

## **WHEEL GUIDE TRACK AND NODE OF SHUTTLE TRAVELING TRACK**

### **TECHNICAL FIELD**

[0001] The present disclosure generally relates to the technical field of warehousing and logistics, in particular, to a wheel guide track and a node of a shuttle traveling track.

### **BACKGROUND**

[0002] Four-way shuttles and rack tracks are generally arranged in a vertical storage warehouse. The four-way shuttles can travel on the rack tracks and are used for transporting goods from one designated location to another.

[0003] At present, the wheel guide tracks (the wheels of the four-way shuttles travel on the wheel guide tracks) in the rack tracks mostly employ the form of stepped tracks or flat tracks. For example, the wheel guide tracks employ square tubes or bent plates. The wheels of the four-way shuttles mostly have flange edges, and the flange edges are stuck inside the wheel guide tracks to guide the wheels. On the primary wheel guide tracks, because the four-way shuttles need to change traveling directions, the primary wheel guide tracks need to be machined with notches at the direction-changing positions to avoid the flange edges of the wheels of the four-way shuttles. There are many notches on the primary wheel guide tracks, and the stress is concentrated at the notches, which causes the primary wheel guide tracks to be prone to cracks. The four-way shuttles also generate loud noise during traveling. In addition, to enable the four-way shuttles to pass the notches smoothly and avoid the driving wheels hanging at the notches, the four-way shuttles need to be provided with more wheels in the traveling directions having the notches.

[0004] The contents of the Background are merely technology known to the inventors and do not represent the prior art in the art.

### **SUMMARY**

[0005] In view of at least one disadvantage of the existing art, the present disclosure provides a wheel guide track, including:

[0006] a bent plate including a first side plate, a second side plate and a groove plate, wherein the groove plate is connected between the first side plate and the second side plate, the groove

plate forms a traveling groove extending in a length direction of the bent plate and two guide flanges, the traveling groove is located between the two guide flanges, and the traveling groove is configured to allow a wheel to travel; and

[0007] a plurality of backing plates;

[0008] wherein a plurality of notches are provided on the bent plate, the notches extend in a width direction of the bent plate, the notches are configured to allow a wheel to pass, the backing plates are arranged in respective notches, and the backing plates are flush with a bottom of the traveling groove.

[0009] According to an aspect of the present disclosure, the first side plate and/or the second side plate are provided with a bend and formed with a support leg, the backing plates are welded to the bent plate.

[0010] According to an aspect of the present disclosure, the first side plate, the second side plate and the groove plate are integrally bent-formed or integrally roll-formed; and/or

[0011] a surface of the wheel guide track is provided with a galvanized layer.

[0012] The present disclosure also provides a shuttle traveling track, including:

[0013] the wheel guide track;

[0014] a sub-guide track having a traveling groove, wherein the sub-guide track is substantially perpendicular to the wheel guide track, and the traveling groove of the sub-guide track is aligned with a notch of the wheel guide track; and

[0015] a connecting assembly arranged at a bottom of the wheel guide track and a bottom of the sub-guide track and fixedly connected with the wheel guide track and the sub-guide track respectively.

[0016] According to an aspect of the present disclosure, the connecting assembly includes:

[0017] a connecting plate having a support surface; and

[0018] a plurality of spacers arranged on the support surface;

[0019] wherein the wheel guide track and the sub-guide track are overlapped on respective spacers and fixedly connected with the connecting plate and the respective spacers, respectively.

[0020] According to an aspect of the present disclosure, the connecting assembly includes:

[0021] a connecting plate having a support surface;

[0022] one or more spacers arranged on the support surface; and

[0023] a hook twisted leg including a first connecting portion and a second connecting portion connected with each other, wherein the first connecting portion is substantially perpendicular to the second connecting portion, and the first connecting portion is overlapped on the support surface;

[0024] wherein the first side plate of the wheel guide track is overlapped on the one or more spacers and fixedly connected with the one or more spacers and the connecting plate; the second side plate of the wheel guide track is overlapped on the support surface and fixedly connected with the second connecting portion; the sub-guide track is overlapped on the first connecting portion and fixedly connected with the first connecting portion and the connecting plate.

[0025] According to an aspect of the present disclosure, the one or more spacers and the first connecting portion have substantially the same thickness.

[0026] According to an aspect of the present disclosure, a plurality of hooks are arranged on the second connecting portion.

[0027] According to an aspect of the present disclosure, the hook twisted leg further includes a third connecting portion, and the third connecting portion is connected with and substantially perpendicular to the second connecting portion;

[0028] the shuttle traveling track further includes a cargo holding track, the cargo holding track is overlapped on the third connecting portion and fixedly connected with the third connecting portion, and the cargo holding track is higher than the sub-guide track and substantially parallel to the sub-guide track.

[0029] According to an aspect of the present disclosure, the cargo holding track includes a mounting portion, a cargo support portion, a transition portion and a track support portion that are sequentially connected by bending, wherein the mounting portion, the cargo support portion and the transition portion define a first groove, and the track support portion is bent outwards with respect to the first groove.

[0030] According to an aspect of the present disclosure, the cargo support portion is overlapped on the third connecting portion, the mounting portion is fixedly connected with the third connecting portion, and the track support portion is overlapped on the second connecting portion.

[0031] According to an aspect of the present disclosure, the connecting plate includes a first support portion, a third side plate, a bottom plate, a fourth side plate and a second support portion that are sequentially connected by bending, the bottom plate, the third side plate and the fourth side plate define a second groove, and the first support portion and the second support portion are bent outwards with respect to the second groove respectively to form the support surface.

[0032] According to an aspect of the present disclosure, the shuttle traveling track further includes an anti-fall mechanism for a vertical storage warehouse, the anti-fall mechanism including:

[0033] a first anti-fall assembly including a first base, a stop rod and a reset spring, wherein the stop rod is arranged on the first base, the stop rod is configured to be switchable between a first blocking position and a first avoidance position, the first blocking position is higher than the first

avoidance position, and the reset spring is connected with the stop rod and configured to enable the stop rod to be reset to the first blocking position; and

[0034] a second anti-fall assembly including a rotary driver and a stop arm connected with each other, wherein the rotary driver is configured to drive the stop arm to switch between a second blocking position and a second avoidance position, the second blocking position is higher than the second avoidance position, and the stop arm is configured to be capable of driving the stop rod to switch from the first blocking position to the first avoidance position when the stop arm switches from the second blocking position to the second avoidance position.

[0035] According to an aspect of the present disclosure, a first mounting hole is arranged on a top of the first base, a second mounting hole is arranged on a side of the first base, and the first mounting hole communicates with the second mounting hole;

[0036] the stop rod includes a first rod member and a second rod member, wherein the first rod member is inserted into the first mounting hole, the second rod member is inserted into the second mounting hole, and the first rod member is connected with the second rod member.

[0037] According to an aspect of the present disclosure, an anti-detachment head is arranged on a top of the first rod member;

[0038] the reset spring is sleeved on the first rod member, one end of the reset spring abuts against the first base, and the other end of the reset spring abuts against the anti-detachment head.

[0039] According to an aspect of the present disclosure, a plurality of first waist-shaped holes are further arranged on the side of the first base.

[0040] According to an aspect of the present disclosure, the second anti-fall assembly further includes a flange plate, and an output shaft of the rotary driver is connected with the stop arm through the flange plate, an anti-detachment protrusion is arranged on an end of the stop arm away from the rotary driver.

[0041] According to an aspect of the present disclosure, the rotary driver is an electric motor or a steering engine.

[0042] According to an aspect of the present disclosure, the second anti-fall assembly further includes a second base, a plurality of second waist-shaped holes are arranged on the second base, and the rotary driver is mounted on the second base.

[0043] According to an aspect of the present disclosure, the shuttle traveling track including a first inlet/outlet:

[0044] the shuttle traveling track further including a lifting basket having a second inlet/outlet, wherein the second inlet/outlet is configured to be capable of being docked with the first inlet/outlet; and

[0045] wherein the first anti-fall assembly and the second anti-fall assembly are arranged at the first inlet/outlet and the second inlet/outlet, respectively.

[0046] Compared with the prior art, the embodiments of the present disclosure provide a wheel guide track and a node of a shuttle traveling track. The wheels of the four-way shuttle are supported by the traveling groove; the wheels of the four-way shuttle are guided by the guide flanges so that the wheels of the four-way shuttle can travel on the wheel guide track and no flange edge needs to be set on the wheels of the four-way shuttle; the wheels of the four-way shuttle can pass the wheel guide track in the width direction of the bent plate by opening notches on the bent plate and arranging backing plates in the notches. The wheel guide tracks can be seamlessly spliced with each other, the four-way shuttle travels more stably on the wheel guide tracks with low noise generated, and the number of driving wheels of the four-way shuttle can be reduced.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0047] The drawings are used for providing a further understanding of the present disclosure and constitute a part of the specification. The drawings are intended to explain the present disclosure in conjunction with the embodiments of the present disclosure and do not constitute a limitation on the present disclosure. In the drawings:

[0048] FIG. 1 shows a schematic view of a wheel guide track according to an embodiment of the present disclosure;

[0049] FIG. 2 shows a perspective view of a wheel guide track according to an embodiment of the present disclosure;

[0050] FIG. 3 shows a schematic view of a wheel guide track according to an embodiment of the present disclosure;

[0051] FIG. 4 shows a schematic view of a shuttle traveling track according to an embodiment of the present disclosure;

[0052] FIG. 5 shows a schematic view of a connecting plate according to an embodiment of the present disclosure;

[0053] FIG. 6 shows a schematic view of a shuttle traveling track according to an embodiment of the present disclosure;

[0054] FIG. 7 shows a schematic view of a hook twisted leg according to an embodiment of the present disclosure;

[0055] FIG. 8 shows a schematic view of a shuttle traveling track according to an embodiment of the present disclosure;

[0056] FIG. 9 shows a schematic view of a cargo holding track according to an embodiment of the present disclosure;

[0057] FIG. 10 shows a schematic view of an anti-fall mechanism for a vertical storage warehouse according to an embodiment of the present disclosure;

[0058] FIG. 11 shows a schematic view of a vertical storage warehouse according to an embodiment of the present disclosure; and

[0059] FIG. 12 shows a schematic view in another direction of the vertical storage warehouse according to an embodiment of the present disclosure.

### **DETAILED DESCRIPTION**

[0060] In the following, only some exemplary embodiments are briefly described. The described embodiments can be modified in various different ways without departing from the spirit or scope of the present disclosure, as would be apparent to those skilled in the art. Accordingly, the drawings and descriptions are to be regarded as illustrative and not restrictive in nature.

[0061] In the description of the present disclosure, it needs to be understood that the orientation or position relations denoted by such terms as “central” “longitudinal” “latitudinal” “length” “width” “thickness” “above” “below” “front” “rear” “left” “right” “vertical” “horizontal” “top” “bottom” “inside” “outside” “clockwise” “counterclockwise” and the like are based on the orientation or position relations as shown in the accompanying drawings, and are used only for the purpose of facilitating description of the present disclosure and simplification of the description, instead of indicating or suggesting that the denoted devices or elements must be oriented specifically, or configured or operated in a specific orientation. Thus, such terms should not be construed to limit the present disclosure. In addition, such terms as “first” and “second” are only used for the purpose of description, rather than indicating or suggesting relative importance or implicitly indicating the number of the denoted technical features. Accordingly, features defined with “first” and “second” can, expressly or implicitly, include one or more of the features. In the description of the present disclosure, “plurality” means two or more, unless otherwise defined explicitly and specifically.

[0062] In the description of the present disclosure, it needs to be noted that, unless otherwise specified and defined explicitly, such terms as “installation” “coupling” and “connection” should be broadly understood as, for example, fixed connection, detachable connection, or integral connection; or mechanical connection, electrical connection or intercommunication; or direct connection, or indirect connection via an intermediary medium; or internal communication

between two elements or interaction between two elements. For those skilled in the art, the specific meanings of such terms herein can be construed in light of the specific circumstances.

[0063] Herein, unless otherwise specified and defined explicitly, if a first feature is “on” or “beneath” a second feature, this can cover direct contact between the first and second features, or contact via another feature therebetween, other than the direct contact. Furthermore, if a first feature is “on”, “above”, or “over” a second feature, this can cover the case that the first feature is right above or obliquely above the second feature, or just indicate that the level of the first feature is higher than that of the second feature. If a first feature is “beneath”, “below”, or “under” a second feature, this can cover the case that the first feature is right below or obliquely below the second feature, or just indicate that the level of the first feature is lower than that of the second feature.

[0064] The disclosure below provides many different embodiments or examples so as to realize different structures described herein. In order to simplify the disclosure herein, the following will give the description of the parts and arrangements embodied in specific examples. Of course, they are only for the exemplary purpose, not intended to limit the present disclosure. Besides, the present disclosure can repeat a reference number and/or reference letter in different examples, and such repeat is for the purpose of simplification and clarity, which does not represent any relation among various embodiments and/or arrangements as discussed. In addition, the present disclosure provides examples of various specific processes and materials, but those skilled in the art can also be aware of application of other processes and/or use of other materials.

[0065] The preferred embodiments of the present disclosure will be described below with reference to the drawings. It should be appreciated that the preferred embodiments described here are only for the purpose of illustrating and explaining, instead of limiting, the present disclosure.

[0066] FIG. 1 shows a schematic view of a wheel guide track 100 according to an embodiment of the present disclosure, and FIG. 2 shows a perspective view of a wheel guide track 100 according to an embodiment of the present disclosure. The following will be described in detail in conjunction with FIGS. 1 and 2.

[0067] As shown in FIGS. 1 and 2, the wheel guide track 100 includes a bent plate 110. The bent plate 110 includes a first side plate 111, a second side plate 112 and a groove plate 113. The groove plate 113 is connected between the first side plate 111 and the second side plate 112. The groove plate 113 is substantially in a horizontal orientation. The first side plate 111 and the second side plate 112 are substantially in a vertical orientation. A traveling groove 114 extending in the length direction (the first direction) of the bent plate and two guide flanges 115 are formed on the groove plate 113. The traveling groove 114 is located between the two guide flanges 115. The width of the traveling groove 114 is slightly larger than the width of the wheel of the four-way

shuttle (for example, the width of the traveling groove 114 is 1%–5% larger than the width of the wheel) so that the wheel of the four-way shuttle can travel in the traveling groove 114. Meanwhile, the guide flanges 115 on both sides of the traveling groove 114 can provide guidance for the wheel so that the wheel of the four-way shuttle can travel on the wheel guide track 100 and the wheel of the four-way shuttle no longer needs to be provided with flange edges.

[0068] According to an embodiment of the present disclosure, as shown in FIGS. 1 and 2, the lower portion of the first side plate 111 is provided with a bend and formed with a support leg 116, and the lower portion of the second side plate 112 is likewise provided with a bend and formed with a support leg 116. The support legs 116 can provide favorable assistance for the stable arrangement of the wheel guide track 100. Preferably, the support leg 116 is bent outwards with respect to the bent plate 110, and a through hole is arranged on the support leg 116 for the user to mount the wheel guide track 100 to corresponding brackets by using fastening components such as bolts.

[0069] According to an embodiment of the present disclosure, as shown in FIGS. 1 and 2, the bent plate 110 (the first side plate 111, the groove plate 113 and the second side plate 112) is manufactured by an integral molding process such as rolling or bending.

[0070] According to an embodiment of the present disclosure, as shown in FIGS. 1 and 2, the surface of the wheel guide track 100 is provided with a galvanized layer to improve the resistance of the wheel guide track 100 to oxidation corrosion.

[0071] FIG. 3 shows a schematic view of a wheel guide track 200 according to an embodiment of the present disclosure. The following will be described in detail in conjunction with FIG. 3.

[0072] As shown in FIG. 3, the wheel guide track 200 includes a bent plate 210 and multiple backing plates 220. The bent plate 210 includes a first side plate 211, a second side plate 212 and a groove plate 213. The groove plate 213 is connected between the first side plate 211 and the second side plate 212. The groove plate 213 is substantially in a horizontal orientation. The first side plate 211 and the second side plate 212 are substantially in a vertical orientation. A traveling groove 214 extending in the length direction (the first direction) of the bent plate and two guide flanges 215 are formed on the groove plate 213. The traveling groove 214 is located between the two guide flanges 215. The width of the traveling groove 214 is slightly larger than the width of the wheel of the four-way shuttle (for example, the width of the traveling groove 214 is 1%–5% larger than the width of the wheel) so that the wheel of the four-way shuttle can travel in the traveling groove 214. Meanwhile, the guide flanges 215 on both sides of the traveling groove 214 can provide guidance for the wheel so that the wheel of the four-way shuttle can travel on the wheel guide track 200 and the wheel of the four-way shuttle no longer needs to be provided with flange edges. Multiple notches 217 are provided (opened) on the bent plate 210. The notch 217

extends in the width direction (the second direction) of the bent plate 210. The notch 217 extends through the first side plate 211, the second side plate 212 and the groove plate 213. The width of the notch 217 is slightly larger than the width of the wheel of the four-way shuttle (for example, the width of the notch 217 is 1%–5% larger than the width of the wheels). The backing plates 220 are arranged in respective notches 217, and the backing plates 220 are flush with the bottom of the traveling groove 214. By arranging the notches 217 on the bent plate 210 and arranging the backing plates 220 in the notches 217, the wheel of the four-way shuttle can pass the wheel guide track 200 in the width direction of the bent plate 210. Preferably, the backing plates 220 are connected with the bent plate 210 by, for example, welding. After the backing plates 220 and the bent plate 210 are welded with each other, the sufficient connection strength between the backing plates 220 and the bent plate 210 can be ensured, stress concentration can be reduced, and the possibility of cracking on the bent plate 210 at the notches 217 can be reduced.

[0073] According to an embodiment of the present disclosure, as shown in FIG. 3, the lower portion of the first side plate 211 is provided with a bend and formed with a support leg 216. In some embodiments, the lower portion of the second side plate 212 may be provided with a bend and formed with a support leg or the lower portion of the first side plate 211 and the lower portion of the second side plate 212 are each provided with a bend and formed with a support leg, and the present disclosure is not limited thereto. The support leg 216 can provide favorable assistance for the stable arrangement of the wheel guide track 200. Preferably, the support leg 216 is bent outwards with respect to the bent plate 210, and a through hole is arranged on the support leg 216 for the user to mount the wheel guide track 200 to corresponding brackets by using fastening components such as bolts.

[0074] According to an embodiment of the present disclosure, as shown in FIG. 3, the bent plate 210 (the first side plate 211, the groove plate 213 and the second side plate 212) is manufactured by an integral molding process such as rolling or bending.

[0075] According to an embodiment of the present disclosure, as shown in FIG. 3, the surface of the wheel guide track 200 is provided with a galvanized layer to improve the resistance of the wheel guide track 200 to oxidation corrosion.

[0076] FIG. 4 shows a schematic view of a shuttle traveling track according to an embodiment of the present disclosure, and a node 300 for connecting a primary track 310 and a sub-track 320 is illustrated in FIG. 4. The following will be described in detail in conjunction with FIG. 4.

[0077] As shown in FIG. 4, the node 300 includes a primary track 310, a sub-track 320 and a connecting assembly 330. The primary track 310 may employ the wheel guide track 200 described above, and the sub-track 320 may employ the wheel guide track 100 described above. The primary track 310 is substantially perpendicular to the sub-track 320. The traveling groove of the sub-track

320 is aligned with the notch of the primary track 310. The connecting assembly 330 is fixedly connected at the bottom of the primary track 310 and the bottom of the sub-track 320. By connecting and supporting the primary track 310 and the sub-track 320 through the connecting assembly 330, the traveling groove 114 of the sub-track 320 can be accurately aligned with the notch 217 of the primary track 310 so that the traveling groove 114 of the sub-track 320, the traveling groove 214 of the primary track 310 and the backing plate 220 are at the same height, and thus the primary track 310 and the sub-track 320 are seamlessly spliced with each other, thereby enabling the four-way shuttle to travel on the primary track 310 and the sub-track 320 stably and fast with low noise generated and facilitating the reduction of the number of driving wheels of the four-way shuttle.

[0078] According to an embodiment of the present disclosure, as shown in FIG. 4, the connecting assembly 330 may include a connecting plate 331 and multiple spacers 332. The connecting plate 331 has a support surface 3311. The spacers 332 are arranged on the support surface 3311. The connecting plate 331 may be arranged in the length direction of the sub-track 320. One end (for example, the left end) of the sub-track 320 is overlapped on a corresponding spacer 332 (the spacer 332 is located at the right end of the connecting plate 331), and the sub-track 320 is fixedly connected with the connecting plate 331 and the corresponding spacer 332 (for example, by fasteners such as bolts). The position of the primary track 310 where the notch 217 is arranged is overlapped on a corresponding spacer 332 (the spacer 332 is located at the left end of the connecting plate 331), and the primary track 310 is fixedly connected with the connecting plate 331 and the corresponding spacer 332 (for example, by fasteners such as bolts).

[0079] FIG. 5 shows a schematic view of a connecting plate 331 according to an embodiment of the present disclosure. As shown in FIG. 5, the connecting plate is substantially U-shaped. The connecting plate 331 may include a first support portion 3312, a third side plate 3313, a bottom plate 3314, a fourth side plate 3315 and a second support portion 3316 that are sequentially connected by bending. The third side plate 3313, the bottom plate 3314 and the fourth side plate 3315 define a second groove 3317 that is substantially U-shaped. The first support portion 3312 and the second support portion 3316 are bent outwards with respect to the second groove 3317 respectively to form the support surface 3311. The connecting plate 331 has a stable structure and can provide effective support for the primary track 310 and the sub-track 320, and the connecting plate 331 also has the advantages of simple structure, ease of production, low cost, and so on.

[0080] FIG. 6 shows a schematic view of a shuttle traveling track according to an embodiment of the present disclosure, and a node 400 for connecting a primary track 310 and a sub-track 320 is illustrated in FIG. 6. The following will be described in detail in conjunction with FIG. 6.

[0081] As shown in FIG. 6, the node 400 also includes a primary track 310, a sub-track 320, a connecting plate 331 and spacers 332 that are the same as those in the embodiment of FIG. 4, where one or more of the spacers 332 may be arranged, which will not be repeated here. As shown in FIG. 6, the node 400 further includes a hook twisted leg 411. The hook twisted leg 411, the connecting plate 331 and the spacer 332 constitute the connecting assembly 410 of the node 400. FIG. 7 shows a schematic view of a hook twisted leg 411 according to an embodiment of the present disclosure. As shown in FIGS. 6 and 7, the hook twisted leg 411 includes a first connecting portion 4111 and a second connecting portion 4112 connected with each other. The first connecting portion 4111 is substantially perpendicular to the second connecting portion 4112. The first connecting portion 4111 is overlapped on the support surface 3311 of the connecting plate 331, one end (for example, the left end) of the sub-track 320 is overlapped on the first connecting portion 4111, and the sub-track 320, the first connecting portion 4111 and the connecting plate 331 are fixedly connected with each other (for example, by fasteners such as bolts). The part of the primary track 310 where the notch 217 is arranged is located above the connecting plate 331. The spacer 332 is located between the first side plate of the primary track 310 and the connecting plate 331, the first side plate of the primary track 310 is overlapped on one or more spacers 332, and the first side plate 211, the spacer 332 and the connecting plate 331 are fixedly connected with each other (for example, by fasteners such as bolts). The second side plate 212 of the primary track 310 is overlapped on the support surface 3311, and the second side plate 212 is fixedly connected with the second connecting portion 4112 of the hook twisted leg 411.

[0082] According to an embodiment of the present disclosure, as shown in FIGS. 5 and 7, the first connecting portion 4111 of the hook twisted leg 411 and the spacer 332 have substantially the same thickness so that the traveling groove of the sub-track 320, the traveling groove of the primary track 310 and the backing plate are at the same height, thereby enabling the four-way shuttle to travel on the primary track 310 and the sub-track 320 stably and fast with low noise generated.

[0083] According to an embodiment of the present disclosure, as shown in FIG. 7, multiple hooks 4113 may be arranged on the second connecting portion 4112. The arrangement of the hooks 4113 allows the second connecting portion 4112 to be connected with the rack upright column so that the bearing load of the sub-track 320 can be transmitted to the rack upright column through the hook twisted legs 411, which is beneficial to increasing the bearing capacity of the sub-track 320.

[0084] According to an embodiment of the present disclosure, as shown in FIG. 7, the hook twisted leg 411 may further include a third connecting portion 4114. The third connecting portion 4114 is connected with and substantially perpendicular to the second connecting portion 4112. The

third connecting portion 4114 can be used for mounting a cargo holding track 420. Specifically, FIG. 8 shows a schematic view of a shuttle traveling track according to an embodiment of the present disclosure. As shown in FIG. 8, both ends of the cargo holding track 420 may be overlapped on the third connecting portions 4114 of two hook twisted legs 411 respectively and fixedly connected with the third connecting portions 4114 (for example, by fasteners such as bolts). The cargo holding track 420 is higher than and roughly parallel to the sub-track 320. The cargo holding track 420 may be used for supporting pallets or goods. The cargo holding track 420 and the sub-track 320 are configured as a separated structure. The cargo holding track 420 and the sub-track 320 are fastened to the hook twisted legs 411 by bolts, which makes it easy to ensure the relative position between the two tracks (the cargo holding track 420 and the sub-track 320). Meanwhile, according to the different working conditions (different four-way shuttles or different pallets or goods), the relative position between the sub-track 320 and the cargo holding track 420 can be changed by changing the structural form of the hook twisted leg 411.

[0085] FIG. 9 shows a schematic view of a cargo holding track 420 according to an embodiment of the present disclosure. As shown in FIG. 9, the cargo holding track 420 may include a mounting portion 421, a cargo support portion 422, a transition portion 423 and a track support portion 424 that are sequentially connected by bending. The mounting portion 421, the cargo support portion 422 and the transition portion 423 define a first groove 425, and the track support portion 424 is bent outwards with respect to the first groove 425. When the cargo holding track 420 is connected onto the third connecting portion 4114 of the hook twisted leg 411, the cargo support portion 422 of the cargo holding track 420 is overlapped on the third connecting portion 4114, the mounting portion 421 is fixedly connected with the third connecting portion 4114 (for example, by fasteners such as bolts), and the track support portion 424 is overlapped on the second connecting portion 4112.

[0086] Compared with the prior art, the embodiments of the present disclosure provide a wheel guide track and a node of a shuttle traveling track. The wheels of the four-way shuttle are supported by the traveling groove; the wheels of the four-way shuttle are guided by the guide flanges so that the wheels of the four-way shuttle can travel on the wheel guide track and no flange edge needs to be provided on the wheels of the four-way shuttle; the wheels of the four-way shuttle can pass the wheel guide track in the width direction of the bent plate by providing notches on the bent plate and arranging backing plates in the notches. The wheel guide tracks can be seamlessly spliced with each other, the four-way shuttle travels more stably on the wheel guide tracks with low noise generated, and the number of driving wheels of the four-way shuttle can be reduced.

[0087] FIG. 10 shows a schematic view of an anti-fall mechanism 500 for a vertical storage warehouse according to an embodiment of the present disclosure. The following will be described in detail in conjunction with FIG. 10.

[0088] As shown in FIG. 10, the anti-fall mechanism 500 includes a first anti-fall assembly 510 and a second anti-fall assembly 520. The first anti-fall assembly 510 includes a first base 511, a stop rod 512 and a reset (restoring) spring 513. The stop rod 512 has a first blocking position and a first avoidance position (in FIG. 10, the stop rod 512 is in the first blocking position). The first blocking position is higher than the first avoidance position. The stop rod 512 is slidably arranged on the first base 511 and is configured to be switchable between the first blocking position and the first avoiding position. The reset spring 513 is connected between the first base 511 and the stop rod 512, and the reset spring 513 can enable the stop rod 512 to be reset to the first blocking position by its elastic force. The second anti-fall assembly 520 includes a rotary driver 521 and a stop arm 522. The rotary driver 521 may be an electric motor or a steering engine. The output shaft of the rotary driver 521 is connected with the stop arm 522. The stop arm 522 has a second blocking position and a second avoidance position (in FIG. 10, the stop arm 522 is between the second blocking position and the second avoidance position). The second blocking position is higher than the second avoidance position. For example, the stop arm 522 is in a vertical orientation when the stop arm 522 is in the second blocking position, and the stop arm 522 is in a horizontal orientation when the stop arm 522 is in the second avoidance position. The rotary driver 521 may drive the stop arm 522 to rotate so that the stop arm 522 can switch between the second blocking position and the second avoidance position. The stop arm 522 is configured to be capable of driving the stop rod 512 to switch from the first blocking position to the first avoidance position when the stop arm 522 switches from the second blocking position to the second avoidance position.

[0089] The first anti-fall assembly 510 and the second anti-fall assembly 520 may be independently mounted. For example, the first anti-fall assembly 510 may be mounted on a rack track (such as the wheel guide tracks 100 and 200 shown in FIGS. 1 to 3 and the traveling tracks shown in FIGS. 4, 6 and 8), and the first anti-fall assembly 510 can prevent the four-way shuttle from rushing out of the rack track. The second anti-fall assembly 520 may be mounted on a lifting basket, and the second anti-fall assembly 520 can prevent the four-way shuttle from rushing out of the lifting basket. When the rack track and the lifting basket are docked with each other, the rotary driver 521 can drive the stop arm 522 to switch from the second blocking position to the second avoidance position, and the stop arm 522 drives the stop rod 512 to switch from the first blocking position to the first avoidance position so that the four-way shuttle can travel between the rack track and the lifting basket. In some embodiments, the second anti-fall assembly 520 may also be

mounted on the rack track, the first anti-fall assembly 510 may also be mounted on the lifting basket, and at this time, the anti-fall mechanism 500 may still have an anti-fall effect. The number of first anti-fall assemblies 510 and the number of second anti-fall assemblies 520 may be determined according to the number of rack tracks and the number of lifting baskets in the vertical storage warehouse, and the present disclosure is not limited thereto.

[0090] According to an embodiment of the present disclosure, as shown in FIG. 10, a first mounting hole 514 may be arranged on the top of the first base 511, a second mounting hole 515 is arranged on a side (the front side, as shown in FIG. 10) of the first base 511, and the first mounting hole 514 communicates with the second mounting hole 515. The stop rod 512 may include a first rod member 516 and a second rod member 517. The first rod member 516 is movably inserted into the first mounting hole 514, the second rod member 517 is movably inserted into the second mounting hole 515, and the first rod member 516 is connected with the second rod member 517. The first rod member 516 is used for blocking the four-way shuttle and preventing the four-way shuttle from rushing out of the rack track or the lifting basket. The second rod member 517 is used for cooperating with the stop arm 522 so that the stop arm 522 can drive the stop rod 512 to switch from the first blocking position to the first avoidance position.

[0091] According to an embodiment of the present disclosure, as shown in FIG. 10, an anti-detachment head 518 is arranged on the top of the first rod member 516. The anti-detachment head 518 may be fixed at the top of the first rod member 516 by welding, screw connection, bolt connection and the like or may be integrally formed with the first rod member 516. It should be noted that the diameter of the anti-detachment head 518 is larger than the diameter of the first rod member 516. The reset spring 513 is sleeved on the first rod member 516. One end (the lower end, as shown in FIG. 10) of the reset spring 513 abuts against the first base 511, and the other end (the upper end, as shown in FIG. 10) abuts against the anti-detachment head 518. The reset spring 513 can provide an upward force for the anti-detachment head 518 (the first rod member 516) to enable the stop rod 512 to be reset (restore) to the first blocking position.

[0092] According to an embodiment of the present disclosure, as shown in FIG. 10, multiple first waist-shaped holes 519 may be arranged on a side (the front side) of the first base 511. The first waist-shaped holes 519 are through holes. By providing multiple first waist-shaped holes 519 on the first base 511, it is convenient for the user to fix the first anti-fall assembly 510 to the rack track or the lifting basket, and it is also convenient for the user to adjust the position of the first anti-fall assembly 510 on the rack track or the lifting basket according to the actual situation, thereby ensuring that the first anti-fall assembly 510 can play an anti-fall role when the rack track and the lifting basket are not docked with each other and preventing the first anti-fall assembly 510

from affecting the traveling of the four-way shuttle when the rack track is docked with the lifting basket.

[0093] According to an embodiment of the present disclosure, as shown in FIG. 10, an anti-detachment protrusion 523 is arranged on the end of the stop arm 522 away from the rotary driver 521 to prevent the stop arm 522 from being detached from the stop rod 512, thereby improving the reliability of the anti-fall mechanism 500.

[0094] According to an embodiment of the present disclosure, as shown in FIG. 10, the second anti-fall assembly 520 may further include a flange plate 524. The output shaft of the rotary driver 521 is connected with the stop arm 522 through the flange plate 524. Specifically, the flange plate 524 is bolted to the output shaft of the rotary driver 521, and the stop arm 522 is bolted to the flange plate 524.

[0095] According to an embodiment of the present disclosure, as shown in FIG. 10, the second anti-fall assembly 520 may further include a second base 525. The rotary driver 521 is mounted on the second base 525. Multiple second waist-shaped holes 526 are arranged on the second base 525. The second waist-shaped holes 526 are through holes. By providing multiple second waist-shaped holes 526 on the second base 525, it is convenient for the user to fix the second anti-fall assembly 520 to the rack track or the lifting basket, and it is also convenient for the user to adjust the position of the second anti-fall assembly 520 on the rack track or the lifting basket according to the actual situation, thereby ensuring that the stop arm 522 of the second anti-fall assembly 520 can drive the stop rod 512 of the first anti-fall assembly 510.

[0096] Specifically, the second base 525 may include a horizontal plate and a vertical plate. As shown in FIG. 10, the horizontal plate is in a horizontal orientation, and the vertical plate is fixedly connected with one end (the rear end, as shown in FIG. 10) of the horizontal plate and substantially perpendicular to the horizontal plate. A mounting hole (not shown) is arranged on the vertical plate, the rotary driver 521 is mounted on the horizontal plate, and the output shaft of the rotary driver 521 passes through the mounting hole and through the vertical plate. A bearing may be arranged between the output shaft of the rotary driver 521 and the mounting hole to provide support for the output shaft of the rotary driver 521.

[0097] Compared with the prior art, the embodiments of the present disclosure provide an anti-fall mechanism 500 for a vertical storage warehouse, and the anti-fall mechanism 500 has a simple structure, occupies small space, is highly maintainable and has low requirements for an electrical control system. The first anti-fall assembly 510 and the second anti-fall assembly 520 of the anti-fall mechanism 500 may be mounted on the rack track and the lifting basket, respectively. The first anti-fall assembly 510 can block the four-way shuttle by the stop rod 512, and the second anti-fall assembly 520 can block the four-way shuttle by the stop arm 522, thereby preventing the four-way

shuttle from rushing out of the rack track or the lifting basket when the rack track and the lifting basket are not docked with each other.

[0098] FIG. 11 shows a schematic view of a vertical storage warehouse 600 according to an embodiment of the present disclosure, and FIG. 12 shows a schematic view in another direction of the vertical storage warehouse 600 according to an embodiment of the present disclosure. The following will be described in detail in conjunction with FIGS. 11 and 12.

[0099] As shown in FIGS. 11 and 12, the vertical storage warehouse 600 includes a rack track 610, a lifting basket 620 and the anti-fall mechanism 500 described above. The rack track is, for example, the wheel guide tracks 100 and 200 shown in FIGS. 1 to 3 and the traveling tracks shown in FIGS. 4, 6 and 8. One or more layers of rack tracks 610 may be arranged in the height direction (one layer of the rack track 610 is schematically shown in FIGS. 11 and 12), and the lifting basket 620 may be moved between the multiple layers of rack tracks 610. The rack track 610 has a first inlet/outlet 611, and the lifting basket 620 has a second inlet/outlet 621. When the lifting basket 620 is substantially flush with the rack track 610, the first inlet/outlet 611 of the rack track 610 is docked with the second inlet/outlet 621 of the lifting basket 620. The first anti-fall assembly 510 and the second anti-fall assembly 520 of the anti-fall mechanism 500 may be mounted at the first inlet/outlet 611 and the second inlet/outlet 621, respectively. For example, as shown in FIGS. 11 and 12, the first anti-fall assembly 510 may be mounted at the first inlet/outlet 611 of the rack track 610, and the second anti-fall assembly 520 may be mounted at the second inlet/outlet 621 of the lifting basket 620. The first anti-fall assembly 510 can prevent the four-way shuttle from rushing out of the rack track 610, and the second anti-fall assembly 520 can prevent the four-way shuttle from rushing out of the lifting basket 620. When the rack track 610 is docked with the lifting basket 620, the rotary driver 521 may drive the stop arm 522 to switch from the second blocking position to the second avoidance position, and the stop arm 522 may drive the stop rod 512 to switch from the first blocking position to the first avoidance position so that the four-way shuttle can travel between the rack track 610 and the lifting basket 620. It should be noted that when there are multiple layers of rack tracks 610, one first anti-fall assembly 510 may be configured for each layer of the rack track 610. In some embodiments, the second anti-fall assembly 520 may also be mounted at the first inlet/outlet 611 of the rack track 610, the first anti-fall assembly 510 may also be mounted at the second inlet/outlet 621 of the lifting basket 620, and by this configuration, the anti-fall mechanism 500 may still have an anti-fall effect.

[0100] The traveling tracks shown in FIGS. 4, 6 and 8 may be provided with the first inlet/outlet. Correspondingly, the shuttle traveling track further includes the lifting basket having a second inlet/outlet, wherein the second inlet/outlet is configured to be capable of being docked with the

first inlet/outlet. The first anti-fall assembly and the second anti-fall assembly are arranged at one of the first inlet/outlet and the second inlet/outlet, respectively.

[0101] According to an embodiment of the present disclosure, the vertical storage warehouse 600 may further include a four-way shuttle (not shown). The four-way shuttle is configured to be capable of traveling on the rack track 610 and the lifting basket 620.

[0102] Compared with the prior art, the embodiments of the present disclosure also provide a vertical storage warehouse 600. By providing the anti-fall mechanism 500 at the rack track 610 and/or the second inlet/outlet 621 of the lifting basket 620, the four-way shuttle can be prevented from rushing out of the rack track 610 or the lifting basket 620 when the rack track 610 and the lifting basket 620 are not docked with each other, and the four-way shuttle can be enabled to travel smoothly on the rack track 610 and the lifting basket 620 when the rack track 610 is docked with the lifting basket 620.

[0103] Finally, it should be noted that the above are merely preferred embodiments of the present utility mode and are not intended to limit the present utility mode. Although the present utility mode has been described in detail with reference to the preceding embodiments, those skilled in the art can still modify the technical solutions described in the preceding embodiments or make equivalent substitutions on part of the technical features therein. All modifications, equivalent substitutions and improvements made within the spirit and principle of the present disclosure fall within the protection scope of the present disclosure.

## CLAIMS

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1. A wheel guide track, comprising:

a bent plate comprising a first side plate, a second side plate and a groove plate, wherein the groove plate is connected between the first side plate and the second side plate, the groove plate forms a traveling groove extending in a length direction of the bent plate and two guide flanges, the traveling groove is located between the two guide flanges, and the traveling groove is configured to allow a wheel to travel; and

a plurality of backing plates;

wherein a plurality of notches are provided on the bent plate, the notches extend in a width direction of the bent plate, the notches are configured to allow a wheel to pass, the backing plates are arranged in respective notches, and the backing plates are flush with a bottom of the traveling groove.

2. The wheel guide track according to claim 1, wherein the first side plate and/or the second side plate are provided with a bend and formed with a support leg, the backing plates are welded to the bent plate.

3. The wheel guide track according to any one of claims 1 to 2, wherein the first side plate, the second side plate and the groove plate are integrally bent-formed or integrally roll-formed; and/or

a surface of the wheel guide track is provided with a galvanized layer.

4. A shuttle traveling track, comprising:

the wheel guide track according to any one of claims 1 to 3;

a sub-guide track having a traveling groove, wherein the sub-guide track is substantially perpendicular to the wheel guide track, and the traveling groove of the sub-guide track is aligned with a notch of the wheel guide track; and

a connecting assembly arranged at a bottom of the wheel guide track and a bottom of the sub-guide track and fixedly connected with the wheel guide track and the sub-guide track respectively.

5. The shuttle traveling track according to claim 4, wherein the connecting assembly comprises:

a connecting plate having a support surface; and

a plurality of spacers arranged on the support surface;

wherein the wheel guide track and the sub-guide track are overlapped on respective spacers and fixedly connected with the connecting plate and the respective spacers, respectively.

6. The shuttle traveling track according to claim 4, wherein the connecting assembly

comprises:

a connecting plate having a support surface;

one or more spacers arranged on the support surface; and

a hook twisted leg comprising a first connecting portion and a second connecting portion connected with each other, wherein the first connecting portion is substantially perpendicular to the second connecting portion, and the first connecting portion is overlapped on the support surface;

wherein the first side plate of the wheel guide track is overlapped on the one or more spacers and fixedly connected with the one or more spacers and the connecting plate; the second side plate of the wheel guide track is overlapped on the support surface and fixedly connected with the second connecting portion; the sub-guide track is overlapped on the first connecting portion and fixedly connected with the first connecting portion and the connecting plate.

7. The shuttle traveling track according to claim 6, wherein the one or more spacers and the first connecting portion have substantially the same thickness.

8. The shuttle traveling track according to claim 6, wherein a plurality of hooks are arranged on the second connecting portion.

9. The shuttle traveling track according to claim 6, wherein the hook twisted leg further comprises a third connecting portion, and the third connecting portion is connected with and substantially perpendicular to the second connecting portion;

the shuttle traveling track further comprises a cargo holding track, the cargo holding track is overlapped on the third connecting portion and fixedly connected with the third connecting portion, and the cargo holding track is higher than the sub-guide track and substantially parallel to the sub-guide track.

10. The shuttle traveling track according to claim 9, wherein the cargo holding track comprises a mounting portion, a cargo support portion, a transition portion and a track support portion that are sequentially connected by bending, wherein the mounting portion, the cargo support portion and the transition portion define a first groove, and the track support portion is bent outwards with respect to the first groove.

11. The shuttle traveling track according to claim 10, wherein the cargo support portion is overlapped on the third connecting portion, the mounting portion is fixedly connected with the third connecting portion, and the track support portion is overlapped on the second connecting portion.

12. The shuttle traveling track according to any one of claims 5 to 11, wherein the connecting plate comprises a first support portion, a third side plate, a bottom plate, a fourth side plate and a second support portion that are sequentially connected by bending, the bottom plate, the third side plate and the fourth side plate define a second groove, and the first support portion

and the second support portion are bent outwards with respect to the second groove respectively to form the support surface.

13. The shuttle traveling track according to any one of claims 4 to 12, further comprising an anti-fall mechanism for a vertical storage warehouse, the anti-fall mechanism comprising:

a first anti-fall assembly comprising a first base, a stop rod and a reset spring, wherein the stop rod is arranged on the first base, the stop rod is configured to be switchable between a first blocking position and a first avoidance position, the first blocking position is higher than the first avoidance position, and the reset spring is connected with the stop rod and configured to enable the stop rod to be reset to the first blocking position; and

a second anti-fall assembly comprising a rotary driver and a stop arm connected with each other, wherein the rotary driver is configured to drive the stop arm to switch between a second blocking position and a second avoidance position, the second blocking position is higher than the second avoidance position, and the stop arm is configured to be capable of driving the stop rod to switch from the first blocking position to the first avoidance position when the stop arm switches from the second blocking position to the second avoidance position.

14. The shuttle traveling track according to claim 13, wherein a first mounting hole is arranged on a top of the first base, a second mounting hole is arranged on a side of the first base, and the first mounting hole communicates with the second mounting hole;

the stop rod comprises a first rod member and a second rod member, wherein the first rod member is inserted into the first mounting hole, the second rod member is inserted into the second mounting hole, and the first rod member is connected with the second rod member.

15. The shuttle traveling track according to claim 14, wherein an anti-detachment head is arranged on a top of the first rod member;

the reset spring is sleeved on the first rod member, one end of the reset spring abuts against the first base, and the other end of the reset spring abuts against the anti-detachment head.

16. The shuttle traveling track according to claim 14, wherein a plurality of first waist-shaped holes are further arranged on the side of the first base.

17. The shuttle traveling track according to claim 13, wherein the second anti-fall assembly further comprises a flange plate, and an output shaft of the rotary driver is connected with the stop arm through the flange plate, an anti-detachment protrusion is arranged on an end of the stop arm away from the rotary driver.

18. The shuttle traveling track according to claim 13, wherein the rotary driver is an electric motor or a steering engine.

19. The shuttle traveling track according to claim 13, wherein the second anti-fall assembly further comprises a second base, a plurality of second waist-shaped holes are arranged on

the second base, and the rotary driver is mounted on the second base.

20. The shuttle traveling track according to claim 13, wherein the shuttle traveling track comprising a first inlet/outlet,

the shuttle traveling track further comprising a lifting basket having a second inlet/outlet, wherein the second inlet/outlet is configured to be capable of being docked with the first inlet/outlet; and

wherein the first anti-fall assembly and the second anti-fall assembly are arranged at the first inlet/outlet and the second inlet/outlet, respectively.