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(54) INTELLIGENT TRACK LAYING METHOD AND INTELLIGENT TRACK LAYING APPARATUS

(57) A rail sorting vehicle with a rail sorting device, a rail pushing vehicle with a rail pushing device, and a rail tractor with a rail traction device are located in front of a rail conveyor vehicle. A roller gripping device is still provided on the rail tractor. A special roller recycling vehicle is provided behind the rail tractor, and has a roller gripping device and a roller drag-out device. A fastener fastening vehicle is provided behind the rail conveyor vehicle, and the fastener fastening vehicle has a fastening device for installing fasteners to fix a rail. In the entire operation process of the entire track laying equipment, except for the need for drivers to drive part of the operating vehicles, process monitoring personnel to monitor the working conditions of each operating vehicle, and workers to perform preliminary fixing of the rails that fall on sleepers,

other operations no longer require manual participation, so that the operation efficiency of the entire equipment is significantly improved, and the quality standard of the operation completed under the control of the automatic control system can be fully ensured.

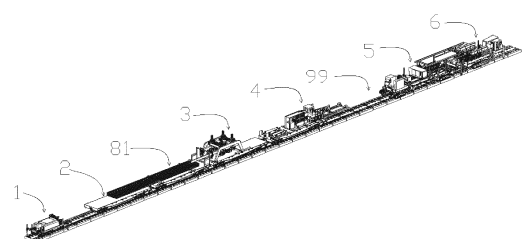


FIG. 1

EP 4 273 321 A1

Description

Technical field

[0001] The present invention relates to an intelligent track laying method and intelligent track laying equipment, which belong to the technical field of rail transit railway track laying.

Technical background

[0002] With the rapid development of rail transit, both manual track laying and semi-mechanized track laying can no longer meet the requirements of railway construction in terms of progress and quality. Intelligent and automated track laying have become the development trend of railway construction.

[0003] In the entire process of automated track laying, how to automatically place and recycle the rollers, how to quickly grasp and lock the rails, implement traction and push on the rails, and how to quickly place and fasten the rail fasteners are issues that the industry continues to study. So far, there still exist defects that the operation speed is slow, some operations still require manual participation and manual remediation, and so on.

[0004] The defects are mainly manifested as follows:

I. As for the roller placement and rail traction operating vehicle and the rail gripping manipulator of the rail sorting vehicle, their main problems are that the rail is not easy to lock after being gripped, the rail is easy to slip when it is pushed, it is necessary to manually drive a wedge block to lock the rail, and it takes time to withdraw the driven wedge block when the rail is released.

II. As for the roller gripping device of the roller recycling vehicle, its main problems are that the recycling mechanism is not set up properly, and the rollers recycled on the operating vehicle need to be manually pushed outside the track bed from under the rail to the middle of the track bed in advance, and the rollers should be placed according to the specified positions and postures, which will take a lot of time and labor costs.

III. As for the roller placement and rail traction operating vehicle and the roller gripping manipulator of the roller recycling vehicle, their main problems are that when improper operation causes the grabbing tool to forcefully collide with objects or be impacted by overload, some of executive components of the manipulator are easily damaged, and the downtime for maintenance requires a lot of time wasted.

IV. As for the roller placement and the roller gripping device of and rail traction operating vehicle, its main problem is that there is only one set of roller place-

ment device, which results in the slow speed of placing the rollers.

5. The fastener fastening operating vehicle is limited to the mechanical device to tighten the track spikes, and in the rail fixing process, the insertion of the insulating block and the placement of the spring bar still need to be completed manually, which also extends the working time and increases the labor costs.

[0005] Through a domestic search, it is found that Chinese Utility Patent Application No. 201811510758.4 for utility model entitled "ROLLER RECYCLING AND PLACING DEVICE FOR TRACK LAYING, RAIL TRACTOR AND RAIL LAYING OPERATION METHOD" is the closest to the present invention. However, the solution described in the patent has the following defects:

1. There is only one set of automatic roller placement device. Due to the long run distance from grabbing the rollers to placing the rollers, the number of rollers placed per unit time is small, resulting in slow operation speed and low efficiency throughout the track laying process.

2. When grasping and locking the rail, the solution involves a process of manually driving the wedge block to lock the rail, which not only delays the time to lock the rail, but also takes time to withdraw the wedge block when the rail is released.

3. The roller placement device runs on longitudinal rails, lateral rails, and vertical rails. Its rail running mode adopts a screw-nut relative rotation propulsion mode. It requires a high-speed rotation of either the screw or the nut to move quickly on the track, resulting in fast abrasion of the screw and nut and high energy consumption.

[0006] Through a domestic search, it is also found that Chinese Application No. 201420327443.7, entitled "RAIL GRABBING DEVICE", is similar to the present invention. Its main technical features are as follows: this patent relates to a rail grabbing device, comprising a grappling hook, a chain link, and an adjustment mechanism, wherein the grappling hook, chain link, and conciliation machine are hinged through pin shafts, and the grappling hook is used to tightly grab the rail. The grappling hook comprises hook claws, a positioning pin, a sliding lock iron, and a connecting plate, wherein the connecting plate is hinged to two hook claws through pin shafts, the sliding lock iron slides in a sliding groove on the connecting plate, and the hook claws are limited by the sliding lock iron. The adjustment mechanism comprises a hanging rod, a nut adjusting handle, a fixed seat, and an adjusting nut, wherein the hanging rod is slidably connected to the fixed seat, an end of the hanging rod is provided with threads that match the adjusting nut, and the adjusting nut is ro-

tated to drive the hanging rod to move up and down.

[0007] This patented solution is only used to grasp the rail and lift it upwards. The entire structure is a flexible structure, which cannot instantly transmit lateral force, longitudinal force, and downward vertical force to the rail, and cannot use the device to quickly grasp and lock the rail. It is difficult to instantly transmit longitudinal force to the rail to realize the longitudinal push of the rail, and the rail cannot be loosened quickly after the rail is grasped and locked.

[0008] Through a domestic search, other track laying patents are also found. Since these patents have different objectives and problems, no track laying equipment can meet requirements of an intelligent, automated, high-standard, and high-speed track laying system.

Summary of the invention

[0009] The technical problems to be solved by the present invention are mainly as follows: the lack of functions and structural defects of the existing track-laying operation executing mechanism require too many manual operations, resulting in low operation efficiency and difficult control of quality standards.

[0010] In view of the above problems, the technical solutions proposed by the present invention are as follows: An intelligent track laying method, comprising: arranging a complete set of track laying equipment composed of multiple operating vehicles that is controlled by an intelligent control system; using a rail sorting vehicle in the equipment to automatically grab front ends of two rails from a rail conveyor vehicle in the equipment on the left and right and directionally push the two rails to a rail pushing vehicle in the equipment; automatically pushing the two rails by the rail pushing vehicle toward a roller recycling vehicle in the equipment; automatically delivering the two rails toward a rail tractor in the equipment by the roller recycling vehicle; automatically grabbing the front ends of the two rails by the rail tractor and making the rail tractor move forward; at the same time, a roller gripping device provided on the rail tractor continuously placing rollers forward along with the vehicle at set positions on both sides of a track bed; making two rails behind be continuously placed on the rollers on both sides of the track bed and continuously dragged forward along with the vehicle on the rollers; then, by using a roller recycling vehicle arranged secondly behind, automatically recycling the rollers pressed under the rails to the roller recycling vehicle to make the rails fall on sleepers; manually performing interval-type preliminary fixing of the rails that fall on sleepers; and finally automatically completing a fastening operation of the rails by a fastener fastening vehicle, thereby realizing intelligent track laying.

[0011] Further, the delivering the two rails toward the rail tractor by the roller recycling vehicle is arranging guide rail devices on both sides of the roller recycling vehicle, making the two rails pass through the guide rail devices arranged on both sides, respectively, and push-

ing the two rails toward the rail tractor in the equipment by the rail pushing vehicle.

[0012] Further, the making the two rails be continuously placed on the rollers on both sides of the track bed and continuously dragged along with the vehicle on the roller is making the roller recycling vehicle remain stationary, and the rail tractor pulling the rails forward continuously, so that the length of the rail between the roller recycling vehicle and the rail tractor is continuously increased, the weight of the rail is used to deform a middle section of the elongated rail and then drop it on a roller wheel of the roller, and the roller wheel is used to rotate so that the rail can be dragged on the roller wheel as the rail tractor moves forward.

[0013] Further, the recycling the rollers pressed under the rails to the roller recycling vehicle is arranging a roller drag-out device and the roller gripping device controlled by an intelligent control system on the roller recycling vehicle; reusing the guide rail devices arranged on both sides of the roller recycling vehicle, and continuously lifting the rails from back to front by the forward movement of the roller recycling vehicle; at the same time, dragging out the roller by the roller drag-out device from under the lifted rail and transferring the roller to the roller recycling vehicle by the roller gripping device, and making the rails behind continuously fall forward on the sleepers.

[0014] Further, the reusing the guide rail devices arranged on both sides of the roller recycling vehicle, and continuously lifting the rails from back to front by the forward movement of the roller recycling vehicle are that the roller recycling vehicle is at a distance from a front end of a rail L that has been laid behind; the rail tractor drags the rails until rear ends of the rails are aligned with the front end of the rail L that has been laid behind and stops moving forward; a rear end of a section of the rail behind the roller recycling vehicle sags and is connected and fixed to the front end of the rail L that has been laid, and then the roller recycling vehicle keeps driving forward according to a speed of recycling the rollers.

[0015] Further, the dragging out the roller from under the lifted rail and transferring the roller to the roller recycling vehicle by the roller drag-out device and the roller gripping device are laterally dragging out the roller from under the rails lifted on both sides toward the middle of the track bed and regularly placing them on both sides of the middle of the track bed by the roller drag-out device when the roller recycling vehicle is continuously moving forward, and transferring the roller from the track bed to a roller basket in a roller recycling area provided on the roller recycling vehicle by the roller gripping device.

[0016] Further, the dragging out the roller from under the rails lifted on both sides toward the middle of the track bed by the roller drag-out device when the roller recycling vehicle is continuously moving forward is integrally arranging the roller drag-out device as a retrograde roller drag-out device capable of retrograding on the rail vehicle, and arranging on the retrograde roller drag-out device a temporary fixator capable of being temporarily

fixed to the rails sliding on the guide rail device, so that during operation, the retrograde roller drag-out device and the rails are temporarily fixed by the temporary fixator, and the retrograde roller drag-out device retrogrades on the roller recycling vehicle moving forward while remaining stationary relative to the track bed for a period of time, which is used to drag out the roller from under the lifted rail.

[0017] In the above method, the roller gripping device on the roller recycling vehicle is divided into a raising roller gripping device and a basket-loading roller gripping device, and at the same time, a roller transport device is provided between a raising opening in a underframe of the roller recycling vehicle and the roller recycling area; the roller placed on the track bed is transferred from the track bed to the transport device by the raising roller gripping device via the raising opening in the underframe of the roller recycling vehicle; the roller is transferred to the roller recycling area by the transport device; and then the roller on the transport device is transferred to a roller basket in the roller recycling area by the basket-loading roller gripping device.

[0018] In the above method, a rail two-way locking manipulator controlled by an intelligent control system and capable of automatic two-way locking for grabbing the rail is arranged on the rail sorting vehicle and the rail tractor; a gripping component and a tilt mechanism capable of tilting the rail two-way locking manipulator are arranged on the rail two-way locking manipulator; and during operation, the gripping component clamps between a rail head and a rail bottom on both sides of the rail, and then the rail two-way locking manipulator is rotated by the tilt mechanism, so that the rail two-way locking manipulator tilts forward or backward, thereby forcing the gripping component upwards to press against bottom surfaces on both sides of the rail head, and downwards to press against top surfaces of the rail bottoms on both sides, and enabling the rail two-way locking manipulator to tilt forward or backward to realize two-way locking of the rail.

[0019] Further, the manually performing interval-type preliminary fixing of the rails that fall on sleepers is to take one pre-installed sleeper for every interval of N pre-installed sleepers on average, insert insulating blocks between the rail bottom of the rails on two sides and a limiting boss of an Iron base plate on the taken pre-installed sleeper, place a spring bar in place, and then tighten spikes to complete preliminary fixation of the laid rails.

[0020] Further, the automatically completing the fastening operation of the rails by a fastener fastening vehicle is arranging an insulating block clamping mechanism, a spike screwing mechanism and a spring bar placement mechanism on the fastener fastening vehicle, wherein during operation, the insulating block is clamped by the insulating block clamping mechanism to insert the insulating block between the rail bottom of the rail on two sides and the limiting boss of the Iron base plate and make a pressing block of the insulating block press the

rail bottom of the rail; then, the track spikes are loosened by the spike screwing mechanism to loosen the spring bar that is pre-pressed on the limiting boss previously by a front-end lower jaw; both sides of the spring bar are clamped by the spring bar placement mechanism to make the spring bar move forward so that the front-end lower jaw of the spring bar presses the insulating block; and finally the track spikes are tightened with the spike screwing mechanism to make the spring bar tightly press the insulating block, and press the rail through the insulating block.

[0021] Intelligent track laying equipment, comprising a rail conveyor vehicle, and a rail sorting vehicle with a rail sorting device, a rail pushing vehicle with a rail pushing device, and a rail tractor with a rail traction device that are sequentially located before the rail conveyor vehicle, wherein a roller gripping device is provided on the rail tractor, and a special roller recycling vehicle is provided behind the rail tractor, and has a roller gripping device and a roller drag-out device; and a fastener fastening vehicle is provided behind the rail conveyor vehicle, and the fastener fastening vehicle has a fastening device for installing fasteners to fix a rail.

[0022] Further, the rail sorting device and the rail traction device each have a rail two-way locking manipulator, and the rail two-way locking manipulator comprises a mounting body fixed on the sorting device or the rail traction device, a rotating frame installed on the mounting body through a rotating shaft, a tilt propeller with one end acting on the rotating frame to push the rotating frame to rotate, and a clamping assembly installed on the rotating frame; a grasping component capable of holding the rail below the clamping assembly; the clamping assembly comprises a clamping frame installed in the rotating frame, and the clamping frame has a first splint and a second splint; the first splint and the second splint have a first hanging pin hole and a second hanging pin hole thereon, respectively, the first hanging pin hole and the second hanging pin hole have a first hanging pin and a second hanging pin therein, respectively, and when the rail is grasped, lower ends of the first splint and the second splint can be inserted under a first bottom surface and a second bottom surface on both sides of a rail head, respectively; bottom ends of the first splint and the second splint of the clamping frame are divided into a first front foot and a first rear foot, and a second front foot and a second rear foot, respectively; when the first pin and the second pin hang on the first bottom surface and the second bottom surface of the rail head, respectively, there is a gap between each of the first front foot and the first rear foot and a first top surface of the rail bottom, and there is a gap between each of the second front foot and the second rear foot and a second top surface of the rail bottom;

[0023] when a lower end of the clamping frame tilts forward with the rotating frame, the first hanging pin and the first rear foot support the first bottom surface and the first top surface, respectively, the second hanging pin

and the second rear foot support the second bottom surface and the second top surface, respectively, and the clamping assembly locks the rail;

when the lower end of the clamping frame tilts backward with the rotating frame, the first hanging pin and the first front foot support the first bottom surface and the first top surface, respectively, the second hanging pin and the second front foot support the second bottom surface and the second top surface, respectively, and the clamping assembly also locks the rail; and

when the clamping frame returns to a vertical position with the rotating frame, locking of the rail by the clamping assembly is released.

[0024] Further, the roller recycling vehicle further has a guide rail device that cooperates with the roller drag-out device and the roller gripping device, and the guide rail device has two horizontally symmetrical lifting pulleys that can lift the rail on bottom surfaces of both sides of the rail head and can slide along the rail in a rolling manner; the roller drag-out device is a retrograde roller drag-out device that can laterally drag out the roller under the lifted rail, and has a general assembly frame that is fixed below the middle of a underframe of the roller recycling vehicle in a suspension manner, a retrograde frame provided on the general assembly frame, a retrograde stabilizer arranged between the retrograde frame and the general assembly frame, a lateral drive mechanism arranged on the retrograde frame, a longitudinal fine-adjusting mechanism provided on the lateral drive mechanism, a lifting mechanism provided on the longitudinal fine-adjusting mechanism, and a lateral hook component provided at a lower end of the lifting mechanism; the retrograde stabilizer comprises a two-way rail provided on the general assembly frame for the retrograde frame to run in both forward and backward directions along a train running direction, a one-way propulsion mechanism installed on the general assembly frame to push the retrograde frame to run forward, and a temporary fixator provided on the retrograde frame to control the retrograde frame to retrograde backward and remain stationary relative to the track bed; and the one-way propulsion mechanism comprises a propulsion tube and an electric cylinder propulsion rod fixed longitudinally in the middle of the retrograde frame, the propulsion tube is fixed to the retrograde frame with a lower surface of a rear section, the cylinder propulsion rod is located in the propulsion tube and can extend out from a rear end of the propulsion tube, and a propulsion head at a rear end of the electric cylinder propulsion rod can withstand a rear frame body of the general assembly frame and apply backward thrust to the general assembly frame.

[0025] Further, the fastening device of the fastener fastening vehicle comprises an insulating block distributing mechanism, an insulating block picking mechanism, a

spike screwing mechanism, and a spring bar placement mechanism, and the insulating block distributing mechanism is arranged on a frame body at the front of the fastener fastening vehicle, and has a vibration disk. The vibration disk has a first vibration channel and a second vibration channel that output the insulating block outward, and also has a distributing plate for distributing the insulating block above the rails on both sides; the insulating block picking mechanism is arranged on a frame body of a rear part of the insulating block distributing mechanism, and has a lateral movement guide rail module running on a longitudinal track, a vertical guide rail module running on the lateral movement guide rail module, and an insulating block clamp installed on the vertical guide rail module with clamp opening downward; the spring bar placement mechanism has a spring bar gripper; the spike screwing mechanism has a spike screwing sleeve; and the fastening device further comprises a longitudinal movement frame running on a longitudinal rail, and a lifting frame provided on the longitudinal movement frame, the lifting frame is provided with a lateral movement sliding plate, and the spring bar gripper and the spike screwing sleeve are both installed under the lateral movement sliding plate.

[0026] The advantages of the present invention are as follows: in the entire operation process of the entire track laying equipment, except for the need for drivers to drive part of the operating vehicles, process monitoring personnel to monitor the working conditions of each operating vehicle, and workers to perform preliminary fixation of the rails that fall on sleepers, other operations no longer require manual participation, so that the operation efficiency of the entire equipment is significantly improved, and the quality standard of the operation completed under the control of the automatic control system can be fully ensured.

Brief description of the drawings

[0027]

FIG. 1 is a perspective schematic view of positional relationships of all operating vehicles in intelligent track laying equipment according to the present invention;

FIG. 2 is a perspective schematic view of the rail tractor;

FIG. 3 is a perspective schematic view of the roller recycling vehicle;

FIG. 4 is a perspective schematic structural view of the roller gripping device;

FIG. 5 is a perspective schematic structural view of the roller manipulator;

FIG. 6 is a perspective schematic structural view of the rail two-way locking manipulator;

FIG. 7 is a partial schematic structural view of the rail two-way locking manipulator;

FIG. 8 is a schematic plan view of the rail two-way locking manipulator supporting the bottom surface of the rail head and the top surface of the rail bottom to lock the rail when the lower end of the clamping frame of the rail two-way locking manipulator is tilted forward;

FIG. 9 is a schematic plan view of the rail two-way locking manipulator supporting the bottom surface of the rail head and the top surface of the rail bottom to lock the rail when the lower end of the clamping frame of the rail two-way locking manipulator is tilted forward;

FIG. 10 is a schematic side view of the roller recycling vehicle;

FIG. 11 is a perspective schematic view of a part of a retrograde roller drag-out device;

FIG. 12 is a perspective schematic view of a part of the retrograde roller drag-out device, in which a structural relationship between an electric cylinder propulsion rod and a rail-type reinforcing rod is mainly shown;

FIG. 13 is a perspective schematic view of the rail pushing vehicle;

FIG. 14 is a perspective schematic view of positional relationships between the rail sorting vehicle, the rail conveyor vehicle, and the rail pushing vehicle;

FIG. 15 is a perspective schematic view of the rail sorting device of the rail sorting vehicle;

FIG. 16 is a perspective schematic structural view of the fastener fastening vehicle with some arrangements hidden in the figure;

FIG. 17 is a schematic view of an assembling relationship between the spring bar gripper and the spike screwing sleeve in a longitudinal movement frame;

FIG. 18 is a partial schematic view of a fastener fastening vehicle;

FIG. 19 is a top schematic view of a vibration disk and related components;

FIG. 20 is a perspective schematic view of an Iron base plate;

FIG. 21 is a perspective schematic view of an insulating block;

FIG. 22 shows that the unfastened rail is placed between two limiting bosses of the Iron base plate of the pre-installed sleeper, and the lower jaw of the front end of the spring bar is temporarily pressed on the limiting bosses;

FIG. 23 shows that the insulating block is placed in place after fastened, and the lower jaw of the front end of the spring bar has been pressed on the top surface of the rail bottom of the rail;

FIG. 24 is a schematic cross-sectional view; and

FIG. 25 is a perspective schematic view of a roller.

[0028] In the figures: 1 fastener fastening vehicle; 2 rail conveyor vehicle; 3 rail sorting vehicle; 4 rail pushing vehicle; 5 roller recycling vehicle; 6 rail tractor; 7 roller; 8 roller wheel; 9 guide rail device; 11 roller recycling area; 12 roller basket; 13 longitudinal rail; 14 lateral rail; 15 vertical rail; 16 longitudinal drive seat; 17 double drive seat; 18 roller manipulator; 19 clamping arm; 20 clamping palm; 21 self-damaging block; 22 broken groove; 23 rail two-way locking manipulator; 231 left traction rail two-way locking manipulator; 232 right traction rail two-way locking manipulator; 233 left sorting rail two-way locking manipulator; 234 right sorting rail two-way locking manipulator; 24 roller gripping device; 241 left turning roller gripping device; 242 right turning roller gripping device; 243 left dropping roller gripping device; 244 right dropping roller gripping device; 245 left raising roller gripping device; 246 right raising roller gripping device; 247 left basket-loading roller gripping device; 248 right basket-loading roller gripping device; 25 mounting body; 251 tilt propeller; 26 rotating frame; 27 clamping frame; 28 first splint; 29 second splint; 30 first hanging pin; 31 second hanging pin; 32 first front foot; 33 first rear foot; 34 second front foot; 35 second rear foot; 36 roller storage area; 37 left dropping opening; 38 right dropping opening; 39 left transfer station; 40 right transfer station; 41 left raising opening; 42 right raising opening; 43 roller recycling area; 44 left conveyor belt; 45 right conveyor belt; 46 hoisting device; 47 retrograde roller drag-out device; 48 general assembly frame; 49 retrograde frame; 50 lateral hook component; 51 two-way rail; 52 temporary fixator; 53 propulsion tube; 54 electric cylinder propulsion rod; 541 rail-type reinforcing rod; 542 slider; 543 connecting plate; 544 support plate; 55 propulsion head; 56 guide device; 57 pushing device; 58 left telescopic arm; 59 right telescopic arm; 60 guide frame; 61 propulsion frame; 62 frame body; 63 vibration disk 64 first vibration channel; 65 second vibration channel; 66 distributing plate; 67 first distributing groove; 68 second distributing groove; 69 longitudinal rail; 70 lateral movement guide rail module; 71 vertical guide rail module; 72 insulating block clamp; 73

spring bar gripper; 74 spike screwing sleeve; 75 longitudinal movement frame; 76 lifting frame; 77 lateral movement sliding plate; 78 abnormal insulating block baffle 81 rail; 82 rail head; 83 first bottom surface; 84 second bottom surface; 85 rail bottom; 86 first top surface; 87 second top surface; 89 pre-installed sleeper; 90 Iron base plate; 91 limiting boss; 92 under-rail backing plate; 93 insulating block; 94 inserting block; 95 pressing block; 96 spring bar; 97 front-end lower jaw; 98 track spike; and 99 track bed.

Detailed description of the embodiments

[0029] The present invention will be further described below in conjunction with the drawings:

As shown in FIGS. 20-23, the present invention is applied to track laying of a high-speed railway ballastless track. The work done before comprises the following: sleepers have been installed on both sides of a ballastless track bed according to set positions; auxiliary mounting members of the sleepers, comprising height adjustment tie plates, Iron base plates 90, track gauge baffles, under-rail fine-adjusting tie plates and under-rail backing plates, have been installed, and spring bars 96 and track spikes 98 have been fixedly pre-installed informally.

[0030] Since the accessories to which the sleepers belong have been pre-installed, the sleepers will be referred to as pre-installed sleepers 89 hereinafter.

[0031] The operating objects associated with the present invention comprises rails 81, pre-installed sleepers 89, Iron base plates 90, spring bars 96 and track spikes 98.

[0032] Rails 81: a rail head 82 located at an upper part of the rail, a rail bottom 85 located at a bottom part of the rail, and lower bottom surfaces on both sides of the rail head 82, which are a first bottom surface 83 and a second bottom surface 84, respectively.

[0033] Pre-installed sleepers 89: they have been installed on both sides of the track bed before the track is laid, and all accessories are pre-installed in place, and will be finally fixed.

[0034] Iron base plates 90: there are upward limiting bosses 91 at both ends of the Iron base plate, they have been installed on the pre-installed sleepers 89 before the track is laid, and an under-rail backing plate 92 is placed between the limiting bosses 91 at both ends.

[0035] Insulating blocks 93: an L-shape is formed by an inserting block 94 and a pressing block 95, and the inserting block 94 and the pressing block 95 are integrally molded.

[0036] Spring bars 96: the spring bar has a front-end lower jaw 97. Before the track is laid, the front-end lower jaw 97 has been temporarily pressed on the limiting boss 91 of the Iron base plate 90.

[0037] Track spikes 98: the track spike has a handle, and the track spike passes through the spring bar 96 during application, and its handle is pressed on the spring bar 96.

[0038] The present invention relies on various operating vehicles to realize the intelligent track laying process, which mainly comprises: laying rails 81 on the pre-installed sleepers 89 on both sides of the track bed, so that the bottom surface of the rail bottom 85 of the rail 81 is pressed against the under-rail backing plate 92 between limiting bosses 91 at both ends of the Iron base plate 90; and fixing the rails 81 with spring bars 96, track spikes 98 and so on.

[0039] The method of the present invention will be described in detail below:

As shown in FIGS. 1, 10, 20, 21, 22, 23 and 24, an intelligent track laying method comprises: arranging a complete set of track laying equipment composed of multiple operating vehicles that is controlled by an intelligent control system; using a rail sorting vehicle 3 in the equipment to automatically grab front ends of two rails 81 from a rail conveyor vehicle 2 in the equipment on the left and right and directionally push the two rails 81 to a rail pushing vehicle in the equipment; automatically pushing the two rails 81 by the rail pushing vehicle toward a roller recycling vehicle 5 in the equipment; automatically delivering the two rails 81 toward a rail tractor 6 in the equipment by the roller recycling vehicle 5; automatically grabbing the front ends of the two rails 81 by the rail tractor 6 and making the rail tractor 6 move forward; at the same time, a roller gripping device 24 provided on the rail tractor 6 continuously placing rollers 7 forward along with the vehicle at set positions on both sides of a track bed; making two rails 81 behind be continuously placed on the rollers 7 on both sides of the track bed and continuously dragged forward along with the vehicle on the rollers; then, by using a roller recycling vehicle behind, automatically recycling the rollers 7 pressed under the rails 81 to the roller recycling vehicle 5 to put the rails between the two limiting bosses 91 of the Iron base plate 90 of the pre-installed sleeper 89; manually performing interval-type preliminary fixing of the rails 81 that fall on sleepers; and finally automatically completing a fastening operation of the rails 81 by a fastener fastening vehicle 1, thereby realizing intelligent track laying.

[0040] The interval-type preliminary fixing is a way of taking one pre-installed sleeper for every interval of N (in general, 2-6) pre-installed sleepers, wherein the operation of placing insulating blocks and fastening fasteners is completed by manually placing the rails with this pre-installed sleeper, and the preliminary fixing of the rails 81 on both sides is realized.

[0041] The length of the rail 81 described in the above method is generally 500 meters at present, and all the operating vehicles in front of the rail conveyor vehicle 2 take the placement of one rail on each side of the track bed as a work process. The fastener fastening vehicle 1 behind the rail conveyor vehicle 2 can be regarded as always following the rail conveyor vehicle 2 to perform the fastening operation forward until the rails on the rail conveyor vehicle 2 are laid.

[0042] In this way, in the entire operation process of

the entire track laying equipment, except for the need for drivers to drive part of the operating vehicles, process monitoring personnel to monitor the working conditions of each operating vehicle, and workers to perform preliminary fixing of the rails that fall on sleepers, other operations no longer require manual participation, so that the operation efficiency of the entire equipment is significantly improved, and the quality standard of the operation completed under the control of the automatic control system can be fully ensured.

[0043] As shown in FIGS. 1, 2, 3, 4, 10, 11, 20, 21, 22, 24 and 25, the delivering the two rails 81 toward the rail tractor 6 by the roller recycling vehicle 5 is arranging guide rail devices 9 on both sides of the roller recycling vehicle 5, making the two rails 81 pass through the guide rail devices 9 arranged on both sides, respectively, and pushing the two rails 81 toward the rail tractor 6 in the equipment by the rail pushing vehicle.

[0044] The making the two rails 81 be continuously placed on the rollers on both sides of the track bed and continuously dragged forward along with the vehicle on the roller is making the roller recycling vehicle 5 remain stationary, and the rail tractor 6 pulling the rails to move forward continuously, so that the length of the rail 81 between the roller recycling vehicle 5 and the rail tractor 6 is continuously increased, the weight of the rail 81 is used to deform a middle section of the elongated rail and then drop it on a roller wheel 8 of the roller, and the roller wheel 8 is used to rotate so that the rail can be dragged on the roller wheel 8 as the rail tractor 6 moves forward.

[0045] The recycling the rollers 7 pressed under the rails 81 to the roller recycling vehicle 5 is arranging a roller drag-out device and the roller gripping device 24 controlled by an intelligent control system on the roller recycling vehicle 5; reusing the guide rail devices 9 arranged on both sides of the roller recycling vehicle 5, and continuously lifting the rails 81 from back to front by the forward movement of the roller recycling vehicle 5; at the same time, dragging out the roller 7 from the lifted rail 81 by the roller drag-out device and transferring the roller to the roller recycling vehicle 5 by the roller gripping device 24, and making the rails 81 behind continuously fall forward on the sleepers.

[0046] The reusing the guide rail devices 9 arranged on both sides of the roller recycling vehicle 5, and continuously lifting the rails 81 from back to front by the forward movement of the roller recycling vehicle 5 are that the roller recycling vehicle 5 is at a distance from a front end of a rail L that has been laid behind; the rail tractor 6 drags the rails 81 until rear ends of the rails 81 are aligned with the front end of the rail L that has been laid behind and stops moving forward; a rear end of a section of the rail 81 behind the roller recycling vehicle 5 sags and is connected and fixed to the front end of the rail L that has been laid, and then the roller recycling vehicle 5 keeps driving forward according to a speed of recycling the rollers.

[0047] The dragging out the roller 7 from the lifted rail

81 and transferring the roller to the roller recycling vehicle 5 by the roller drag-out device and the roller gripping device 24 are laterally dragging out the roller 7 from under the rails 81 lifted on both sides toward the middle of the track bed 99 and regularly placing them on both sides of the middle of the track bed 99 by the roller drag-out device when the roller recycling vehicle 5 is continuously moving forward, and transferring the roller 7 from the track bed 99 to a roller basket 12 in a roller recycling area 11 provided on the roller recycling vehicle by the roller gripping device 24.

[0048] The dragging out the roller 7 from under the rails 81 lifted on both sides toward the middle of the track bed 99 by the roller drag-out device when the roller recycling vehicle 5 is continuously moving forward is integrally arranging the roller drag-out device as a retrograde roller drag-out device 47 capable of retrograding on the rail vehicle, and arranging on the retrograde roller drag-out device 47 a temporary fixator 52 capable of being temporarily fixed to the rails 81 sliding on the guide rail device 9, so that during operation, the retrograde roller drag-out device 47 and the rails 81 are temporarily fixed by the temporary fixator 52, and the retrograde roller drag-out device 47 retrogrades on the roller recycling vehicle 5 moving forward while remaining stationary relative to the track bed for a period of time, which is used to drag out the roller from under the lifted rail 81.

[0049] In the above method, the roller gripping device on the roller recycling vehicle 5 is divided into a raising roller gripping device and a basket-loading roller gripping device, and at the same time, a roller transport device is provided between a raising opening in a underframe of the roller recycling vehicle 5 and the roller recycling area 11; the roller 7 placed on the track bed 99 is transferred from the track bed to the transport device by the raising roller gripping device via the raising opening in the underframe of the roller recycling vehicle 5; the roller 7 is transferred to the roller recycling area 11 by the transport device; and then the roller 7 on the transport device is transferred and placed into a roller basket 12 in the roller recycling area 11 by the basket-loading roller gripping device.

[0050] As shown in FIGS. 1, 6, 7, 8, 9, 20, 21, 22 and 23, in the above method, a rail two-way locking manipulator 23 controlled by an intelligent control system and capable of automatic two-way locking for grabbing the rail 81 is arranged on the rail sorting vehicle 3 and the rail tractor 6; a gripping component and a tilt mechanism capable of tilting the rail two-way locking manipulator are arranged on the rail two-way locking manipulator 23; and during operation, the gripping component clamps between a rail head 82 and a rail bottom 85 on both sides of the rail 81, and then the rail two-way locking manipulator 23 is rotated by the tilt mechanism, so that the rail two-way locking manipulator 23 tilts forward or backward, thereby forcing the gripping component upwards to press against bottom surfaces on both sides of the rail head 82, and downwards to press against top surfaces of the

rail bottoms 85 on both sides, and enabling the rail two-way locking manipulator 23 to tilt forward or backward to realize two-way locking of the rail 81.

[0051] The manually performing interval-type preliminary fixing of the rails 81 that fall on sleepers is taking one pre-installed sleeper for every interval of N pre-installed sleepers 89 on average, inserting an insulating block 93 between the rail bottom 85 of the rail 81 on two sides and a limiting boss 91 of an Iron base plate 90 on the taken pre-installed sleeper 89, placing a spring bar 96 in place, and then tightening track spikes 98 to complete preliminary fixing of the laid rails.

[0052] The automatically completing the fastening operation of the rails 81 by a fastener fastening vehicle 1 is arranging an insulating block clamping mechanism, a spike screwing mechanism and a spring bar placement mechanism on the fastener fastening vehicle 1, wherein during operation, the insulating block 93 is clamped by the insulating block clamping mechanism to insert the insulating block 93 between the rail bottom 85 of the rail 81 on two sides and the limiting boss 91 of the Iron base plate 90 and make a pressing block 95 of the insulating block 93 press the rail bottom 85 of the rail; then, the track spikes 98 are loosened by the spike screwing mechanism to loosen the spring bar 96 that is pre-pressed on the limiting boss 91 previously by a front-end lower jaw 97; both sides of the spring bar 96 are clamped by the spring bar placement mechanism to make the spring bar 96 move forward so that the front-end lower jaw 97 of the spring bar 96 presses the insulating block 93; and finally the track spikes 98 are tightened with the spike screwing mechanism to make the spring bar 96 tightly press the insulating block 93, and press the rail through the insulating block 93.

[0053] The equipment of the present invention will be described in detail below:

In order to simplify the description and facilitate the understanding, the structures and functions of devices or components with common features that appear more frequently below will first be described:

Roller gripping device 24: as shown in FIGS. 4 and 5, it has a longitudinal rail 13, a lateral rail 14 running on the longitudinal rail 13, and a vertical rail 15 running on the lateral rail 14; its running mode adopts a running mode of gears and racks in cooperation, and the racks comprise a longitudinal rack, a lateral rack and a vertical rack, which are arranged on the longitudinal rail 13, the lateral rail 14 and the vertical rail 15, respectively.

[0054] The roller gripping device 24 further has a longitudinal drive seat 16 fixed on one side of the lateral rail 14. The longitudinal drive seat 16 is provided with a longitudinal drive gear driven by a motor. The gear teeth of the longitudinal drive gear mesh with the teeth of the longitudinal rack, and the rotation of the longitudinal drive gear can drive the lateral rail 14 to move longitudinally.

[0055] The roller gripping device 24 further has a longitudinal double drive seat 17 running on the lateral rail 14, and the vertical rail 15 runs on the longitudinal double

drive seat 17.

[0056] The longitudinal double drive seat 17 is provided with a lateral drive gear driven by a motor, the gear teeth of the lateral drive gear mesh with the teeth of the lateral rack, and the rotation of the lateral drive gear drives the longitudinal double drive seat 17 and the vertical rail 15 to move laterally.

[0057] The longitudinal double drive seat 17 is provided with a vertical drive gear driven by a motor, the teeth of the vertical drive gear mesh with the teeth of the vertical rack, and the rotation of the vertical drive gear drives the vertical rail 15 to move vertically.

[0058] The roller gripping device 24 has a roller manipulator 18 installed at a lower end of the vertical rail 15.

[0059] Roller manipulator 18: as shown in FIG. 5, it has two clamping arms 19 symmetrically arranged on the left and right and respective clamping palms 20 under the two clamping arms 19. Above the two clamping arms 19 is an actuator with a pushing cylinder to open and close the two clamping arms 19, and the two clamping palms 20 are used to clamp or release the roller 7 with the opening and closing of the two clamping arms 19. In the present invention, the roller manipulator 18 is designed to prevent damage to important parts in the event of a collision or overload, that is: an upper gripping arm 19 is disconnected from a lower gripping palm 20, a self-damaging block 21 is provided between the gripping arm 19 and the gripping palm 20, and the clamping arm 19 and the clamping palm 20 are fixedly connected by the self-damaging block 21; and the self-damaging block 21 is provided with a broken groove 22 that is easy to break off.

[0060] The roller manipulator 18 is arranged in the roller gripping device 24 of the rail tractor 6 and the roller gripping device 24 of the roller recycling vehicle 5, and is used to grasp the roller wheel 8 of the roller.

[0061] Rail two-way locking manipulator: as shown in FIGS. 6, 7, 8 and 9, the rail two-way locking manipulator 23 comprises a mounting body 25 fixed on the sorting device or rail traction device, a rotating frame 26 installed on the mounting body 25 through a rotating shaft, a tilt propeller 251 with one end acting on the rotating frame 26 to push the rotating frame 26 to rotate, and a clamping assembly installed on the rotating frame 26. The clamping assembly comprises a clamping frame 27 installed in the rotating frame 26, and the clamping frame 27 has a first splint 28 and a second splint 29. The first splint 28 and the second splint 29 are provided with a first hanging pin hole and a second hanging pin hole, respectively. The first hanging pin hole and the second hanging pin hole have a first hanging pin 30 and a second hanging pin 31, respectively. When the rail 81 is grasped, lower ends of the first splint 28 and the second splint 29 can be inserted under the first bottom surface 83 and the second bottom surface 84 on both sides of the rail head 82, respectively. Bottom ends of first splint 28 and second splint 29 of the clamping frame 27 are divided into a first front foot 32 and a first rear foot 33, and second front foot 34 and a second rear foot 35, respectively. When the first

pin 30 and the second pin 31 hang on the first bottom surface 83 and the second bottom surface 84 of the rail head, respectively, there is a gap between each of the first front foot 32 and the first rear foot 33 and a first top surface 86 of the rail bottom 85, and there is a gap between each of the second front foot 34 and the second rear foot 35 and a second top surface 87 of the rail bottom 85.

[0062] When a lower end of the clamping frame 27 tilts forward with the rotating frame 26, the first hanging pin 30 and the first rear foot 33 support the first bottom surface 83 and the first top surface 86, respectively, the second hanging pin 31 and the second rear foot 35 support the second bottom surface 84 and the second top surface 87, respectively, and the clamping assembly locks the rail 81.

[0063] When the lower end of the clamping frame 27 tilts backward with the rotating frame 26, the first hanging pin 30 and the first front foot 32 support the first bottom surface 83 and the first top surface 86, respectively, the second hanging pin 31 and the second front foot 34 support the second bottom surface 84 and the second top surface 87, respectively, and the clamping assembly also locks the rail 81.

[0064] When the clamping frame 27 returns to a vertical position with the rotating frame 26, locking of the rail 81 by the clamping assembly is released.

[0065] Another important feature of the rail two-way locking manipulator 23 is that after the rotating frame 26 is tilted to lock the rail, as long as the rail 81 is not absolutely horizontal, that is, the rail 81 forms an angle with a horizontal plane, when the rail two-way locking manipulator 23 exerts a horizontal force on the rail in a horizontal direction, a component force perpendicular to the rail will be generated, so that the rail two-way locking manipulator 23 will lock the rail tighter, which is very helpful for horizontal pushing and pulling of the rail 81.

[0066] Propulsion cylinder: the present invention uses Propulsion cylinders in many mechanisms, especially in the rail two-way locking manipulator. These Propulsion cylinders may be oil cylinders, pneumatic cylinders, or electric cylinders.

[0067] As shown in FIGS. 1, 22, 23 and 24, intelligent track laying equipment comprises a rail conveyor vehicle 2, and a rail sorting vehicle 3 with a rail sorting device, a rail pushing vehicle with a rail pushing device, and a rail tractor 6 with a rail traction device 6 that are sequentially located before the rail conveyor vehicle 2, wherein a roller gripping device 24 is still provided on the rail tractor 6, and a special roller recycling vehicle 5 is provided between the rail pushing vehicle and the rail tractor 6, which has a roller gripping device 24 and a roller drag-out device; and a fastener fastening vehicle 1 is provided behind the rail conveyor vehicle 2, and the fastener fastening vehicle 1 has a fastening device for installing fasteners to fix a rail 81.

[0068] The structure of each operating vehicle is explained below:

I. Rail tractor 6. As shown in FIGS. 1, 2, 4, 6, 22 and 23, the rail tractor 6 runs on the track bed 99 through crawler wheels and rubber wheels during operation.

[0069] A traction device of the rail tractor 6 is provided at a rear end of the rail tractor 6, and has a left traction rail two-way locking manipulator 231 and a right traction rail two-way locking manipulator 232 arranged on the left and right, which are used to grasp the front ends of the left and right rails 81 transmitted by the roller recycling vehicle 5 behind and make the left and right rails 81 follow the forward movement of the rail tractor 6 to drag forward, respectively. The distance between two rail two-way locking manipulators 23 is consistent with the rail gauge of two rails of the railway.

[0070] The rail tractor 6 comprises a roller storage area 36 provided in the middle of the underframe, a left dropping opening 37 and a right dropping opening 38 provided in front of the roller storage area 36, and a left transfer station 39 and a right transfer station 40 that are provided in the areas of the left dropping opening 37 and the right dropping opening 38, respectively.

[0071] The roller gripping device 24 of the rail tractor 6 is divided into two groups. Among them, one group comprises a left turning roller gripping device 241 and a right turning roller gripping device 242 located in the roller storage area 36, which are used to transfer the rollers 7 in the roller storage area 36 to the left transfer station 39 and the right transfer station 40, respectively. The other group comprises a left drop roller gripping device 243 and a right dropping roller gripping device 244 respectively located in the areas of the left dropping opening 37 and right dropping opening 38, which are used to place the rollers 7 of the left transfer station 39 and the right transfer station 40 to both sides of the track bed through the left dropping opening 37 and the right dropping opening 38, respectively.

[0072] II. Roller recycling vehicle 5. As shown in FIGS. 1, 3, 4, 5, 10, 11, 12, 22 and 23, the roller recycling vehicle 5 is walked on the track bed 99 through crawler wheels and rubber wheels during operation.

[0073] Guide rail devices 9 that cooperate with the roller drag-out device and the roller gripping device 24 are provided below both sides of the underframe of the roller recycling vehicle 5. A left raising opening 41 and a right raising opening 42 are provided in the middle and rear of the underframe of the roller recycling vehicle 5. A roller recycling area 11 is provided on the underframe in front of the left raising opening 41 and the right raising opening 42. The roller recycling area 11 is provided with a roller basket 12. A left conveyor belt 44 and a right conveyor belt 45 are provided between the left raising opening 41 and the right raising opening 42 and the roller recycling area 11, respectively. A hoisting device 46 for transferring the roller basket 12 to the rail tractor 6 forward is provided above the roller recycling area 11. The roller drag-out device is a retrograde roller drag-out device 47 provided under the underframe of the roller recycling vehicle 5,

and the roller gripping device 24 is divided into a left raising roller gripping device 245 and a right raising roller gripping device 246 arranged in the areas of the left raising opening 41 and the right raising opening 42, and a left basket-loading roller gripping device 247 and the right basket-loading roller gripping device 248 arranged in the roller recycling area 11.

[0074] The guide rail device 9 has two horizontally symmetrical lifting pulleys that can lift the rail on bottom surfaces of both sides of the rail head 82 and can slide along the rail in a rolling manner. The retrograde roller drag-out device 47 is arranged below the underframe of the recycling vehicle, and has a general assembly frame 48 that is fixed below the middle of the underframe of the roller recycling vehicle in a suspension manner, a retrograde frame 49 provided on the general assembly frame 48, a retrograde stabilizer arranged between the retrograde frame 49 and the general assembly frame 48, a lateral drive mechanism arranged on the retrograde frame 49, a longitudinal fine-adjusting mechanism provided on the lateral drive mechanism, a lifting mechanism provided on the longitudinal fine-adjusting mechanism, and a lateral hook component 50 provided at a lower end of the lifting mechanism. The lateral hook component 50 can move forward and backward, and left and right, and vertically. The retrograde stabilizer comprises a two-way rail 51 provided on the general assembly frame 48 for the retrograde frame 49 to run in both forward and backward directions along a train running direction, a one-way propulsion mechanism installed on the general assembly frame 48 to push the retrograde frame 49 to run forward, and a temporary fixator 52 provided on the retrograde frame 49 to control the retrograde frame 49 to retrograde backward and remain stationary relative to the track bed 99. The temporary fixator 52 has a temporary clamping component. During operation, the roller recycling vehicle 5 is continuously driven forward. The temporary clamping component clamps the rail 81 under the underframe of the roller recycling vehicle 5, and forces the retrograde frame 49 to remain stationary relative to the track bed 99 and slide in an opposite direction relative to the roller recycling vehicle 5 on the two-way rail 51. The one-way propulsion mechanism comprises a propulsion tube and an electric cylinder propulsion rod 54 53 longitudinally fixed in the middle of the retrograde frame 49. The propulsion tube 53 is fixed to the retrograde frame 49 with the lower surface of the rear section. The electric cylinder propulsion rod 54 is located in the propulsion tube 53, and can extend out from a rear end of the propulsion tube 53. A propulsion head 55 at a rear end of the electric cylinder propulsion rod 54 can withstand the frame body of the rear part of the general assembly frame 48 and apply a backward thrust to the general assembly frame 48, so that the retrograde frame 49 obtains a forward reaction force enabling the entire retrograde roller drag-out device 47 to quickly slide forward after completing one lateral drag-out of the roller 7, so as to perform the next task of dragging out the roller 7

laterally.

[0075] The electric cylinder propulsion rod 54 further has a rail-type reinforcing rod 541 extending along with the electric cylinder propulsion rod 54 when the electric cylinder propulsion rod 54 is extended, which shares the gravity with the extended section of the electric cylinder propulsion rod 54. At least two sliders 542 for the rail-type reinforcing rod 541 to slide are provided below the rail-type reinforcing rod 541. The slider 542 is fixedly arranged on a horizontally arranged support plate 544 fixedly connected to the retrograde frame 49 above the propulsion tube 53. A rear end of the rail-type reinforcing rod 541 is connected to the propulsion head 55 at the rear of the electric cylinder propulsion rod 54 through a connecting plate 543. Restricted by the at least two sliders 542 for the rail-type reinforcing rod 541 to slide, the rail-type reinforcing rod 541 maintains a horizontal posture.

[0076] The above-mentioned front and rear directions are based on the forward driving direction of the roller recycling vehicle 5 as a forward direction.

[0077] The retrograde roller drag-out device 47 uses the lateral hook component 50 to laterally drag the rollers 7 from under the rails 81 on both sides to the middle of the track bed 99 and regularly place them on both sides of the track bed 99. The rollers 7 on both sides are transferred by the left raising roller gripping device 245 and the raising roller gripping device 246 to the left conveyor belt 44 and the right conveyor belt 45 via the left raising opening 41 and the right raising opening 42, respectively. The rollers 7 are conveyed by the left conveyor belt 44 and the right conveyor belt 45 to the roller recovery area 11, respectively. Then, the rollers 7 are transferred and placed into a roller basket 12 of the roller recovery area 11 by the left basket-loading roller gripping device 247 and the right basket-loading roller gripping device 248, respectively.

[0078] The roller basket 12 on which the rollers 7 are placed are transferred by the hoisting device to the rail tractor 6 in front.

[0079] III. Rail pushing vehicle. As shown in FIGS. 1, 13, 14, 23 and 24, the rail pushing vehicle runs by wheel-to-wheel on the rails 81 on both sides that have been preliminarily fixed manually.

[0080] The rail pushing vehicle is a relatively conventional operating vehicle, and only adaptive improvements are made in the present invention. Its function is to use the guide devices 56 provided on both sides, and the pushing device 57 with push wheels to push the steel rails on both sides forward to the roller recycling vehicle 5.

[0081] IV. Rail sorting vehicle 3. As shown in FIGS. 14, 15, 23 and 24, the rail sorting vehicle 3 runs by wheel-to-wheel on the rails 81 on both sides that have been preliminarily fixed manually.

[0082] The rail sorting device is arranged on the underframe of the rail sorting vehicle 3, and both sides of its rear end are provided with a left telescopic arm 58 and a right telescopic arm 59 with lifting mechanisms, and a left sorting rail two-way locking manipulator 233 and a

right sorting rail two-way locking manipulator 234 respectively arranged at rear ends of the left telescopic arm 58 and the right telescopic arm 59, respectively. The rail sorting device further comprises several guide frames 60 and propulsion frames 61 arranged below front sections of the left telescopic arm 58 and the right telescopic arm 59. The propulsion frame 61 has a propulsion wheel, and the front of the guide frame 60 has a guide plate and a guide pulley.

[0083] During operation, the left sorting rail two-way locking manipulator 233 and the right sorting rail two-way locking manipulator 234 each grab a front end of a rail 81 from the rail conveyor vehicle 2 behind on the left and right, respectively, and use the contraction of the left telescopic arm 58 and the right telescopic arm 59 to insert the rail 81 on the left and the rail 81 on the right into the guide frame 60 and the propulsion frame 61 on both sides, respectively. The propulsion wheels in the propulsion frames 61 push the rails 81 to the rail pushing vehicle at the front.

[0084] V. Rail conveyor vehicle 2. As shown in FIGS. 1, 14, 23, and 24, the rail conveyor vehicle 2 runs by wheel-to-wheel on the rails 81 on both sides that have been preliminarily fixed manually.

[0085] The rail conveyor vehicle 2 is loaded with a plurality of rails 81, and the plurality of rails 81 are arranged in layers on the rail conveyor vehicle 2, and there are intervals between the rails 81 placed in each layer, which is convenient for the rail two-way locking manipulators 23 to grasp the rails.

[0086] VI. Fastener fastening vehicle 1. As shown in FIGS. 16, 17, 18, 19, 20, 21, 22, 23 and 24, the fastener fastening vehicle 1 runs by wheel-to-wheel on the rails 81 on both sides that have been preliminarily fixed manually.

[0087] The fastening device of the fastener fastening vehicle 1 comprises an insulating block distributing mechanism, an insulating block picking mechanism, a spike screwing mechanism, a spring bar placement mechanism, and an insulating block distributing mechanism arranged on both sides of the fastener fastening vehicle 1. The insulating block distributing mechanism is arranged on the frame body 62 at the front of the fastener fastening vehicle 1, and has a vibration disk 63. The vibration disk 63 has a first vibration channel 64 and a second vibration channel 65 that output the insulating blocks 93 outwards. The insulating block distributing mechanism further has a distributing plate 66 for distributing insulating blocks 93 above the rails 81 on both sides, and the distributing plate 66 is provided with a first distributing groove 67 and a second distributing groove 68 that are parallel. The insulating block picking and loading mechanism is arranged on the frame body 62 at the rear of the insulating block distributing mechanism 62, and has a lateral movement guide rail module 70 that runs on the longitudinal track 69, a vertical guide rail module 71 that runs on the lateral movement guide rail module 70, and an insulating block clamp 72 with the clamp open-

ing downwardly installed on the vertical guide rail module 71. The spring bar placement mechanism has a spring bar gripper 73. The spike screwing mechanism has a spike screwing sleeve 74. The fastening device further comprises a longitudinal movement frame 75 running on the longitudinal rail 13, and a lifting frame 76 provided on the longitudinal movement frame 75. A lateral sliding plate 77 is provided on the lifting frame 76. The spring bar gripper 73 and the spike screwing sleeve 74 are both installed under the lateral sliding plate 77.

[0088] During operation, the vibration disk 63 is loaded with many disordered insulating blocks 93. The vibration disk 63 vibrates in a clockwise or counterclockwise direction. A part of the insulating blocks 93 will enter the first vibration channel 64 and the second vibration channel 65 in a correct posture. A part of insulating block 93 that enters the first vibration channel 64 and the second vibration channel 65 in an abnormal posture will be removed by the abnormal insulating block baffle 78 arranged above the first vibration channel 64 and the second vibration channel 65 in the vibration disk. The insulating blocks 93 that enter the first vibration channel 64 and the second vibration channel 65 in the correct posture enters the first distributing groove 67 and the second distributing groove 68 provided on the distributing plate 66, respectively. The distributing plate slides toward the insulating block clamp 72 on a side where it is located. The insulating blocks 93 in the first distributing groove 67 and the second distributing groove 68 is clamped by the insulating block clamp 72, and inserting blocks 94 of the two insulating blocks 93 are inserted into inserting seams between rail bottoms 85 on both sides of the rail 81 on the side where it is located and the Iron base plate limiting bosses 91, respectively, so that the pressing blocks 95 of the two insulating blocks 93 are pressed against top surfaces of the rail bottoms 85 on both sides of the rail, respectively. After that, the track spike 98 is loosened by the spike screwing sleeve 74, and then the spring bar 96 is clamped by the spring bar gripper 73 and moved forward, so that the front-end lower jaw 97 of the spring bar 96 is pressed against the insulating block 93, and finally the track spike 98 is tightened by the spike screwing sleeve 74 so as to complete the fastening operation of the rail fastener.

[0089] It should be noted that the left traction rail two-way locking manipulator 231, the right traction rail two-way locking manipulator 232, the left sorting rail two-way locking manipulator 233, and the right sorting rail two-way locking manipulator 234 have the same structure and function as the rail two-way locking manipulator 23 except that the left traction rail two-way locking manipulator 231, the right traction rail two-way locking manipulator 232, the left sorting rail two-way locking manipulator 233 and the right sorting rail two-way locking manipulator 234 are different in terms of respective positions and undertaken tasks. The left turning roller gripping device 241, the right turning roller gripping device 242, the left dropping roller gripping device 243, the right dropping roller

gripping device 244, the left raising roller gripping device 245, the right raising roller gripping device 246, the left basket-loading roller gripping device 247 and the right basket-loading roller gripping device 248 have the same structure and function as the roller gripping device 24, except that the left turning roller gripping device 241, the right turning roller gripping device 242, the left dropping roller gripping device 243, the right dropping roller gripping device 244, the left raising roller gripping device 245, the right raising roller gripping device 246, the left basket-loading roller gripping device 247 and the right basket-loading roller gripping device 248 are different in terms of respective positions and undertaken tasks.

[0090] The above-mentioned embodiments are only used to describe the present invention more clearly, and cannot be regarded as limiting the protection scope covered by the present invention. Any modification in equivalent forms should be regarded as falling within the protection scope covered by the present invention.

Claims

1. An intelligent track laying method, **characterized by** arranging a complete set of track laying equipment composed of multiple operating vehicles that is controlled by an intelligent control system; using a rail sorting vehicle (3) in the equipment to automatically grab front ends of two rails (81) from a rail conveyor vehicle (2) in the equipment on the left and right and directionally push the two rails (81) to a rail pushing vehicle (4) in the equipment; automatically pushing the two rails (81) by the rail pushing vehicle (4) toward a roller recycling vehicle (5) in the equipment; automatically delivering the two rails (81) toward a rail tractor (6) in the equipment by the roller recycling vehicle (5); automatically grabbing the front ends of the two rails (81) by the rail tractor (6) and making the rail tractor (6) move forward; at the same time, a roller gripping device (24) provided on the rail tractor (6) continuously placing rollers (7) forward along with the vehicle at set positions on both sides of a track bed; making two rails (81) behind be continuously placed on the rollers on both sides of the track bed and continuously dragged forward along with the vehicle on the rollers (); then, by using a roller recycling vehicle arranged secondly behind, automatically recycling the rollers (7) pressed under the rails (81) to the roller recycling vehicle (5) to make the rails (81) fall on sleepers; manually performing interval-type preliminary fixing of the rails (81) that fall on sleepers; and finally automatically completing a fastening operation of the rails (81) by a fastener fastening vehicle (1), thereby realizing intelligent track laying.
2. The intelligent track laying method according to claim 1, **characterized in that** the delivering the two rails (81) toward the rail tractor (6) by the roller recycling vehicle (5) is arranging guide rail devices (9) on both sides of the roller recycling vehicle (5), making the two rails (81) pass through the guide rail devices (9) arranged on both sides, respectively, and pushing the two rails (81) toward the rail tractor (6) in the equipment by the rail pushing vehicle (4).
3. The intelligent track laying method according to claim 2, **characterized in that** the making the two rails (81) be continuously placed on the rollers on both sides of the track bed and continuously dragged forward along with the vehicle on the roller is making the roller recycling vehicle (5) remain stationary, and the rail tractor (6) pulling the rails to move forward continuously, so that the length of the rail (81) between the roller recycling vehicle (5) and the rail tractor (6) is continuously increased, the weight of the rail (81) is used to deform a middle section of the elongated rail and then drop it on a roller wheel (8) of the roller, and the roller wheel (8) is used to rotate so that the rail can be dragged on the roller wheel (8) as the rail tractor (6) moves forward.
4. The intelligent track laying method according to claim 3, **characterized in that** the recycling the rollers (7) pressed under the rails (81) to the roller recycling vehicle (5) is arranging a roller drag-out device and the roller gripping device (24) controlled by an intelligent control system on the roller recycling vehicle (5); reusing the guide rail devices (9) arranged on both sides of the roller recycling vehicle (5), and continuously lifting the rails (81) from back to front by the forward movement of the roller recycling vehicle (5); at the same time, dragging out the roller (7) from under the lifted rail (81) by the roller drag-out device and transferring the roller (7) to the roller recycling vehicle (5) by the roller gripping device (24), and making the rails (81) behind continuously fall forward on the sleepers.
5. The intelligent track laying method according to claim 4, **characterized in that** the reusing the guide rail devices (9) arranged on both sides of the roller recycling vehicle (5), and continuously lifting the rails (81) from back to front by the forward movement of the roller recycling vehicle (5) are that the roller recycling vehicle (5) is at a distance from a front end of a rail L that has been laid behind; the rail tractor (6) drags the rails (81) until rear ends of the rails (81) are aligned with the front end of the rail L that has been laid behind and stops moving forward; a rear end of a section of the rail (81) behind the roller recycling vehicle (5) sags and is connected and fixed to the front end of the rail L that has been laid, and then the roller recycling vehicle (5) keeps driving forward according to a speed of recycling the rollers.

6. The intelligent track laying method according to claim 4, **characterized in that** the dragging out the roller (7) from under the lifted rail (81) and transferring the roller (7) to the roller recycling vehicle (5) by the roller drag-out device and the roller gripping device (24) are laterally dragging out the roller (7) from under the rails (81) lifted on both sides toward the middle of the track bed (99) and regularly placing them on both sides of the middle of the track bed (99) by the roller drag-out device when the roller recycling vehicle (5) is continuously moving forward, and transferring the roller (7) from the track bed (99) to a roller basket (12) in a roller recycling area (11) provided on the roller recycling vehicle by the roller gripping device (24).
7. The intelligent track laying method according to claim 6, **characterized in that** the dragging out the roller (7) from under the rails (81) lifted on both sides toward the middle of the track bed (99) by the roller drag-out device when the roller recycling vehicle (5) is continuously moving forward is integrally arranging the roller drag-out device as a retrograde roller drag-out device (47) capable of retrograding on the rail vehicle, and arranging on the retrograde roller drag-out device (47) a temporary fixator (52) capable of being temporarily fixed to the rails (81) sliding on the guide rail device (9), so that during operation, the retrograde roller drag-out device (47) and the rails (81) are temporarily fixed by the temporary fixator (52), and the retrograde roller drag-out device (47) retrogrades on the roller recycling vehicle (5) moving forward while remaining stationary relative to the track bed for a period of time, which is used to drag out the roller from under the lifted rail (81).
8. The intelligent track laying method according to claim 6, **characterized in that** the roller gripping device on the roller recycling vehicle (5) is divided into a raising roller gripping device and a basket-loading roller gripping device, and at the same time, a roller transport device is provided between a raising opening in a underframe of the roller recycling vehicle (5) and the roller recycling area (11); the roller (7) placed on the track bed (99) is transferred from the track bed to the transport device by the raising roller gripping device via the raising opening in the underframe of the roller recycling vehicle (5); the roller (7) is transferred to the roller recycling area (11) by the transport device; and then the roller (7) on the transport device is transferred to a roller basket (12) in the roller recycling area (11) by the basket-loading roller gripping device.
9. The intelligent track laying method according to anyone of claims 1-6, **characterized in that** a rail two-way locking manipulator (23) controlled by an intelligent control system and capable of automatic two-way locking for grabbing the rail (81) is arranged on the rail sorting vehicle (3) and the rail tractor (6); a gripping component and a tilt mechanism capable of tilting the rail two-way locking manipulator (23) are arranged on the rail two-way locking manipulator (23); and during operation, the gripping component clamps between a rail head (82) and a rail bottom (85) on both sides of the rail (81), and then the rail two-way locking manipulator (23) is rotated by the tilt mechanism, so that the rail two-way locking manipulator (23) tilts forward or backward, thereby forcing the gripping component upwards to press against bottom surfaces on both sides of the rail head (82), and downwards to press against top surfaces of the rail bottoms (85) on both sides, and enabling the rail two-way locking manipulator (23) to tilt forward or backward to realize two-way locking of the rail (81).
10. The intelligent track laying method according to claim 1, **characterized in that** the manually performing interval-type preliminary fixing of the rails (81) that fall on sleepers is taking one pre-installed sleeper for every interval of N pre-installed sleepers (89) on average, inserting an insulating block (93) between the rail bottom (85) of the rail (81) on two sides and a limiting boss (91) of an Iron base plate (90) on the taken pre-installed sleeper (89), placing a spring bar (96) in place, and then tightening track spikes (98) to complete preliminary fixation of the laid rails.
11. The intelligent track laying method according to claim 10, **characterized in that** the automatically completing the fastening operation of the rails (81) by a fastener fastening vehicle (1) is arranging an insulating block clamping mechanism, a spike screwing mechanism and a spring bar placement mechanism on the fastener fastening vehicle (1), wherein during operation, the insulating block (93) is clamped by the insulating block clamping mechanism to insert the insulating block (93) between the rail bottom (85) of the rail (81) on two sides and the limiting boss (91) of the Iron base plate (90) and make a pressing block of the insulating block (93) press the rail bottom (85) of the rail; then, the track spikes are loosened by the spike screwing mechanism to loosen the spring bar (96) that is pre-pressed on the limiting boss (91) previously by a front-end lower jaw (97); both sides of the spring bar (96) are clamped by the spring bar placement mechanism to make the spring bar (96) move forward so that the front-end lower jaw (97) of the spring bar (96) presses the insulating block (93); and finally the track spikes (98) are tightened with the spike screwing mechanism to make the spring bar (96) tightly press the insulating block (93), and press the rail through the insulating block (93).
12. An intelligent track laying equipment, comprising a rail conveyor vehicle (2), and a rail sorting vehicle

(3) with a rail sorting device, a rail pushing vehicle (4) with a rail pushing device, and a rail tractor (6) with a rail traction device that are sequentially located before the rail conveyor vehicle (2), **characterized in that** a roller gripping device (24) is provided on the rail tractor (6), and a special roller recycling vehicle (5) is provided behind the rail tractor (6), and has a roller gripping device (24) and a roller drag-out device; and a fastener fastening vehicle (1) is provided behind the rail conveyor vehicle (2), and the fastener fastening vehicle (1) has a fastening device for installing fasteners to fix a rail (81).

13. The intelligent track laying equipment according to claim 12, **characterized in that** the rail sorting device and the rail traction device each have a rail two-way locking manipulator (23), and the rail two-way locking manipulator (23) comprises a mounting body (25) fixed on the sorting device or the rail traction device, a rotating frame (26) installed on the mounting body (25) through a rotating shaft, a tilt propeller (251) with one end acting on the rotating frame (26) to push the rotating frame (26) to rotate, and a clamping assembly installed on the rotating frame (26); a grasping component capable of holding the rail (81) is below the clamping assembly; the clamping assembly comprises a clamping frame (27) installed in the rotating frame (26), and the clamping frame (27) has a first splint (28) and a second splint (29); the first splint (28) and the second splint (29) have a first hanging pin hole and a second hanging pin hole thereon, respectively, the first hanging pin hole and the second hanging pin hole have a first hanging pin (30) and a second hanging pin (31) therein, respectively, and when the rail (81) is grasped, lower ends of the first splint (28) and the second splint (29) can be inserted under a first bottom surface (83) and a second bottom surface (84) on both sides of a rail head (82), respectively; bottom ends of the first splint (28) and the second splint (29) of the clamping frame (27) are divided into a first front foot (32) and a first rear foot (33), and a second front foot (34) and a second rear foot (35), respectively; when the first pin (30) and the second pin (31) hang on the first bottom surface (83) and the second bottom surface (84) of the rail head, respectively, there is a gap between each of the first front foot (32) and the first rear foot (33) and a first top surface (86) of the rail bottom (85), and there is a gap between each of the second front foot (34) and the second rear foot (35) and a second top surface (87) of the rail bottom (85);

when a lower end of the clamping frame (27) tilts forward with the rotating frame (26), the first hanging pin (30) and the first rear foot (33) support the first bottom surface (83) and the first top surface (86), respectively, the second hanging pin (31) and the second rear foot (35) support

the second bottom surface (84) and the second top surface (87), respectively, and the clamping assembly locks the rail (81);

when the lower end of the clamping frame (27) tilts backward with the rotating frame (26), the first hanging pin (30) and the first front foot (32) support the first bottom surface (83) and the first top surface (86), respectively, the second hanging pin (31) and the second front foot (34) support the second bottom surface (84) and the second top surface (87), respectively, and the clamping assembly also locks the rail (81); and when the clamping frame (27) returns to a vertical position with the rotating frame (26), locking of the rail (81) by the clamping assembly is released.

14. The intelligent track laying equipment according to claim 12, **characterized in that** the roller recycling vehicle (5) further has a guide rail device (9) that cooperates with the roller drag-out device and the roller gripping device (24), and the guide rail device (9) has two horizontally symmetrical lifting pulleys that can lift the rail on bottom surfaces of both sides of the rail head (82) and can slide along the rail in a rolling manner; the roller drag-out device is a retrograde roller drag-out device (47) that can laterally drag out the roller (7) under the lifted rail (81), and has a general assembly frame (48) that is fixed below the middle of a underframe of the roller recycling vehicle in a suspension manner, a retrograde frame (49) provided on the general assembly frame (48), a retrograde stabilizer arranged between the retrograde frame (49) and the general assembly frame (48), a lateral drive mechanism arranged on the retrograde frame (49), a longitudinal fine-adjusting mechanism provided on the lateral drive mechanism, a lifting mechanism provided on the longitudinal fine-adjusting mechanism, and a lateral hook component (50) provided at a lower end of the lifting mechanism; the retrograde stabilizer comprises a two-way rail (51) provided on the general assembly frame (48) for the retrograde frame (49) to run in both forward and backward directions along a train running direction, a one-way propulsion mechanism installed on the general assembly frame (48) to push the retrograde frame (49) to run forward, and a temporary fixator (52) provided on the retrograde frame (49) to control the retrograde frame (49) to retrograde backward and remain stationary relative to the track bed (99); and the one-way propulsion mechanism comprises a propulsion tube (53) and an electric cylinder propulsion rod (54) fixed longitudinally in the middle of the retrograde frame (49), the propulsion tube (53) is fixed to the retrograde frame (49) with a lower surface of a rear section, the cylinder propulsion rod (54) is located in the propulsion tube (53) and can extend out from a rear end of the propulsion

tube (53), and a propulsion head (55) at a rear end of the electric cylinder propulsion rod (54) can withstand a rear frame body of the general assembly frame (48) and apply backward thrust to the general assembly frame (48).

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15. The intelligent track laying equipment according to claim 12, **characterized in that** the fastening device of the fastener fastening vehicle (1) comprises an insulating block distributing mechanism, an insulating block picking and loading mechanism, a spike screwing mechanism, and a spring bar placement mechanism, and the insulating block distributing mechanism is arranged on a frame body (62) at the front of the fastener fastening vehicle (1), and has a vibration disk (63), wherein the vibration disk (63) has a first vibration channel (64) and a second vibration channel (65) that output the insulating block (93) outward, and also has a distributing plate (66) for distributing the insulating block (93) above the rails (81) on both sides; the insulating block picking mechanism is arranged on a frame body (62) of a rear part of the insulating block distributing mechanism, and has a lateral movement guide rail module (70) running on a longitudinal track (69), a vertical guide rail module (71) running on the lateral movement guide rail module (70), and an insulating block clamp (72) installed on the vertical guide rail module (71) with clamp opening downward; the spring bar placement mechanism has an spring bar gripper (73); the spike screwing mechanism has a spike screwing sleeve (74); and the fastening device further comprises a longitudinal movement frame (75) running on a longitudinal rail (13), and a lifting frame (76) provided on the longitudinal movement frame (75), the lifting frame (76) is provided with a lateral movement sliding plate (77), and the spring bar gripper (73) and the spike screwing sleeve (74) are both installed under the lateral movement sliding plate (77).

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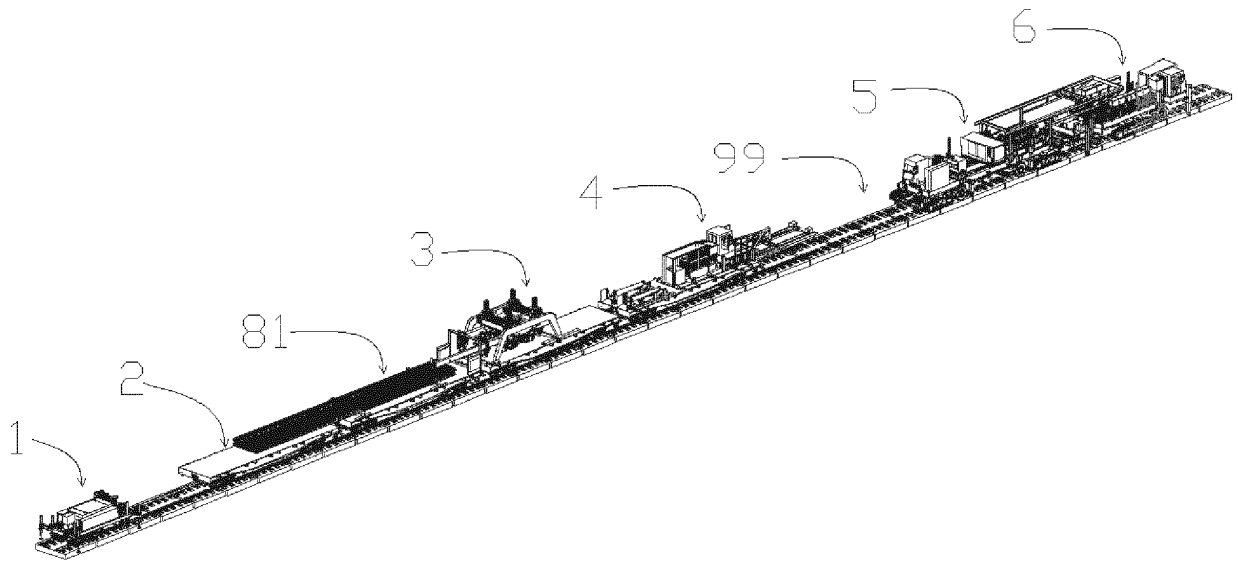


FIG. 1

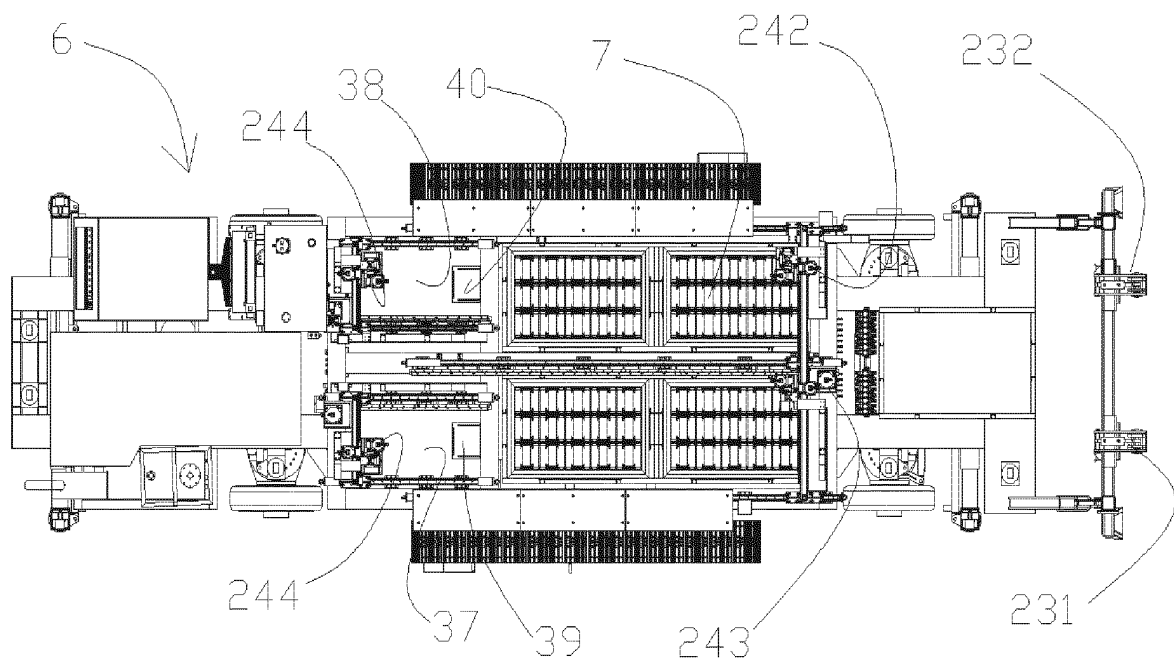


FIG. 2

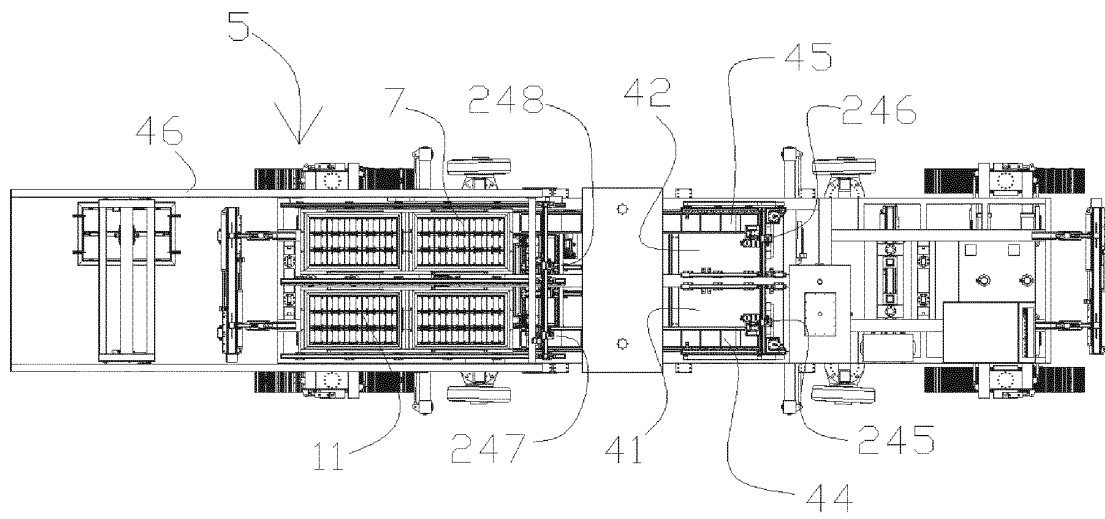


FIG.

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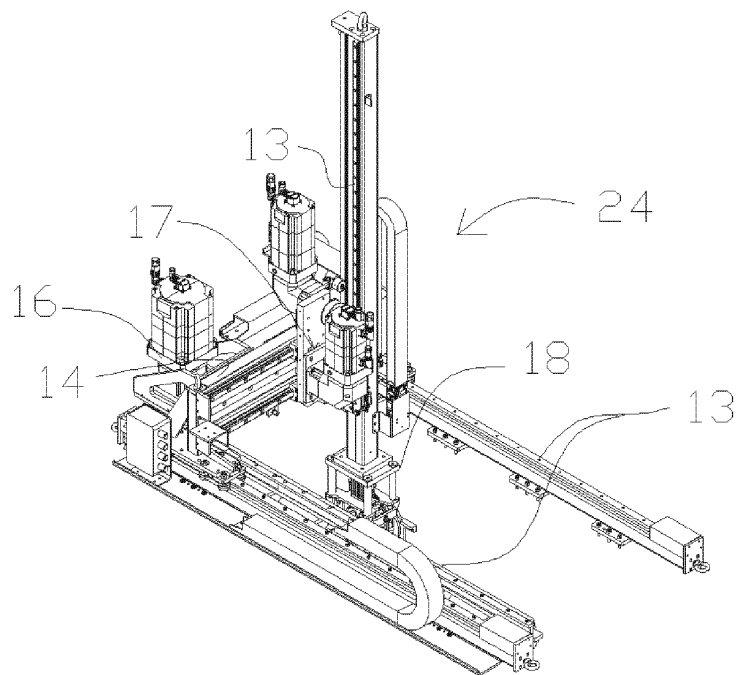


FIG. 4

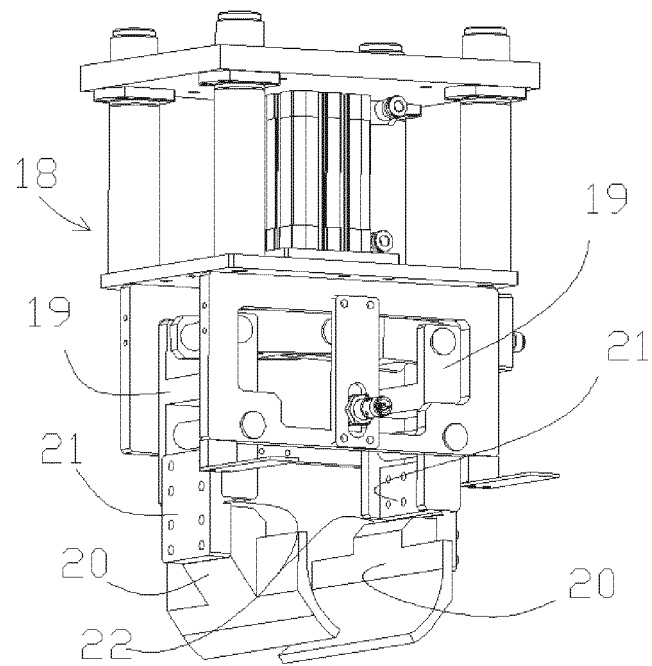


FIG. 5

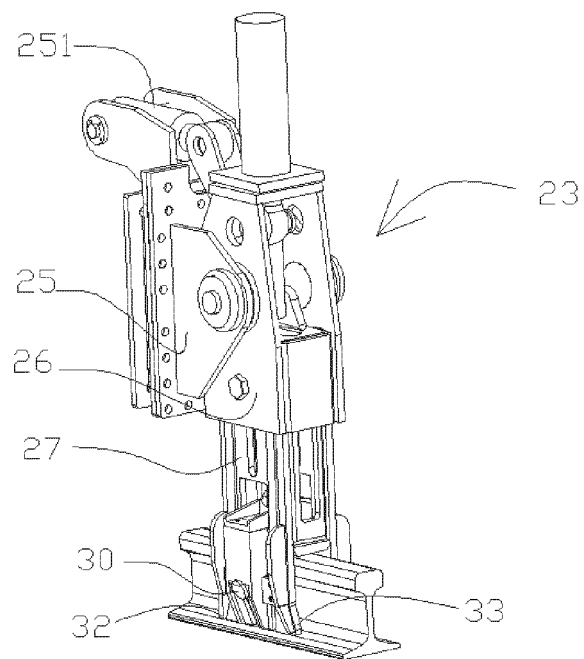


FIG. 6

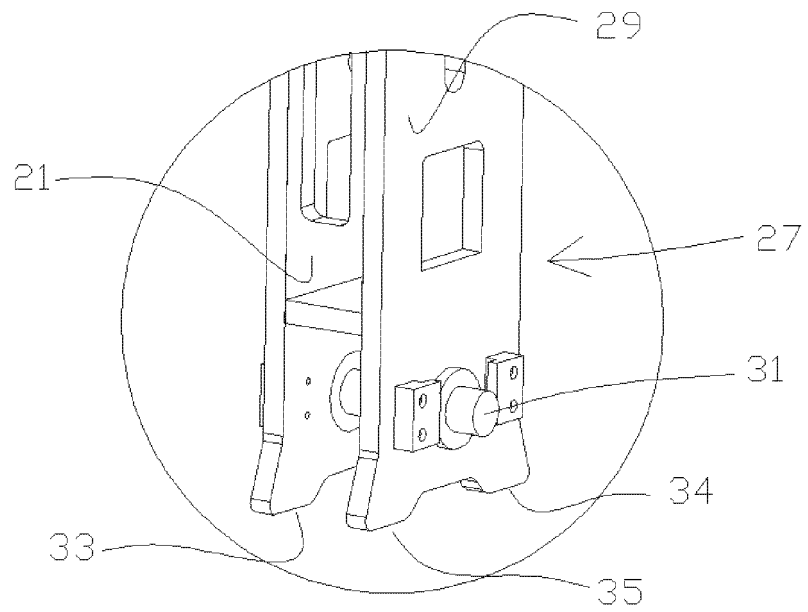


FIG. 7

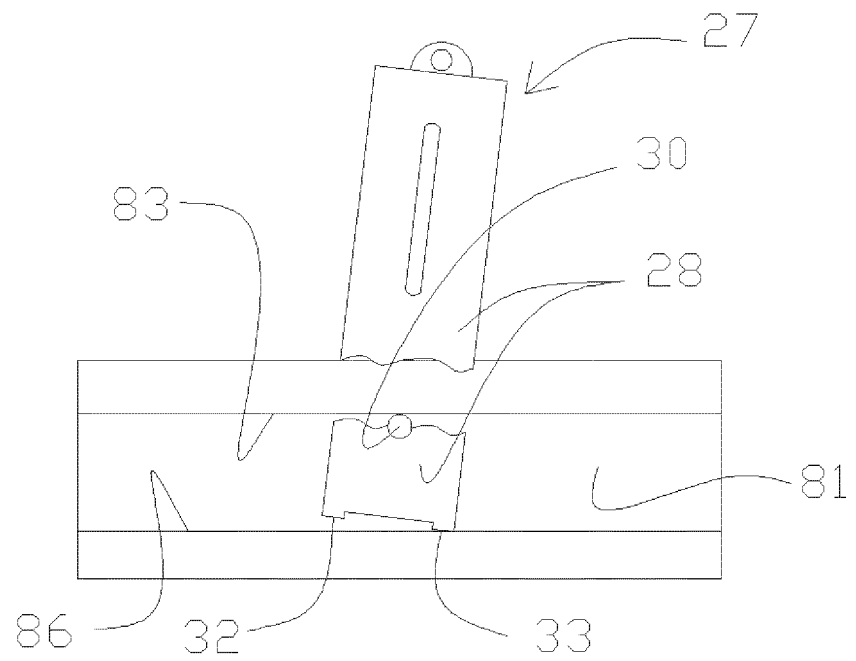


FIG. 8

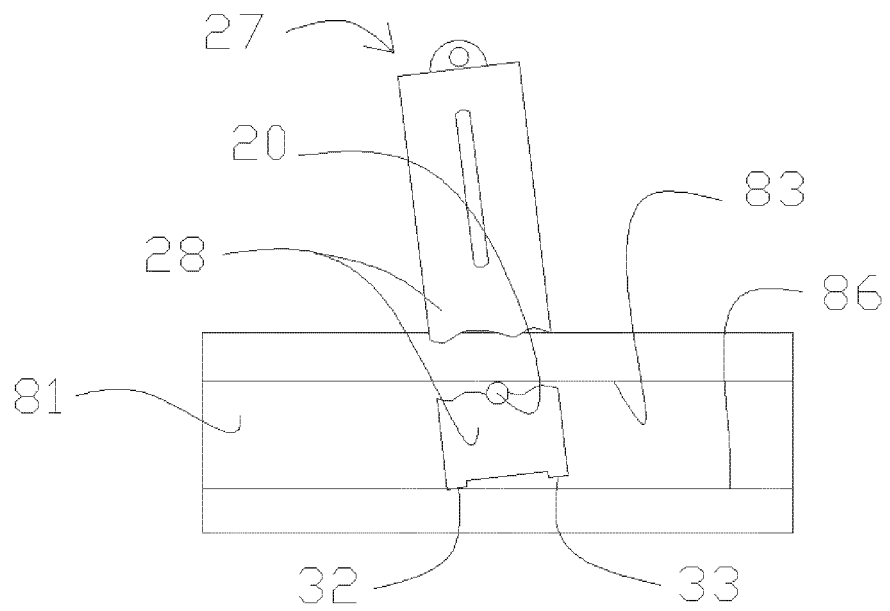


FIG. 9

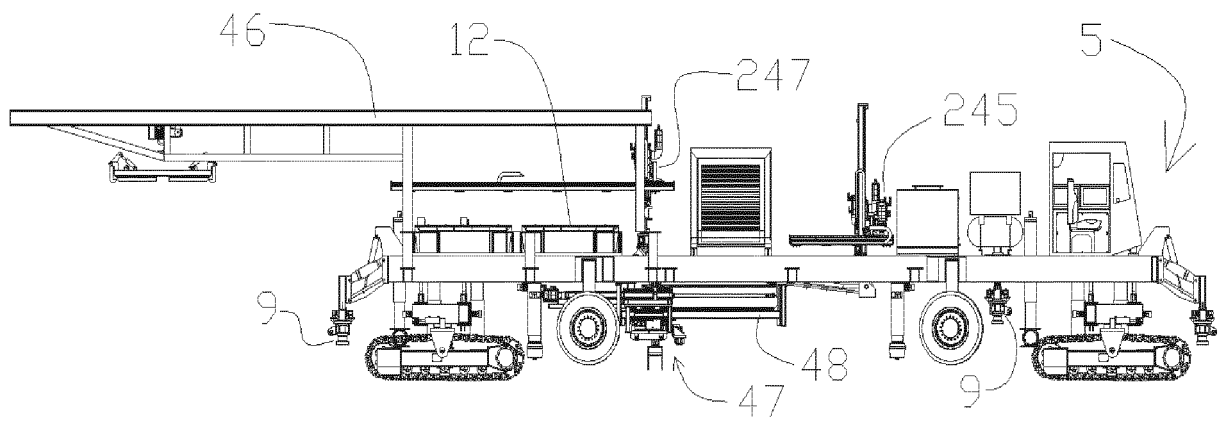


FIG. 10

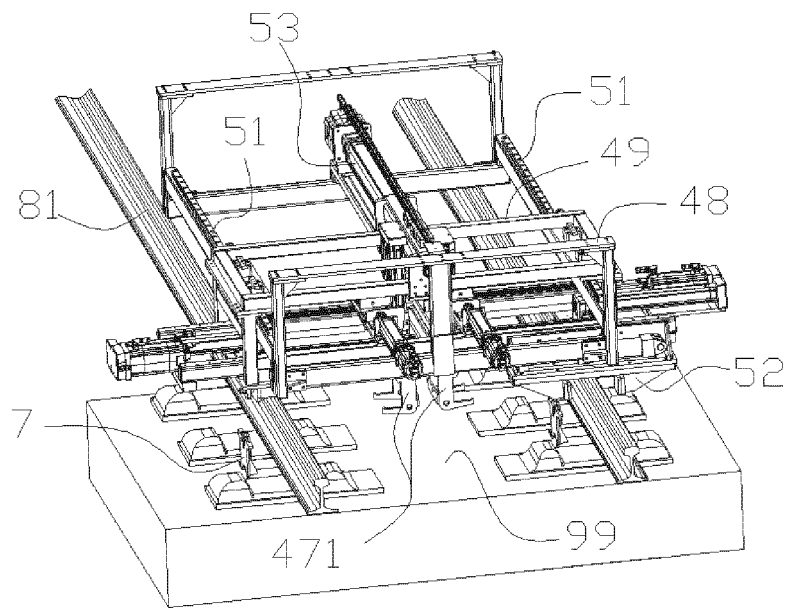


FIG. 11

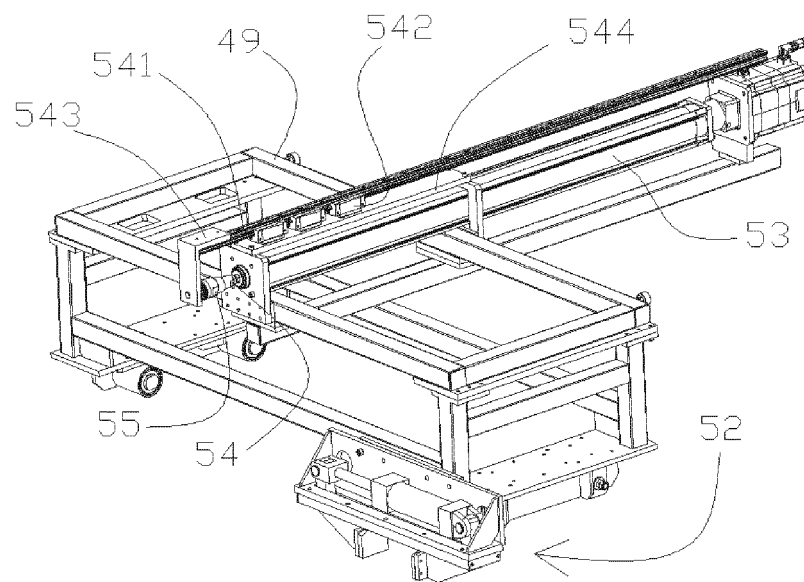


FIG. 12

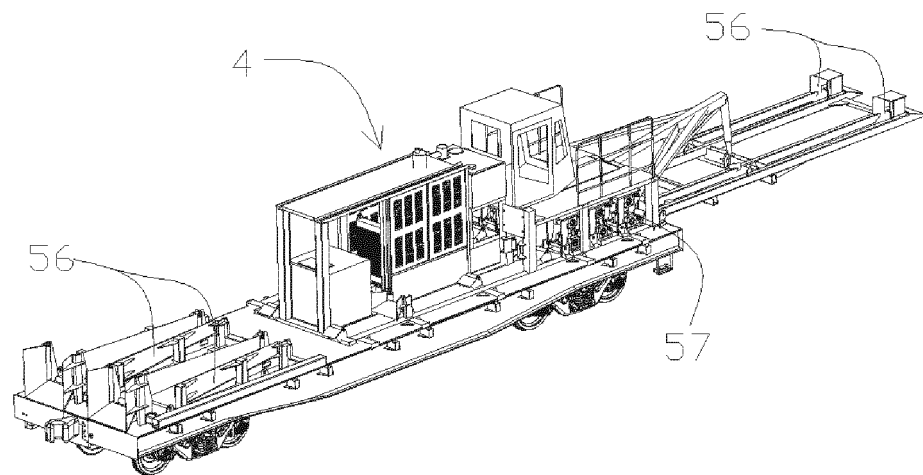


FIG. 13

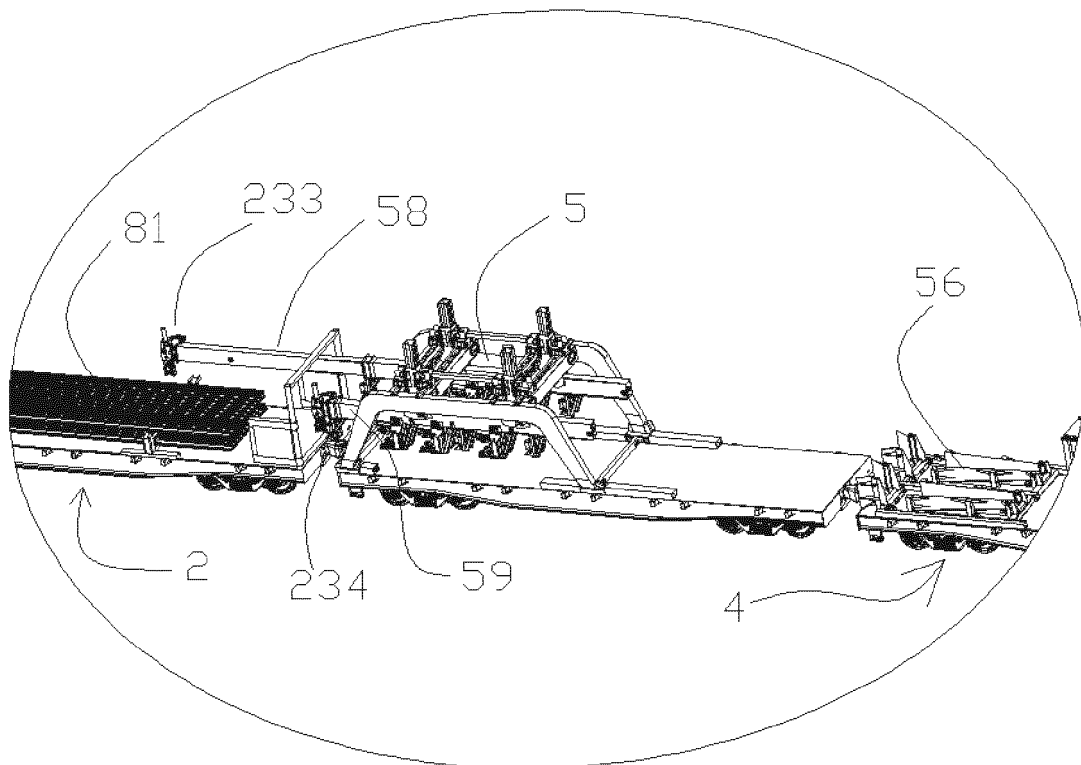


FIG. 14

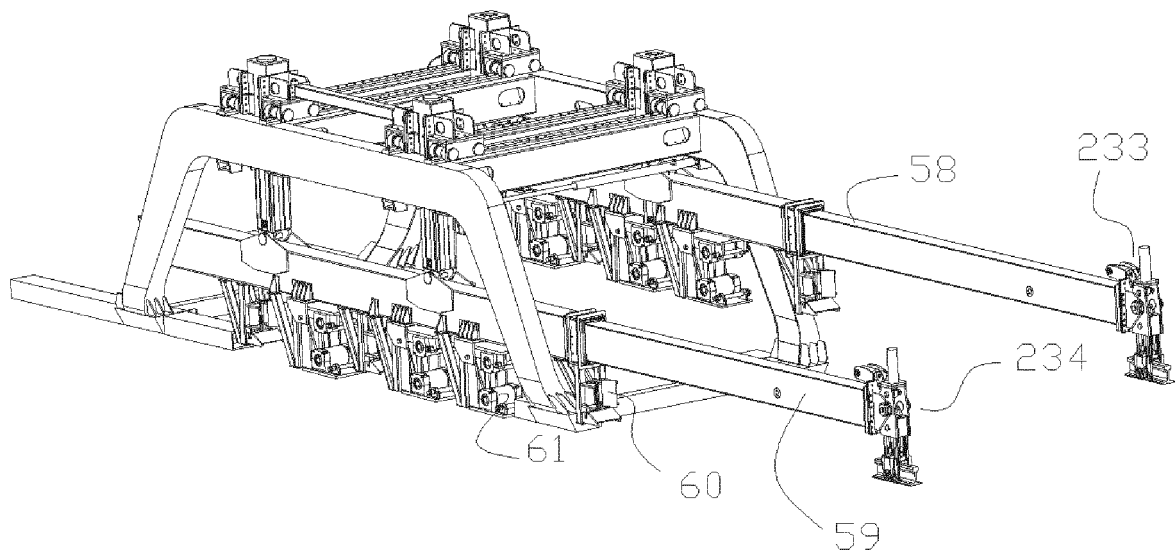


FIG. 15

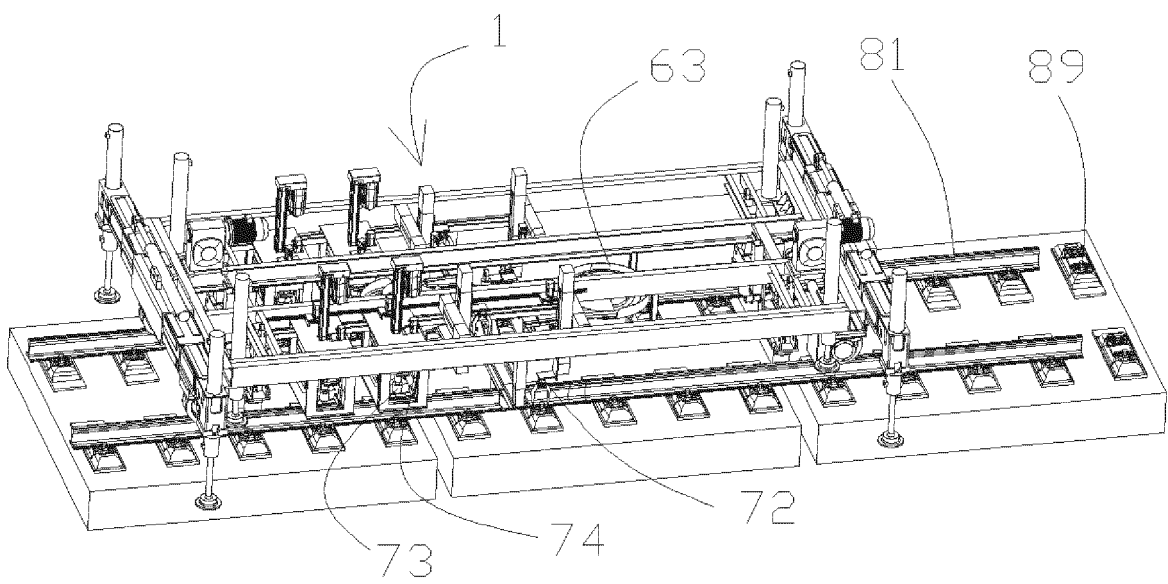


FIG. 16

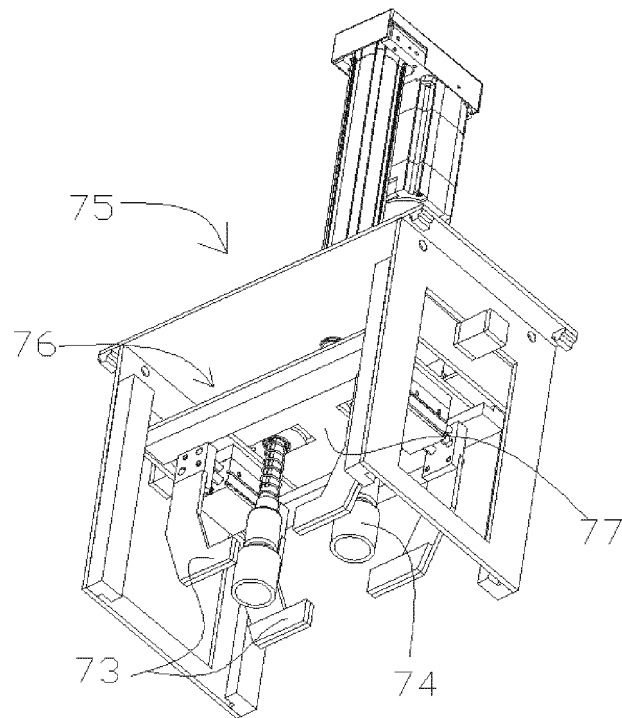


FIG. 17

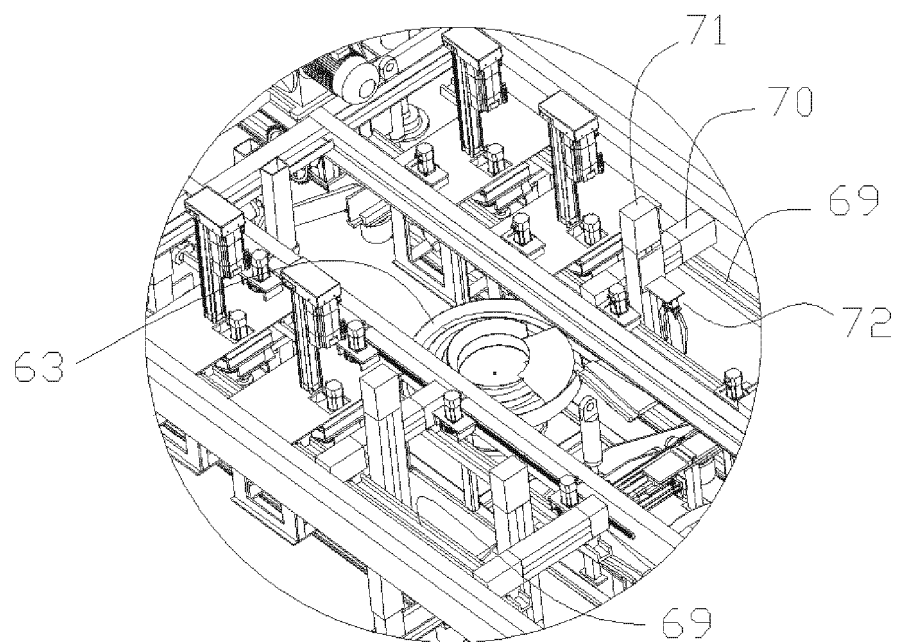


FIG. 18

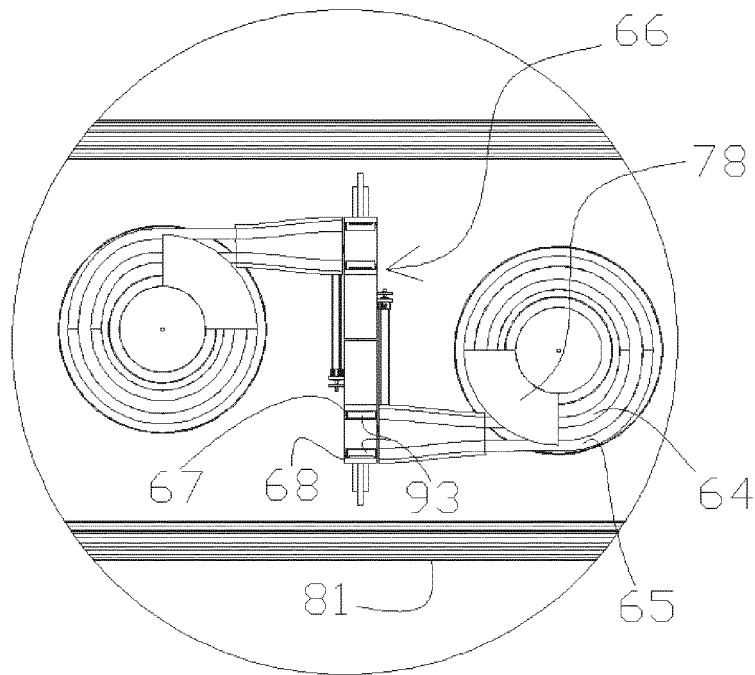


FIG. 19

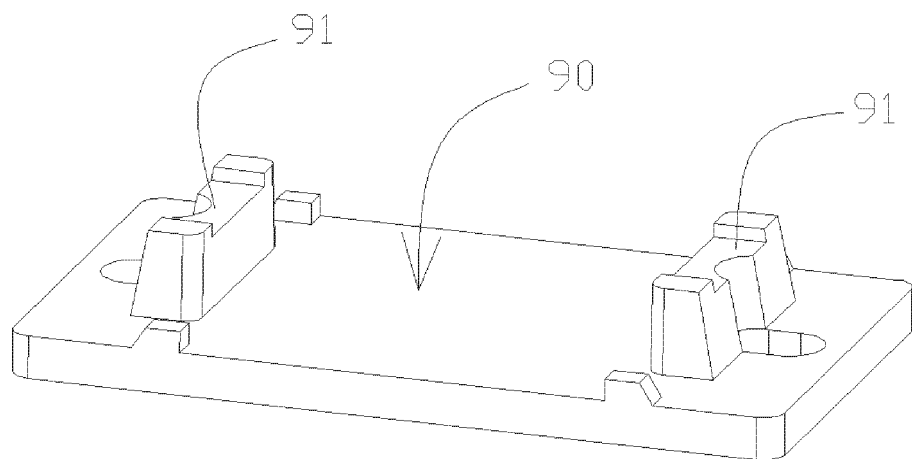


FIG. 20

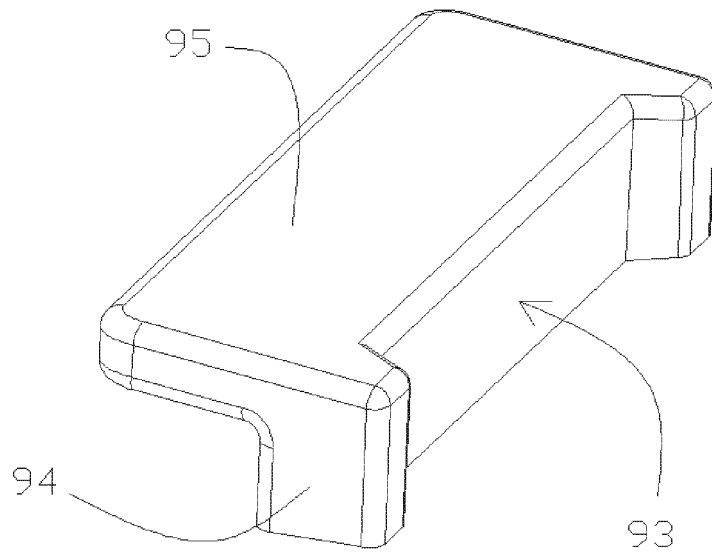


FIG. 21

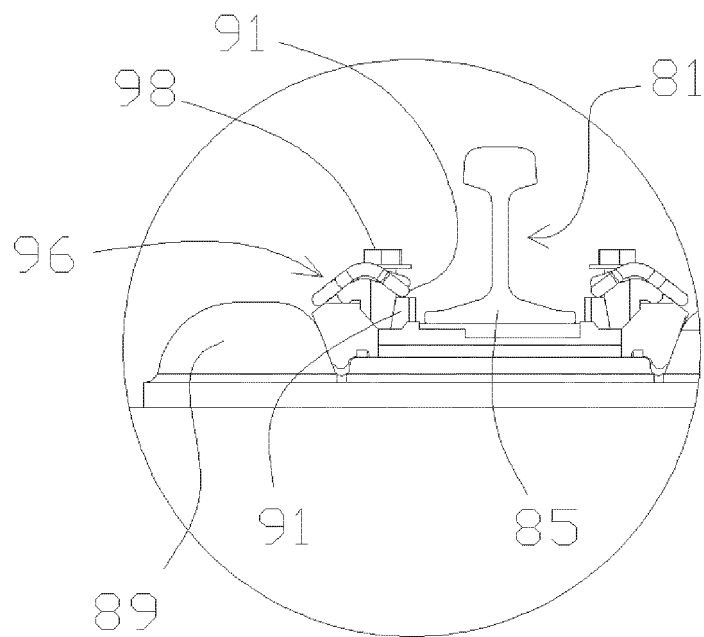


FIG. 22

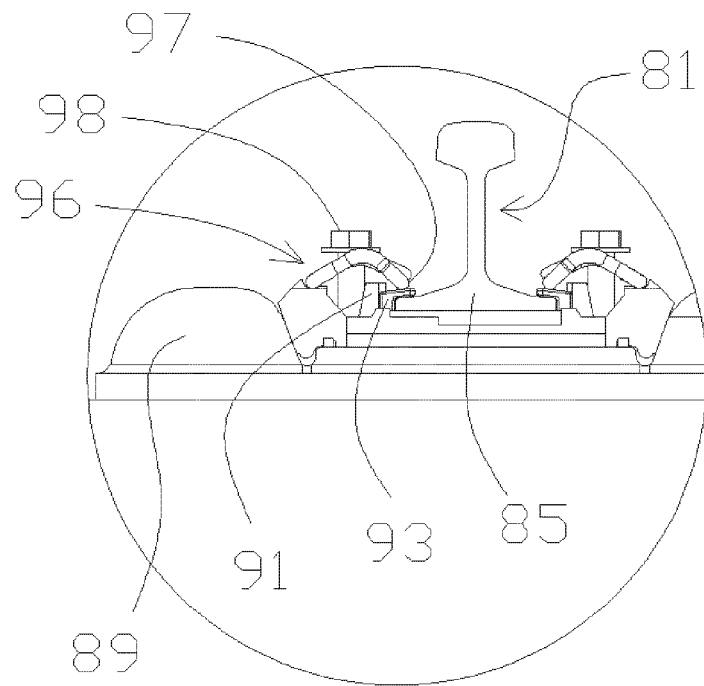


FIG. 23

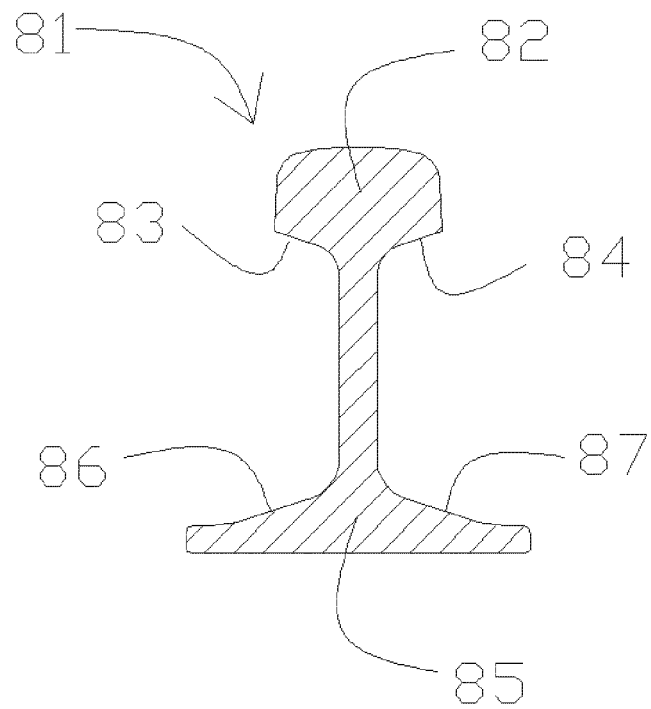


FIG. 24

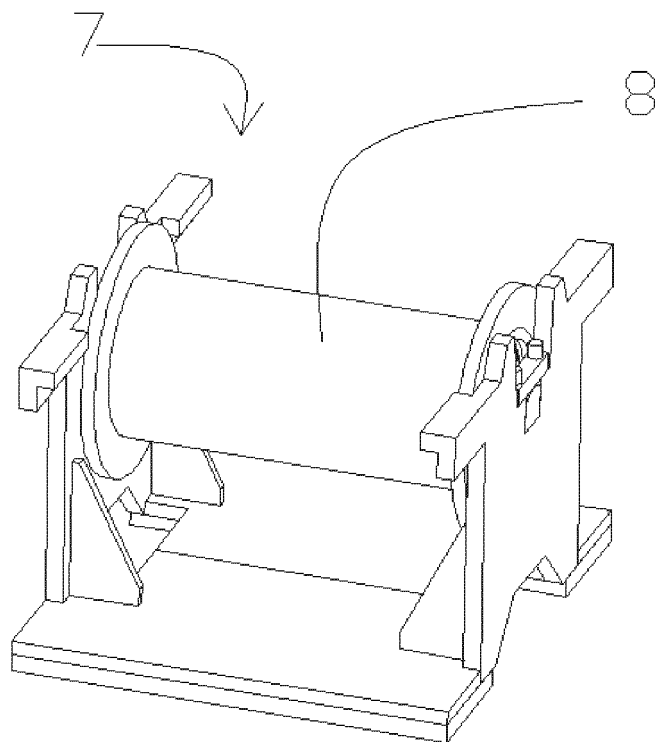


FIG. 25

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2021/101709

A. CLASSIFICATION OF SUBJECT MATTER

E01B 29/16(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E01B; B66C; B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, CNPAT, CNKI: 铺轨, 滚筒, 辊, 滚轮, 回收, 夹, 倾斜, 锁紧, 扣件, rail, roller, cycle, collect, clip, inclin+, lock

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 112813745 A (CHINA RAILWAY NO.4 ENGINEERING GROUP CO., LTD. et al.) 18 May 2021 (2021-05-18) claims 1-15	1-15
Y	CN 112012057 A (HUNAN CHANGYUAN YUECHENG MACHINERY CO., LTD.) 01 December 2020 (2020-12-01) description, specific embodiments, and figure 1	1-12
Y	CN 105625118 A (HU, Deling) 01 June 2016 (2016-06-01) description, paragraphs 0026-0032 and figures 1-8	1-12
Y	CN 207404711 U (WUYANG IRON & STEEL CO., LTD.) 25 May 2018 (2018-05-25) description, paragraphs 0018-0022 and figures 1-3	9
PY	CN 112853830 A (ZHUSHOU XUYANG ELECTROMECHANICAL TECHNOLOGY DEVELOPMENT CO., LTD. et al.) 28 May 2021 (2021-05-28) description, specific embodiments, and figures 1-8	9, 13
PY	CN 112853833 A (ZHUSHOU XUYANG ELECTROMECHANICAL TECHNOLOGY DEVELOPMENT CO., LTD. et al.) 28 May 2021 (2021-05-28) description, specific embodiments, and figures 1-10	1-15

☒ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

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“P” document published prior to the international filing date but later than the priority date claimed

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“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search

17 September 2021

Date of mailing of the international search report

28 September 2021

Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/
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Facsimile No. (86-10)62019451

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2021/101709

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 2010320280 A1 (MIGUELEZ TAPIA, F. J.) 23 December 2010 (2010-12-23) entire document	1-15

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

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