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(54) **FORKLIFT SUPPORTING LEG, AND AUTOMATED GUIDED FORKLIFT**

(57) A forklift support leg and an automated guided forklift. The forklift support leg (1) includes a support leg body (2), a hinging plate (3) and a driving wheel assembly (4). The hinging plate (3) is connected with the driving wheel assembly (4) and hinged to the support leg body

(2). The hinging plate (3) is perpendicularly disposed relative to a support direction of driving wheels of the driving wheel assembly (4), or obliquely disposed relative to the support direction of the driving wheels of the driving wheel assembly (4).

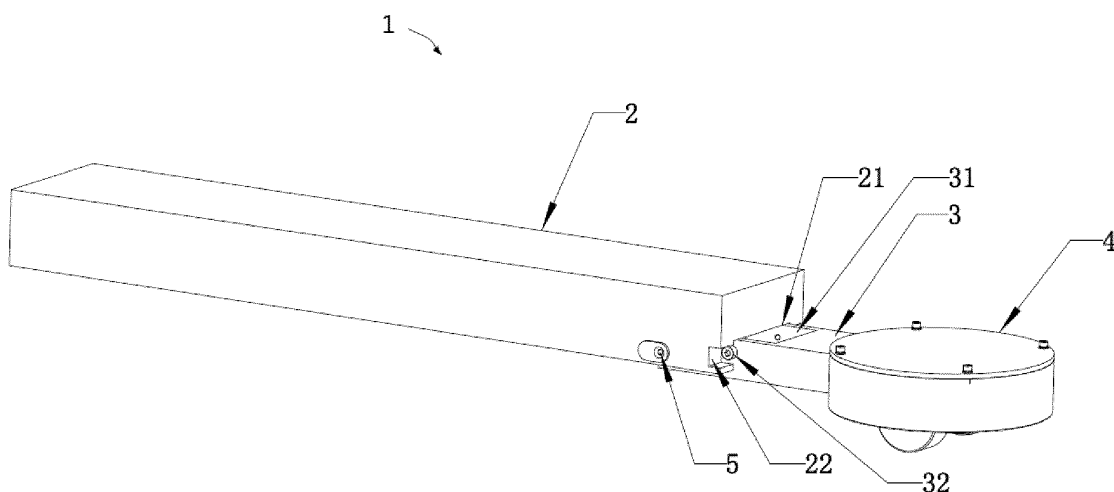


FIG. 1a

Description

TECHNICAL FIELD

[0001] The present disclosure relates to the field of automated guided transport technologies, and in particular to a forklift support leg and an automated guided forklift.

BACKGROUND

[0002] As the fast-developing technologies such as artificial intelligence and computer are successfully applied to conventional transport vehicles, unmanned vehicles appear. One of the unmanned vehicles is an automated guided forklift, which has become important transportation equipment in the fields such as intelligent warehousing, intelligent factory and logistics.

SUMMARY

[0003] According a first aspect of embodiments of the present disclosure, there is provided a forklift support leg, including a support leg body, a hinging plate and a driving wheel assembly. The hinging plate is connected with the driving wheel assembly and hinged to the support leg body. The hinging plate is perpendicularly disposed relative to a support direction of one or more driving wheels of the driving wheel assembly, or obliquely disposed relative to the support direction of the one or more driving wheels of the driving wheel assembly.

[0004] In some embodiments of the present disclosure, the driving wheel assembly includes a vertically-disposed driving outer frame, a driving module disposed in a cavity enclosed by the driving outer frame, and the one or more driving wheels connected with the driving module, an edge of a lower part of the one or more driving wheels protrudes from a bottom of the driving outer frame; the hinging plate is located outside the driving outer frame and fixedly connected with the driving outer frame.

[0005] In some embodiments of the present disclosure, when the hinging plate is obliquely disposed relative to the support direction of the one or more driving wheels of the driving wheel assembly, an included acute angle between the hinging plate and the support direction of the one or more driving wheels of the driving wheel assembly is greater than or equal to 80 degrees and less than 90 degrees.

[0006] In some embodiments of the present disclosure, a first through hole is disposed in the hinging plate, a second through hole is disposed in the support leg body, the first through hole corresponds to the second through hole, and a hinging shaft is inserted through the first through hole and the second through hole.

[0007] In some embodiments of the present disclosure, a first groove with an opening facing downward is disposed on the support leg body; a second groove with an opening facing upward is disposed proximate to a

hinging position on an upper surface of the hinging plate, and the second groove corresponds to the first groove; a spring is disposed in the second groove, a top end of the spring is abutted against a lower surface of the first groove, and a bottom end of the spring is abutted against an upper surface of the second groove; an abutting position where the bottom end of the spring is abutted against on the upper surface of the second groove is located at a side of the hinging shaft proximate to the driving wheel assembly; or, a torsional spring is disposed on the hinging shaft, an end of the torsional spring is abutted against the support leg body, and other end is abutted against the hinging plate from above the hinging plate; wherein an abutting position of the torsional spring on the hinging plate is located at a side of the hinging shaft proximate to the driving wheel assembly.

[0008] In some embodiments of the present disclosure, a third groove with an opening facing toward the driving wheel assembly is disposed on the support leg body, the third groove does not penetrate through a lower surface and an upper surface of the support leg body, and the hinging plate is inserted into the third groove through the opening; a second groove with an opening facing upward is disposed proximate to a hinging position on an upper surface of the hinging plate, and the second groove corresponds to the third groove; a spring is disposed in the second groove, a top end of the spring is abutted against an upper surface of the third groove and a bottom end of the spring is abutted against an upper surface of the second groove; wherein an abutting position where the bottom end of the spring is abutted against on the upper surface of the second groove is located at a side of the hinging shaft proximate to the driving wheel assembly; or, a torsional spring is disposed on the hinging shaft, an end of the torsional spring is abutted against the support leg body, and other end is abutted against the hinging plate from above the hinging plate; wherein an abutting position of the torsional spring on the hinging plate is located at a side of the hinging shaft proximate to the driving wheel assembly.

[0009] In some embodiments of the present disclosure, a limiting structure for limiting a range that the hinging plate rotates relative to the support leg body is disposed on the forklift support leg.

[0010] In some embodiments of the present disclosure, a first groove with an opening facing downward is disposed on the support leg body, and a first end of the hinging plate is inserted a predetermined length into the first groove on the support leg body and hinged on the support leg body by a hinging shaft; the limiting structure includes a first limiting structure for limiting a range that the hinging plate rotates upward relative to the support leg body, and/or, a second limiting structure for limiting a range that the hinging plate rotates downward relative to the support leg body; the first limiting structure includes the first groove; the second limiting structure includes a limiting groove opened at an end of the support leg body and a limiting column disposed on a side portion of the

hinging plate, and the limiting column is located in the limiting groove.

[0011] In some embodiments of the present disclosure, the hinging plate is hinged on a first end of the support leg body and the hinging position is proximate to a bottom of the support leg body.

[0012] In some embodiments of the present disclosure, a third groove with an opening facing toward the driving wheel assembly is disposed on the support leg body, the third groove does not penetrate through a lower surface and an upper surface of the support leg body, and a first end of the hinging plate is inserted a predetermined length into the third groove on the support leg body through the opening, and hinged on the support leg body by a hinging shaft; the limiting structure includes the third groove.

[0013] In some embodiments of the present disclosure, a third groove with an opening facing toward the driving wheel assembly is disposed on the support leg body, the third groove does not penetrate through a lower surface and an upper surface of the support leg body, and a first end of the hinging plate is inserted a predetermined length into the third groove on the support leg body through the opening, and hinged on the support leg body by a hinging shaft; the limiting structure includes a limiting groove opened at an end of the support leg body and a limiting column disposed on a side portion of the hinging plate, and the limiting column is located in the limiting groove.

[0014] In some embodiments of the present disclosure, the driving wheel assembly is located outside the support leg body.

[0015] According to a second aspect of embodiments of the present disclosure, there is provided an automated guided forklift, including a chassis, one or more chassis driving wheel assemblies and/or one or more casters disposed at a bottom of the chassis and one or more forklift support legs connected at one or more positions of the chassis proximate to the bottom of the chassis, and the one or more forklift support legs extend transversely at an end of the chassis. The one or more forklift support legs are the forklift support leg described in any one of the above embodiments.

[0016] In some embodiments of the present disclosure, one or more chassis driving wheel assemblies and one or more casters are disposed at the bottom of the chassis; wherein the one or more chassis driving wheel assemblies include a first chassis driving wheel assembly and the one or more casters include a first caster and a second caster; the first chassis driving wheel assembly, the first caster and the second caster are disposed in a spacing; wherein the first chassis driving wheel assembly is located between the first caster and the second caster, and the first caster and/or the second caster is rigidly connected with the bottom of the chassis.

[0017] In some embodiments of the present disclosure, one or more chassis driving wheel assemblies and one or more casters are disposed at the bottom of the

chassis; wherein the one or more chassis driving wheel assemblies are first chassis driving wheel assemblies, and the one or more casters are first casters; the first chassis driving wheel assembly and the first caster are disposed in a spacing, and the first caster is rigidly connected with the bottom of the chassis.

[0018] In some embodiments of the present disclosure, one or more chassis driving wheel assemblies are disposed at the bottom of the chassis and include a first chassis driving wheel assembly and a second chassis driving wheel assembly, and the first chassis driving wheel assembly and the second chassis driving wheel assembly are disposed in a spacing.

[0019] In some embodiments of the present disclosure, a chassis driving wheel assembly is disposed in a middle of the bottom of the chassis.

[0020] In some embodiments of the forklift support leg and the automated guided forklift in the present disclosure, by perpendicularly or obliquely disposing the hinging plate relative to the support direction of the driving wheels, the driving wheel assembly is hinged on the support leg body. On one hand, an integral structure formed by connecting the driving wheel assembly and the support leg body has a small thickness, helping adapt to low operation space; on the other hand, the driving wheel assembly may float up and down relative to the support leg body such that an effective driving force may be provided even in a case where the ground is uneven, resulting in good ground adaptation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] In order to more clearly describe the technical solutions in the embodiments of the present disclosure or in the prior arts, drawings required for descriptions of the embodiments or prior arts will be briefly introduced. However, the drawings described hereunder are only some embodiments, and other drawings may also be obtained by a person skilled in the art based on these drawings without making creative work.

FIG. 1a a schematic diagram showing a structure of a forklift support leg according to some embodiments of the present disclosure.

FIG. 1b is a schematic diagram showing a driving wheel assembly of the forklift support leg shown in FIG. 1a moves downwards when in a hole on the ground.

FIG. 2a is a schematic diagram showing a stereoscopic structure of the driving wheel assembly of the forklift support leg shown in FIG. 1a.

FIG. 2b is a schematic diagram showing a stereoscopic exploded structure of the driving wheel assembly of the forklift support leg in FIG. 1a.

FIG. 2c is a top view showing the driving wheel assembly without a cover in the forklift support leg in FIG. 1a.

FIG. 2d is a schematic diagram showing a driving

module is limited in the driving wheel assembly of the forklift support leg in FIG. 1a.

FIG. 3 is a schematic diagram showing a hinging plate is downwardly obliquely disposed relative to a support direction of driving wheels.

FIG. 4a is a schematic diagram showing a structure of the hinging plate of the forklift support leg in FIG. 1a, where a spring is disposed.

FIG. 4b is a schematic diagram showing a structure of the hinging plate of the forklift support leg in FIG. 1a, where a torsional spring is disposed.

FIG. 5a is a schematic diagram showing a structure of a forklift support leg according to some embodiments of the present disclosure.

FIG. 5b is a schematic diagram showing the driving wheel assembly of the forklift support leg in FIG. 5a moves downwards when in a hole on the ground.

FIG. 6 is a schematic diagram showing a side structure of an automated guided forklift placed on the ground according to some embodiments of the present disclosure.

FIG. 7 is a schematic diagram showing a stereoscopic structure of the automated guided forklift shown in FIG. 6.

FIG. 8 is a schematic diagram showing a stereoscopic structure of a chassis driving wheel assembly according to some embodiments of the present disclosure.

FIG. 9 is a schematic diagram showing a structure of an automated guided forklift according to some embodiments of the present disclosure.

FIG. 10 is a schematic diagram showing a structure of an automated guided forklift according to some embodiments of the present disclosure.

FIG. 11 is a schematic diagram showing a structure of an automated guided forklift according to some embodiments of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0022] The embodiments of the present disclosure will be detailed in combination with accompanying drawings. It will be understood that the embodiments described herein are only some embodiments rather than all embodiments. All other embodiments obtained by a person skilled in the art based on the embodiments of the present disclosure without requiring creative work shall all fall within the scope of protection of the present disclosure.

[0023] In the related arts, an automated guided forklift includes a chassis. A forklift support leg is connected at a position of the chassis proximate to the bottom of the chassis, and extends transversely at an end of the chassis. A driving wheel assembly is fixedly connected at an end of the forklift support leg.

[0024] In such an automated guided forklift, since the driving wheel assembly is fixedly connected at an end of the forklift support leg, in a case where the ground is uneven, for example, in a case where the ground is pitted

or upheaved, the driving wheel assembly may be suspended and thus unable to provide a driving force or sufficient driving force, bringing poor adaptation of the automated guided forklift to the ground.

[0025] Some embodiments of the present disclosure provide a forklift support leg and an automated guided forklift having the forklift support leg. The forklift support leg includes a support leg body, a hinging plate and a driving wheel assembly. The driving wheel assembly is hinged to the support leg body through the hinging plate. The driving wheel assembly may float/move up and down relative to the support leg body. In a case where the ground is uneven, for example, in case where the ground is pitted, a driving wheel of the driving wheel assembly can be in contact with the ground to generate a driving force, thus having a robust ground adaptation. In this way, the problem of inability to provide a driving force or sufficient driving force due to suspension of the driving wheel assembly may be avoided. In some embodiments, the forklift support leg may be applied to an automated guided forklift.

[0026] FIG. 1a is a diagram showing a structure of a forklift support leg according to some embodiments of the present disclosure. As shown in FIG. 1a, a forklift support leg 1 includes a support leg body 2, a hinging plate 3 and a driving wheel assembly 4. The hinging plate 3 is connected to the driving wheel assembly 4 and hinged to the support leg body 2. The hinging plate 3 is perpendicularly or obliquely disposed relative to a support direction, i.e., a vertical direction at the time of the forklift support leg being on a horizontal plane, of a driving wheel of the driving wheel assembly 4.

[0027] By using the hinging plate 3 perpendicularly or obliquely disposed relative to the support direction of the driving wheel, the driving wheel assembly 4 is hinged to the support leg body 2. In this case, on one hand, an integral structure formed by connecting the driving wheel assembly 4 and the support leg body 2 has a small thickness, helping adapt to low operation space; on the other hand, the driving wheel assembly 4 may float up and down relative to the support leg body 2 such that an effective driving force may be provided even when running on uneven ground, resulting in good ground adaptation. FIG. 1b is a schematic diagram showing the driving wheel assembly in FIG. 1a floats down in a case where there is a pit on the ground.

[0028] The support leg body 2 may be mounted onto a forklift. For example, an end of the support leg body 2 is mounted on a body of the forklift and another end of the support leg body 2 is connected with the driving wheel assembly 4 through the hinging plate 3. The support leg body 2 may be an elongated structure, for example, an elongated plate-like structure, an elongated column-like structure or an elongated groove-like structure. The support leg body 2 may be made of metal materials such as steel, iron or aluminum alloy, for example, formed by welding metal sheets.

[0029] The hinging plate 3 may also be referred to as

a hinging block or a hinging piece. The hinging plate 3 is used to connect the driving wheel assembly 4 and the support leg body 2. The hinging plate 3 may be shaped like plate or bar and made of metal materials.

[0030] The driving wheel assembly 4 provides the driving force for the support leg body 2. As shown in FIGS. 2a and 2b, the driving wheel assembly 4 may include a vertically-disposed driving outer frame 401. A driving module 402 (e.g., a driving motor and a speed reducer mechanism) is disposed in a cavity enclosed by the driving outer frame 401, and a driving wheel 403 is connected to the driving module 402.

[0031] As shown in FIG. 1a, an edge of a lower part of the driving wheel 403 protrudes out of the bottom of the driving outer frame 401, to be in frictional contact with the ground. The hinging plate 3 is located outside the driving outer frame 401 and fixedly connected to the driving outer frame 401. For example, the hinging plate 3 may be fixedly connected with the driving outer frame 401 by welding or bolting.

[0032] The driving module 402 may be fixedly disposed relative to the driving outer frame 401. The driving module 402 and the driving outer frame 401 may float up and down together relative to the support leg body 2.

[0033] In some embodiments, as shown in FIG. 2b, the driving module 402 may also be disposed floatably relative to the driving outer frame 401. In this case, the driving outer frame 401 may float up and down relative to the support leg body while the driving module 402 may float up and down relative to the driving outer frame 401, thus forming a two-stage floating mechanism. As a result, the driving wheel assembly 4 has good ground adaptation.

[0034] In order to limit a relative position between the driving module 402 and an inner wall of the driving outer frame 401, and thus maintain a stable positional relationship between the driving module 402 and the inner wall of the driving outer frame 401 so as to enable the driving module 402 to be always in a central position inside the driving outer frame 401, the driving wheel assembly 4 may further include a circumferential limiting structure for the driving module 402. As shown in FIG. 2b, the circumferential limiting structure may include a first pin 404 and a second pin 405 disposed at both ends of the driving module 402. The first pin 404 and the second pin 405 are disposed symmetrically relative to the driving module 402. A first side plate 406 is sleeved on the first pin 404, and a second side plate 407 is sleeved on the second pin 405. The first side plate 406 is sleeved on the first pin 404 via a middle through hole, and the second side plate 407 is sleeved on the second pin 405 via a middle through hole. A first bearing 408 and a second bearing 409 are symmetrically disposed relative to the first pin 404 at both ends of the first side plate 406, and a third bearing 410 and a fourth bearing 411 are symmetrically disposed relative to the second pin 405 at both ends of the second side plate 407. The first bearing 408, the second bearing 409, the third bearing 410 and the fourth bearing 411 are rollably connected on the inner wall of the driving outer

frame 401.

[0035] As shown in FIGS. 2c and 2d, in a case where the driving wheel assembly 4 travels, the first bearing 408, the second bearing 409, the third bearing 410 and the fourth bearing 411 are rollably connected on the inner wall of the driving outer frame 401 respectively, and the first side plate 406 and the second side plate 407 are consistently maintained in a horizontal state. Thus, circumferential limiting effect may be applied to the driving module 402, such that the driving module 402 may be stabilized in the central position inside the driving outer frame 401.

[0036] As shown in FIGS. 2b and 2c, in order to prevent the driving module 402 and the driving wheel 403 from entirely slipping out from the bottom of the driving outer frame 401, a limiting step 412 is disposed on the inner wall of the driving outer frame 401. After the first side plate 406 is sleeved on the first pin 404, a fifth bearing 413 may also be disposed on the first pin 404; and after the second side plate 407 is sleeved on the second pin 405, a sixth bearing 414 may also be disposed on the second pin 405. The fifth bearing 413 and the sixth bearing 414 are located over the limiting step 412. With the fifth bearing 413, the sixth bearing 414 and the limiting step 412, the driving module 402 and the driving wheel 403 may be prevented from entirely slipping out from the bottom of the driving outer frame 401. Furthermore, the first to sixth bearings 408 to 414 may be replaced with rollers or rolling balls.

[0037] As shown in FIG. 2b, in order to prevent foreign matters from falling into the driving outer frame 401 from the top of the driving outer frame 401 so as to avoid affecting normal operation of the driving wheel assembly 4, a cover 415 may be disposed on the top of the driving outer frame 401. The cover 415 may be fixed on the top of the driving outer frame 401 by screws or welding. Upper edges of the fifth bearing 413 and the sixth bearing 414 are higher than upper surfaces of the driving module 402, the first side plate 406 and the second side plate 407, such that the upper edges of the fifth bearing 413 and the sixth bearing 414 may be in contact with a lower surface of the cover 415 and roll on the lower surface of the cover 415, so as to prevent the driving module 402 from rubbing or colliding with the lower surface of the cover 415.

[0038] There may be one or two driving wheels 403 connected with the driving module 402. As shown in FIGS. 2b to 2d, there are two driving wheels, i.e., a driving wheel 403a and a driving wheel 403b. The two driving wheels are disposed in parallel at both sides of the driving module 402.

[0039] In addition to providing the driving force for the support leg body 2, the driving wheel assembly 4 may also provide a steering drive for the support leg body 2. In an example, the driving module 402 of the driving wheel assembly 4 may include a differential driving module 402, such that a steering drive may be provided for the support leg body 2 by use of a differential drive pro-

vided by the differential driving module 402 to the parallel driving wheels 403a and 403b.

[0040] As mentioned above, the hinging plate 3 may be perpendicularly disposed relative to the support direction (i.e., the vertical direction) of the driving wheels 403 of the driving wheel assembly 4, or obliquely disposed relative to the support direction of the driving wheels 403 of the driving wheel assembly 4, for example, upwardly or downwardly obliquely disposed.

[0041] In a case where the hinging plate 3 is disposed obliquely relative to the support direction of the driving wheels 403, an included acute angle α between the hinging plate 3 and the support direction of the driving wheels 403 is greater than or equal to 80 degrees and less than 90 degrees, for example, greater than 82 degrees and less than 88 degrees, or greater than 85 degrees and less than 90 degrees, or, greater than 86 degrees and less than 90 degrees. In an example, the acute angle α is 80 degrees, and in another example, the acute angle α is 85 degrees, and in still another example, the acute angle is 88 degrees.

[0042] In a case where a length of the hinging plate 3 is given and the hinging positions of the hinging plate 3 on the support leg body 2 are same, downwardly obliquely configuration of the hinging plate 3 relative to the support direction of the driving wheels 403 enables the driving wheel assembly 4 to have a great range to float up and down and thus has strong ground adaptation. FIG. 3 is a schematic diagram showing the hinging plate is downwardly obliquely disposed relative to the support direction of the driving wheels.

[0043] The hinging plate 3 may be hinged to the support leg body 2 by a hinging chain or a hinging shaft. As shown in FIG. 1a, hinging is performed by a hinging shaft. A first through hole is opened on the hinging plate 3, a second through hole corresponding to the first through hole is opened on the support leg body 2, and the hinging shaft 5 is inserted through the first through hole and the second through hole.

[0044] In some embodiments, in order to enable the driving wheels 403 to be in close contact with the ground and increase a friction between the driving wheels 403 and the ground so as to increase the driving force, a downward pre-pressure may be applied to the driving wheel assembly 4.

[0045] In an example, a spring may be disposed at a hinging position between the hinging plate 3 and the support leg body 2 or near the hinging position. A downward pre-pressure is applied to the hinging plate 3 through the spring and then transferred to the driving wheel assembly 4 through the hinging plate 3.

[0046] FIG. 4a is a schematic diagram showing a structure of the hinging plate in FIG. 1a. For clearly illustrating the positional relationship between parts, a hinging shaft, a spring and a limiting column are also shown in FIG. 4a.

[0047] As shown in FIGS. 1a and 4a, a first groove 21 with an opening facing downward may be disposed on the support leg body 2, and a second groove 31 with an

opening facing upward may be disposed proximate to the hinging position on an upper surface of the hinging plate 3, where the second groove 31 corresponds to the first groove 21. A spring 6 may be disposed in the second groove such that a top end of the spring 6 is abutted against a lower surface (concave surface) of the first groove, and a bottom end of the spring 6 is abutted against an upper surface (concave surface) of the second groove. An abutting position which the bottom end of the spring 6 is abutted against on the upper surface of the second groove is located at a side of the hinging shaft 5 proximate to the driving wheel assembly 4.

[0048] In another example, a torsional spring (in FIG. 4b) may be disposed on the hinging shaft 5. A downward pre-pressure is applied to the hinging plate 3 through the torsional spring and then transferred to the driving wheel assembly 4 through the hinging plate 3. The torsional spring is disposed on the hinging shaft in such a way that an end of the torsional spring is abutted against the support leg body 2 and another end of the torsional spring is abutted against the hinging plate 3 from above the hinging plate 3. An abutting position of the torsional spring on the hinging plate 3 is located at a side of the hinging shaft 5 proximate to the driving wheel assembly 4.

[0049] In some embodiments, the hinging plate 3 is hinged onto the support leg body 2 and may rotate up and down relative to the support leg body 2. In a case where the support leg body 2 bears a large load, the hinging plate 3 may be caused to rotate upward too much relative to the support leg body 2 and the hinging position between the support leg body 2 and the hinging plate 3 contacts the ground, thus disabling the support effect of the driving wheel assembly 4. In order to avoid occurrence of this circumstance, a first limiting structure for limiting a range that the hinging plate 3 rotates upward may be disposed on the forklift support leg 1.

[0050] By referring to FIG. 1a, the first groove 21 with an opening facing downward on the support leg body 2 may be used directly as the first limiting structure, thereby simplifying the limiting structure. An end of the hinging plate 3 (i.e., the hinging end) is inserted into the first groove 21 on the support leg body 2 by a predetermined length (e.g., 2 cm to 10 cm), and then hinged to the support leg body 2 through the hinging shaft 5. In other words, the predetermined length is a distance between an inserting position where the hinging shaft 5 is inserted into the support leg body 2 and the end of the support leg body 2. In this case, when the hinging plate 3 rotates upward around the hinging shaft 5 by an angle relative to the support leg body 2, the upper surface of the hinging plate 3 is abutted against the lower surface (concave surface) of the first groove 21, so as to limit the hinging plate 3 from further rotating upward.

[0051] In addition to rotating upward around the hinging shaft, the hinging plate 3 may also rotate downward around the hinging shaft 5. If the hinging plate 3 rotates downward too much, the driving wheel assembly 4 may be easily tipped over. In order to avoid this occurrence,

a second limiting structure for limiting a range that the hinging plate 3 rotates downward may be disposed on the forklift support leg 1.

[0052] As shown in FIG. 1a, the second limiting structure may include a limiting column 32 disposed on a side portion of the hinging plate 3. A limiting groove 22 is opened at an end of the support leg body 2 and the limiting column 32 is located in the limiting groove 22. Thus, in a case where the hinging plate 3 rotates downward by a given angle around the hinging shaft 5 relative to the support leg body 2, the limiting column 32 is abutted against the bottom of the limiting groove 22 so as to limit the hinging plate 3 from further rotating downward. It is understood that the second limiting structure may also prevent excessively upward rotation.

[0053] It will be understood that, a groove is disposed on the hinging plate as shown in FIG. 1a, and in some embodiments, no groove may be disposed on the hinging plate.

[0054] As shown in FIG. 1a, the hinging plate 3 may be hinged at a first end of the support leg body 2 (an end close to the hinging plate), and the hinging position is proximate to the bottom of the support leg body 2 such that the driving wheel assembly 4 may have a large floating range.

[0055] After the driving wheel assembly 4 is hinged to the support leg body 2 through the hinging plate 3, the driving wheel assembly 4 may be located below the support leg body 2. As shown in FIG. 1a, after the driving wheel assembly 4 is hinged to the support leg body 2 through the hinging plate 3, the driving wheel assembly 4 may be located outside the support leg body 2, that is, the driving wheel assembly 4 and the support leg body 2 may be disposed in parallel in a horizontal direction. In this way, the entire height of the forklift support leg 1 may be effectively reduced, such that the entire height (thickness) of the forklift support leg 1 is small and suitable for a low operation space.

[0056] In some embodiments, in order to enable the driving wheels 403 to be in close contact with the ground and increase the friction between the driving wheels 403 and the ground, so as to increase the driving force, a downward pre-pressure may be applied to the driving wheel assembly 4.

[0057] In some embodiments, a spring may be disposed at or proximate to a hinging position between the hinging plate 3 and the support leg body 2. A downward pre-pressure is applied to the hinging plate 3 through the spring and then transferred to the driving wheel assembly 4 through the hinging plate 3.

[0058] FIG. 4a is a schematic diagram showing a structure of the hinging plate in FIG. 1a. For clearly illustrating the positional relationship between parts, a hinging shaft, a spring and a limiting column are also shown in FIG. 4a.

[0059] As shown in FIGS. 5a and 4a, a first groove 21 with an opening facing toward the driving wheel assembly 4 may be disposed on the support leg body 2, and the first groove 21 does not penetrate through the upper sur-

face or lower surface of the support leg body 2. The hinging plate 3 is inserted into the first groove 21 through the opening. A second groove 31 with an opening facing upward is disposed proximate to the hinging position on the upper surface of the hinging plate 3, and the second groove 31 corresponds to the first groove 21. A spring 6 is disposed in the second groove 31 such that a top end of the spring 6 is abutted against the upper surface of the first groove 21, and a bottom end of the spring 6 is abutted against the upper surface (concave surface) of the second groove. The abutting position that the bottom end of the spring 6 is abutted against on the upper surface of the second groove is located at a side of the hinging shaft 5 proximate to the driving wheel assembly 4.

[0060] In another example, a torsional spring (in FIG. 4b) may be disposed on the hinging shaft 5. A downward pre-pressure is applied to the hinging plate 3 through the torsional spring and then transferred to the driving wheel assembly 4 through the hinging plate 3. The torsional spring is disposed on the hinging shaft 5 in such a way that an end of the torsional spring is abutted against the support leg body 2 and another end of the torsional spring is abutted against the hinging plate 3 from above the hinging plate 3. An abutting position of the torsional spring on the hinging plate 3 is located at a side of the hinging shaft 5 proximate to the driving wheel assembly 4.

[0061] In some embodiments, the hinging plate 3 is hinged onto the support leg body 2 and may rotate up and down relative to the support leg body 2. In a case where the support leg body 2 bears a large load, the hinging plate 3 may be caused to rotate upward too much relative to the support leg body 2 and the hinging position between the support leg body 2 and the hinging plate 3 contacts the ground, thus disabling the support effect of the driving wheel assembly 4. Besides, if the hinging plate 3 rotates downward too much, the driving wheel assembly 4 may be easily tipped over. In order to avoid this occurrence, a first limiting structure for limiting a range that the hinging plate 3 rotates upward and downward may be disposed on the forklift support leg 1.

[0062] As shown in FIGS. 5a, a first groove 21 with an opening facing toward the driving wheel assembly 4 may be disposed on the support leg body 2, and the first groove does not penetrate through the upper surface or lower surface of the support leg body 2. The first groove on the support leg body may be used directly as the first limiting structure, so as to simplify the limiting structure. A first end of the hinging plate 3 (i.e., hinging end) is inserted through the opening into the first groove 21 on the support leg body 2 by a predetermined length (e.g., 2-10 cm), and then hinged to the support leg body 2 through the hinging shaft 5. In other words, the predetermined length is a distance between an inserting position where the hinging shaft 5 is inserted into the support leg body 2 and the end of the support leg body 2. In a case where the hinging plate 3 rotates upward around the hinging shaft 5 by an angle relative to the support leg body 2, the upper surface of the hinging plate 3 is abutted against the upper

surface of the first groove 21, so as to limit the hinging plate 3 from further rotating upward. In a case where the hinging plate 3 rotates downward around the hinging shaft 5 by an angle relative to the support leg body 2, the lower surface of the hinging plate 3 is abutted against the lower surface of the first groove 21, so as to limit the hinging plate 3 from further rotating downward. It is to be noted that, a groove is disposed on the hinging plate as shown in FIG. 5a and in some embodiments, no groove may be disposed on the hinging plate.

[0063] Additionally or optionally, in some embodiments, a second limiting structure may be disposed on the forklift support leg 1. As shown in FIGS. 5a and 5b, the second limiting structure may include a limiting column 32 disposed on a side portion of the hinging plate 3. A limiting groove 22 is opened at an end of the support leg body 2 and the limiting column 32 is located in the limiting groove 22. Thus, in a case where the hinging plate 3 rotates downward by a given angle around the hinging shaft 5 relative to the support leg body 2, the limiting column 32 is abutted against the bottom of the limiting groove 22 so as to limit the hinging plate 3 from further rotating downward. In a case where the hinging plate 3 rotates upward by a given angle around the hinging shaft 5 relative to the support leg body 2, the limiting column 32 is abutted against the top of the limiting groove 22 so as to limit the hinging plate 3 from further rotating upward.

[0064] FIG. 6 is a schematic diagram showing a side structure of an automated guided forklift on the ground according to some embodiments of the present disclosure. FIG. 7 is a schematic diagram showing a stereoscopic structure of the automated guided forklift in FIG. 6. As shown in FIGS. 6 and 7, the automated guided forklift includes a chassis 7. A chassis driving wheel assembly and a caster are disposed at the bottom of the chassis. A forklift support leg 1 is connected at a position of the chassis 7 proximate to the bottom of the chassis 7. The forklift support leg 1 extends transversely at an end of the chassis 7. The chassis driving wheel assembly includes a first chassis driving wheel assembly 8, and the caster includes a first caster 9 and a second caster 10. The first chassis driving wheel assembly 8, the first caster 9 and the second caster 10 are disposed in a spacing. The first chassis driving wheel assembly 8 is disposed between the first caster 9 and the second caster 10. The first caster 9 and the second caster 10 are rigidly connected to the bottom of the chassis to provide stable support for the chassis. The forklift support leg 1 may be the forklift support leg as described in any one of the above embodiments.

[0065] In some embodiments, by perpendicularly or obliquely disposing the hinging plate relative to the support direction of the driving wheels, the driving wheel assembly is hinged to the support leg body. Thus, on one hand, an integral structure formed by connecting the driving wheel assembly and the support leg body has a small thickness, helping adapt to low operation space; on the

other hand, the driving wheel assembly may float up and down relative to the support leg body such that an effective driving force may still be provided even in a case where the ground is uneven, resulting in good ground adaptation.

[0066] The chassis 7 may be a vertically-disposed frame type structure or box type structure. A main control unit may be disposed on the chassis 7 to control the chassis driving wheel assembly and the driving wheel assembly.

[0067] In order to enable the automated guide forklift to operate stably, two forklift support legs 1 may be connected in parallel on the chassis 7. Each forklift support leg 1 has the same structure as the forklift support leg described in any one of the above embodiments as well as the same beneficial effects, and thus will not be repeated herein.

[0068] As shown in FIG. 6, one or more forks 11 and one or more lift driving mechanisms (not shown) are disposed on the chassis 7. The forks may be used to insert under a load and then lift it, and may perform lifting actions with the drive of the lift driving mechanism. There may be two forks 11 arranged in parallel. The forks 11 and the forklift support legs 1 may be located at a same side of the chassis 7. The forks 11 are disposed above the forklift support legs 1.

[0069] As shown in FIG. 7, a first chassis driving wheel assembly 8, a first caster 9 and a second caster 10 are disposed in a spacing at the bottom of the chassis 7. The first chassis driving wheel assembly 8 is located between the first caster 9 and the second caster 10. The first caster 9 and the second caster 10 both are rigidly connected to the bottom of the chassis 7, so as to provide strong support for the chassis 7, thus preventing the chassis 7 from tilting due to uneven force.

[0070] The chassis driving wheel assembly may be used to provide a travel drive to the chassis. In an example, the chassis driving wheel assembly may not only provide a travel drive for the chassis 7 but also a steering drive for the chassis 7. In this case, the chassis driving wheel assembly may also be referred to as steering wheel assembly.

[0071] FIG. 8 is a schematic diagram showing a stereoscopic structure of a chassis driving wheel assembly according to some embodiments of the present disclosure. As shown in FIG. 8, the chassis driving wheel assembly, for example, the first chassis driving wheel assembly 8, may include a travel motor reducer box assembly 81 and a travel wheel 82 mounted on the travel motor reducer box assembly 81. A mounting plate 83 for mounting the travel motor reducer box assembly 81 to the chassis 7 is disposed on the travel motor reducer box assembly 81. A gear ring 84 is sleeved on a periphery of the travel motor reducer box assembly 81 to engage with a steer driving gear 85. The steer driving gear 85 is mounted on a steer driving motor assembly 86. The travel motor reducer box assembly 81 may drive the travel wheel 82 to travel, and the steer driving motor assembly

86 may drive the steer driving gear 85 to rotate the gear ring 84 which then drives the travel motor reducer box assembly 81 and the travel wheel 82 to steer.

[0072] As shown in FIG. 8, in order to enable the travel wheel 82 to float up and down relative to the chassis 7, one or more springs 87 may be disposed between the travel motor reducer box assembly 81 and the mounting plate 83. A guide groove 88 for guiding the travel motor reducer box assembly 81 to float up and down may be disposed on the mounting plate 83. Further, a guide block 89 may be disposed on the travel motor reducer box assembly 81 and located in the guide groove 88. The guide block may slide up and down along the guide groove 88.

[0073] The chassis driving wheel assembly and the driving wheel assembly 4 on the forklift support leg 1 may be interchangeable.

[0074] FIG. 9 is a schematic diagram showing a structure of an automated guided forklift according to some embodiments of the present disclosure. As shown in FIG. 9, the structure of the automated guided forklift in FIG. 9 is basically same as the structure of the automated guided forklift in FIG. 7 except that, the second caster 10 is omitted at the bottom of the chassis 7, and the first chassis driving wheel assembly 8 is mounted at the mounting position of the second caster 10, that is, the first chassis driving wheel assembly 8 and the first caster 9 are disposed in parallel at both sides of the bottom of the chassis 7, where the first caster 9 is rigidly connected to the bottom of the chassis 7 to provide strong support for the chassis 7.

[0075] In some embodiments, only one chassis driving wheel assembly and one caster may be disposed at the bottom of the chassis 7. Thus, with the travel and steering requirements satisfied, the number of the casters may be reduced, helping reduce the costs.

[0076] FIG. 10 is a schematic diagram showing a structure of an automated guided forklift according to some embodiments of the present disclosure. As shown in FIG. 10, the structure of the automated guided forklift in FIG. 10 is basically same as the structure of the automated guided forklift in FIG. 7, except that, the first caster 9 and the second caster 10 are omitted at the bottom of the chassis 7, and the first chassis driving wheel assembly 8 and the second chassis driving wheel assembly 12 are mounted respectively at the mounting positions of the first caster 9 and the second caster 10, that is, two chassis driving wheels are disposed in parallel at both sides of the bottom of the chassis 7.

[0077] The structure of the second chassis driving wheel assembly is the same as the structure of the first chassis driving wheel assembly. In some embodiments, two chassis driving wheel assemblies are disposed in parallel at the bottom of the chassis 7 to produce good travel drive capability and flexible steering capability.

[0078] FIG. 11 is a schematic diagram showing a structure of an automated guided forklift according to some embodiments of the present disclosure. As shown in FIG. 11, the structure of the automated guided forklift in FIG.

11 is basically same as the structure of the automated guided forklift in FIG. 7, except that, the first caster 9 and the second caster 10 are omitted at the bottom of the chassis 7, that is, the chassis driving wheel is disposed in the middle of the bottom of the chassis 7.

[0079] In some embodiments, by using the main control unit of the chassis 7, the chassis driving wheel assembly and the driving wheel assembly may be controlled at the same time to achieve the movement of the automated guided forklift. For example, the wheels in chassis driving wheel assembly and the driving wheel assembly may be controlled to be in a same direction to achieve translation of the entire vehicle in any direction. For another example, the wheels of chassis driving wheel assembly and the driving wheel assembly may be controlled to be perpendicular to a rotational center at the same time, so as to achieve spinning of the entire vehicle around the center, thus achieving the practical application effect of omni-directional movement.

[0080] It will be noted that the relational terms such as "first" and "second" used herein are merely intended to distinguish one entity or operation from another entity or operation rather than to require or imply any such actual relation or order existing between these entities or operations. Also, the term "including", "containing" or any variation thereof is intended to encompass non-exclusive inclusion, so that a process, method, article or device including a series of elements includes not only those elements but also other elements not listed explicitly or those elements inherent to such a process, method, article or device. Without more limitations, an element defined by the statement "including a..." shall not be precluded to include additional same elements present in a process, method, article or device including the elements.

[0081] Different embodiments in the present disclosure are described in a related manner. Each embodiment focuses on the differences from other embodiments with those same or similar parts among the embodiments referred to each other.

[0082] The above descriptions are merely specific examples of the present disclosure to which the scope of protection of the present disclosure is not limited. Any changes or substitutions that easily occur to a person skilled in the art in the technical scope of the present disclosure should fall in the scope of protection of the present disclosure. Therefore, the scope of protection of the present disclosure is indicated as in appended claims.

Claims

1. A forklift support leg, comprising:

a support leg body,
a driving wheel assembly, and
a hinging plate, connected with the driving wheel

assembly and hinged to the support leg body; wherein the hinging plate is perpendicularly disposed relative to a support direction of one or more driving wheels of the driving wheel assembly, or obliquely disposed relative to the support direction of the one or more driving wheels of the driving wheel assembly.

2. The forklift support leg according to claim 1, wherein the driving wheel assembly comprises a vertically-disposed driving outer frame, a driving module disposed in a cavity enclosed by the driving outer frame, and the one or more driving wheels connected with the driving module,

an edge of a lower part of the one or more driving wheels protrudes from a bottom of the driving outer frame;
the hinging plate is located outside the driving outer frame and fixedly connected with the driving outer frame.

3. The forklift support leg according to claim 1 or 2, wherein, when the hinging plate is obliquely disposed relative to the support direction of the one or more driving wheels of the driving wheel assembly, an included acute angle between the hinging plate and the support direction of the one or more driving wheels of the driving wheel assembly is greater than or equal to 80 degrees and less than 90 degrees.

4. The forklift support leg according to any one of claims 1 to 3, wherein a first through hole is disposed in the hinging plate, a second through hole is disposed in the support leg body, the first through hole corresponds to the second through hole, and a hinging shaft is inserted through the first through hole and the second through hole.

5. The forklift support leg according to claim 4, wherein a first groove with an opening facing downward is disposed on the support leg body; a second groove with an opening facing upward is disposed proximate to a hinging position on an upper surface of the hinging plate, and the second groove corresponds to the first groove;

wherein a spring is disposed in the second groove, a top end of the spring is abutted against a lower surface of the first groove, and a bottom end of the spring is abutted against an upper surface of the second groove; an abutting position where the bottom end of the spring is abutted against on the upper surface of the second groove is located at a side of the hinging shaft proximate to the driving wheel assembly;
or,
a torsional spring is disposed on the hinging

shaft, an end of the torsional spring is abutted against the support leg body, and other end is abutted against the hinging plate from above the hinging plate; wherein an abutting position of the torsional spring on the hinging plate is located at a side of the hinging shaft proximate to the driving wheel assembly.

6. The forklift support leg according to claim 4, wherein a third groove with an opening facing toward the driving wheel assembly is disposed on the support leg body, the third groove does not penetrate through a lower surface and an upper surface of the support leg body, and the hinging plate is inserted into the third groove through the opening; a second groove with an opening facing upward is disposed proximate to a hinging position on an upper surface of the hinging plate, and the second groove corresponds to the third groove;

wherein a spring is disposed in the second groove, a top end of the spring is abutted against an upper surface of the third groove and a bottom end of the spring is abutted against an upper surface of the second groove; wherein an abutting position where the bottom end of the spring is abutted against on the upper surface of the second groove is located at a side of the hinging shaft proximate to the driving wheel assembly;
or,
a torsional spring is disposed on the hinging shaft, an end of the torsional spring is abutted against the support leg body, and other end is abutted against the hinging plate from above the hinging plate; wherein an abutting position of the torsional spring on the hinging plate is located at a side of the hinging shaft proximate to the driving wheel assembly.

7. The forklift support leg according to any one of claims 1 to 3, wherein a limiting structure for limiting a range that the hinging plate rotates relative to the support leg body is disposed on the forklift support leg.

8. The forklift support leg according to claim 7, wherein a first groove with an opening facing downward is disposed on the support leg body, and a first end of the hinging plate is inserted a predetermined length into the first groove on the support leg body and hinged on the support leg body by a hinging shaft;

the limiting structure comprises a first limiting structure for limiting a range that the hinging plate rotates upward relative to the support leg body, and/or, a second limiting structure for limiting a range that the hinging plate rotates downward relative to the support leg body;
wherein the first limiting structure comprises the

- first groove;
the second limiting structure comprises a limiting groove opened at an end of the support leg body and a limiting column disposed on a side portion of the hinging plate, and the limiting column is located in the limiting groove. 5
9. The forklift support leg according to any one of claims 1 to 7, wherein the hinging plate is hinged on a first end of the support leg body and the hinging position is proximate to a bottom of the support leg body. 10
10. The forklift support leg according to claim 7, wherein a third groove with an opening facing toward the driving wheel assembly is disposed on the support leg body, the third groove does not penetrate through a lower surface and an upper surface of the support leg body, and a first end of the hinging plate is inserted a predetermined length into the third groove on the support leg body through the opening, and hinged on the support leg body by a hinging shaft; the limiting structure comprises the third groove. 15
11. The forklift support leg according to claim 7, wherein a third groove with an opening facing toward the driving wheel assembly is disposed on the support leg body, the third groove does not penetrate through a lower surface and an upper surface of the support leg body, and a first end of the hinging plate is inserted a predetermined length into the third groove on the support leg body through the opening, and hinged on the support leg body by a hinging shaft; the limiting structure comprises a limiting groove opened at an end of the support leg body and a limiting column disposed on a side portion of the hinging plate, and the limiting column is located in the limiting groove. 20 25 30 35
12. The forklift support leg according to any one of claims 1 to 11, wherein the driving wheel assembly is located outside the support leg body. 40
13. An automated guided forklift, comprising a chassis, one or more chassis driving wheel assemblies and/or one or more casters disposed at a bottom of the chassis and one or more forklift support legs connected at one or more positions of the chassis proximate to the bottom of the chassis, and the one or more forklift support legs extend transversely at an end of the chassis; 45 50
wherein the one or more forklift support legs are the forklift support leg according to any one of claims 1 to 12.
14. The automated guided forklift according to claim 13, wherein one or more chassis driving wheel assemblies and one or more casters are disposed at the bottom of the chassis; wherein the one or more chassis driving wheel assemblies comprise a first chassis driving wheel assembly and the one or more casters comprise a first caster and a second caster; the first chassis driving wheel assembly, the first caster and the second caster are disposed in a spacing; wherein the first chassis driving wheel assembly is located between the first caster and the second caster, and the first caster and/or the second caster is rigidly connected with the bottom of the chassis; or, one or more chassis driving wheel assemblies and one or more casters are disposed at the bottom of the chassis; wherein the one or more chassis driving wheel assemblies are first chassis driving wheel assemblies, and the one or more casters are first casters; the first chassis driving wheel assembly and the first caster are disposed in a spacing, and the first caster is rigidly connected with the bottom of the chassis. 55
15. The automated guided forklift according to claim 13, wherein one or more chassis driving wheel assemblies are disposed at the bottom of the chassis and comprise a first chassis driving wheel assembly and a second chassis driving wheel assembly, and the first chassis driving wheel assembly and the second chassis driving wheel assembly are disposed in a spacing; or, a chassis driving wheel assembly is disposed in a middle of the bottom of the chassis.

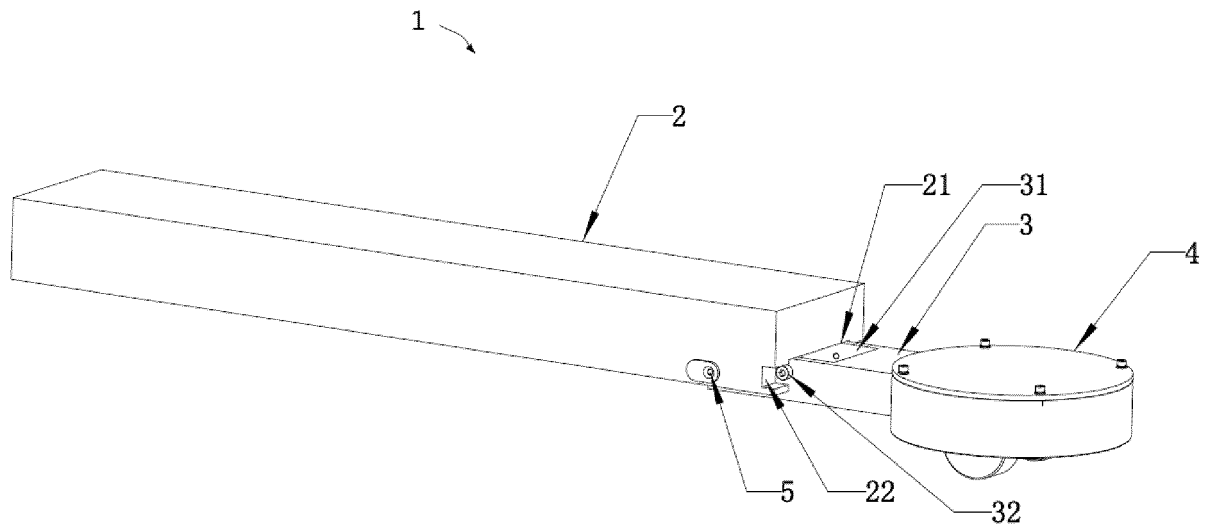


FIG. 1a

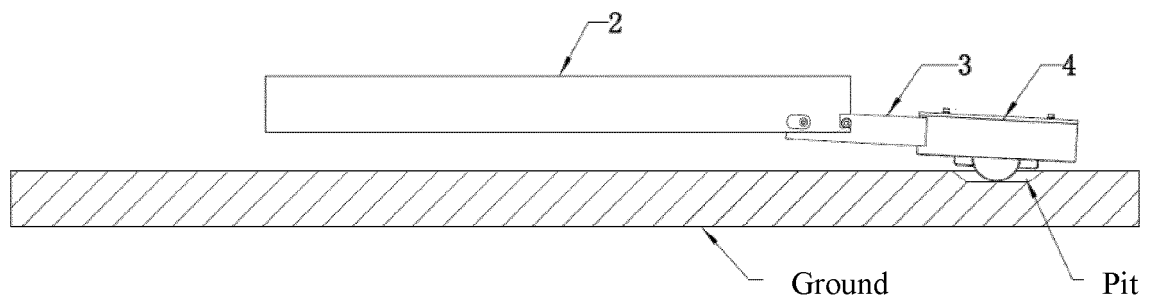


FIG. 1b

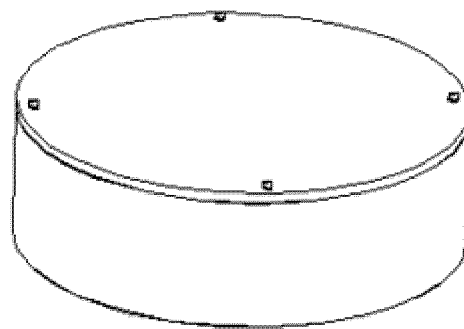


FIG. 2a

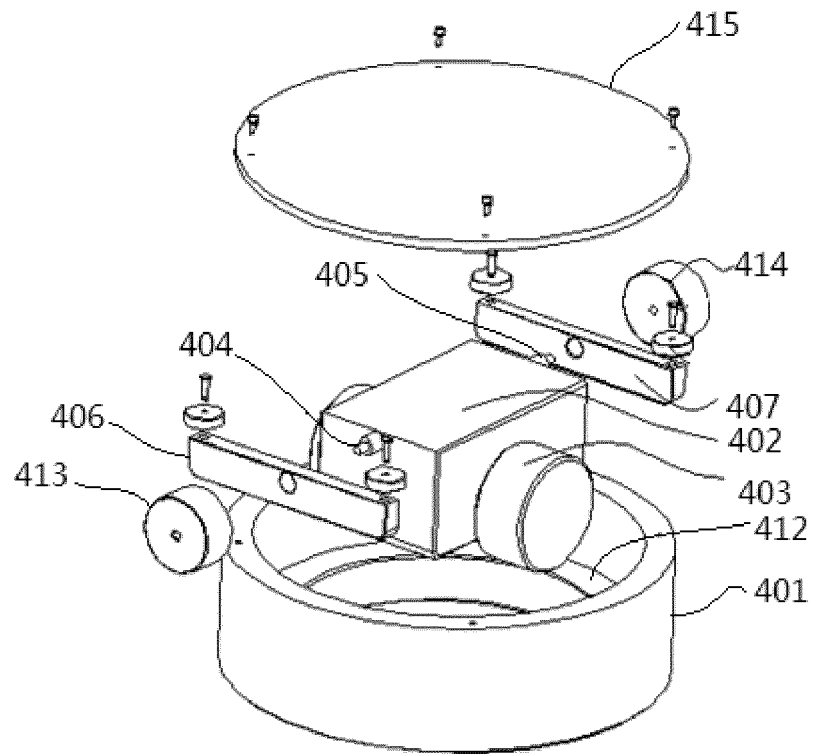


FIG. 2b

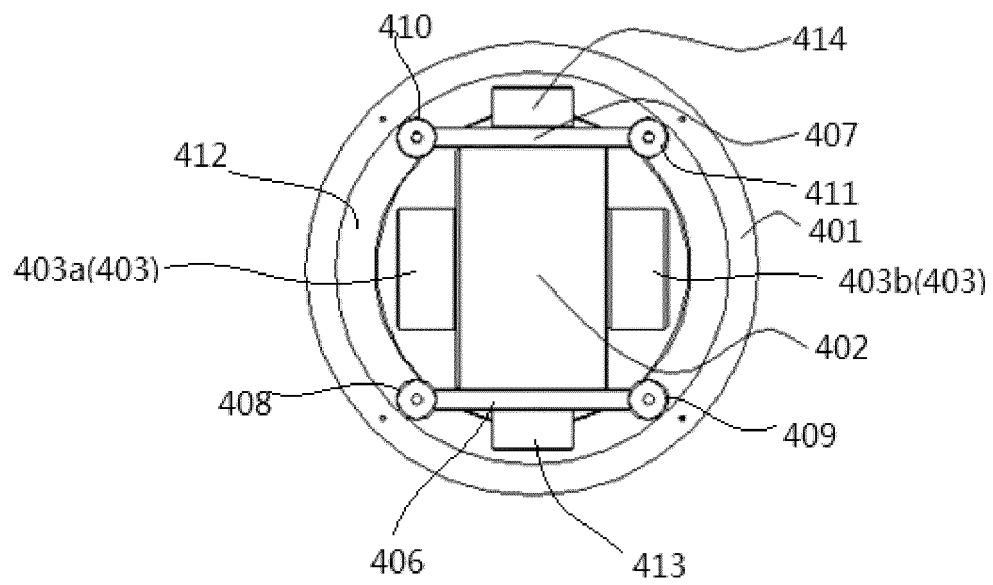


FIG. 2c

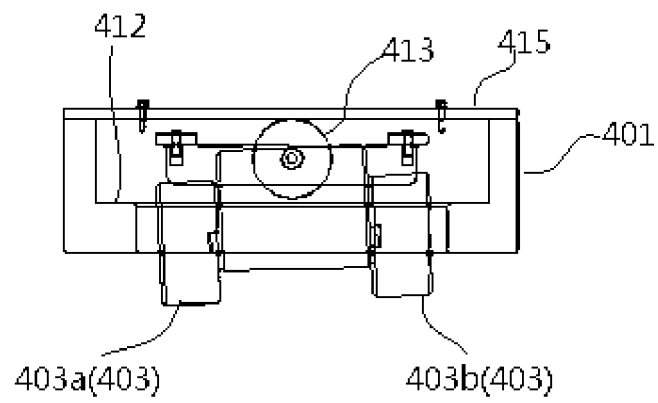


FIG. 2d

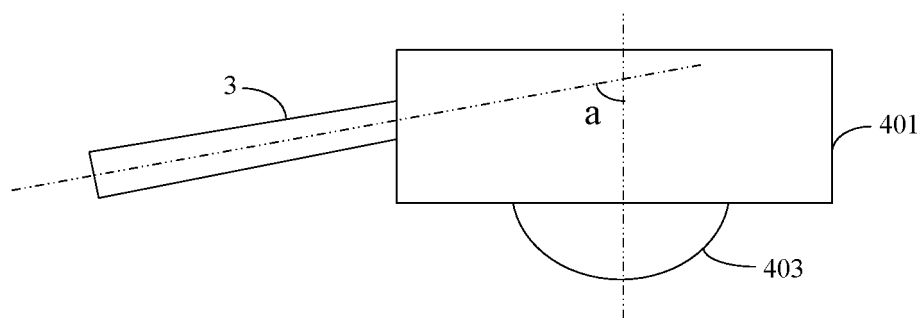


FIG. 3

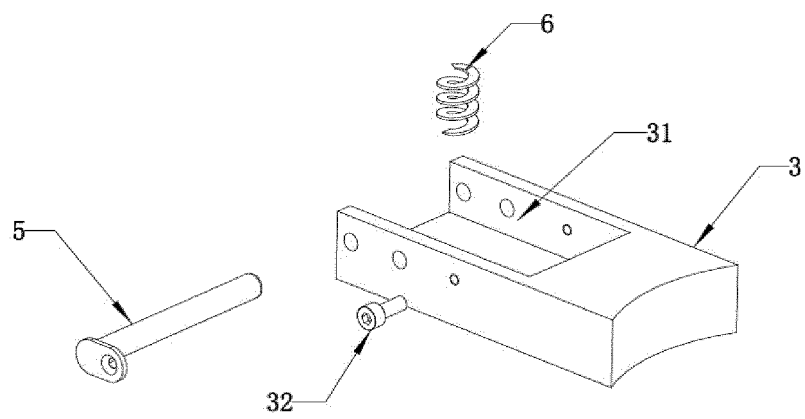


FIG. 4a

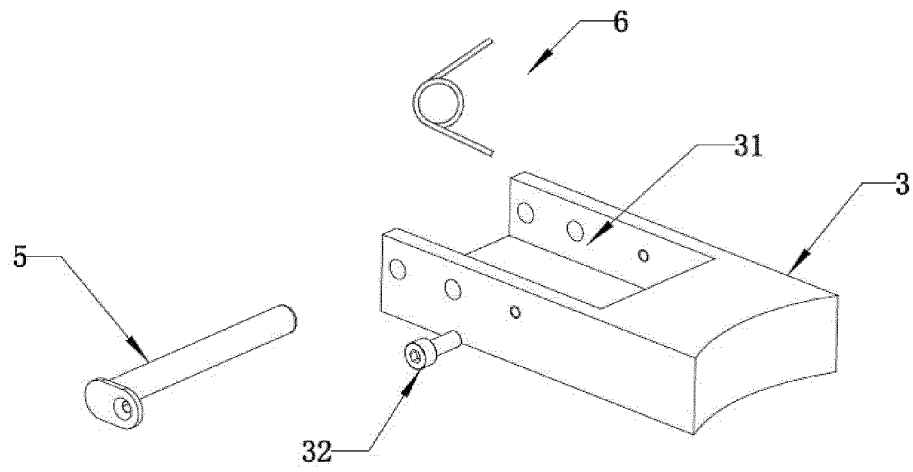


FIG. 4b

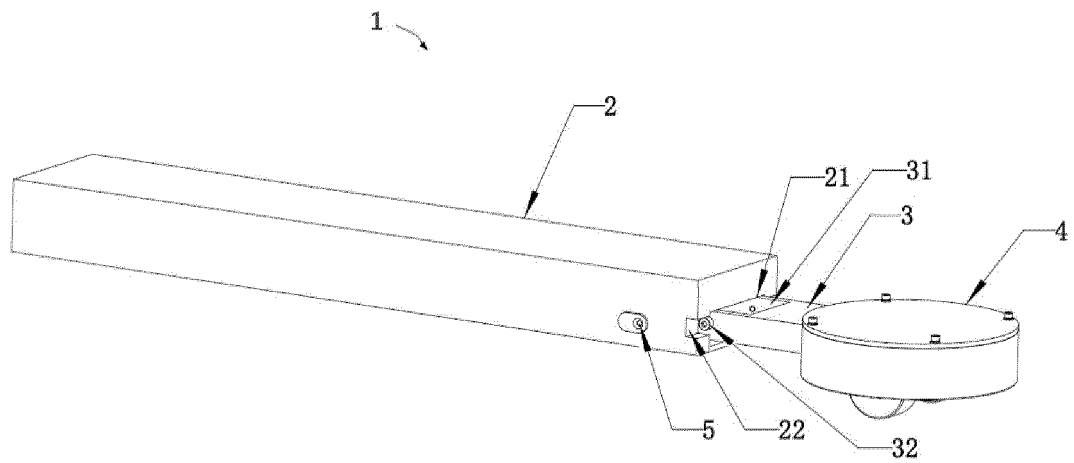


FIG. 5a

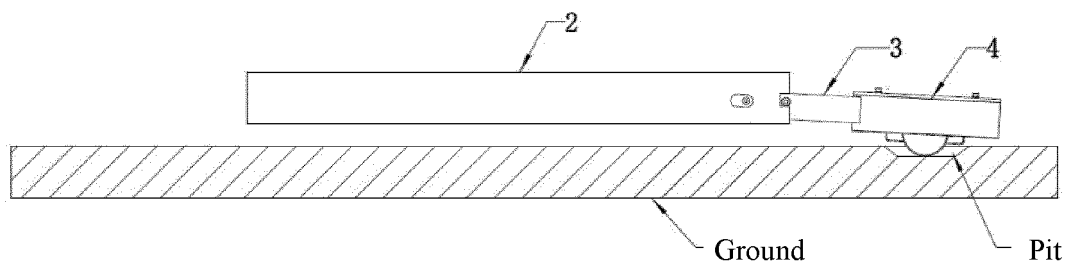


FIG. 5b

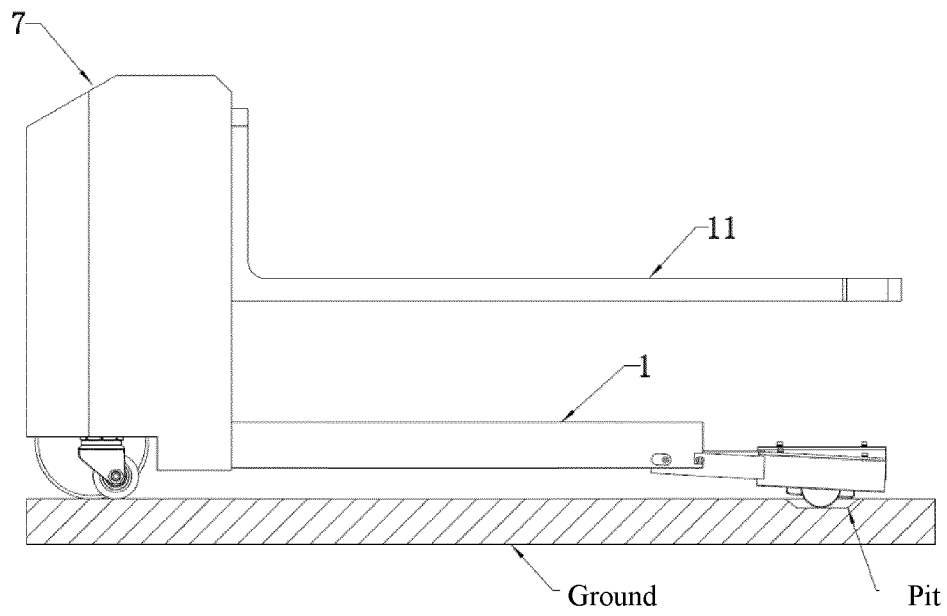


FIG. 6

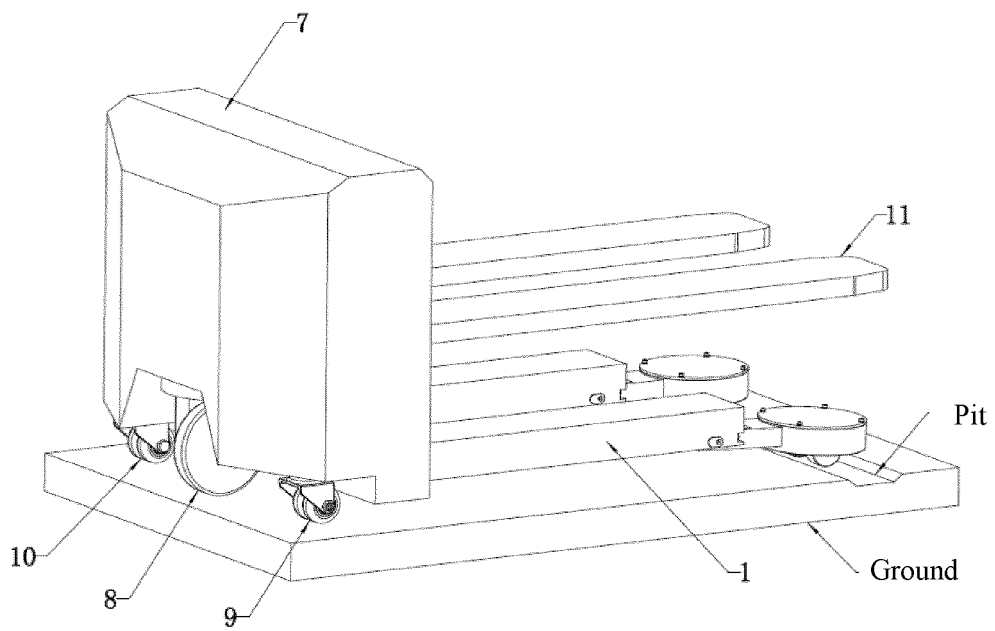


FIG. 7

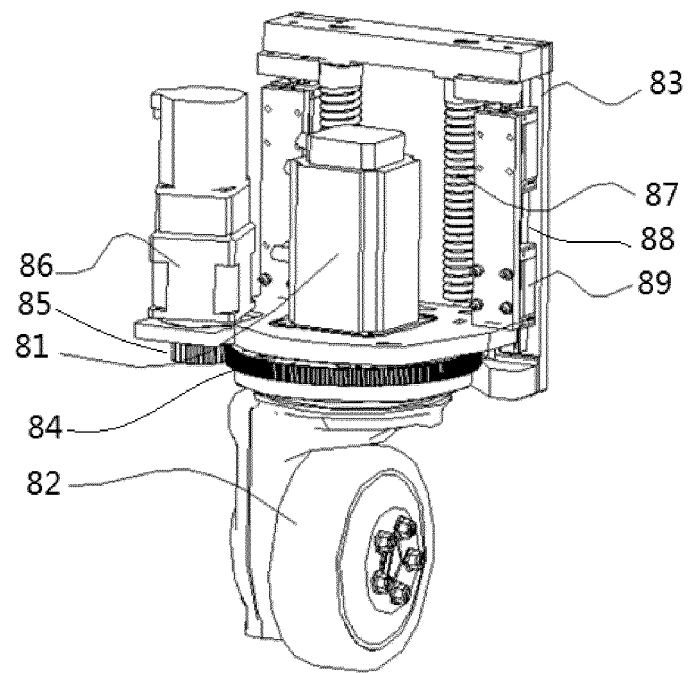


FIG. 8

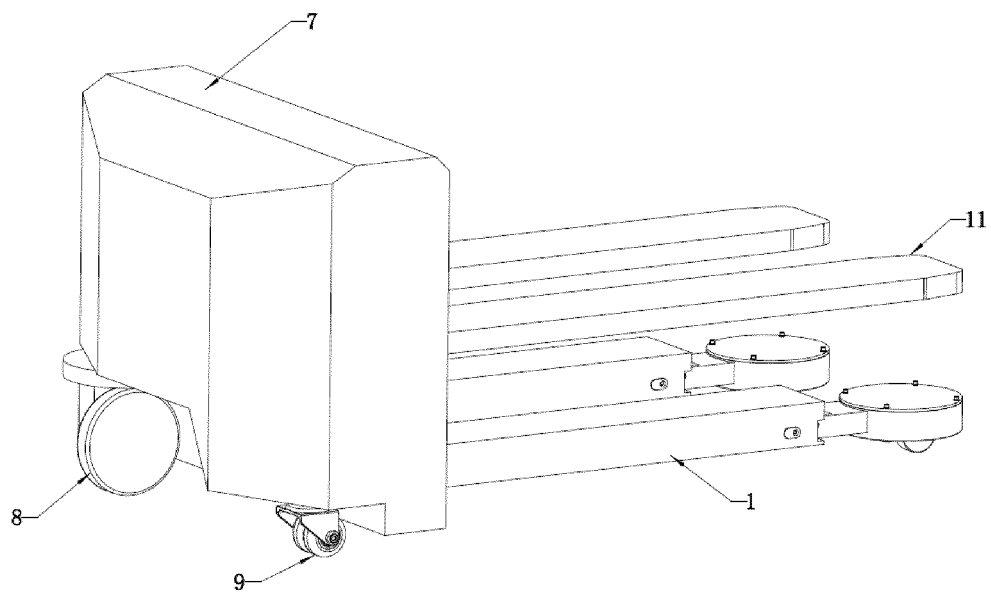


FIG. 9

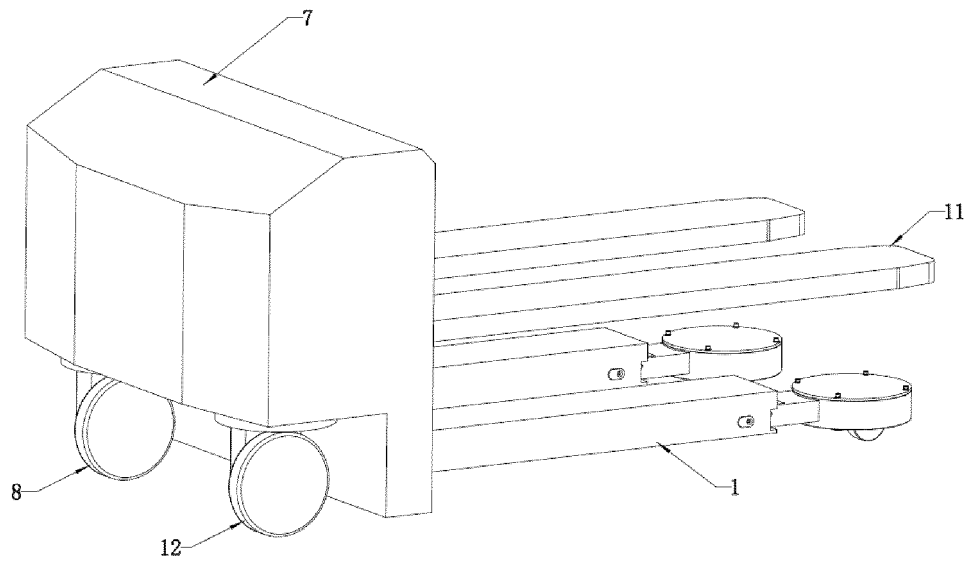


FIG. 10

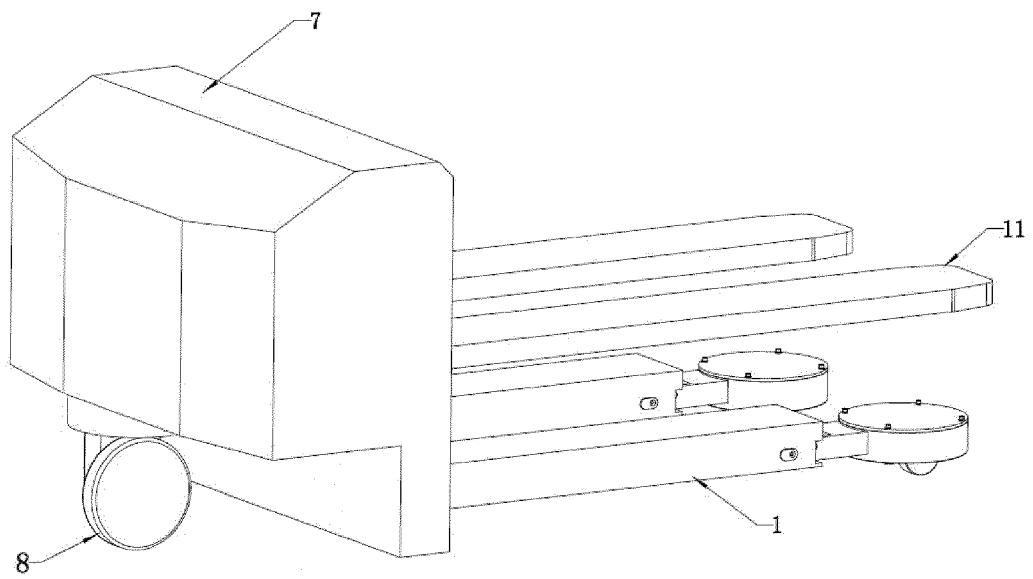


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2021/111884

A. CLASSIFICATION OF SUBJECT MATTER

B66F 9/075(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)

B66F

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)

CNABS, CNKI, SIPOABS, DWPI: 叉车, 腿, 支撑, 轮, 铰接, 轴, 弹簧, 扭簧, fork, stack, leg, support, wheel, hinge, axis, spring

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 111792580 A (HANGZHOU HIKROBOT TECHNOLOGY CO., LTD.) 20 October 2020 (2020-10-20) see claims 1-12	1-5, 7-9, 12-15
Y	CN 210176388 U (HANGZHOU HIKROBOT TECHNOLOGY CO., LTD.) 24 March 2020 (2020-03-24) see description paragraph 35, figure 1	1-15
Y	CN 105752886 A (GUANGDONG JATEN ROBOT & AUTOMATION CO., LTD.) 13 July 2016 (2016-07-13) see description paragraphs 19, 22, figures 1-4	1-15
Y	DE 3710757 A1 (GENKINGER HERMANN GMBH) 20 October 1988 (1988-10-20) see abstract, and figure 1	1-15
A	CN 201670692 U (ANHUI DEMO FORKLIFT TRUCK CO., LTD.) 15 December 2010 (2010-12-15) see entire document	1-15
A	CN 205527560 U (ZHEJIANG EP EQUIPMENT CO., LTD.) 31 August 2016 (2016-08-31) see entire document	1-15

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

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“O” document referring to an oral disclosure, use, exhibition or other means

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

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“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

“&” document member of the same patent family

Date of the actual completion of the international search

26 October 2021

Date of mailing of the international search report

11 November 2021

Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/
CN)
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100088
China

Facsimile No. (86-10)62019451

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2021/111884

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 208561596 U (ANBO MACHINERY HEBEI CO., LTD.) 01 March 2019 (2019-03-01) see entire document	1-15

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2021/111884

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 111792580 A	20 October 2020	None	
CN 210176388 U	24 March 2020	None	
CN 105752886 A	13 July 2016	CN 105752886 B	04 December 2020
DE 3710757 A1	20 October 1988	DE 3710757 C2	15 June 1989
CN 201670692 U	15 December 2010	None	
CN 205527560 U	31 August 2016	None	
CN 208561596 U	01 March 2019	None	

Form PCT/ISA/210 (patent family annex) (January 2015)