

Title

AUTOMATIC ELECTRICITY TAKING SYSTEM AND METHOD FOR RUBBER TYRED CONTAINER GANTRY CRANE

Field of the Invention

- 5 The invention relates to a matching technique of a gantry crane used in container terminals or storage yards, in particular to a novel automatic electricity taking system and a method for a rubber tyred container gantry crane.

Background of the Invention

- 10 With the rise of oil price and the increasingly stringent environmental requirements, it has become a trend to change the power of a rubber tyred container gantry crane (RTG) from fuel oil to electricity. One of the most important parts of the technique of electrically driving a RTG is how to transfer commercial power to a RTG with long-distance movement.

- 15 In the present method, an electricity taking bracket is disposed besides a RTG runway, a slide contact wire connected with commercial power is mounted on the electricity taking bracket, and a current collecting trolley moving together with the RTG is needed. The trolley is electrically connected to a gantry crane, and the trolley is proved with a current collector having a carbon brush at the end part. During taking electricity process, the current collecting trolley is mounted on the electricity taking bracket, and the carbon brush is connected with the slide contact wire to transmit
20 electricity on the slide contact wire to the RTG.

 A technical problem to be solved in the process is how the trolley is mounted on the electricity taking bracket and how to make the trolley take electricity and do synchronous movement with the RTG.

The most conventional method is realized by manual operation: the trolley is first mounted on the electricity taking bracket, then the plug of the trolley is inserted in the RTG to realize electric connection, and the trolley is connected to the slide contact wire by manually towing a steel rope to realize power supply of the RTG. Such manual operation takes time and labor, has low efficiency, and has electroshock danger caused by inserting or pulling out the plug in rainy day, thereby having low safety.

Chinese application 200910050482.0 discloses a structure for automatically connecting a trolley. In taking electricity process, a trolley is horizontally pushed out by a connection device connected with a RTG to be pressed on a guide plate of an electricity taking bracket, the RTG moves forward and drives the trolley to move, under the action of an inclined guide plate arranged on the electricity taking bracket the trolley generates an upward component force by depending on a resultant force of a forward traction force and a bracing force of the guide plate and then is lifted to a preset height to realize rail entry, and the carbon brush of a current collector is led into a slide contact wire through a trumpet-shaped guide opening to automatically take electricity.

The electricity system with such structure realizes rail entry based on the cooperation among pressure of the connection device, the forward force of the RTG and the inclined guide plate, and the trolley needs to be accurately positioned in both vertical and horizontal directions at the leading section of the inclined guide plate, and thus the connection device is required to supply a sufficient horizontal pressure (approximately 750KG) for the trolley to ensure the trolley to adhere the guide plate in the whole leading process. The trolley is lifted to the preset height through the guide plate in vertical direction, the lifting force is only a vertically upward component force generated by the inclined guide plate resisting the pressure force of the lifting wheel of the trolley perpendicular to the plate surface, and therefore, a sufficient lifting force requires a large enough forward traction force. Accordingly, the trolley's force condition is as follows: the pressed trolley moves forward at a certain speed, the lifting wheel of the trolley generates an impact force to the inclined guide plate when contacting with the inclined guide plate, the force reacts on the lifting wheel, the component force generated vertically is used for overcoming the

trolley gravity (about 150KG), the downward component force (larger than 50KG) of the friction force between a universal ball and a backup plate and the downward component force of the friction force between the lifting wheel and the inclined guide plate are generated under the action of the pressure of the trolley, therefore, only the

5 vertically downward component force can reach over 200KG, the angle of the inclined guide plate is 22 degrees, and the force acting on the lifting wheel can be over 220KG. The impact force generated at the instant of the collision is more than four to five times larger than the normal force, therefore, in every rail entry a strong impact force of approximate 1 ton will act on the lifting wheel and the whole frame of

10 the trolley, resulting in repeated deformations of the support member of the lifting wheel, which causes that the trolley can not be lifted to the required level and thus a traveling wheel and a guide wheel come into a collision with the rail. Though the support member of the lifting wheel is strengthened to prevent easy deformation, the impact force will act on the frame of the trolley to generate a clockwise turning torque

15 which is transferred to an up-down slide linear-motion ball bearing and a vertical seat type insert bearing supported by the frame to damage these parts, and thus, the impact has great influence on the service life and the reliability of the whole machine. In addition, in the whole process of rail entry, there is a balance among a plurality of forces, the fluctuation of one force possibly causes failure of rail entry (for example,

20 insufficient air pressure of the connection device, shake of the RTG, etc.), and so there is a high demand on the system. The power for pressing the trolley on the backup plate is compressed air, in a compressed air system for supplying compressed air, abnormal operation of any one of air cylinder, reversing valve, air compressor, pressure limited valve, air pipe, pipe joint, motor, belt and drain valve will lead to

25 insufficient air pressure, and the compressed air system self has low reliability, while the design of the RTG having a flexible telescopic arm requires a compressed air system with relative small resistance, which determines that the whole system has limited reliability in the key course of leading in and leading out the trolley. Moreover, the traction of the trolley is realized depending on the connection device,

30 during traveling the connection device is always pressed on the electricity taking bracket, and the electricity taking bracket has light load and small foundation settlement. However, the load of the RTG can reach 200 tons during operation, after being used for a long time, the partial foundation of a runway beam has great settlement (even break), the settlement difference of the runway beam relative to the

foundation of the electricity taking bracket can reach over 40cm, and fluctuating range of the trolley positioned at the end part of the connection device in the above system is merely about $\pm 10\text{cm}$, the trolley thus cannot work at the position with serious settlement, and the fluctuating range cannot be enlarged because the trolley is limited by the rigidity of the linear motion ball bearing slide way and the size of the frame of the trolley, and in conclusion, the design has defects.

Summary of the Invention

In order to solve the technical problems of the prior art, the invention provides an automatic electricity taking system and a method for a rubber tyred container gantry crane, which can eliminate design defects through separate connection device and traction device to improve the reliability of the whole system.

Accordingly, the invention employs the following technical scheme:

An automatic electricity taking system for rubber tyred container gantry crane comprises:

an current collecting trolley including a frame, guide wheels, traveling wheels, a current collector and an induction component, and cables of the current collector and the induction component are connected to a gantry crane;

an electricity taking bracket disposed besides a the gantry crane runway is provided with a slide contact wire and traveling wheel guide rails and comprises a middle section and an current collecting traveling trolley leading-in section positioned at the end part, wherein the leading-in section is provided with an upper guide groove and a lower guide groove and a backup plate, the guide grooves are provided with guide plates used for positioning the trolley in horizontal direction;

a traction device for connecting both ends of the current collecting trolley and the gantry crane at least includes a flexible traction cable used for automatically centering the trolley in the electricity taking bracket and pulling the current collecting trolley to move with the gantry crane in the middle section;

The traction device for connecting both ends of the current collecting trolley and the gantry crane at least includes a flexible cable used for moving the current collecting trolley along with the gantry crane.

Said automatic electricity taking system further comprises:

- 5 a connection device disposed at the side surface of the gantry crane, comprising an upward-downward movement mechanism, a horizontal telescopic mechanism and a coupling mechanism capable of realizing connection and separation between the connection device and the current collecting trolley, wherein the connection device can be connected to or separated from the current collecting trolley via the coupling
- 10 mechanism when the upward-downward movement mechanism works, and the current collecting trolley parks on the electricity taking bracket through the guide wheels and the traveling wheels;

Said traction device and the connection device are arranged separately.

- The invention employs the following technical measures or any combination of
- 15 the measures to improve and supplement the above technical scheme:

Said coupling mechanism comprises a first coupling assembly connected to the current collecting trolley and a second coupling assembly connected to the connection device, and the first coupling assembly and the second coupling assembly are connected when moving towards each other and separated when moving reversely.

- 20 The guide grooves of the leading-in section of the current collecting bracket are open upwards. The upper rail and the lower rail of the middle section can be open either upward or downward, and if both are open upward, the current collecting trolley uses the same group of the guide wheels and the traveling wheels at the leading-in section and the middle section; if one of the upper rail and the lower rail of
- 25 the middle section is open downward, the current collecting trolley requires two separate groups of the guide wheels and the traveling wheels for being used for the guide grooves of the leading-in section and the wheel guide rails of the middle section, respectively.

Said upward-downward movement mechanism is arranged at the connection end of the connection device to the gantry crane or at the coupling end of the connection device to the traveling trolley and is provided with a guide positioning mechanism which is of a slide rail or a guide rail.

- 5 Said upward-downward movement mechanism is of an air cylinder, or a hydraulic cylinder, or a mandrel, or a pull rod, or a worm gear mechanism, or a chain-sprocket mechanism.

- 10 Said horizontal telescopic mechanism can be of a double-arm translation mechanism, or a single-arm translation mechanism, or a telescopic translation mechanism, or a guide rail type translation mechanism or a trunk type electricity taking bow translation mechanism.

- 15 Said traction device comprises a flexible traction cable, a protective rigid cable and a pothook and suspension loop mechanism, wherein the flexible cable and the rigid cable form a cable group and are respectively arranged at both ends of the current collecting trolley, one end of the cable group is connected to the current collecting trolley through the pothook and suspension loop mechanism, and the other end is connected to the gantry crane.

- 20 The front end of each guide groove is provided with a guide section with reduced width from the front to the rear, the rear end of the guide section is communicated with the guide groove, and the width of the rear end of the guide section is equal to the guide groove.

Matching with the above system, the invention further provides an automatic electricity taking method for rubber tyred container gantry crane, which is characterized by comprising the following steps that:

- 25 1) the gantry crane is driven to the leading-in section of the slide wire bracket, and the current collecting trolley is confirmed to be connected to the connection device through the coupling mechanism;

2) the horizontal telescopic mechanism of the connection device starts to work and horizontally pushes the current collecting trolley towards the electricity taking bracket till the guide wheels of the current collecting trolley are positioned on the backup plate which is in front of the guide grooves of the electricity taking bracket, a
5 corresponding inductive switch starts to work, and then the action of horizontal push terminates.

3) the upward-downward movement mechanism of the connection device starts to work and drives the coupling mechanism and the current collecting trolley to move downward against the backup plate, such that the guide wheels and the traveling
10 wheels enter the guide grooves to realize positioning of the trolley in vertical direction;

4) the upward-downward movement mechanism continues to move downward to separate the coupling mechanism, and the trolley parts on the electricity taking bracket;

15 5) the horizontal telescopic mechanism starts to work and draws the connection device back; and

6) the gantry crane pulls the current collecting trolley to move towards the middle section of the slide wire via the traction device, the trolley firstly passes through the guide plate for positioning the trolley in the guide groove in horizontal
20 direction, and the horizontal displacement of the guide wheels arranged horizontally is reduced to realize the positioning of the trolley in horizontal direction; the trolley continues to move, such that the carbon brush of the current collector on the trolley can be smoothly led to the slide contact wire and is connected to the slide contact wire, electric energy of slide contact wire is thus transferred to the gantry crane
25 through the current collecting trolley, and the power for gantry crane is immediately switched into commercial power.

The invention has the following advantages: depending on two separate mechanisms, the invention realizes accurate positioning of the trolley both in vertical and horizontal directions by two steps, ensures smooth and reliable rail entry of the

trolley in respect of design without strong impact during rail entry and prevents damage to parts; after rail entry, the trolley is separated from the connection device and pulled by the flexible traction device such that the carbon brush of the current collector can be led in and led out of the safe slide contact wire, and the trolley can
5 work normally even in large partial settlement, thereby having strong adaptability and good following function.

Brief Description of the Drawings

Figure 1 is a structural diagram of the trolley and the connection device of the invention;

10 Figure 2 is another structural diagram of the trolley and the connection device of the invention;

Figure 3 is another structural diagram of the trolley and the connection device of the invention;

15 Figure 4 is another structural diagram of the trolley and the connection device of the invention;

Figure 5 is another structural diagram of the trolley and the connection device of the invention;

Figure 6 is another structural diagram of the trolley and the connection device of the invention;

20 Figure 7 is another structural diagram of the trolley and the connection device of the invention;

Figure 8 and figure 9 are structural diagrams of the trolley and the electricity taking bracket of the invention;

Figure 10 is a partial enlargement view of part A in figure 9;

Figure 11 is a partial enlargement view of part B in figure 9;

Figure 12 is a structural diagram of the guide section of the electricity taking bracket of the invention; and

Figure 13 to figure 17 are a schematic diagram of the current collecting trolley
5 entering the rails.

Detailed Description of the Embodiments

Embodiment 1

Figure 1 shows an automatic electricity taking system for rubber tyred container gantry crane, in which a current collecting trolley 1 is connected to a connection
10 device through a coupling mechanism, and the current collecting trolley 1 comprises guide wheels 12, traveling wheels and a current collector 11. In the connection device, a horizontal telescopic device 2 comprises two symmetrical adjustment arms 21 positioned between a mounting frame 23 and the trolley, and a telescopic rod 24 and a mandrel 22 are arranged between the two adjustment arms. The mandrel adjusts the
15 distance between the two adjustment arms to move the trolley horizontally. An upward-downward movement mandrel mechanism 3 is mounted between the connection device and the coupling mechanism and connected with the second coupling assembly of the coupling mechanism, and the first coupling assembly of the coupling device is connected to the trolley. The second coupling assembly can move
20 upward to suspend the first coupling assembly above the second coupling assembly or move downward to be separated from the first coupling assembly.

Both ends of the current collecting trolley 1 are connected with a RTG through a traction device 4 to realize traction, and the traction device comprises a flexible traction cable and a protective flexible cable of rigid cable, wherein one of the cables
25 must be flexible.

The electricity taking bracket 5 (as shown in figure 8 and figure 9) is provided with slide contact wires 53 and trolley traveling wheel guide rails and comprises a

middle section and a current collecting traveling trolley leading-in section positioned at the end part, wherein the leading-in section is provided with guide grooves 51 which are provided with guide plate 52 used for positioning the trolley in horizontal direction. The guide grooves are open upward with a certain depth supposed to exceed
5 the height of the guide wheels (as shown in figure 11). A guide section can be arranged before each guide groove for further facilitating rail entry (as shown in figure 12), the guide section is provided with an inclined guide plate 511, such that the width of the guide section is reduced gradually from the front to the rear, the rear end of the guide section is communicated with the guide groove, and the width of the
10 rear end is equal to that of the guide groove. The width of the guide grooves is slightly greater than that of the guide wheels to facilitate the guide wheels to enter the rails even in the condition of slight inclination.

In the mechanism shown in figure 9, a horizontal telescopic mechanism 2 is provided with the upward-downward movement mandrel mechanisms 3 at both sides
15 to facilitate vertical displacement control.

Figure 10 shows one mode of the coupling mechanism, wherein a pothook structure 6 comprises a pothook on the connection device and a suspension loop on the current collecting trolley 1. The side of the connection device attaching the current collecting trolley can be additionally provided with a roller wheel or a roller cylinder
20 7 to facilitate the connection device to move relative to the trolley upward and downward so as to be separated from the trolley.

Embodiment 2

As shown in figure 2, an automatic electricity taking system for rubber tyred container gantry crane also employs a double-arm translation mechanism, upward-downward movement mandrel mechanisms 3 are mounted between the horizontal
25 telescopic mechanism 2 and the gantry crane, and the rest is the same with embodiment 1.

Embodiment 3

Figure 3 shows an automatic electricity taking system for rubber tyred container gantry crane, in which the distance between two adjustment arms 21 of a double-arm translation mechanism can be adjusted by a crank rod mechanism 25 to realize horizontal translation of the trolley, and the rest is the same with
5 embodiment 2.

Embodiment 4

Figure 4 shows an automatic electricity taking system for rubber tyred container gantry crane, in which a horizontal telescopic mechanism 2 employs a telescopic translation mechanism comprising a plurality of expansion joints. Upward-downward
10 movement mandrel mechanisms 3 are mounted between a mounting frame 23 and a gantry crane, and the mounting frame can be driven by the upward-downward movement mandrel mechanisms 3 to slide upward and downward on a vertical slide rail 31. The rest is same with embodiment 2.

Embodiment 5

Figure 5 shows an automatic electricity taking system for rubber tyred container gantry crane, in which a horizontal telescopic mechanism is of a trunk beam type translation mechanism which pushes out or pulls back the trolley through inter-rotation of connection rods 26. Upward-downward movement mandrel mechanisms 3
15 are mounted between the trunk beam type translation mechanism and a coupling mechanism, and a mounting frame 23 can move vertically to some extent. The rest is same with embodiment 1.
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Embodiment 6

Figure 6 shows an automatic electricity taking system for rubber tyred container gantry crane, in which a horizontal telescopic mechanism 2 is of a single-arm
25 translation mechanism comprising a swinging arm 29, a bracing rod 27 and a mandrel 28, the mandrel 28 drives the swinging arm to change the angle so as to realize the object of translation. The rest is same with embodiment 4.

Embodiment 7

Figure 6 shows an automatic electricity taking system for rubber tyred container gantry crane, in which a horizontal telescopic mechanism 2 is of a guide way type translation mechanism, a telescopic arm can slide in a guide hole to realize the object
5 of translation. The rest is same with embodiment 4.

The electricity taking system operates as follows:

1) the current collecting trolley is connected to the connection device through the coupling device (as shown in figure 13);

2) the horizontal telescopic mechanism starts to work and pushes the current
10 collecting trolley towards the electricity taking bracket till the guide wheels of the current collecting trolley are positioned above the guide grooves of the electricity taking bracket (as shown in figure 14);

3) the upward-downward movement mechanism starts to work and drives the coupling mechanism and the current collecting trolley to move downward such that
15 the guide wheels enter the guide grooves (as shown in figure 15);

4) the upward-downward movement mechanism continues to move downward to separate the coupling mechanism, and the trolley parts on the electricity taking bracket (as shown in figure 16);

5) the horizontal telescopic mechanism starts to work and draws the connection
20 device back (as shown in figure 17);

6) The gantry crane pulls the current collecting trolley to move forward via the traction device, the trolley firstly passes through the guide plate 511 for positioning the trolley in the guide groove, in horizontal direction, and the horizontal displacement of the guide wheels arranged horizontally is reduced to realize the
25 positioning of the trolley in horizontal direction; the trolley continues to move, such that the carbon brush of the current collector on the trolley can be smoothly led to the

slide contact wire via a bell mouth 512 and is connected to the slide contact wire, the current collector is connected to the slide contact wire, and electric energy on the slide contact wire is transferred to the gantry crane through the current collecting trolley.

5 In the same way, after the operation of electricity taking is completed, when the trolley needs to be taken off from the electricity taking bracket, it is convenient that only the operations of horizontal outward movement, upward movement, continuous upward movement with pothook entry and horizontal inward movement need to be finished.

10 In the invention, the trolley only needs to move smoothly along a preset path with a smaller force, and there is no impact in the whole process; the accuracy of rail entry is high, and the trolley can enter the rails even the trolley is slightly inclined; the connection process and the traction process are separate, the traction process depends on the flexible cable which can work in the condition of over 1 meter of vertical offset and thus is especially suitable for working environment with partial settlement of the
15 RTG.

Once the connection of the trolley is finished, i.e. after the trolley is positioned on the slide wire bracket in vertical direction, the connection device is separated from the trolley and retracts separately, the trolley is pulled by the separate flexible traction device to move forward and firstly passes through the guide plate for positioning
20 horizontally, the pressure of the guide wheels to the guide plate (the pressure is generated for overcoming torque reaction generated by the gravity of the trolley on the bracket and is only 5-15 percent of the weight of the trolley, which smaller than 20KG), the horizontal motion space of the guide wheels is gradually reduced to realize horizontal positioning of the trolley, and then the carbon brush of the current
25 collector can be led to the safe slide contact wire under the leading action of a trumpet-shaped guide opening; therefore, the connection device only needs to finish the connection of the current collecting trolley, i.e. two motions of vertical movement and horizontal extension and retraction, having greatly lowered requirements and significant improvement of reliability. Substantially, the trolley can realize smooth
30 motion without impact when being positioned both in vertical and horizontal directions. After positioning in both vertical and horizontal directions by two steps,

the carbon brush of the current collector is led in the slide contact wire, and the reliability of the whole process is higher. In addition, the traction cable of the flexible traction device is 3 meters in length, when the maximum permitted extension length (rigid cable length) is set to 0.2 meters, the vertical extension length and the horizontal extension length of the trolley relative to the gantry crane reach to ± 0.5 meters and ± 1 meter ($3.2*3.2-3*3=1*1+0.5*0.5$), respectively, the extension length of 0.2 meters are completely within the flexible deformation range, and the cable can return to the initial length after an external force is eliminated. The suspension loop of the cable on the gantry crane is substantially centered, and the maximum displacement ranges of the trolley relative to the gantry crane both in vertical and horizontal directions can reach 2 meters and 1 meter, respectively, the maximum deviation (in horizontal direction) of the cart of the gantry crane is only ± 0.5 meters, settlements (in vertical direction) of the bracket and a cart runway do not exceed 0.5 meters (± 0.25), the flexible cable thus can complement the deviation of the gantry crane and the deflection caused by uneven settlements of the bracket in a storage yard and the gantry crane runway foundation through flexible deformation, the center of the trolley and the center of the connection device can substantially keep in the same position on the leading-in section through basically equal horizontal pulling forces to facilitate taking the trolley, and the flexible cable can effectively buffer impact when the trolley moves horizontally. The following ability and the adaptability of the trolley pulled by the flexible cable are better than directly pulled relatively rigid connection device.

The invention is suitable for novel oil-to-electricity projects as well as prior manual oil-to-electricity engineering of reconstructing manual plugging type current collecting trolleys, namely that the manual plugging type current collecting trolleys only needs to be slightly reconstructed, and the leading-in section with upward opening is additionally configured in front of the prior bracket to conveniently lead the trolley into the rails. If the leading-in section is positioned on the same foundation with the RTG runway, the accurate rail entry of the trolley can be ensured perfectly.

Besides the above mandrel for example, the upward-downward movement mechanisms of the invention can be air cylinder, hydraulic cylinder, mandrel, pull rod, or mechanical transmission such as worm gear or chain sprocket, etc., and the

type and the mounting position of the vertical and the horizontal telescopic mechanisms can be selected as required.

It is noted that the forgoing embodiments are merely illustrative of the invention in principle and efficacy and are not to be construed in a limiting sense. Various
5 changes will become apparent to those of ordinary skill in the art. The invention is defined by the appended claims.

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What is claimed is:

1. An automatic electricity taking system for rubber tyred container gantry crane comprising:

an current collecting trolley including a frame, guide wheels, traveling wheels, a current collector and an induction component, and cables of the current collector and the induction component being connected to a gantry crane;

an electricity taking bracket disposed besides the gantry crane runway being provided with a slide contact wire and traveling wheel guide rails, comprising a middle section and an current collecting traveling trolley leading-in section positioned at the end part, wherein the leading-in section is provided with an upper guide groove and a lower guide groove and a backup plate, and the guide grooves are provided with guide plates used for positioning the trolley in horizontal direction;

a traction device for connecting both ends of the current collecting trolley and the gantry crane at least including a flexible traction cable used for automatically centering the trolley in the electricity taking bracket in the leading-in section and pulling the current collecting trolley to move with the gantry crane in the middle section;

the automatic electricity taking system further comprising:

a connection device disposed at the side surface of the gantry crane, comprising an upward-downward movement mechanism, a horizontal telescopic mechanism and a coupling mechanism capable of realizing connection and separation between the connection device and the current collecting trolley, wherein the connection device can be connected to or separated from the current collecting trolley via the coupling mechanism when the upward-downward movement mechanism works, and the current collecting trolley parks on the electricity taking bracket through the guide wheels and the traveling wheels after being separated; and

the traction device and the connection device being arranged separately.

2. The automatic electricity taking system for rubber tyred container gantry crane according to claim 1, characterized in that: the coupling mechanism comprises a first coupling assembly connected to the current collecting trolley and a second coupling assembly connected to the connection device, and the first coupling assembly and the

second coupling assembly are connected when moving towards each other and separated when moving reversely.

3. The automatic electricity taking system for rubber tyred container gantry crane according to claim 2, characterized in that: the guide grooves of the leading-in section of the current collecting bracket are open upwards.

4. The automatic electricity taking system for rubber tyred container gantry crane according to claim 3, characterized in that: the upward-downward movement mechanism is arranged at the connection end of the connection device to the gantry crane or at the coupling end of the connection device to the traveling trolley and is provided with a guide positioning mechanism which is of a slide rail or a guide rail.

5. The automatic electricity taking system for rubber tyred container gantry crane according to claim 4, characterized in that: the upward-downward movement mechanism is of an air cylinder, or a hydraulic cylinder, or a mandrel, or a pull rod, or a worm gear mechanism, or a chain-sprocket mechanism, or a leading screw.

6. The automatic electricity taking system for rubber tyred container gantry crane according to claim 4, characterized in that: the horizontal telescopic mechanism can be of a double-arm translation mechanism, or a single-arm translation mechanism, or a telescopic translation mechanism, or a guide rail type translation mechanism or a trunk type electricity taking bow translation mechanism.

7. The automatic electricity taking system for rubber tyred container gantry crane according to any of claim 4 to claim 6, characterized in that: the traction device comprises a flexible traction cable, a protective rigid cable and a pothook and suspension loop mechanism, wherein the flexible cable and the rigid cable form a cable group and are respectively arranged at both ends of the current collecting trolley, one end of the cable group is connected to the current collecting trolley through the pothook and suspension loop mechanism, and the other end is connected to the gantry crane.

8. The automatic electricity taking system for rubber tyred container gantry crane according to any of claim 4 to claim 6, characterized in that: the front end of each guide groove is provided with a guide section with reduced width from the front to the rear, the

rear end of the guide section is communicated with the guide groove, and the width of the rear end of the guide section is equal to the guide groove.

9. An automatic electricity taking method for rubber tyred container gantry crane according to claim 2, characterized by comprising the following steps that:

1) the gantry crane is driven to the leading-in section of the slide wire bracket, and the current collecting trolley is confirmed to be connected to the connection device through the coupling mechanism;

2) the horizontal telescopic mechanism of the connection device starts to work and horizontally pushes the current collecting trolley towards the electricity taking bracket till the guide wheels of the current collecting trolley are positioned on the backup plate which is in front of the guide grooves of the electricity taking bracket, a corresponding induction component starts to work, and then the action of horizontal push terminates;

3) the upward-downward movement mechanism of the connection device starts to work and drives the coupling mechanism and the current collecting trolley to move downward against the backup plate, such that the guide wheels and the traveling wheels enter the guide grooves to realize positioning of the trolley in vertical direction;

4) the upward-downward movement mechanism continues to move downward to separate the coupling mechanism, and the trolley parks on the electricity taking bracket;

5) the horizontal telescopic mechanism starts to work and draws the connection device back; and

6) the gantry crane pulls the current collecting trolley to move towards the middle section of the slide wire via the traction device, the trolley firstly passes through the guide plate for positioning the trolley in the guide groove in horizontal direction, and the horizontal displacement of the guide wheels arranged horizontally is reduced to realize the positioning of the trolley in horizontal direction; the trolley continues to move, such that the carbon brush of the current collector on the trolley can be smoothly led to the slide contact wire and is connected to the slide contact wire, electric energy of slide contact wire is thus transferred to the gantry crane through the current collecting trolley, and the power for gantry crane is immediately switched into commercial power.