(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 4 817 988 A1

(12) EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:
07.10.2026 Bulletin 2026/41

(21) Application number: **24896290.4**

(22) Date of filing: **15.11.2024**

(51) International Patent Classification (IPC):
B61D 23/02 *(2006.01)*

(86) International application number:
PCT/CN2024/132255

(87) International publication number:
WO 2025/113199 (05.06.2025 Gazette 2025/23)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

(30) Priority: **30.11.2023 CN 202311622834**
29.03.2024 CN 202410375459

(71) Applicant: **Nanjing Kangni Mechanical&electrical Co., Ltd.**
Nanjing, Jiangsu 210038 (CN)

(72) Inventors:
- **CHEN, Hui**
  Nanjing, Jiangsu 210038 (CN)
- **LIU, Luoming**
  Nanjing, Jiangsu 210038 (CN)
- **DING, Ruiquan**
  Nanjing, Jiangsu 210038 (CN)
- **ZHANG, Gaoxiang**
  Nanjing, Jiangsu 210038 (CN)
- **JIA, Yuntong**
  Nanjing, Jiangsu 210038 (CN)
- **ZHOU, Tingdong**
  Nanjing, Jiangsu 210038 (CN)

(74) Representative: **Murgitroyd & Company**
165-169 Scotland Street
Glasgow G5 8PL (GB)

(54) RELEASE AND RETRIEVAL APPARATUS FOR RAILCAR EVACUATION RAMP

(57) Disclosed is a release and retrieval apparatus for a railcar evacuation ramp, comprising a speed reducer and left and right retrieval discs that are arranged at two ends of the speed reducer and used for winding a pull strap; a left half shaft and a right half shaft respectively connected to the left retrieval disc and the right retrieval disc are arranged at left and right ends of the speed reducer; an output end of the speed reducer is connected to the left half shaft, and transmission is carried out between the left half shaft and the right half shaft by means of a transition shaft. When a power apparatus drives the speed reducer to rotate, reduce speed, and increase torque, power output of the speed reducer is transmitted directly to the left retrieval disc by means of the left half shaft, and is transmitted to the right half shaft by means of the transition shaft and then transmitted to the right retrieval disc, which is used for retrieving the pull strap. During release, synchronous rotation is carried out by the left retrieval disc and the right retrieval disc by means of the transition shaft, and thereby synchronous movement of the left retrieval disc and the right retrieval disc for the pull strap can be achieved without the discs being connected to the same shaft; the speed reducer can be mounted on the same axis as the retrieval discs, achieving a reduction in size that facilitates installation of the whole retrieval apparatus.

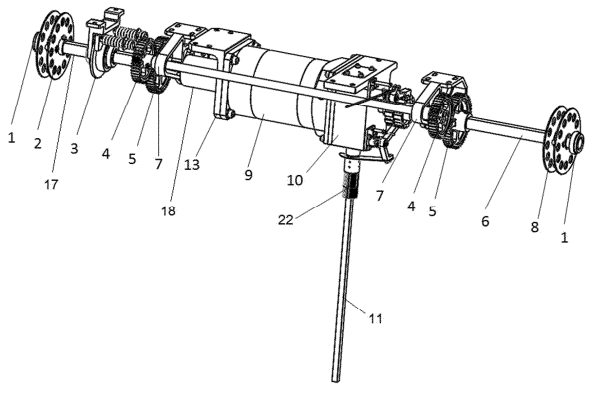


FIG. 1

EP 4 817 988 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to railcar accessories, and in particular to a release and retrieval apparatus for a railcar evacuation ramp.

BACKGROUND

[0002] Emergency evacuation ramps are often retracted through retrieval devices. For example, Chinese Invention Patent (Publication No. CN 108454643 A) discloses a deceleration retrieval device for an emergency evacuation system of a driverless metro train. The emergency evacuation ramp needs to be retracted manually to avoid the impact of power failure. However, this solution only considers the retrieval process, without considering automatic release, of the emergency evacuation ramp. Chinese Invention Patent (Publication No. CN 110329291 A) discloses an emergency evacuation ramp for a rail transit train, which is provided with a ratchet wheel and pawl structure. A driving gear is arranged on one side of the ratchet wheel, and the ratchet wheel can be engaged with or disengaged from the driving gear under the actuation of a shifting fork mechanism. When being engaged with the driving gear, the ratchet wheel can drive the driving gear to rotate, thereby controlling the retrieval of the emergency evacuation ramp. When the ratchet wheel is disengaged from the driving gear, the driving gear rotates freely to release the emergency evacuation ramp. The device improves safety during release and retrieval of the emergency evacuation ramp. However, since a pushing mechanism and a retrieval disc of the device are installed separately, installation and commissioning become more complicated, and ramp release and retrieval are not sufficiently simple. The device needs to be further optimized.

SUMMARY

[0003] An objective of the present invention is to provide a release and retrieval apparatus for a railcar evacuation ramp that is easy to install and has a reduced size.

[0004] Technical solution: the release and retrieval apparatus for a railcar evacuation ramp provided in the present invention includes a speed reducer, a left retrieval disc and a right retrieval disc that are arranged at two ends of the speed reducer and used for winding a pull strap; a left half shaft and a right half shaft respectively connected to the left retrieval disc and the right retrieval disc are arranged at left and right ends of the speed reducer; an output end of the speed reducer is connected to the left half shaft, and transmission is carried out between the left half shaft and the right half shaft by means of a transition shaft. When a power apparatus drives the speed reducer to rotate, reduce speed, and increase torque, power output of the speed reducer is transmitted directly to the left retrieval disc by means of the left half shaft, and is transmitted to the right half shaft by means of the transition shaft and then transmitted to the right retrieval disc, which is used for retrieving the pull strap. During release, synchronous rotation is carried out by the left retrieval disc and the right retrieval disc by means of the transition shaft, and thereby synchronous movement of the left retrieval disc and the right retrieval disc for the pull strap can be achieved without the discs being connected to the same shaft; the speed reducer can be mounted on the same axis as the retrieval discs, achieving a reduction in size that facilitates installation of the whole retrieval apparatus.

[0005] Preferably, the left half shaft and the right half shaft are parallel to the transition shaft, first gears are sleeved on middle portions of the left half shaft and the right half shaft respectively, second gears that mesh with the first gears are sleeved on two ends of the transition shaft, the left half shaft and the right half shaft rotate synchronously via the first gears, the second gears, and the transition shaft, and meshing transmission of the gears ensures the stability of transmission.

[0006] Preferably, a damping line disc assembly is disposed on the left half shaft, the damping line disc assembly is configured to adjust resistance and reduce a rotational speed of the retrieval discs when releasing the retrieval discs, thus making the release of the pull strap smoother.

[0007] Preferably, support seats for supporting the transition shaft are sleeved on the left half shaft and the right half shaft, respectively.

[0008] An input end of the speed reducer does not provide torque amplification effect, but is provided with a one-way retrieval mechanism with a margin to enhance the safety of retrieval.

[0009] Preferably, a first ratchet wheel and a first pawl for unidirectional retrieval of the pull strap are connected to the input end of the speed reducer, and a second ratchet wheel and a second pawl for preventing excessive retrieval of the pull strap are connected to the input end of the speed reducer, the first ratchet wheel and the second ratchet wheel are coaxially connected. Since the first ratchet wheel is connected to the input end of the speed reducer, the first ratchet wheel does not provide a torque amplification effect through an output end of the speed reducer.

[0010] A locking mechanism of the speed reducer used in the present invention includes an adapter; a transmission assembly connected to the input end of the speed reducer, and a deflection assembly for changing a power direction of the speed reducer are arranged inside the adapter; an end of the transmission assembly extending out of the adapter is connected to the first ratchet wheel, and an outer side wall of the adapter is rotatably connected to the first pawl; and an end of the deflection assembly extending out of the adapter is provided with a connector to drive a front end of the first pawl to enter a

tooth groove of the first ratchet wheel. The end of the deflection assembly extending out of the adapter is engaged with an output shaft of a power apparatus. During engagement, the output shaft of the power apparatus drives the connector to move toward the adapter, and the connector is driven to rotate to complete a locking action of the locking mechanisms.

[0011] Preferably, the connector is a connecting piece, and the connecting piece slides in an axial direction of the deflection assembly to drive the front end of the first pawl into a tooth groove of the first ratchet wheel.

[0012] Preferably, a distal end of the deflection assembly is provided with a sleeve that is connected to the power apparatus, the sleeve is configured to push the connecting piece to slide in the axial direction of the deflection assembly, and the sleeve is detachably connected to the deflection assembly.

[0013] Preferably, a detent ball is disposed at an end of a deflection shaft, a side hole is formed in an inner wall of the sleeve, and the deflection shaft and the sleeve are detachably connected through the detent ball and the side hole.

[0014] Preferably, a protruding end of the deflection assembly is connected to the sleeve through a connecting shaft with a smaller diameter than that of the deflection assembly; and the connecting piece is sleeved on the connecting shaft, and a stepped structure is formed between the connecting shaft and the deflection assembly/worm shaft, limiting excessive sliding of the connecting piece.

[0015] Preferably, the connecting piece is an elastic piece; and a connecting piece connected to a connecting end of the first pawl to the first pawl has a vertical swing angle of no more than 10°, allowing the connecting piece to swing within an appropriate range to ensure its service life.

[0016] Preferably, in order to ensure that when the sleeve is removed, the first pawl can disengage smoothly from the first ratchet wheel, a torsion spring is disposed between the adapter and the first pawl to push the front end of the first pawl out of the tooth groove of the first ratchet wheel.

[0017] Preferably, the transmission assembly is a worm gear, and the deflection assembly is a worm shaft.

[0018] Preferably, an end of the adapter is connected to a second ratchet wheel in an opposite direction to the first ratchet wheel, an outer side wall of the adapter is rotatably connected to the second pawl, a front end of the second pawl extends into a tooth groove of the second ratchet wheel, and the second ratchet wheel and second pawl are configured to prevent excessive rotation of the speed reducer.

[0019] On this basis, the present invention provides a high-safety release and retrieval apparatus for a railcar evacuation ramp, including the above release and retrieval apparatus for a railcar evacuation ramp and the locking mechanism for the speed reducer. An input end of the speed reducer is connected to the adapter that deflects a power direction of the speed reducer, the speed reducer is connected to the first ratchet wheel and the second ratchet wheel through the adapter, the first pawl and the second pawl are rotatably connected to side walls of the adapter respectively, the first pawl and the second pawl are arranged vertically, the front end of the second pawl is engaged with the second ratchet wheel due to its own weight, and the front end of the first pawl is engaged with the first ratchet wheel due to its own weight. During safe motion of the railcar, the front end of the first pawl is disengaged from the tooth groove of the first ratchet wheel due to its own weight. In the event of an emergency, an emergency door is opened, and the pull strap is released smoothly.

[0020] Preferably, a torsion spring is provided between the first pawl and the adapter to enable the front end of the first pawl to disengage from the first ratchet wheel.

[0021] Preferably, one end of the worm gear of the adapter is connected to the input end of the speed reducer, and the other end is connected to either the first ratchet wheel or the second ratchet wheel; and the worm shaft of the speed reducer is connected to a power apparatus, and the power apparatus is a hand crank or an electric screwdriver. Preferably, a rear end of the second pawl is connected to the emergency door of the railcar. When the emergency door is opened, the front end of the second pawl is driven to disengage from the second ratchet wheel. During safe motion of the railcar, the emergency door is closed, the second pawl is not driven to rotate, and the front end of the second pawl is engaged with the tooth groove of the second ratchet wheel due to its own weight, preventing the pull strap from excessive retrieval due to misoperation. In the event of an emergency, when the emergency door is rotated and opened, the second pawl is driven to disengage. After use, the pull strap can be smoothly retrieved by the retrieval disc, and the evacuation ramp is accordingly retrieved.

[0022] Preferably, one end of the connecting piece is sleeved on the worm shaft of the adapter, and the other end of the connecting piece is connected to a rear end of the first pawl. The connecting piece slides in an axial direction of the worm shaft to drive the front end of the first pawl into the tooth groove of the first ratchet wheel. When the worm shaft of the adapter is connected to the power apparatus, the connecting piece is pushed to slide a given distance along the worm shaft, the connecting piece drives the first pawl to rotate, and the front end of the first pawl is engaged with the first ratchet wheel, such that the first ratchet wheel can rotate only in an unidirectional direction, and the retrieval discs rotate only in the unidirectional direction. When the power apparatus is disconnected, the first pawl is disengaged from the first ratchet wheel due to its own weight or by the torsion spring, and the left retrieval disc and the right retrieval disc can be released freely.

[0023] Beneficial effects: Compared with the prior art, the present invention has the following significant advan-

tages: 1. It features compact structure, reduced size, and large load-bearing capacity; 2. It facilitates simple release and retrieval operation, smooth transmission, and easy commissioning and maintenance; and 3. It has a minimal impact on a size of the existing door system and applicable to various operational conditions.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

FIG. 1 is a schematic diagram of an overall structure of the present invention from a first perspective.
FIG. 2 is a schematic diagram of an overall structure of the present invention from a second perspective.
FIG. 3 is a schematic diagram of an overall structure of the present invention from a third perspective.
FIG. 4 is an enlarged view of a partial structure in FIG. 1.
FIG. 5 is a sectional view of a structure of a pushing device and a power apparatus of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0025] The technical solution of the present invention will be further described below with reference to the accompanying drawings.

Embodiment 1:

[0026] As shown in the figures, a release and retrieval apparatus for a railcar evacuation ramp includes end bearing seats 1, a left retrieval disc 2, a damping line disc assembly 3, first gears 5, second gears 4, a right half shaft 6, a mounting bracket 7, a right retrieval disc 8, a speed reducer 9, an adapter 10, a manual lever 11, a transition shaft 12, a speed reducer mounting base 13, a first ratchet wheel 14, a second ratchet wheel 15, a first pawl 16, a left half shaft 17, a coupling sleeve 18, and a second pawl 19. The speed reducer 9 and the mounting bracket 7 are arranged in a central portion. A left output end of the speed reducer 9 is connected to the left half shaft 17 through the coupling sleeve 18, the left retrieval disc 2 and one end bearing seat 1 are installed on an end portion of the left half shaft 17, and the damping line disc assembly 3 is installed in a central portion of the left half shaft. The adapter 10 and the right half shaft 6 are arranged on a right side of the speed reducer 9, the right half shaft 6 and the left half shaft 17 are aligned on a same axis, the right retrieval disc 8 and one end bearing seat 1 are installed on an end portion of the right half shaft 6, and the right half shaft 6 is not directly connected to the speed reducer 9.

[0027] The first gear 5 is fixedly mounted on shaft bodies of the left half shaft 17 and the right half shaft 6, and the mounting bracket 7 is sleeved over the shaft bodies, a rear of the mounting bracket 7 is configured to support the left half shaft 17 and the right half shaft 6 together with the end bearing seat 1, a front of the mounting bracket 7 is rotatably connected to the transition shaft 12, and both ends of the transition shaft 12 are respectively connected to the second gears 4 that mesh with the first gears 5. When the left retrieval disc 2 and the right retrieval disc 8 move, synchronous operation may be achieved through the transition shaft 12.

[0028] When releasing a pull strap connected to the evacuation ramp, the left retrieval disc 2 and the right retrieval disc 8 on both sides of the apparatus rotate synchronously and quickly in a clockwise direction due to the transmission among the first gear 5, the second gear 4, and the transition shaft 12, and the damping line disc assembly 3 adjusts resistance to slow down a rotation speed of the left retrieval disc 2. When retrieving the pull strap connected to the evacuation ramp, an input end of the speed reducer 9 is manually rotated or connected to an electric screwdriver to serve as a power apparatus. Taking manual operation as an example, power from manual rotation is inputted to the input end of the speed reducer 9. After deceleration and torque amplification by the speed reducer 9, the amplified power is transmitted to the left retrieval disc 2 via the left half shaft 17, and simultaneously transmitted to the right retrieval disc 8 through two gear sets consisting of the first gear 5, and the second gear 4, as well as the transition shaft 12, and the right half shaft 6, thereby completing the retrieval of the pull strap.

[0029] The release and retrieval apparatus for a railcar evacuation ramp of the present invention is installed on a top of the railcar at a given height. In order to facilitate power input, the adapter 10 for changing a power input direction of the speed reducer 9 is arranged at the input end of the speed reducer 9 (that is, between the speed reducer 9 and the right half shaft 6). The power apparatus inputs power to the speed reducer 9 via the adapter 10, a transmission assembly connected to the input end of the speed reducer 9, and a deflection assembly for changing a power direction are arranged inside the adapter 10, the transmission assembly and the deflection assembly together form a transmission group, which may be a worm gear and worm shaft assembly or may be a bevel gear set. Taking the worm gear and worm shaft assembly as an example, the transmission assembly serves as a worm gear (not shown in the figure), and the deflection assembly serves as the worm shaft 102. When the power is manually inputted, the manual lever 11 is connected to the worm shaft of the adapter 10. By rotating the manual lever 11, an input end of the worm gear of the adapter 10 inputs the power of the manual lever 11 to the speed reducer 9 through the worm gear.

Embodiment 2:

[0030] The release and retrieval apparatus for a railcar evacuation ramp in this embodiment is basically the same as that in Embodiment 1, except that the input

end of the speed reducer 9 is directly connected to, or through the adapter 10 connected to a first locking mechanism and a second locking mechanism, thereby forming a complete safe release and retrieval structure. The first locking mechanism is configured to ensure safety during retrieval and prevent the left retrieval disc and the right retrieval disc from releasing the pull strap during the retrieval process, and the second locking mechanism is configured to prevent excessive retrieval of the pull strap.

[0031] The first locking mechanism and the second locking mechanism may be common ratchet wheel and pawl structures, or other structures capable of performing unidirectional motion. Taking the ratchet wheel and pawl structure as an example, the first locking mechanism includes a first ratchet wheel 14 and a first pawl 16. The input end of the speed reducer 9 is directly connected to, or connected through the adapter 10 to, the first ratchet wheel 14, and the first pawl 16 is rotatably connected to an end face of the input end of the speed reducer 9 or to a side wall of the adapter 10 proximal to the right half shaft 6. When a front end of the first pawl 16 extends into a tooth groove of the first ratchet wheel 14, the speed reducer 9 can rotate only in one direction to retract the pull strap. The front end of the first pawl 16 may fall into the tooth groove of the first ratchet wheel 14 due to its own weight, or may be pushed into the tooth groove by external force. In order to ensure smooth release of the pull strap, in this embodiment, the front end of the first pawl 16 is pushed to enter the first ratchet wheel 14 under the action of external force, a pushing device for pushing the first pawl 16 to extend into the first ratchet wheel 14 is arranged on the speed reducer 9 or the adapter 10. For the convenience of manual operation, the pushing device is disposed at a bottom of the speed reducer 9 or the adapter 10. The pushing device may be electrically driven or manually driven, and may be a sliding pushing device, such as a sliding block, or a rotatable pushing device, such as a cam. To facilitate automatic release of the pull strap, a torsion spring 20 is disposed between the speed reducer 9 or the adapter 10 and the first pawl 16. When the torsion spring 20 is not deformed, the front end of the first pawl 16 is disengaged from the first ratchet wheel 14.

[0032] The second locking mechanism includes a second ratchet wheel 15 and a second pawl 19, the second ratchet wheel 15 connected side by side and coaxially with the first ratchet wheel 14 is connected to the input end of the speed reducer 9 or to one end of the worm shaft of the adapter 10 proximal to the right half shaft 6, and the second pawl 19 is rotatably connected to an end face of the input end of the speed reducer 9 or to a side wall of the adapter 10 proximal to the right half shaft 6. Ratchet teeth of the first ratchet wheel 14 and the second ratchet wheel 15 are in opposite directions, and rotation shafts of the first pawl 16 and the second pawl 19 are arranged opposite each other in a vertical direction (that is, front ends of the first pawl 16 and the second pawl 19 are oriented toward each other and closely arranged). A front end of the second pawl 19 extends into a tooth groove of the second ratchet wheel 15 due to its own weight or external force. To avoid affecting the retrieval of the pull strap, the second pawl 19 is driven by the external force into the second ratchet wheel 15. To reduce additional operations, a rear end of the second pawl 19 (an end distal to the second ratchet wheel 15) is connected to a connecting rope, and the rear end of the second pawl 19 is further connected to an emergency door of the railcar through the connecting rope.

[0033] When releasing a pull strap connected to the evacuation ramp, the first pawl 16 is disengaged from the first ratchet wheel 14 due to its own weight or the torsion spring 20, such that the left retrieval disc 2 and the right retrieval disc 8 can rotate backward synchronously to release the pull strap. Since the emergency door must be opened first before releasing the evacuation ramp, the rotation of the emergency door drives the front end of the second pawl 19 to disengage from the second ratchet wheel 15, a locking state of the second locking mechanism is released, and the evacuation ramp can be retracted after use. During retrieval, the pushing device drives the front end of the first pawl 16 to extend into the first ratchet wheel 14, such that the first ratchet wheel 14 can only rotate forward in one direction, the speed reducer 9 or the worm gear of the adapter 10 can only rotate forward in one direction, power is inputted to the speed reducer 9 directly or through the manual lever 11 and the adapter 10. After deceleration and torque amplification by the speed reducer 9, the power is transmitted to the left retrieval disc 2 via the left half shaft 17, and synchronously transmitted to the right retrieval disc 8 through two gear sets consisting of the first gears 5, and the second gears 4, as well as the transition shaft 12, and the right half shaft 6, thereby completing the retrieval of the pull strap. After the emergency door is closed, the second pawl 19 drops back into the second ratchet wheel 15, and the worm gear of the adapter 10 can no longer rotate forward in one direction, and further retrieval cannot be performed. After the retrieval is completed, the pushing device stops pushing, the front end of the first pawl 16 is disengaged from the first ratchet wheel 14. When the emergency door is opened, the pull strap can be released smoothly and automatically.

Embodiment 3:

[0034] The pull strap release and retrieval device of this embodiment is basically the same as that in Embodiment 2, except that the pushing device for driving the first pawl 16 to rotate is a connecting piece 21, the connecting piece 21 may be a metal sheet capable of deforming and rapidly returning to its original state, or it may be made of other materials.

[0035] One end of the connecting piece 21 is sleeved on the worm shaft 102 of the adapter 10, and the other end thereof is connected to a rear end of the first pawl 16. In order to cause the connecting piece 21 to slide within

an appropriate range, the connecting piece 21 is sleeved on a connecting shaft having a diameter smaller than that of the worm shaft 102. A stepped structure is formed between the connecting shaft and the worm shaft 102 to limit excessive sliding of the connecting piece 21.

[0036] The first ratchet wheel 14 and the first pawl 16 rotate in a plane parallel to a side wall of the adapter 10, and the first pawl 16 has an L-shaped cross-section, and has a bent portion 161 at its rear end. A plane where the bent portion 161 is located is parallel to or at a given angle with respect to a bottom surface of the adapter 10. The bent portion 161 may be bent in a forward direction (toward the first pawl 16) or a reverse direction. The connecting piece 21 is connected to the first pawl 16 through the bent portion 161, the connecting piece 21 slides in an axial direction of the connecting shaft of the worm shaft 102, thereby driving the front end of the first pawl 16 to extend into the first ratchet wheel 14.

[0037] The worm shaft 102 is detachably connected to a sleeve 22. Specifically, a detent ball 101 is disposed on the connecting shaft of the worm shaft of the adapter 10, and a side hole (not shown in the figure) that mates with the detent hall 101 is formed on a side wall of the sleeve 22, and the detent ball 101 is snap-fitted into the side hole of the sleeve 22 to form a connection.

[0038] The sleeve 22 moves in an axial direction of the worm shaft 102, such that the manual lever 11 is connected to an end portion of the worm shaft 102 of the adapter 10; and the sleeve 22 slides along the worm shaft 102 to push the connecting piece 21 to slide in the axial direction of the worm shaft 102.

[0039] When in use, the sleeve 22 is connected to the end portion of the worm shaft of the adapter 10. During the connection, a front end of the sleeve 22 pushes the connecting piece 21, the connecting piece 21 in turn drives the first pawl 16 to rotate, such that the front end of the first pawl 16 rotates until the front end of the first pawl 16 is engaged with the tooth groove of the first ratchet wheel 14, the detent ball 101 is snap-fitted into the side hole of the sleeve 22 at the same time, the sleeve 22 is fixed to a shaft end of the worm shaft 102 of the adapter 10, the manual lever 11 is then connected to the sleeve 22, and the manual lever 11 is then rotated to realize the retrieval of the pull strap. During retrieval, the first ratchet wheel 14 moves in synchronization with the motion of the left retrieval disc and the right retrieval disc, and the first ratchet wheel 14 rotates forward in one direction. One end of the connecting piece 21 proximal to the first pawl 16 swings up and down, and the front end of the first pawl 16 is driven to swing up and down accordingly, thereby allowing smooth retrieval of the pull strap. When the rotation of the manual lever 11 needs to be stopped during retrieval, and the left retrieval disc 2 and the right retrieval disc 8 tend to release the pull strap, in which case, the front end of the first pawl 16 is engaged with the tooth groove of the first ratchet wheel 14, and the front end of the first pawl 16 forms a force dead point, preventing the pull strap from being released. After the retrieval of pull strap is completed, the sleeve 22 is removed, the connecting piece 21 loses its support, and the elastic force disappears. Under the action of the torsion spring or due to the weight of the first pawl 16, the front end thereof is disengaged from the tooth groove of the first ratchet wheel 14, thereby releasing the force dead point, that is, removing the sleeve 22 does not lock the rotation of the first ratchet wheel 14.

Claims

1. A release and retrieval apparatus for a railcar evacuation ramp, comprising a speed reducer, and a left retrieval disc (2) and a right retrieval disc (8) that are arranged at two ends of the speed reducer (9) and used for winding a pull strap, **characterized in that** a left half shaft (17) and a right half shaft (6) respectively connected to the left retrieval disc and the right retrieval disc are arranged at a left end and a right end of the speed reducer (9), an output end of the speed reducer (9) is connected to the left half shaft, and transmission is carried out between the left half shaft and the right half shaft by means of a transition shaft (12).

2. The release and retrieval apparatus for a railcar evacuation ramp according to claim 1, **characterized in that** first gears (5) are sleeved on middle portions of the left half shaft and the right half shaft respectively, second gears (4) that mesh with the first gears (5) are respectively sleeved on two ends of the transition shaft, and the left half shaft and the right half shaft rotate synchronously through the first gears, the second gears, and the transition shaft.

3. The release and retrieval apparatus for a railcar evacuation ramp according to claim 1 or 2, **characterized in that** the left half shaft is connected to the output end of the speed reducer through a coupling sleeve (18), support seats (7) for supporting the transition shaft are sleeved on the left half shaft and the right half shaft respectively, and end bearing seats are arranged on sides of the left retrieval disc and the right retrieval disc distal to the speed reducer, respectively.

4. The release and retrieval apparatus for a railcar evacuation ramp according to claim 1 or 2, **characterized in that** a damping line disc assembly (3) is arranged on the left half shaft.

5. The release and retrieval apparatus for a railcar evacuation ramp according to claim 1, **characterized in that** a first ratchet wheel (14) and a first pawl (16) for unidirectional retrieval of the pull strap are connected to an input end of the speed reducer (9), and a second ratchet wheel (15) and a second pawl

(19) for preventing excessive retrieval of the pull strap are also are connected to the input end of the speed reducer; and the first ratchet wheel and the second ratchet wheel are coaxially connected in opposite directions.

6. The release and retrieval apparatus for a railcar evacuation ramp according to claim 5, **characterized in that** the input end of the speed reducer is provided with an adapter (10) for deflecting a power direction of the speed reducer, the speed reducer is connected to the first ratchet wheel and the second ratchet wheel through the adapter, the first pawl and the second pawl are rotatably connected to side walls of the adapter respectively, the first pawl and the second pawl are arranged vertically, and a torsion spring (20) is disposed between the first pawl and the adapter and is configured to enable a front end of the first pawl to be disengaged from the first ratchet wheel.

7. The release and retrieval apparatus for a railcar evacuation ramp according to claim 6, **characterized in that** a rear end of the second pawl is connected to an emergency door of the railcar, and when the emergency door is opened, a front end of the second pawl is driven to disengage from the second ratchet wheel.

8. The release and retrieval apparatus for a railcar evacuation ramp according to claim 6, **characterized in that** the adapter is a worm gear and worm shaft assembly, one end of a worm gear of the adapter is connected to the input end of the speed reducer, and the other end of the worm gear is connected to either the first ratchet wheel or the second ratchet wheel; and the worm shaft of the adapter is connected to a power apparatus.

9. The release and retrieval apparatus for a railcar evacuation ramp according to claim 8, **characterized in that** a side or a bottom of the adapter is provided with a pushing device for pushing the front end of the first pawl to extend into a tooth groove of the first ratchet wheel.

10. The release and retrieval apparatus for a railcar evacuation ramp according to claim 9, **characterized in that** the pushing device is an elastic connecting piece (21), one end of the connecting piece is sleeved on the worm shaft at the bottom of the adapter, and the other end of the connecting piece is connected to a rear end of the first pawl; and the connecting piece slides in an axial direction of the worm shaft to drive the front end of the first pawl to enter the tooth groove of the first ratchet wheel.

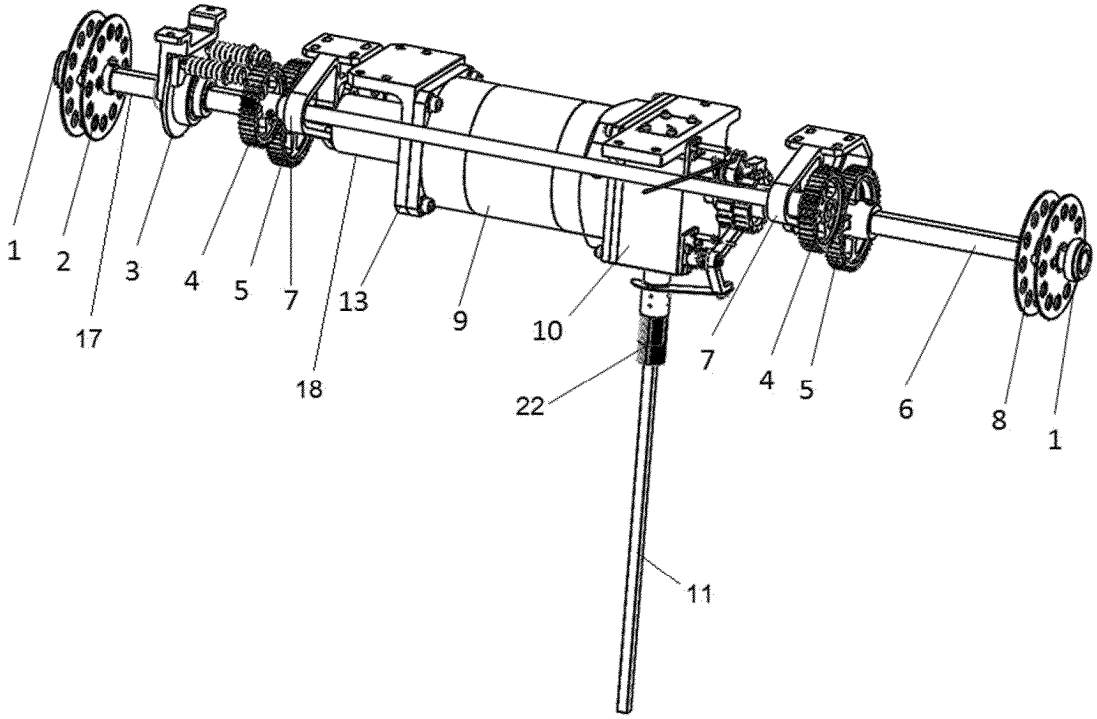


FIG. 1

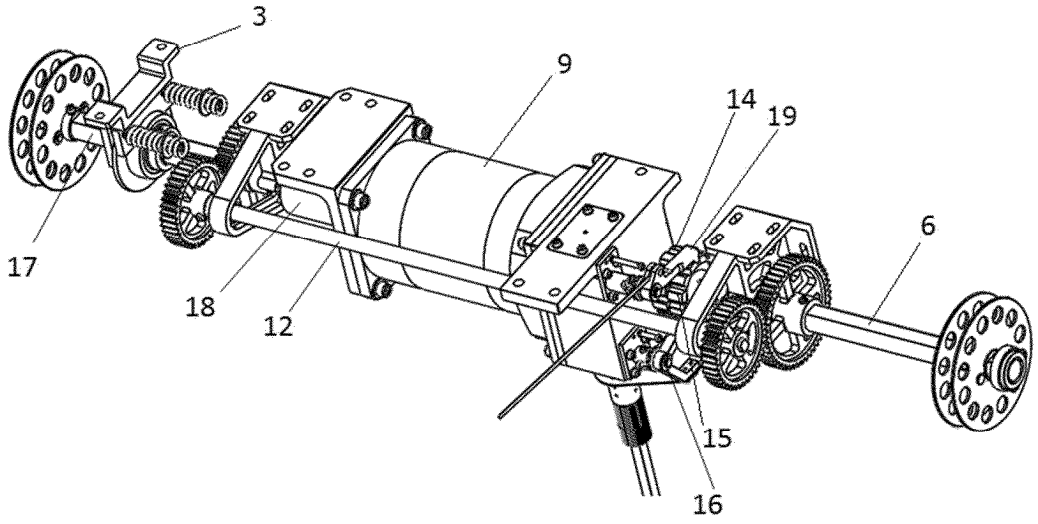


FIG. 2

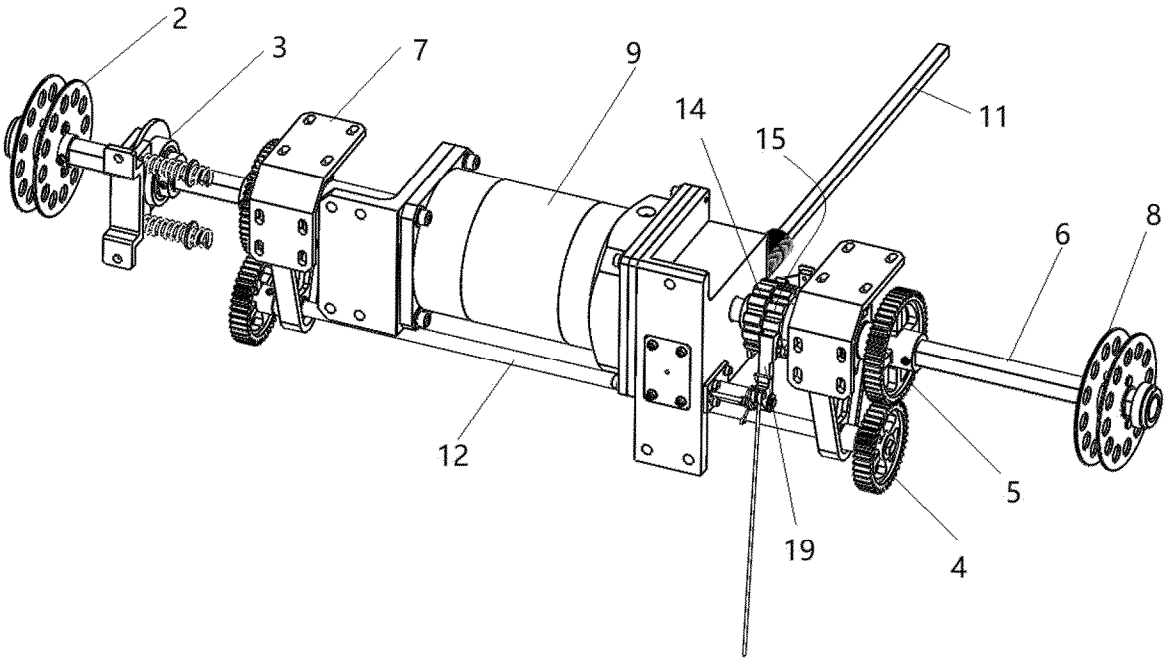


FIG. 3

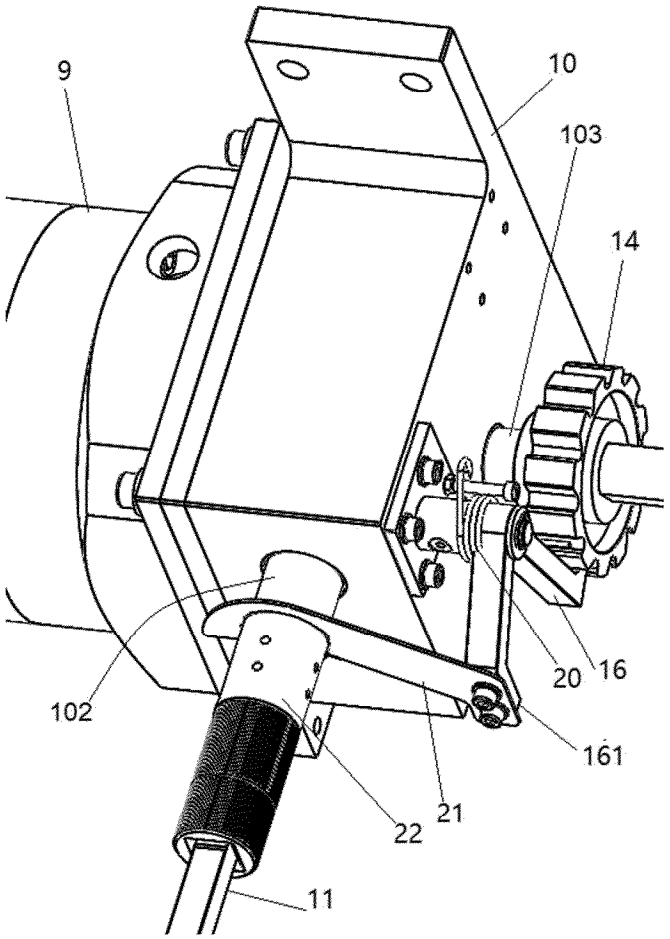


FIG. 4

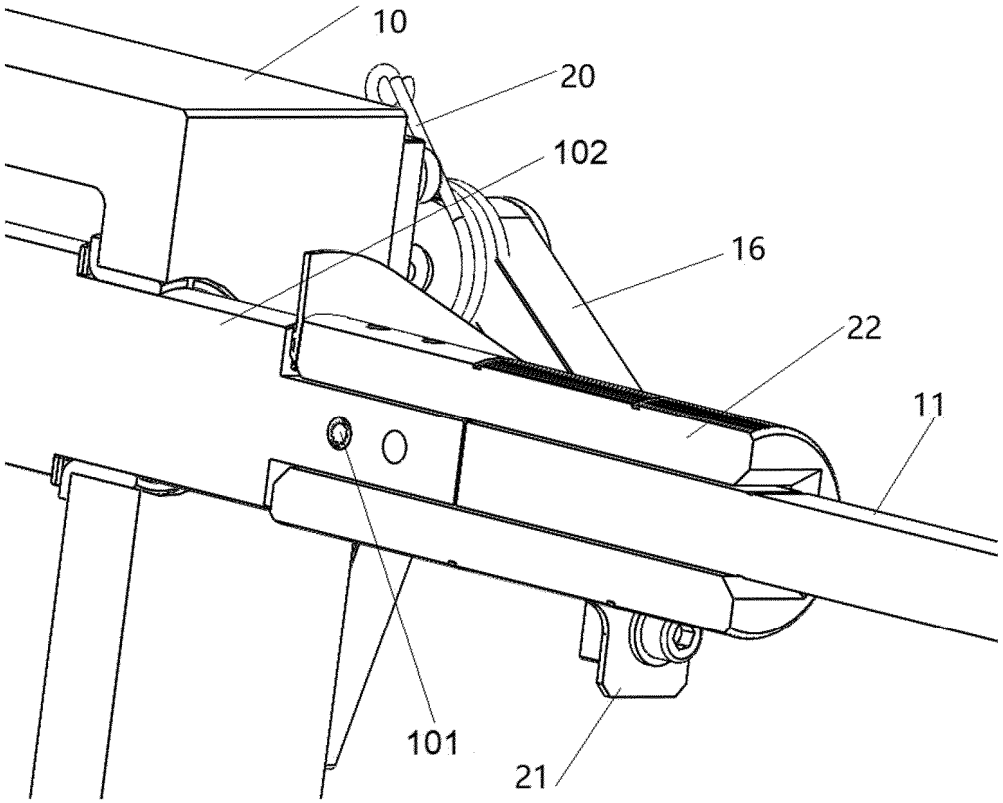


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2024/132255

A. CLASSIFICATION OF SUBJECT MATTER

B61D 23/02(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)

IPC:B61D

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)

CNTXT, ENTXTC, CJFD: 轨道, 车辆, 疏散, 坡道, 应急, 门, 轴, 左, 右, 过渡; VEN, WPABS, ENTXT: railway, vehicle, escape, emergent, evacuation, ramp, door, left, right, axle, middle.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 118025246 A (NANJING KANGNI MECHANICAL & ELECTRICAL CO., LTD.) 14 May 2024 (2024-05-14) claims 1-10	1-10
PX	CN 118238855 A (NANJING KANGNI MECHANICAL & ELECTRICAL CO., LTD.) 25 June 2024 (2024-06-25) description, paragraphs 24-44, and figures 1-5	1-10
Y	CN 216102096 U (CHENGDU XINZHU ROAD & BRIDGE MACHINERY CO., LTD.) 22 March 2022 (2022-03-22) description, paragraphs 19-47, and figures 1-10	1-10
Y	CN 115157925 A (ZHEJIANG GEELY HOLDING GROUP CO., LTD. et al.) 11 October 2022 (2022-10-11) description, paragraphs 19-51, and figures 1-3	1-10
A	CN 204998537 U (KTK GROUP CO., LTD.) 27 January 2016 (2016-01-27) entire document	1-10

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"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	Date of mailing of the international search report
14 February 2025	**22 February 2025**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088**	Telephone No.

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2024/132255

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 203198967 U (CHANGZHOU EVERGREEN TRANSPORT TECHNOLOGY CO., LTD.) 18 September 2013 (2013-09-18) entire document	1-10
A	US 2018319410 A1 (WESTINGHOUSE AIR BRAKE TECHNOLOGIES CORP.) 08 November 2018 (2018-11-08) entire document	1-10

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2024/132255

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 118025246 A	14 May 2024	None	
CN 118238855 A	25 June 2024	None	
CN 216102096 U	22 March 2022	CN 113696921 A	26 November 2021
		CN 113696921 B	21 January 2025
CN 115157925 A	11 October 2022	None	
CN 204998537 U	27 January 2016	None	
CN 203198967 U	18 September 2013	None	
US 2018319410 A1	08 November 2018	WO 2017091323 A1	01 June 2017
		US 11148685 B2	19 October 2021

Form PCT/ISA/210 (patent family annex) (July 2022)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 108454643 A **[0002]**
- CN 110329291 A **[0002]**