matches with the Database to find out the corresponding coordinate value, the robot manipulator carries the battery to the corresponding charging station to verify and make secondary confirmation by DMP sensor, and places the battery to the corresponding charging station accurately for charging the battery. When the battery is fully charged, the battery management system will inform the host computer, and the host computer gives command to change the RFID tag to full flag, and then this information will be uploaded back to the host computer for recording.

[0048] Picking up the battery: the PLC controller accepts the full charging station label issued by the host computer and matches with the Database to find out the corresponding coordinate value. The robot manipulator reaches to the corresponding charging station to verify and make secondary confirmation by DMP sensor, and then picks up the battery. In this case, the host computer sets this charging station label as vacancy.

[0049] Installing the battery: the PLC controller controls the robot manipulator to reach to the bottom of the vehicle in accordance with the coordinate value when removing the battery, and according to the position and angle of the battery when removing the battery, rectifies the deviation for the battery through rotating electrical machine mounted on the robot manipulator, restores the posture of the battery when removed, and installs the battery accurately to the bottom of the vehicle, the robot returns back to the standby position of the origin to complete the entire process for electric changing.

[0050] The beneficial effects of this invention are: to adjust the posture of the battery, identify the battery automatically and replace the battery of the vehicle quickly, accurately and safely to achieve the control of the Cartesian coordinate robot in three directions, to correct and position the battery with small angle and make information interaction between the main control systems.

DESCRIPTION OF FIGURES

[0051] FIG. 1, the structure schematic main view of the battery quick-change system of electric passenger car chassis based on the Cartesian coordinate robot for the case of invention implementation.

[0052] FIG. 2, the view corresponding to the plan view of FIG. 1;

[0053] FIG. 3, the main view of the system structure when the quick-change robot picking up the battery;

[0054] FIG. 4, the view corresponding to the plan view of FIG. 3 (the electric changing vehicle is not shown);

[0055] FIG. 5, the main view of the system structure when the quick-change robot placing the battery;

[0056] FIG. 6, the view corresponding to the plan view of FIG. 3;

[0057] FIG. 7, the schematic front view of the quick-change robot;

[0058] FIG. 8, the left view of the quick-change robot;

[0059] FIG. 9, the control system block diagram of the quick-change robot.

[0060] Wherein, 1. electric changing vehicle, 2. electric changing platform, 3. quick-change robot, 4. charging rack, 5. X-axis linear positioning system, 6. Z-axis up-down platform, 7. Y-axis telescopic platform, 8. R-axis angle correction system, 9. battery tray, 10. battery, 11. V-shaped stop bit, 12. X-axis two-track rack, 13. X-axis driving motor, 14. Y-axis driving motor, 15. R-axis driving motor, 16. Z-axis up-down motor, 17. Z-axis two-track rack, 18. drive, 19. distance measuring sensor, 20. Y-axis two-track rack, 21. battery management module, 22. PLC controller, 23. operating handle, 24. limit switch, 25. encoder, 26. emergency stop switch, 27. host computer, 28. battery identification module, 29. RFID Reader, 30. detection module of battery position.

MODE OF CARRYING OUT THE INVENTION

[0061] This invention combining with the figures and embodiments will be further described below.

[0062] FIG. 1 to FIG. 9, a battery quick-change system of electric passenger car chassis based on the Cartesian coordinate robot, which comprises electric changing platform 2, electric changing platform 2 and quick-change robot 3 and charging rack 4 along the same straight line; the said quick-change robot 3 comprises battery tray 9 and the Cartesian coordinate robot of four degrees of freedom, the said Cartesian coordinate robot comprises X-axis linear positioning system 5, Z-axis up-down platform 6, Y-axis telescopic platform 7 and R-axis angle correction system 8, the X-axis linear positioning system 5 comprises X-axis two-track rack 12, the Z-axis up-down platform 6 comprises Y-axis two-track rack 20, the R-axis angle correction system 8 comprises R-axis driving motor 15; the both ends of X-axis two-track rack 12 extend separately to the electric changing platform 2 and the charging rack 4; the Z-axis two-track rack 17 is connected with the X-axis two-track rack 12 vertically and movably, and the Y-axis two-track rack 20 is mounted on the Z-axis two-track rack 17 vertically and movably; cooperatively, the X-axis driving motor 13 is provided on X-axis two-track rack 12, the Y-axis driving motor 14 on Y-axis two-track rack 20, the Z-axis up-down motor 16 on Z-axis two-track rack 17, and the battery tray 9 connected with the R-axis driving motor 15 is provided on Y-axis two-track rack 20; each of driving motors is connected with the corresponding encoder 25, and each encoder 25 is connected to the corresponding drive 18; there are equipped with a distance measuring sensor 19 on the battery tray 9, and the corresponding limit switches 24 on the both ends of each two-track rack; the drive 18, each limit switch 24 and the distance measuring sensor 19 of each driving motor are connected with the control system.

[0063] The said X-axis driving motor 13, the Y-axis driving motor 14, the Z-axis up-down motor 16 and the R-axis driving motor 15 are all stepping motor, on which are respectively equipped with gears in conjunction with the corresponding two-track racks.

[0064] The said X-axis driving motor 13 and Z-axis up-down motor 16 move in a way of linkage, and only when the

X-axis driving motor 13 and the Z-axis up-down motor 16 reach the set position, the Y-axis driving motor 14 can take its movement, only the Y-axis driving motor 14 moves to the specified position, the R-axis driving motor 15 can be in motion.

[0065] Between the said X-axis two-track rack 12 and the Z-axis two-track rack 17, the Z-axis two-track rack 17 and the Y-axis two-track rack 20 are respectively and vertically in connection with each other through the slider.

[0066] The said control system comprises a host computer 27, the motion control module connected with the host computer 27, the battery management module 21, the battery identification module 28, the detection module of battery position 30; wherein said motion control module comprises a PLC controller 22 and a operating handle 23; the PLC controller 22 is connected to the each limit switch 24 and also to the corresponding encoder 25 through each drive 18; at the same time, the PLC controller 22 is also connected with the emergency stop switch 26; the PLC controller 22 is in communication with the host computer 27 via the CAN Bus; the said operating handle 23 is connected with the host computer 27; the said detection module of battery position 30 is in connection with the distance measuring sensor 19.

[0067] The said battery identification module 28 is connected with the RFID Reader 29.

[0068] The said distance measuring sensor 19 is actually laser distance measuring sensor, which is connected with the host computer 27 through the detection module of battery position 30 via the CAN Bus.

[0069] The said detection module of battery position 30 is actually two DMP sensors, which are mounted on the battery tray 9 to cooperate with the reflective device provided on the battery charging station.

[0070] The said host computer 27 is in connection with the battery management module 21, the PLC controller 22, the battery identification module 28, the detection module of battery position 30 and the operating handle 23 via the CAN Bus.

[0071] The said electric changing platform 2 is equipped with stop bit 11 in V-shaped for electric changing vehicles 1.

[0072] After the overall system is powered on, the reset instruction is issued by the host computer 27, each of the drive motors of the robot is reset, and the host computer 27 records the current position as the origin of the coordinates of the robot movement.

[0073] After a vehicle drives into V-shaped stop bit 11 of a electric changing platform, the electric changing platform 1 will report the presence of the vehicle to the background monitoring system which will send work instruction to the quick-change robot 3 via the Bus after receiving the report information;

[0074] The quick-change robot 3 moves quickly to the bottom of the chassis of the electric changing vehicle 1 for implementing the action of removing the battery through the position control function of the position control module of X-axis linear positioning system 5, Z-axis up-down platform 6 and Y-axis telescopic platform 7;

[0075] Detect the position of removing the battery, and record the relevant data;

[0076] The quick-change robot 3 moves from the bottom of the vehicle chassis and drops to a safe position;

[0077] Adjust the position of the battery to a correct placement through R-axis angle correction system 8;

[0078] The quick-change robot 3 moves to the specified position (empty) of the battery charging rack 4, and detects to determine the position (by the DMP sensor);

[0079] Put the battery on the charging rack 4, and make identification (by the RFID Card Reader), then upload to the background monitoring system, after that the quick-change robot 3 exits;

[0080] In accordance with the instruction of the background monitoring system, the quick-change robot 3 moves to the specified position (fully charged battery) of the battery charging rack 4, and detects to determine the position (by the DMP sensor) and battery identity (by the RFID Card Reader);

[0081] After confirming without any error, take down the battery from the charging rack 4, after that the quick-change robot 3 exits;

[0082] The quick-change robot 3 drops to a safe position, and makes lateral movement to the front of the vehicle chassis;

[0083] Adjust the position of the battery to a certain angle suitable for installation (by R-axis angle correction system 8 and the memory information of the removed battery earlier);

[0084] The battery tray 9 of the quick-change robot 3 moves to the bottom of the vehicle chassis, and installs the battery on the vehicle;

[0085] The quick-change robot 3 leaves from the bottom of the vehicle chassis, returns to the safe position and waits for the next work instruction.

[0086] The carrying out processes of the quick-change robot 3: according to the coordinate point demonstrated before, extend the battery tray 9 to the bottom of the vehicle battery accurately, the Y-axis two-track rack 20 moves upward for removing the battery, detect the position and angle of the battery relative to the robot manipulator by three distance measuring sensors 19, and conducts the local storage.

[0087] Each driving motor accepts the work instruction, checks to confirm by DMP sensor, and places the battery to the corresponding charging station accurately for charging the battery. When the battery is fully charged, the battery management module 21 will inform the host computer 27, and the host computer 27 gives command to change the RFID tag to full flag, and then this information will be uploaded back to the host computer 27 for recording.

[0088] The PLC controller 22 accepts the full charging station label issued by the host computer 27 and matches with the Database to find out the corresponding coordinate value. The battery tray 9 reaches to the corresponding charging station to verify and make secondary confirmation by DMP sensor, and then picks up the battery. In this case, the host computer 27 sets this charging station label as vacancy.

[0089] The PLC controller 22 controls the robot manipulator to reach to the bottom of the vehicle in accordance with the coordinate value when removing the battery, and according to the position and angle of the battery when removing the battery, rectifies the deviation for the battery through the R-axis driving motor 15 mounted on the robot manipulator, restores the posture of the battery when removed, and installs the battery accurately to the bottom of the vehicle, the robot returns back to the standby position of the origin to complete the entire process for electric changing.

1. A battery quick-change system of electric passenger car chassis based on the Cartesian coordinate robot is wherein it comprises electric changing platform, and this platform, quick-change robot and charging rack along the same straight line; the said quick-change robot comprises the battery tray

and the Cartesian coordinate robot of four degrees of freedom, the said Cartesian coordinate robot comprises X-axis linear positioning system, Z-axis up-down platform, Y-axis telescopic platform and R-axis angle correction system; the said X-axis linear positioning system comprises X-axis two-track rack, the Z-axis up-down platform comprises Y-axis two-track rack, and the R-axis angle correction system comprises R-axis driving motor; the both ends of X-axis two-track rack extend to the electric changing platform and charging rack respectively; the Z-axis two-track rack is connected with the X-axis two-track rack vertically and movably, and the Y-axis two-track rack is mounted on the Z-axis two-track rack vertically and movably; cooperatively, the X-axis driving motor is provided on the X-axis two-track rack, the Y-axis driving motor on the Y-axis two-track rack, the Z-axis up-down motor on the Z-axis two-track rack, and the battery tray connected with the R-axis driving motor is provided on the Y-axis two-track rack; each of driving motors is connected with the corresponding encoder, and each of encoders is connected to the corresponding drive; there are equipped with a distance measuring sensor on the battery tray, and the corresponding limit switches on the both ends of each two-track rack; the drive, each limit switch and the distance measuring sensor of each driving motor are connected with the control system; the X-axis driving motor and Z-axis up-down motor move in a way of linkage, and only when the X-axis driving motor and the Z-axis up-down motor reach the set position, the Y-axis driving motor will take its movement, only the Y-axis driving motor moves to the specified position, the R-axis driving motor will be in motion.

2. As described in claim 1, the feature wherein the battery quick-change system of electric passenger car chassis based on the Cartesian coordinate robot is that the said X-axis driving motor, the Y-axis driving motor, the Z-axis up-down motor and the R-axis driving motor are all stepping motor, on which are respectively equipped with gears in conjunction with the corresponding two-track racks.

3. (canceled)

4. As described in claim 1, the feature wherein the battery quick-change system of electric passenger car chassis based on the Cartesian coordinate robot is that between the said X-axis two-track rack and the Z-axis two-track rack, the Z-axis two-track rack and the Y-axis two-track rack are respectively and vertically in connection with each other through the slider.

5. As described in claim 1, the feature wherein the battery quick-change system of electric passenger car chassis based on the Cartesian coordinate robot is that the said control system comprises a host computer, the motion control module connected with the host computer, the battery management module, the battery identification module, the detection module of battery position; wherein said motion control module comprises a PLC controller and an operating handle; the PLC controller is connected to the each limit switch and also to the corresponding encoder through each drive; at the same time, the PLC controller is also connected with the emergency stop switch; the PLC controller is in communication with the host computer via the CAN Bus; the said operating handle is connected with the host computer; the said detection module of battery position is in connection with the distance measuring sensor.

6. As described in claim 5, the feature wherein the battery quick-change system of electric passenger car chassis based

on the Cartesian coordinate robot is that the said battery identification module is connected with the RED Reader.

7. As described in claim 5, the feature wherein the battery quick-change system of electric passenger car chassis based on the Cartesian coordinate robot is that the said distance measuring sensor is actually laser distance measuring sensor, which is connected with the host computer through the detection module of battery position via the CAN Bus.

8. As described in claim 5, the feature wherein the battery quick-change system of electric passenger car chassis based on the Cartesian coordinate robot is that the said detection module of battery position is actually two DMP sensors, which are mounted on the battery tray to cooperate with the reflective device provided on the battery charging station.

9. As described in claim 5, the feature wherein the battery quick-change system of electric passenger car chassis based on the Cartesian coordinate robot is that the said host computer is in connection with the battery management module, the PLC controller, the battery identification module, the detection module of battery position and the operating handle via the CAN Bus.

10. As described in claim 1, the feature wherein the battery quick-change system of electric passenger car chassis based on the Cartesian coordinate robot is that the said electric changing platform is equipped with stop bit in V-shaped for electric changing vehicles.

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