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

(11) **EP 4 001 200 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
30.04.2025 Bulletin 2025/18

(21) Application number: **21173137.7**

(22) Date of filing: **10.05.2021**

(51) International Patent Classification (IPC):
B66D 1/12 *(2006.01)* ***B66D 1/22*** *(2006.01)*
B66D 3/18 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B66D 1/12; B66D 1/225; B66D 3/18

(54) PORTABLE EMBEDDED DIRECT-CURRENT ELECTRIC HOIST

TRAGBARES EINGEBETTETES ELEKTRISCHES GLEICHSTROMHEBEZEUG

TREUIL ÉLECTRIQUE PORTABLE ENCASTRÉ À COURANT CONTINU

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **23.11.2020 CN 202011325016**

(43) Date of publication of application:
25.05.2022 Bulletin 2022/21

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(56) References cited:
CN-A- 108 657 982
CN-A- 111 204 671
CN-U- 203 199 931
CN-U- 206 156 640
JP-A- H05 316 908

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to the technical field of electric hoists, and in particular, to a portable embedded direct-current electric hoist with easy installation, a small volume, and good safety performance.

BACKGROUND

[0002] With the development of society and the progress of science and technology, people's economic income has been greatly increased, material living standards have undergone fundamental changes, and people have increasingly higher requirements on purchased hoisting equipment. Many hoisting equipment currently on the market uses an alternate-current motor, which is not convenient and cumbersome for outdoor or family use. At present, foreign countries are developing a small number of direct-current electric hoist products, with a structure that a motor, a reducer, and a steel wire rope drum are connected in series on the same axis, which has disadvantages of a large size in length, a bulky structure, and low mechanical efficiency. Moreover, the motor of the electric hoist products developed by the foreign countries adopts a brushed commutator direct-current motor, and a carbon brush needs to be replaced after a period of use. In use, a commutator frequently contacts the carbon brush to commutate at a high speed in case of a severe environment and high strength, which easily causes damage or even burn-in to the commutator. Besides, since the direct-current electric hoist is not provided with a braking device, there are serious safety risks, and the potential danger is self-evident. It at best can only be called a tractor but cannot be used as an electric hoist. Therefore, it is an urgent problem to develop a direct-current electric hoist with a simple and convenient structure, good safety performance, and practicability. Therefore, lots of manufacturers and people of insight are carrying out development and trial production in view of the above problems, but so far there has not been a more ideal product. JPH05316908A discloses the preamble of claim 1 and provides the fishing reel not causing the runaway of a control system by noises on the driving of an electric motor and capable of surely transmitting the power of the motor to the spool for the smooth delivery of the fishing line, when the fishing line is delivered; an electric motor M for transmitting a driving power to a spool 5 for winding up a fishing line 4 is formed into a reciprocatively rotatable brushless type motor; when the fishing line 4 is wound up, the electric motor M is driven in the forward direction, and when the fishing line 4 is delivered, the electric motor M is driven in the backward direction. CN206156640U discloses a miniature lifting machine of frequency conversion control adjustable speed, including two base supports, all there is the end cover on two base supports, install the reel of end cover free rotation relatively between two end covers, fixed mounting has DC Brushless motor and planetary gearbox in the reel, and DC Brushless motor connects planetary gearbox, the planetary gearbox accordant connection spline housing, the outer wall of spline housing is connected in order to drive the reel rotation with the meshing of the inner wall of reel, DC brushless motor deviates from planetary gearbox one end and installs the electromagnetic braking device, and electromagnetic braking device periphery side is provided with friction sleeve, DC brushless motor inserts the alternating current 220V power through the integrated circuit who takes the frequency conversion function, takes the integrated circuit of frequency conversion function to convert direct current power supply to DC brushless motor. CN111204671A discloses a mini winch for storing and placing a detecting instrument on the air water interface; a roller assembly is installed in the middle of a rack, the upper portion of the rack is provided with a rope press assembly, and a driving element is placed on one end of the roller assembly and drives the roller assembly to rotate. The other end of the roller assembly transmits power to a rope arrangement mechanism, a cutting structure is arranged below the rope arrangement mechanism and installed on the bottom of the rack, and an operation system is installed in an electric appliance and communication element mounting box of the top of the rack. CN108657982A discloses a portable lifting traction device, and relates to the technical field of lifting equipment; the portable lifting traction device comprises a shell and a mechanism working part, the shell is arranged outside the mechanism working part, and the mechanism working part also comprises a driving part, a transmission part, a planetary deceleration part, a clutch device, a hoist working portion, a first support plate, a second support plate and a plurality of support columns; the first support plate and the second support plate are oppositely arranged and supported and fixed by the support columns, the hoist working portion is arranged between the first support plate and the second support plate, the driving portion is arranged outside the first support plate, the planetary deceleration portion is arranged outside the second support plate, and the clutch device is arranged at the end of the planetary deceleration portion. CN203199931U discloses an embedded type electric block which comprises a rope roll support, a steel wire rope roll (6), a wire pressing structure (7), a motor (14), a rope roll gear ring (24), a motor base (16), a gear box body (12) and a gear transmission structure; a left machine frame side board (3) and a right machine frame side board (11) are fixedly connected so that the rope roll support can be formed; the steel wire rope roll (6) is arranged on the left machine frame side board (3) and the right machine frame side board (11); the gear box body (12) is fixed on the right machine frame side board (11); the motor base (16) is fixed on the gear box body (12). The motor (14) is arranged in the steel wire rope roll (6) and fixed on the motor base (16); the rope roll gear ring

(24) is fixed on the steel wire rope roll (6) and arranged in the gear box body (12); the gear transmission structure is arranged between the gear box body (12) and the motor base (16); an output gear shaft (15) drives the rope roll gear ring (24) to rotate through the gear transmission structure.

SUMMARY

[0003] In order to overcome the above shortcomings existing in the prior art, an objective of the present disclosure is to provide a portable embedded direct-current electric hoist with a simple and reasonable structure, flexible and easy operation, a small volume, high transmission efficiency, a good braking effect, safe and reliable use.

[0004] The present disclosure adopts the following technical solution to solve the technical problem thereof: the portable embedded direct-current electric hoist includes a permanent magnet brushless direct-current motor, a controller, left and right end plates, a rope drum, a first reducer, and a second differential transmission device, the left and right end plates are fixedly connected into a whole through a connecting rod, the rope drum is rotatably arranged on the left and right end plates, a built-in motor base fixed to the right end plate is provided in the rope drum, the permanent magnet brushless direct-current motor and the first reducer are fixed, in an abutting manner, to the built-in motor base, so that the permanent magnet brushless direct-current motor and the first reducer are embedded in the rope drum, and the second differential transmission device is fixed to the left end plate and is connected to the first reducer through a transmission shaft; and during operation, the permanent magnet brushless direct-current motor drives, through the first reducer and the transmission shaft, the second differential transmission device to rotate, and the second differential transmission device drives the rope drum to rotate.

[0005] As a further solution of the present disclosure, the first reducer includes an inner fixed mount, a first sun wheel, a first planetary wheel, a first planetary carrier, an inner gear ring, and an outer fixed mount, the outer fixed mount and the inner gear ring are fixedly connected to the inner fixed mount, the first sun wheel is rotatably arranged on the inner fixed mount and abuts an output shaft of the permanent magnet brushless direct-current motor, the first planetary carrier is rotatably arranged on the outer fixed mount and abuts the transmission shaft, the first planetary wheel is rotatably correspondingly arranged on a fixed shaft of the first planetary carrier, and the first planetary wheel engages with the first sun wheel at an inner side and the inner gear ring at an outer side, respectively; and during operation, the permanent magnet brushless direct-current motor drives the first planetary wheel through the first sun wheel, and the first planetary wheel rotates relative to the inner gear ring to drive, through the first planetary carrier, the transmission shaft to rotate, so as to achieve one-stage reduction output.

[0006] According to the invention, the second differential transmission device includes a second sun wheel, a second planetary wheel, a floating planetary carrier, a fixed gear ring, a moving gear ring, and a second box body, the fixed gear ring is fixed to the second box body, the second sun wheel is rotatably arranged on the second box body and abuts the transmission shaft, the second planetary wheel is rotatably arranged on the floating planetary carrier, the second planetary wheel engages with the second sun wheel at an inner side and the fixed gear ring at an outer side respectively, the moving gear ring sleeves the second sun wheel, with one end simultaneously engaging with the second planetary wheel at an outer side and another end being connected to a fixed end plate on the rope drum, and the moving gear ring and the fixed gear ring are designed into a differential matching structure with different quantities of teeth; during operation, the first reducer drives the second sun wheel through the transmission shaft, the second sun wheel drives the second planetary wheel, the second planetary wheel rotates relative to the fixed gear ring to drive the moving gear ring and the rope drum to rotate, so as to achieve two-stage reduction and differential output; and in case of shutdown, a heavy object actively drives the moving gear ring through the rope drum, the moving gear ring drives the second planetary wheel to rotate, and in this case, since the quantity of the teeth of the fixed gear ring is different from that of the moving gear ring, the second planetary wheel is incapable of rotating relative to the fixed gear ring, resulting in one-way interlocking and achieving differential reverse mechanical braking.

[0007] According to the invention, in case of shutdown, the controller uses reverse electromotive force generated by the permanent magnet brushless direct-current motor to achieve electromagnetic braking.

[0008] As a further solution of the present disclosure, the left and right end plates are provided with a suspension mechanism, the suspension mechanism includes a suspension component connected to the left and right end plates and a protective hook rotatably arranged on the connecting rod, a protective hook hanging plate is fixed to the suspension component, the protective hook hanging plate is provided with a hanging hole matching the protective hook, the suspension component is provided with an elastically resettable protective buckle, and the protective buckle is provided with a protective buckle wrench.

[0009] As a further solution of the present disclosure, the controller is fixed to the right end plate through a controller housing, upper and lower limit components are correspondingly arranged between the left and right end plates below the rope drum, and the controller housing is correspondingly provided with upper and lower limit controllers matching the upper and lower limit components and electrically connected to the controller.

[0010] As a further solution of the present disclosure,

an aviation socket electrically connected to the controller and an aviation plug matching the aviation socket are fixed to the controller housing, the aviation plug is connected to a control handle through a control line, the control handle is provided with an emergency stop switch and up-down start switch, and a detachable lithium battery pack is arranged at a bottom of the control handle.

[0011] As a further solution of the present disclosure, the rope drum is provided with a rope drum perforated groove, a steel wire rope is introduced from the rope drum perforated groove and is wound on the rope drum, a tail of the steel wire rope is fixed to a fixed groove buckle of a rope drum left end plate through a tenon block, and a head of the steel wire rope is connected to a hook component for hanging a heavy object.

[0012] After the above structure is employed, there are the following advantages and effects compared with the prior art. Firstly, there is no precedent at home and abroad to apply a permanent magnet brushless direct-current motor technology to the field of hoisting. Mechanical commutation is replaced with electronic commutation. There are advantages of reliable performance, never wear, a low failure rate, a long life, a low no-load current, high efficiency, a small volume, and so on. Secondly, two-stage reduction is achieved through the first reducer and the second differential transmission device, so that less power can output a larger torque, greatly improving the hoisting capability. Thirdly, differential reverse mechanical braking is achieved through the second differential transmission device, electromagnetic braking is achieved through the controller and the permanent magnet brushless direct-current motor, and dual braking functions of mechanical braking and electromagnetic braking are available at the same time, which can avoid accidents of sudden sliding of load, so as to ensure safe and reliable hoisting. Since the permanent magnet brushless direct-current motor and the first reducer are fixed, in an abutting manner, to the built-in motor base, so that the permanent magnet brushless direct-current motor and the first reducer are embedded in the rope drum, which solves the problems of a large size in length, a bulky structure, and low mechanical efficiency, so as to make the present disclosure more safe and reliable and have better safety performance while being fast, time-saving, and portable. Fifthly, there is no need to temporarily pull a power supply, safe disassembly, installation, and use anytime and anywhere are available as required. Sixthly, the structure of the control handle is convenient for hand-held operations, and the lithium battery pack can be changed according to the power.

BRIEF DESCRIPTION OF DRAWINGS

[0013]

FIG. 1 is a schematic diagram of a matching structure according to the present disclosure.

FIG. 2 is a schematic diagram of a three-dimensional structure according to the present disclosure.

FIG. 3 is a schematic diagram of a usage state of a suspension mechanism according to the present disclosure.

[0014] In the drawings, 1: second differential transmission device, 2: left end plate; 3: connecting rod; 4: first reducer; 5: rope drum; 6: right end plate; 7: permanent magnet brushless direct-current motor; 8: controller; 9: second box body; 10: fixed gear ring; 11: second planetary wheel; 12: second sun wheel; 13: floating planetary carrier; 14: moving gear ring; 15: fixed end plate; 16: transmission shaft; 17: outer fixed mount; 18: first planetary carrier; 19: inner gear ring; 20: first planetary wheel; 21: first sun wheel; 22: inner fixed mount; 23: built-in motor base; 24: protective hook hanging plate; 25: suspension component; 26: aviation plug; 27: controller housing; 28: control line; 29: emergency stop switch and up-down start switch; 30: control handle; 31: lithium battery pack; 32: lower limit component; 33: upper limit component; 34: protective hook; 35: protective buckle wrench; 36: protective buckle; 37: aviation socket; 38: steel wire rope; 39: rope drum left end plate; 40: steel wire rope fixed groove buckle; 41: hook component.

DESCRIPTION OF EMBODIMENTS

[0015] FIG. 1 to FIG. 3 show a specific implementation solution of a portable embedded direct-current electric hoist according to the present disclosure, including a permanent magnet brushless direct-current motor 7, a controller 8, left and right end plates 2 and 6, a rope drum 5, a first reducer 4, and a second differential transmission device 1. The left and right end plates 2 and 6 are fixedly connected into a whole through a connecting rod 3, and the rope drum 5 is rotatably arranged on the left and right end plates 2 and 6. A built-in motor base 23 fixed to the right end plate 6 is provided in the rope drum 5. The permanent magnet brushless direct-current motor 7 and the first reducer 4 are fixed, in an abutting manner, to the built-in motor base 23, so that the permanent magnet brushless direct-current motor 7 and the first reducer 4 are embedded in the rope drum 5. The second differential transmission device 1 is fixed to the left end plate 2 and is connected to the first reducer 4 through a transmission shaft 16. During operation, the permanent magnet brushless direct-current motor 7 drives, through the first reducer 4 and the transmission shaft 16, the second differential transmission device 1 to rotate, and the second differential transmission device 1 drives the rope drum 5 to rotate.

[0016] In order to achieve one-stage reduction, the first reducer 4 includes an inner fixed mount 22, a first sun wheel 21, a first planetary wheel 20, a first planetary carrier 18, an inner gear ring 19, and an outer fixed mount 17. The outer fixed mount 17 and the inner gear ring 19 are fixedly connected to the inner fixed mount 22. The first sun wheel 21 is rotatably arranged on the inner fixed

mount 22 and abuts an output shaft of the permanent magnet brushless direct-current motor 7. The first planetary carrier 18 is rotatably arranged on the outer fixed mount 17 and abuts the transmission shaft 16. The first planetary wheel 20 is rotatably correspondingly arranged on a fixed shaft of the first planetary carrier 18. The first planetary wheel 20 engages with the first sun wheel 21 at an inner side and the inner gear ring 19 at an outer side, respectively. During operation, the permanent magnet brushless direct-current motor 7 drives the first planetary wheel 20 through the first sun wheel 21, and the first planetary wheel 20 rotates relative to the inner gear ring 19 to drive, through the first planetary carrier 18, the transmission shaft 16 to rotate, so as to achieve one-stage reduction output.

[0017] In order to achieve two-stage reduction, differential output, and reverse braking, the second differential transmission device 1 includes a second sun wheel 12, a second planetary wheel 11, a floating planetary carrier 13, a fixed gear ring 10, a moving gear ring 14, and a second box body 9. The fixed gear ring 10 is fixed to the second box body 9. The second sun wheel 12 is rotatably arranged on the second box body 9 and abuts the transmission shaft 16. The second planetary wheel 11 is rotatably arranged on the floating planetary carrier 13. The second planetary wheel 11 engages with the second sun wheel 12 at an inner side and the fixed gear ring 10 at an outer side respectively. The moving gear ring 14 sleeves the second sun wheel 12, with one end simultaneously engaging with the second planetary wheel 11 at an outer side and another end being connected to a fixed end plate 15 on the rope drum 5. The moving gear ring 14 and the fixed gear ring 10 are designed into a differential matching structure with different quantities of teeth. During operation, the first reducer 4 drives the second sun wheel 12 through the transmission shaft 16, the second sun wheel 12 drives the second planetary wheel 11, and the second planetary wheel 11 rotates relative to the fixed gear ring 10 to drive the moving gear ring 14 and the rope drum 5 to rotate, so as to achieve two-stage reduction and differential output. In case of shutdown, a heavy object actively drives the moving gear ring 14 through the rope drum 5, the moving gear ring 14 drives the second planetary wheel 11 to rotate, and in this case, since the quantity of the teeth of the fixed gear ring 10 is different from that of the moving gear ring 14, the second planetary wheel 11 is incapable of rotating relative to the fixed gear ring 10, resulting in one-way interlocking and achieving differential reverse mechanical braking.

[0018] In order to achieve an electromagnetic braking function, in case of shutdown, the controller 8 uses reverse electromotive force generated by the permanent magnet brushless direct-current motor 7 to achieve electromagnetic braking.

[0019] In order to facilitate installation and suspension and ensure safe use, the left and right end plates 2 and 6 are provided with a suspension mechanism, the suspension mechanism includes a suspension component 25 connected to the left and right end plates 2 and 6 and a protective hook 34 rotatably arranged on the connecting rod 3, a protective hook hanging plate 24 is fixed to the suspension component 25, the protective hook hanging plate 24 is provided with a hanging hole matching the protective hook 34, the suspension component 25 is provided with an elastically resettable protective buckle 36, and the protective buckle 36 is provided with a protective buckle wrench 35. When the present disclosure is used for horizontal, traction, and other functions, the suspension mechanism needs to be removed, and after removal, the functions can be achieved by fixing bolt holes on the left and right end plates 2 and 6 with bolts.

[0020] In order to ensure safe hoisting and easy operation, the controller 8 is fixed to the right end plate 6 through a controller housing 27, upper and lower limit components 33 and 32 are correspondingly arranged between the left and right end plates 2 and 6 below the rope drum 5, and the controller housing 27 is correspondingly provided with upper and lower limit controllers matching the upper and lower limit components 33 and 32 and electrically connected to the controller 8. An aviation socket 37 electrically connected to the controller 8 and an aviation plug 26 matching the aviation socket 37 are fixed to the controller housing 27, the aviation plug 26 is connected to a control handle 30 through a control line 28, the control handle 30 is provided with an emergency stop switch and up-down start switch 29, and a detachable lithium battery pack 31 is arranged at a bottom of the control handle 30.

[0021] In order to facilitate disassembly, replacement, and fixation of a steel wire rope 38, the rope drum 5 is provided with a rope drum perforated groove, the steel wire rope 38 is introduced from the rope drum perforated groove and is wound on the rope drum 5, a tail of the steel wire rope 38 is fixed to a fixed groove buckle 40 of a rope drum left end plate 39 through a tenon block, and a head of the steel wire rope 38 is connected to a hook component 41 for hanging a heavy object. The hook component 41 consists of a hook, a limit spring assembly, and a limit counter weight.

[0022] In case of normal hoisting according to the present disclosure, the control handle 30 is manipulated, the control handle 30 controls, through the controller 8, the permanent magnet brushless direct-current motor 7 to drive the first sun wheel 21, the first sun wheel 21 drives the first planetary wheel 20, the first planetary wheel 20 rotates relative to the inner gear ring 19 to drive the first planetary carrier 18, and the first planetary carrier 18 drives the transmission shaft 16 to rotate, so as to achieve one-stage reduction output. The transmission shaft 16 drives the second sun wheel 12, the second sun wheel 12 drives the second planetary wheel 11 to rotate relative to the fixed gear ring 10, and the second planetary wheel 11 also simultaneously drives the moving gear ring 14 and the rope drum 5 to rotate to achieve two-stage reduction and differential output.

[0023] When abnormal conditions occur in the hoisting

process, for example, the power suddenly fails, the load exceeds the output torque and rotation stops, and so on, the heavy object actively drives the moving gear ring 14 through the rope drum 5, and the moving gear ring 14 drives the second planetary wheel 11 to rotate. In this case, since the quantity of the teeth of the fixed gear ring 10 is different from that of the moving gear ring 14, the second planetary wheel 11 is incapable of rotating relative to the fixed gear ring 10, resulting in one-way interlocking and achieving differential reverse mechanical braking. Meanwhile, the controller 8 uses reverse electromotive force generated by the permanent magnet brushless direct-current motor 7 to achieve electromagnetic braking for the permanent magnet brushless direct-current motor 7. Thus, dual braking functions of differential reverse mechanical braking and electromagnetic braking are achieved.

[0024] The above are merely specific embodiments of the present disclosure, instead of limiting the present disclosure in any form. Simple alterations, equivalent changes or modifications can made without departing from the scope of the appended claims.

Claims

1. A portable embedded direct-current electric hoist, comprising a permanent magnet brushless direct-current motor (7), a controller (8), left and right end plates (2, 6), a rope drum (5), a first reducer (4), and a second differential transmission device (1), wherein the left and right end plates (2, 6) are fixedly connected into a whole through a connecting rod (3), and the rope drum (5) is rotatably arranged on the left and right end plates (2, 6); a built-in motor base (23) fixed to the right end plate (6) is provided in the rope drum (5), the permanent magnet brushless direct-current motor (7) and the first reducer (4) are fixed, in an abutting manner, to the built-in motor base (23), so that the permanent magnet brushless direct-current motor (7) and the first reducer (4) are embedded in the rope drum (5); the second differential transmission device (1) is fixed to the left end plate (2) and is connected to the first reducer (4) through a transmission shaft (16); and during operation, the permanent magnet brushless direct-current motor (7) drives, through the first reducer (4) and the transmission shaft (16), the second differential transmission device (1) to rotate, and the second differential transmission device (1) drives the rope drum (5) to rotate; **characterized in that**, the second differential transmission device (1) comprises a second sun wheel (12), a second planetary wheel (11), a floating planetary carrier (13), a fixed gear ring (10), a moving gear ring (14), and a second box body (9); the fixed gear ring (10) is fixed to the second box body (9), the second sun wheel (12) is rotatably arranged on the second box body (9) and abuts the transmission shaft (16), the second planetary wheel (11) is rotatably arranged on the floating planetary carrier (13), the second planetary wheel (11) engages with the second sun wheel (12) at an inner side and the fixed gear ring (10) at an outer side, respectively; the moving gear ring (14) sleeves the second sun wheel (12), with one end simultaneously engaging with the second planetary wheel (11) at an outer side and another end being connected to a fixed end plate (15) on the rope drum (5); the moving gear ring (14) and the fixed gear ring (10) are designed into a differential matching structure with different quantities of teeth; during operation, the first reducer (4) drives the second sun wheel (12) through the transmission shaft (16), the second sun wheel (12) drives the second planetary wheel (11), the second planetary wheel (11) rotates relative to the fixed gear ring (10) to drive the moving gear ring (14) and the rope drum (5) to rotate, so as to achieve two-stage reduction and differential output; and in case of shutdown, a heavy object actively drives the moving gear ring (14) through the rope drum (5), the moving gear ring (14) drives the second planetary wheel (11) to rotate, since the quantity of the teeth of the fixed gear ring (10) is different from the quantity of the moving gear ring (14), the second planetary wheel (11) is incapable of rotating relative to the fixed gear ring (10), resulting in one-way interlocking and achieving differential reverse mechanical braking; and wherein in case of shutdown, the controller (8) uses reverse electromotive force generated by the permanent magnet brushless direct-current motor (7) to achieve electromagnetic braking.

2. The portable embedded direct-current electric hoist according to claim 1, wherein the first reducer (4) comprises an inner fixed mount (22), a first sun wheel (21), a first planetary wheel (20), a first planetary carrier (18), an inner gear ring (19), and an outer fixed mount (17), the outer fixed mount (17) and the inner gear ring (19) are fixedly connected to the inner fixed mount (22), the first sun wheel (21) is rotatably arranged on the inner fixed mount (22) and abuts an output shaft of the permanent magnet brushless direct-current motor (7), the first planetary carrier (18) is rotatably arranged on the outer fixed mount (17) and abuts the transmission shaft (16), the first planetary wheel (20) is rotatably correspondingly arranged on a fixed shaft of the first planetary carrier (18), and the first planetary wheel (20) engages with the first sun wheel (21) at an inner side and the inner gear ring (19) at an outer side, respectively; and during operation, the permanent magnet brushless direct-current motor (7) drives the first planetary wheel (20) through the first sun wheel (21), and the first planetary wheel (20) rotates relative to the inner gear ring (19) to drive, through the first planetary carrier (18), the transmission shaft (16) to rotate,

so as to achieve one-stage reduction output.

3. The portable embedded direct-current electric hoist according to claim 1, wherein the left and right end plates (2, 6) are provided with a suspension mechanism, the suspension mechanism comprises a suspension component (25) connected to the left and right end plates (2, 6) and a protective hook (34) rotatably arranged on the connecting rod (3); and a protective hook hanging plate (24) is fixed to the suspension component (25), the protective hook hanging plate (24) is provided with a hanging hole matching the protective hook (34), the suspension component (25) is provided with an elastically resettable protective buckle (36), and the protective buckle (36) is provided with a protective buckle wrench (35).

4. The portable embedded direct-current electric hoist according to claim 1, wherein the controller (8) is fixed to the right end plate (6) through a controller housing (27), upper and lower limit components (33, 32) are correspondingly arranged between the left and right end plates (2, 6) below the rope drum (5), and the controller housing (27) is correspondingly provided with upper and lower limit controllers matching the upper and lower limit components (33, 32) and electrically connected to the controller (8).

5. The portable embedded direct-current electric hoist according to claim 4, wherein an aviation socket (37) electrically connected to the controller (8) and an aviation plug (26) matching the aviation socket (37) are fixed to the controller housing (27), the aviation plug (26) is connected to a control handle (30) through a control line (28), the control handle (30) is provided with an emergency stop switch and up-down start switch (29), and a detachable lithium battery pack (31) is arranged at a bottom of the control handle (30).

6. The portable embedded direct-current electric hoist according to claim 5, wherein the rope drum (5) is provided with a rope drum perforated groove, a steel wire rope (38) is introduced from the rope drum perforated groove and is wound on the rope drum (5), a tail of the steel wire rope (38) is fixed to a fixed groove buckle (40) of a rope drum left end plate (39) through a tenon block, and a head of the steel wire rope (38) is connected to a hook component (41) for hanging a heavy object.

Patentansprüche

1. Tragbarer eingebetteter Gleichstrom-Elektrozug, der einen permanentmagnetischen bürstenlosen Gleichstrommotor (7), eine Steuerung (8), eine linke und eine rechte Endplatte (2, 6), eine Seiltrommel (5), ein erstes Untersetzungsgetriebe (4) und eine zweite Differentialgetriebevorrichtung (1) umfasst, wobei die linke und die rechte Endplatte (2, 6) durch eine Verbindungsstange (3) fest zu einem Ganzen verbunden sind und die Seiltrommel (5) drehbar auf der linken und der rechten Endplatte (2, 6) angeordnet ist; in der Seiltrommel (5) ein an der rechten Endplatte (6) befestigter Einbaumotorsockel (23) vorgesehen ist, wobei der permanentmagnetische bürstenlose Gleichstrommotor (7) und das erste Untersetzungsgetriebe (4) anstoßend an dem Einbaumotorsockel (23) befestigt sind, so dass der permanentmagnetische bürstenlose Gleichstrommotor (7) und das erste Untersetzungsgetriebe (4) in der Seiltrommel (5) eingebettet sind; die zweite Differentialgetriebevorrichtung (1) an der linken Endplatte (2) befestigt ist und über eine Übertragungswelle (16) mit dem ersten Untersetzungsgetriebe (4) verbunden ist; und während des Betriebs der permanentmagnetische bürstenlose Gleichstrommotor (7) über das erste Untersetzungsgetriebe (4) und die Übertragungswelle (16) die zweite Differentialgetriebevorrichtung (1) zur Drehung antreibt, und die zweite Differentialgetriebevorrichtung (1) die Seiltrommel (5) zur Drehung antreibt; **dadurch gekennzeichnet, dass** die zweite Differentialgetriebevorrichtung (1) ein zweites Sonnenrad (12), ein zweites Planetenrad (11), einen schwimmenden Planetenträger (13), einen festen Zahnkranz (10), einen beweglichen Zahnkranz (14) und einen zweiten Gehäusekörper (9) umfasst; der feste Zahnkranz (10) an dem zweiten Gehäusekörper (9) befestigt ist, das zweite Sonnenrad (12) drehbar an dem zweiten Gehäusekörper (9) angeordnet ist und an der Übertragungswelle (16) anliegt, das zweite Planetenrad (11) drehbar an dem schwimmenden Planetenträger (13) angeordnet ist, das zweite Planetenrad (11) an einer Innenseite mit dem zweiten Sonnenrad (12) bzw. an einer Außenseite mit dem festen Zahnkranz (10) in Eingriff steht; der bewegliche Zahnkranz (14) das zweite Sonnenrad (12) ummantelt, wobei ein Ende gleichzeitig mit dem zweiten Planetenrad (11) an einer Außenseite in Eingriff steht und das andere Ende mit einer festen Endplatte (15) auf der Seiltrommel (5) verbunden ist; der bewegliche Zahnkranz (14) und der feste Zahnkranz (10) in einer Differentialanpassungsstruktur mit unterschiedlichen Zahnzahlen ausgebildet sind; während des Betriebs das erste Untersetzungsgetriebe (4) das zweite Sonnenrad (12) über die Übertragungswelle (16) antreibt, das zweite Sonnenrad (12) das zweite Planetenrad (11) antreibt, das zweite Planetenrad (11) sich relativ zum festen Zahnkranz (10) dreht, um den beweglichen Zahnkranz (14) und die Seiltrommel (5) anzutreiben, so dass eine zweistufige Untersetzung und ein Differentialausgang erreicht werden; und im Falle des

Stillstands ein schweres Objekt den beweglichen Zahnkranz (14) aktiv durch die Seiltrommel (5) antreibt, der bewegliche Zahnkranz (14) das zweite Planetenrad (11) zur Drehung antreibt, da die Anzahl der Zähne des festen Zahnkranzes (10) sich von der Anzahl der Zähne des beweglichen Zahnkranzes (14) unterscheidet, das zweite Planetenrad (11) nicht in der Lage ist, sich relativ zum festen Zahnkranz (10) zu drehen, was zu einer Einwegverriegelung führt und eine mechanische Differentialrückwärtsbremsung erreicht; und wobei im Falle des Abschaltens die Steuerung (8) die von dem permanentmagnetischen bürstenlosen Gleichstrommotor (7) erzeugte gegenläufige elektromotorische Kraft verwendet, um eine elektromagnetische Bremsung zu erreichen.

2. Tragbarer, eingebetteter Gleichstrom-Elektrozug nach Anspruch 1, wobei das erste Untersetzungsgetriebe (4) eine innere feste Halterung (22), ein erstes Sonnenrad (21), ein erstes Planetenrad (20), einen ersten Planetenträger (18), einen inneren Zahnkranz (19) und eine äußere feste Halterung (17) umfasst, die äußere feste Halterung (17) und der innere Zahnkranz (19) fest mit der inneren festen Halterung (22) verbunden sind, das erste Sonnenrad (21) drehbar auf der inneren festen Halterung (22) angeordnet ist und an einer Ausgangswelle des permanentmagnetischen bürstenlosen Gleichstrommotors (7) anliegt, der erste Planetenträger (18) drehbar auf der äußeren festen Halterung (17) angeordnet ist und an der Übertragungswelle (16) anliegt, das erste Planetenrad (20) entsprechend drehbar auf einer festen Welle des ersten Planetenträgers (18) angeordnet ist, und das erste Planetenrad (20) an einer Innenseite mit dem ersten Sonnenrad (21) bzw. an einer Außenseite mit dem inneren Zahnkranz (19) in Eingriff steht; und während des Betriebs der permanentmagnetische bürstenlose Gleichstrommotor (7) das erste Planetenrad (20) über das erste Sonnenrad (21) antreibt, und das erste Planetenrad (20) sich relativ zu dem inneren Zahnkranz (19) dreht, um über den ersten Planetenträger (18) die Übertragungswelle (16) zur Drehung anzutreiben, um eine einstufige Untersetzungsleistung zu erzielen.

3. Tragbarer, eingebetteter Gleichstrom-Elektrozug nach Anspruch 1, wobei die linke und die rechte Endplatte (2, 6) mit einem Aufhängungsmechanismus versehen sind, der Aufhängungsmechanismus eine Aufhängungskomponente (25), das mit der linken und der rechten Endplatte (2, 6) verbunden ist, und einen Schutzhaken (34) umfasst, der drehbar an der Verbindungsstange (3) angeordnet ist; und eine Schutzhaken-Aufhängeplatte (24) an der Aufhängungskomponente (25) befestigt ist, die Schutzhaken-Aufhängeplatte (24) mit einem Aufhängeloch versehen ist, das zu dem Schutzhaken (34) passt, die Aufhängungskomponente (25) mit einer elastisch rückstellbaren Schutzschnalle (36) versehen ist und die Schutzschnalle (36) mit einem Schutzschnallenschlüssel (35) versehen ist.

4. Tragbarer eingebetteter Gleichstrom-Elektrozug nach Anspruch 1, wobei die Steuerung (8) über ein Steuerungsgehäuse (27) an der rechten Endplatte (6) befestigt ist, obere und untere Begrenzungsbauteile (33, 32) entsprechend zwischen der linken und rechten Endplatte (2, 6) unterhalb der Seiltrommel (5) angeordnet sind und das Steuerungsgehäuse (27) entsprechend mit zu den oberen und unteren Begrenzungsbauteilen (33, 32) passenden oberen und unteren Begrenzungssteuerungen versehen und mit der Steuerung (8) elektrisch verbunden ist.

5. Tragbarer, eingebetteter Gleichstrom-Elektrozug nach Anspruch 4, wobei eine elektrisch mit der Steuerung (8) verbundene Flugzeugsteckdose (37) und ein zur Flugzeugsteckdose (37) passender Flugzeugstecker (26) am Steuerungsgehäuse (27) befestigt sind, der Flugzeugstecker (26) über eine Steuerleitung (28) mit einem Steuergriff (30) verbunden ist, der Steuergriff (30) mit einem Not-Aus-Schalter und einem Auf-Ab-Startschalter (29) versehen ist und ein abnehmbarer Lithium-Batteriepack (31) an einer Unterseite des Steuergriffs (30) angeordnet ist.

6. Tragbarer, eingebetteter Gleichstrom-Elektrozug nach Anspruch 5, wobei die Seiltrommel (5) mit einer Seiltrommel-Lochrille versehen ist, ein Stahldrahtseil (38) aus der Seiltrommel-Lochrille eingeführt und auf die Seiltrommel (5) gewickelt wird, ein Ende des Stahldrahtseils (38) an einer festen Rillenschnalle (40) einer linken Endplatte (39) der Seiltrommel durch einen Zapfenblock befestigt wird und ein Kopf des Stahldrahtseils (38) mit einer Hakenkomponente (41) zum Aufhängen eines schweren Gegenstands verbunden wird.

Revendications

1. Un palan électrique à courant continu intégré et portable, comprenant un moteur à courant continu sans balai à aimant permanent (7), un contrôleur (8), des plaques d'extrémité gauche et droite (2, 6), un tambour à câble (5), un premier réducteur (4), et un deuxième dispositif de transmission différentielle (1), dans lequel les plaques d'extrémité gauche et droite (2, 6) sont reliées de manière fixe en un tout par une bielle (3), et le tambour à câble (5) est disposé de manière rotative sur les plaques d'extrémité gauche et droite (2, 6); une base de moteur

intégrée (23) fixée à la plaque d'extrémité droite (6) est prévue dans le tambour à câble (5), le moteur à courant continu sans balai à aimant permanent (7) et le premier réducteur (4) sont fixés, de manière à venir en butée, à la base de moteur intégrée (23), de sorte que le moteur à courant continu sans balai à aimant permanent (7) et le premier réducteur (4) sont intégrés dans le tambour à câble (5); le deuxième dispositif de transmission différentielle (1) est fixé à la plaque d'extrémité gauche (2) et est relié au premier réducteur (4) par l'intermédiaire d'un arbre de transmission (16); et lors du fonctionnement, le moteur à courant continu sans balais à aimant permanent (7) entraîne, par l'intermédiaire du premier réducteur (4) et de l'arbre de transmission (16), le deuxième dispositif de transmission différentielle (1) en rotation, et le deuxième dispositif de transmission différentielle (1) entraîne le tambour à câble (5) en rotation; **caractérisé en ce que** le deuxième dispositif de transmission différentielle (1) comprend une deuxième roue solaire (12), une deuxième roue satellite (11), un porte-satellites flottant (13), une couronne dentée fixe (10), une couronne dentée mobile (14) et un deuxième corps de boîte (9); la couronne dentée fixe (10) est fixée au deuxième corps de boîte (9), la deuxième roue solaire (12) est disposée de manière rotative sur le deuxième corps de boîte (9) et en butée contre l'arbre de transmission (16), la deuxième roue satellite (11) est disposée de manière rotative sur le porte-satellites flottant (13), la deuxième roue satellite (11) s'engage avec la deuxième roue solaire (12) du côté intérieur et avec la couronne dentée fixe (10) du côté extérieur, respectivement; la couronne dentée mobile (14) manchonne la deuxième roue solaire (12), avec une extrémité s'engageant simultanément avec la deuxième roue satellite (11) sur un côté extérieur et l'autre extrémité étant reliée à une plaque d'extrémité fixe (15) sur le tambour à câble (5); la couronne dentée mobile (14) et la couronne dentée fixe (10) sont conçues sous la forme d'une structure d'assemblage différentiel avec des différentes quantités de dents; lors du fonctionnement, le premier réducteur (4) entraîne la deuxième roue solaire (12) par l'intermédiaire de l'arbre de transmission (16), la deuxième roue solaire (12) entraîne la deuxième roue satellite (11), la deuxième roue satellite (11) pivote par rapport à la couronne dentée fixe (10) pour entraîner la couronne dentée mobile (14) et le tambour à câble (5) en rotation, de manière à obtenir une réduction en deux étages et une sortie différentielle; et en cas d'arrêt, un objet lourd entraîne activement la couronne dentée mobile (14) par le tambour à câble (5), la couronne dentée mobile (14) entraîne la deuxième roue satellite (11) en rotation, étant donné que la quantité de dents de la couronne dentée fixe (10) est différente de la quantité de dents de la couronne dentée mobile (14), la deuxième roue satellite (11) est incapable de pivoter par rapport à la couronne dentée fixe (10), ce qui entraîne un verrouillage unidirectionnel et permet d'obtenir un freinage mécanique différentiel inverse; et dans lequel, en cas d'arrêt, le contrôleur (8) utilise la force électromotrice inverse générée par le moteur à courant continu sans balai à aimant permanent (7) pour réaliser le freinage électromagnétique.

2. Le palan électrique à courant continu intégré et portable selon la revendication 1, dans lequel le premier réducteur (4) comprend un support fixe interne (22), une première roue solaire (21), une première roue satellite (20), un premier porte-satellites (18), une couronne dentée interne (19), et un support fixe externe (17), le support fixe externe (17) et la couronne dentée interne (19) sont reliés de manière fixe au support fixe interne (22), la première roue solaire (21) est disposée de manière rotative sur le support fixe interne (22) et vient en butée contre un arbre de sortie du moteur à courant continu sans balai à aimant permanent (7), le premier porte-satellites (18) est disposé de manière rotative sur le support fixe externe (17) et vient en butée contre l'arbre de transmission (16), la première roue satellite (20) est disposée de manière rotative sur un arbre fixe du premier porte-satellites (18), et la première roue satellite (20) s'engage avec la première roue solaire (21) du côté intérieur et avec la couronne dentée interne (19) du côté extérieur, respectivement; et lors du fonctionnement, le moteur à courant continu sans balai à aimant permanent (7) entraîne la première roue satellite (20) par l'intermédiaire de la première roue solaire (21), et la première roue satellite (20) pivote par rapport à la couronne dentée interne (19) pour entraîner, par l'intermédiaire du premier porte-satellites (18), l'arbre de transmission (16) en rotation, de manière à obtenir une sortie de réduction en un étage.

3. Le palan électrique à courant continu intégré et portable selon la revendication 1, dans lequel les plaques d'extrémité gauche et droite (2, 6) sont pourvues d'un mécanisme de suspension, le mécanisme de suspension comprend un composant de suspension (25) relié aux plaques d'extrémité gauche et droite (2, 6) et un crochet de protection (34) disposé de manière rotative sur la bielle (3); et une plaque de suspension du crochet de protection (24) est fixée au composant de suspension (25), la plaque de suspension du crochet de protection (24) est pourvue d'un trou de suspension correspondant au crochet de protection (34), le composant de suspension (25) est pourvu d'une boucle de protection à réinitialisation élastique (36), et la boucle de protection (36) est pourvue d'une clé de boucle de protection (35).

4. Le palan électrique à courant continu intégré et portable selon la revendication 1, dans lequel le contrôleur (8) est fixé à la plaque d'extrémité droite (6) par l'intermédiaire d'un boîtier de contrôleur (27), des composants de limite supérieure et inférieure (33, 32) sont disposés de manière correspondante entre les plaques d'extrémité gauche et droite (2, 6) sous le tambour à câble (5), et le boîtier de contrôleur (27) est pourvu de manière correspondante de contrôleurs de limite supérieure et inférieure correspondant aux composants de limite supérieure et inférieure (33, 32) et reliés électriquement au contrôleur (8).

5. Le palan électrique à courant continu intégré et portable selon la revendication 4, dans lequel une prise aviation (37) reliée électriquement au contrôleur (8) et une fiche aviation (26) correspondante à la prise aviation (37) sont fixées au boîtier du contrôleur (27), la fiche aviation (26) est reliée à une poignée de commande (30) par l'intermédiaire d'une ligne de commande (28), la poignée de commande (30) est pourvue d'un interrupteur d'arrêt d'urgence et d'un interrupteur de démarrage haut-bas (29), et un pack de batteries lithium amovible (31) est disposée au bas de la poignée de commande (30).

6. Le palan électrique à courant continu intégré et portable selon la revendication 5, dans lequel le tambour à câble (5) est pourvu d'une rainure perforée, un câble d'acier (38) est introduit par cette rainure perforée du tambour de câble et enroulé sur le tambour de câble (5), une extrémité du câble d'acier (38) est fixée à une boucle de rainure fixe (40) d'une plaque d'extrémité gauche du tambour de câble (39) par l'intermédiaire d'un bloc de tenon, et une extrémité du câble d'acier (38) est reliée à un composant de crochet (41) pour suspendre un objet lourd.

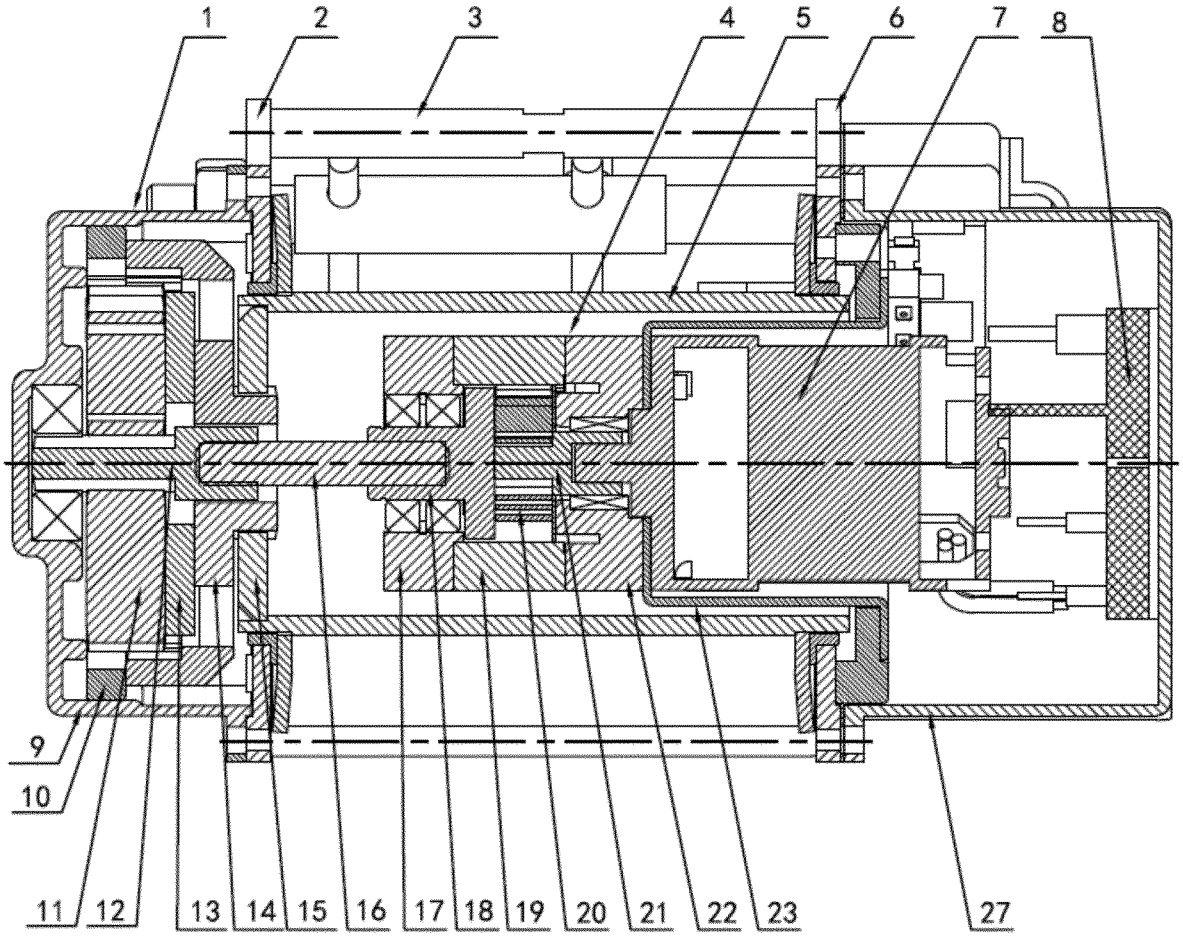

FIG. 1

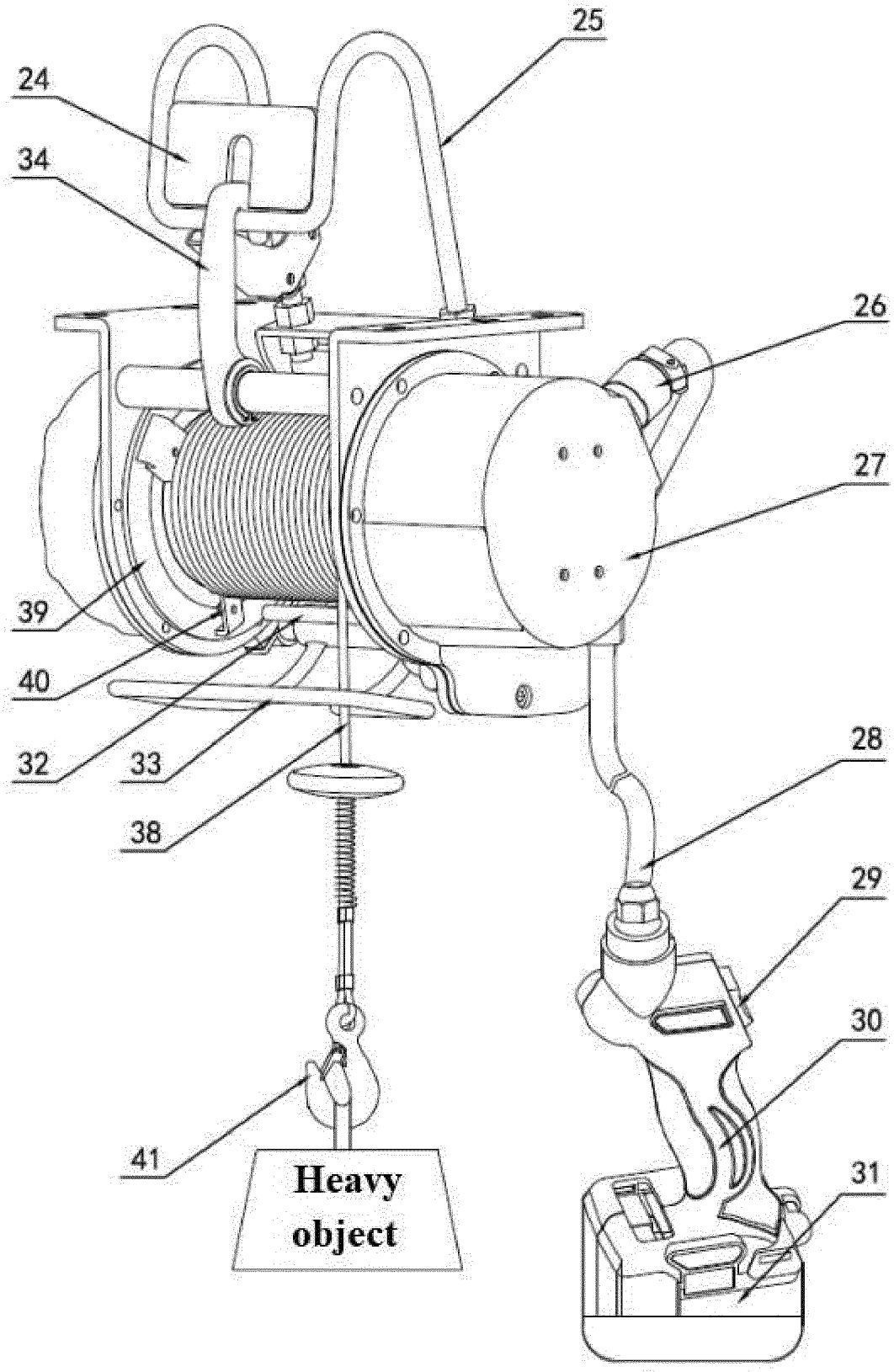

FIG. 2

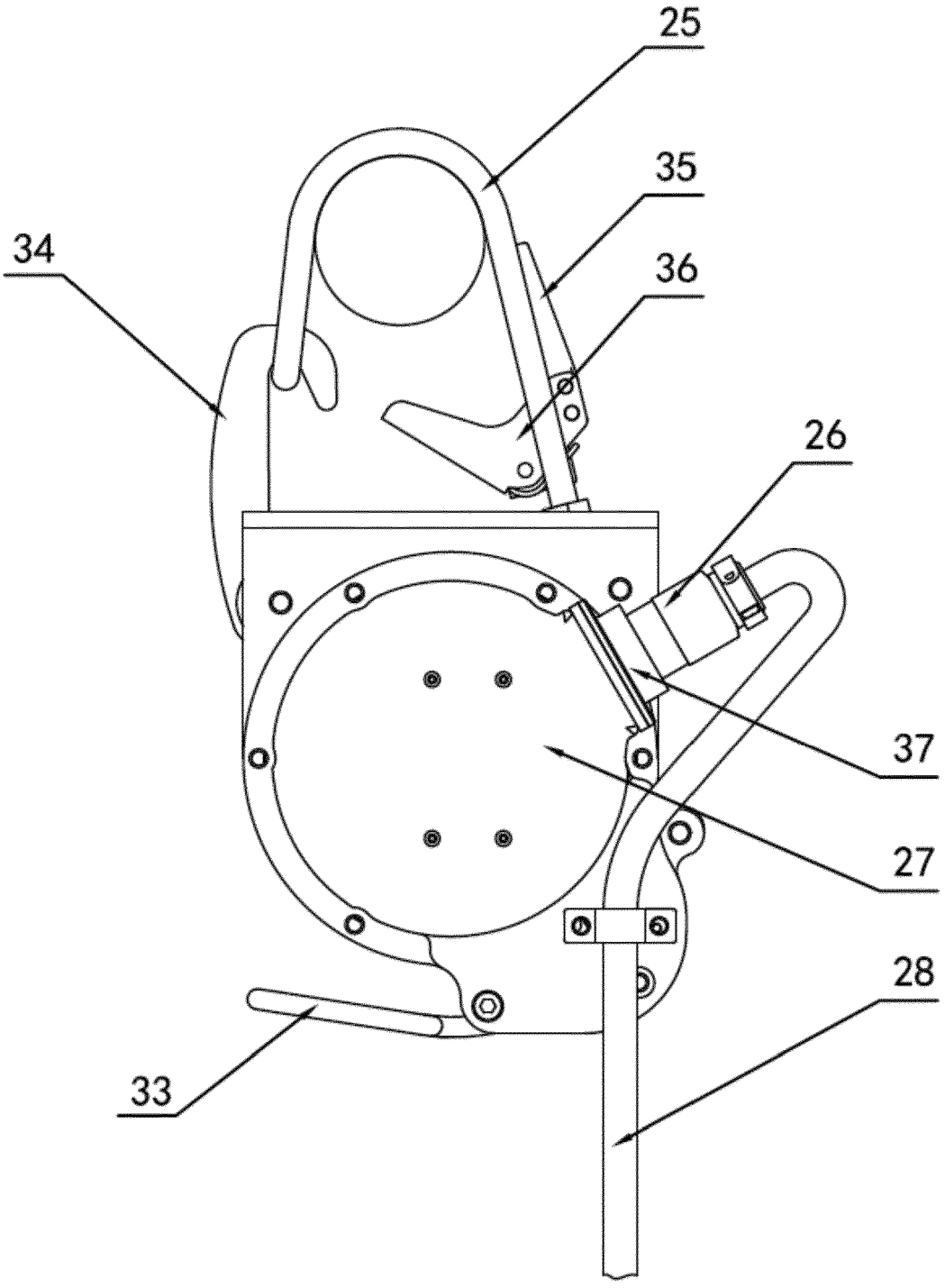

FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H05316908 A **[0002]**
- CN 206156640 U **[0002]**
- CN 111204671 A **[0002]**
- CN 108657982 A **[0002]**
- CN 203199931 U **[0002]**