



(11) **EP 2 653 613 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
13.06.2018 Bulletin 2018/24

(51) Int Cl.:
E01D 21/00 ^(2006.01) **E01D 19/16** ^(2006.01)
B65H 49/00 ^(2006.01) **B65H 54/00** ^(2006.01)
B65H 59/38 ^(2006.01)

(21) Application number: **10860703.7**

(86) International application number:
PCT/CN2010/079953

(22) Date of filing: **17.12.2010**

(87) International publication number:
WO 2012/079251 (21.06.2012 Gazette 2012/25)

(54) **METHOD FOR HORIZONTAL WINDING AND HORIZONTAL UNWINDING PARALLEL STEEL STRANDED WIRE**

VERFAHREN ZUM HORIZONTAL EN AUF- UND ABWICKELN EINES PARALLELEN STAHLITZENDRAHTES

PROCÉDÉ D'ENROULEMENT HORIZONTAL ET DE DÉROULEMENT HORIZONTAL DE FIL TORONNÉ D'ACIER PARALLÈLE

(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

(43) Date of publication of application:
23.10.2013 Bulletin 2013/43

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a parallel wire strand consisting of a multiplicity of individual wires. More particular, the invention relates to horizontally winding and unwinding a parallel wire strand consisting of a multiplicity of individual wires onto and from a cable reel for fanning out and rearranging the wire strands for transport, storage or installation.

BACKGROUND OF THE INVENTION

[0002] The main cable strands are the chief bearing members of suspension bridge. The cable strand is made of high strength galvanized wire of 5mm in diameter. Formerly specifications for the cable strand were available in 61 wires, 91 wires and 127 wires. At present the over-length large main cable strands reach 5000m in length, in 169 wires of 5mm diameter. The weight of a cable strand reaches 120 tons. Commonly the cross-section of cable strand is regular hexagon. Some special cable strands may be rectangular or other shapes. A cable strand is bound with composite material bands at interval of 1.5m~2m. Traditionally, the winding of main cable strands of suspension bridge all applied large diameter steel reels for winding horizontal parallel wire strands at home and abroad. This process is called by reel processing for short. The one of the characteristics of reel processing was that the manufacturing, shipping and unwinding of cable strands all could not get rid of large diameter steel reel. During the transportation of cable strands on steel reels to large bridge building site, cable strands could give birth to oval traumas from falling down shown in fig. 1, owing to their deadweight. Consequently the cable strands oval traumas from falling down therefore caused cable strand winding loosen and friction between cable strands generated by steel reel rotating. While cable strands were winding along with steel reel rotating continually, this kind of trauma from falling down could result in so-called "Hula-circles" effect, in consequence it disturbed the original arrangement order and could be very difficult to unwinding cable strand from steel reel. Further more, in unwinding cable strand the dragging and pulling forces suddenly made the loose cable strands to be tightened or loosened every now and then, which could aggravate the frictions between cable strands and scratch binding bands on strand until breakage and make cable strand steel wires incoherent. During the procedure of unwinding cable strands the "Hula-circles" which had emerged would become more and more bigger along with the unwinding process of cable strands, its loosen amount would increase gradually, and cable strand would collide with ground, until unwinding job implementation had no means of normal proceed. In order to remedy this phenomenon in construction site it was necessary to reshape and bind strands continually by

labor. Therefore the working machines should be shut down, after tightening cable strands wires, proceeded with unwinding strand for those already formative "Hula-circles". This not only brought unlimited inconvenience to assembly molding of main cable of suspension bridge, but also more seriously influence the time limit for a project. Particularly the longer the cable strand, the more serious the "Hula-circles" developed, furthermore the longer the cable strand, the more difficult the remedy measures carried out, even could not carry out. According to experiences under the precondition of holding good cable strand shape, adopting reel processing technology, commonly when cable strand length is over 1500m, "Hula-circles" will be easy to appear during unwinding process of cable strand. When the "Hula-circles" phenomena become serious, it will direct influence site construction schedule and cable strand quality. Known methods for winding and unwinding a parallel wire strand upon a base of a cable reel are described in WO 91/19664 A1, WO 02/34647 A1, CN 201560392 U and CN 201560386 U.

SUMMARY OF THE INVENTION

[0003] A primary and general object of the present invention is to overcome the aforementioned drawbacks by providing a method for horizontally winding and unwinding a parallel wire strand with high working efficiency, fine quality of winding and unwinding cable strands and low labor intensity.

[0004] To this end, according to present invention, a method for horizontally winding and horizontally unwinding a parallel wire strand is disclosed.

[0005] A method for horizontally winding and horizontally unwinding a parallel wire strand upon a base of a cable reel for transport, storage or installation, a parallel wire strand made up of a plurality of tightly adjacent vertically and horizontally arranged parallel wires, the strand including at least a leading end fitting securing the ends of the wires together, is characterized in that the method comprises the following steps :

(a) Performing the winding operation, the operation procedure is as follows:

Fix the guide frame on the ground, the guide frame is composed of the base , support frame , electric hoist, fixed pulley , steel wire rope , lifting mechanism , roller, the pressure sensor, speed encoder, altimeter encoder and limit roller. Fix the base on the ground and fix the support frame and electric hoist on the base. A fixed pulley is equipped at the top of the support frame, also a steel wire rope which one end is connected with electric hoist and the other end is connected with lifting mechanism is wound on the fixed pulley . The lifting mechanism is equipped with three rollers , 2 pressure sensors and a speed encoder, the 3 rollers are arranged in "triangle" shape, that is, three straight lines connecting

the circle center points of three rollers make up of a triangle. A pressure sensor and a speed encoder are equipped at one side of the three rollers, at the side of the fixed pulley , altimeter encoder, electric hoist, pressure sensor, speed encoder are equipped. Both the speed encoder and the altimeter encoder are connected with the programmable logical controller (hereinafter referred to as PLC) by the telecommunication wires. Fix the rotation axis on the ground at one side of the guide frame , connecting the rotation platform with the rotation axis; meantime, the rotating platform rotating about the rotation axis 21. The upper surface of the rotation platform shall be flush with the ground, the platform rail is paved on the rotation platform and the railcar is located on the rail . to The characteristics of rotation platform facilitate the rail platform car easy to select multi-directions and link up with workshop rails.

The inner module is composed at least by four support plates and the support rod at the top section, the four support plates were aligned uniformly in the ring shape. There is a gap between the adjacent support plates , the gap length shall be the width of the support plate of 80% to 150%. Operator can get into the inner module to operate through gaps between support plates. The support rod shall be fixed by the hinge at the top of the support plate , each support plate shall fix two support rods and the two top rods shall be symmetrically fixed on the support plate at left and right sides. The bottom of supporting plate and the railcar are connected by the bolt. The top support plate will lean outward. After fixing the support plate and railcar, the centers of gravity of four support plates should be located outside of each hinge.

Put a ring shape tray onto the railcar and hitch it outside the inner module . Lifting points which are used for lifting the tray and looped cable strands which are wound on the tray shall be set at the tray edges, and lay the water proof film covered on the surface of the tray .

Put one end of strand through the guide rollers and fix it onto the inner module , then drive rotation platform to rotate, which will drive the railcar and inner module to rotate together. Along with the rotation, the strand will be wound on the inner module one circle by another from the bottom end of the inner module till to the top of the inner module , and then wind the strand from the top of the inner module to the bottom. Repeat this operation until all the strands wrapped into wire strands. During the upward winding procedure, the PLC will control the electric hoist to pull the steel wire rope, thus to lift the lifting mechanism which will enable the guide roller to move upward with the distance which is equivalent to the strand diameter during each circle. During the downward winding procedure, the PLC will control the electric hoist to pull to steel wire rope , thus to pull

down the lifting mechanism which will enable the guide roller to move downward with the distance which is equivalent to the strand diameter during each circle, therefore this guarantees that strands are capable of arranging on the inner module regularly and compactly.

After all the strands are winded into wire strands, dismantle the bolts between the bottom of the inner module and the railcar . Lift the support rod on the inner module which will make the 4 pieces support plates gather together inward, and then extract the inner module from the wire strands. After this, use the prepared waterproof film on the tray to cover the whole outside surface of the wire strand . Connect the platform track on the rotating platform with the track on the ground, pull the railcar to remove the wire strand , until this, the strand winding operation is finished.

(b) Performing the unwinding operation, the operation procedure is as follows:

Fix the guide frame on the ground, the guide frame is composed by the base , support frame , electric hoist, fixed pulley , steel wire rope , lifting mechanism , roller, the pressure sensor, speed encoder, altimeter encoder and limit roller. Fix the base on the ground and fix the support frame and electric hoist on the base . A fixed pulley shall be equipped at the top of the support frame , also the steel wire rope whose one end is connected with electric hoist and the other end is connected with lifting mechanism shall be wound on the fixed pulley . The lifting mechanism is equipped with 3 rollers , 2 pressure sensors and a speed encoder. The 3 Rollers are arranged in "triangle" shape, that is, three straight lines connecting the circle center points of three rollers make up of a triangle. A pressure sensor and a speed encoder shall be equipped at one side of the three rollers, altimeter encoder at the side of the fixed pulley, electric hoist, pressure sensor, speed encoder shall be equipped. Both the speed encoder and the altimeter encoder shall be connected with PLC by the telecommunication wires. Fix the rotation axis on the ground at one side of the guide frame , connecting the rotation platform with the rotation axis, meantime, the rotating platform will rotate around the rotation axis . The hydraulic brake which is connected with PLC through pressure sensor is equipped in the rotation axis . During the rotation of the rotating platform , release the hydraulic brake . When the rotating platform stops, the hydraulic brake is always imposing friction on the rotating platform , thus applying portion of reverse compression to prevent against rotating platform continually rotating, bring about cable strand dropped out and damaged when dragging forces temporarily stop.

[0006] The inner module is composed by at least four support plates . The four support plates are aligned uni-

formly in the ring shape. The gaps shall be retained between the adjacent support plates, the gap length shall be the width of the support plate of 80% to 150%. The bottoms of the support plates are connected by the hinge with the rotating platform, all the 4 pieces support plates will lean inward. In the middle of the 4 pieces support plates, a hydraulic jack is equipped. The support rod of the hydraulic jack is connected with four pieces push rods, and each push rod shall withstand a piece of support plate.

[0007] Remove the waterproof film cover from the strand, lift the strand wire strands together with the tray onto the rotating platform, meantime, set the strand wire strands over the inner module. Actuate the hydraulic jack, with the force of the support rod applied to the push rod, the 4 pieces support plates will push outward by the push rod which will fix the strand wire strands.

[0008] Pull one leading end of the strand through out of the guide roller, then pull the strand to drive the inner module and the tray to rotate, thus to drive the rotating platform to rotate around the rotation axis. Along with this operation, the strand shall be released and become straight status.

[0009] During the downward winding procedure, the PLC will control the electric hoist to pull to steel wire rope, thus to pull down the lifting mechanism which will enable the guide roller move downward with the distance which is equivalent to the strand diameter during each circle. During the upward winding procedure, the PLC will control the electric hoist to pull the steel wire rope, thus to lift the lifting mechanism which will enable the guide roller move upward with the distance which is equivalent to the strand diameter during each circle. Repeat these operations back and forth till the wire strands become straight status, and fulfill the whole unwinding operation.

[0010] The method in accordance with the present invention specifies advantageously that the rotation axis is vertical to the ground at the side of the guide frame.

[0011] Further the method in accordance with the present specifies advantageously that in horizontal winding operation the bottom of the support plate is connected with the railcar by bolts, the top of the support plate shall lean outward and the angle between the support plate and upper surface of railcar is between $60^\circ \sim 85^\circ$.

[0012] Further the method in accordance with the present invention specifies advantageously that in horizontal unwinding operation the bottom of the support plate is connected with the rotating platform by the hinge, all the 4 pieces support plate will lean inward and the angle between the support plate and upper surface of railcar is between $60^\circ \sim 85^\circ$.

[0013] Under the controlling action of the PLC, the unwinding of cable strand is restricted to prevent against out of control for strand, avoiding cable strand damage or injury or loss; in unwinding strand operation, can keep line shape relatively straight and level to protect strand and prevent binding band breakdown, when the speed of unwinding strand is slowed down or stop, gradually

control hydraulic brake to lock turning axle; the introduction of pressure sensor furthermore facilitates PLC to control hydraulic brake smoothly.

[0014] Thus according to the invention it is possible to solve the "Hula-circles" effect problem, and remarkably increase cable strand erection benefits and cable strand quality of carrying out the method of the invention. The advantages of present invention are: reasonable arrangement of operating sequence, winding strand, strand wire strands formation, package and transportation, as well as unwinding complete in one breath, reduce labor intensity and operation time; cable strand wire strands formation compact and regular arrangement; winding strand and unwinding strand all may be able to go with a swing; when unwinding strand trauma from falling down phenomena is eliminated, unable to damage cable strand and binding band; Increase automaticity, equipments are controllable and tunable, real-time monitoring correlated data, reduce labor intensity, increase security; shipping reel simplicity and removable, have no use for large size reel, save a great deal of manufacture and transportation costs.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

Figure 1 is a structure schematic for the strand drop phenomenon in the existing technology;

Figure 2 is a structure schematic for strand winding on the inner module when winding strand;

Figure 3 is the front view of the guide frame in this invention;

Figure 4 is the left view of the guide frame in this invention,

Figure 5 is a structure schematic for extraction of the inner module when winding strand finished,

Figure 6 is a structure schematic for straighten of the strand wire strands when unwinding strand.

DETAILED DESCRIPTION OF THE EMBODIMENTS OF THE INVENTION

[0016] The accompanying drawings and description herein-below disclose embodiments suitable for carrying out the method of the invention.

Embodiment 1

[0017] A method for horizontally winding and horizontally unwinding a parallel wire strand upon a base of a cable reel for transport, storage or installation, a parallel wire strand made up of a plurality of tightly adjacent vertically and horizontally arranged parallel wires, the strand including at least a leading end fitting securing the ends of the wires together, comprising the steps of:

(a) Performing the winding operation, the operation

procedure is as follows:

As shown in figure 2, fix the guide frame 1 on the ground, the guide frame 1 is composed by the base 11, support frame 12, electric hoist 13, fixed pulley 14, steel wire rope 15, lifting mechanism 16, roller 17, the pressure sensor 181, speed encoder 182, altimeter encoder 183 and limit roller 19 as shown in figure 3 and 4. Fix the base 1 on the ground and fix the support frame 12 and electric hoist 13 on the base 1. A fixed pulley 14 is equipped at the top of the support frame 12, also a steel wire rope 15 which one end is connected with electric hoist 13 and the other end is connected with lifting mechanism 16 is wound on the fixed pulley 14. The lifting mechanism 16 is equipped with three rollers 17, 2 pressure sensors 181 and a speed encoder 182, the 3 rollers 17 are arranged in a "triangle" shape, that is, three straight lines connecting the circle center points of three rollers make up of a triangle. A pressure sensor 181 and a speed encoder 182 are equipped at one side of the three rollers, at the side of the fixed pulley 14, altimeter encoder 183, electric hoist 13, pressure sensor 181, speed encoder 182 are equipped. Both the speed encoder 182 and the altimeter encoder 183 are connected with PLC by the telecommunication wires. Fix the rotation axis 21 on the ground at one side of the guide frame 1, connecting the rotation platform 2 with the rotation axis, meantime, the rotating platform 2 will rotate about the rotation axis 21. The upper surface of the rotation platform 2 shall be flush with the ground, the platform rail 22 is paved on the rotation platform and the railcar 3 is located on the rail 22. Three straight lines connecting the circle center points of three rollers make up of a triangle. The characteristics of rotation platform facilitate rail platform car easy to select multi-directions and link up with workshop rails.

The inner module 4 is composed by at least four support plates 41 and the support rod 42 at the top section, the four support plates 41 was aligned uniformly in the ring shape. There are gaps between the adjacent support plates 41, the gap length shall be the width of the support plate 41 of 80% to 150% (in this embodiment, 150%). Operator can get into the inner module to operate through gaps between support plates. The support rod 42 shall be fixed by the hinge at the top of the support plate 41, each support plate 41 shall fix two support rods and the two top of the rod 42 shall be symmetrically fixed on the support plate 41 at left and right sides. The supporting plate 41 and the railcar 3 is connected by the bolt. The top of support plate 41 will lean outward. After fixing the support plate 41 and railcar 3, the centers of gravity of four support plates should be located outside of each hinge.

Put a ring shaped tray 5 onto the railcar 3 and hitch it outside the inner module 4. Lifting points which are used for lifting the tray and looped cable strands

which are wound on the tray shall be set at the tray edges, and lay the water proof film cover on the surface of the tray 5.

Put one end of strand 10 through the guide rollers 11 and fix it onto the inner module 4, then drive rotation platform 2 to rotate in the direction of arrow B as shown in figure 2, which will drive the railcar 3 and inner module 4 to rotate together. Along with the rotation, the strand 10 will be wound on the inner module 4 one circle by another from the bottom end of the inner module 4 till to the top of the inner module 4, and then wind the strand 10 from the top of the inner module 4 to the bottom. Repeat this operation until all the strands 10 wrapped into wire strands. During the upward winding procedure, the PLC will control the electric hoist 13 to pull the steel wire rope, thus to lift the lifting mechanism 16 which will enable the guide roller 11 move upward with the distance which is equivalent to the strand 10 diameter during each circle. During the downward winding procedure, the PLC will control the electric hoist 13 to pull to steel wire rope 15, thus to pull down the lifting mechanism 16 which will enable the guide roller 11 move downward with the distance which is equivalent to the strand 10 diameter during each circle, therefore guarantee that strands are capable of arranging on the inner module 2 regularly and compactly.

After all the strands 10 are wound into wire strands, as shown in figure 5, dismantle the bolts between the bottom of the inner module 4 and the railcar 3. Lift the support rod 42 on the inner module 4 in the direction of arrow C as shown in figure 3 which will make the 4 pieces support plates 41 gather together inward, and then extract the inner module 4 from the wire strand. After this, use the prepared waterproof film on the tray 5 to cover the whole outside surface of the wire strand 10. Connect the platform track 22 on the rotating platform 2 with the track on the ground, pull the railcar 3 to move the wire strand 10, until this winding operation is finished.

(b) Performing the unwinding operation, the operation procedure is as follows:

As shown in figure 6, fix the guide frame 1 on the ground, the guide frame 1 is shown in figure 3 and 4 and composed by the base 11, support frame 12, electric hoist 13, fixed pulley 14, steel wire rope 15, lifting mechanism 16, roller 17, the pressure sensor 181, speed encoder 182, altimeter encoder 183 and limit roller 19. Fix the base 1 on the ground and fix the support frame 12 and electric hoist 13 on the base 1. A fixed pulley 14 shall be equipped at the top of the support frame 12, also the steel wire rope 15 whose one end is connected with electric hoist 13 and the other end is connected with lifting mechanism 16 shall be wound on the fixed pulley 14. The lifting mechanism 16 is equipped with 3 rollers 17, 2 pressure sensors 181 and a speed encoder 182. The

3 Roller 17 is arranged in a "triangle" shape, that is, three straight lines connecting the circle center points of three rollers make up of a triangle. A pressure sensor 181 and a speed encoder 182 shall be equipped at one side of the three rollers, at the side of the fixed pulley 14, altimeter encoder (183), electric hoist 13, pressure sensor 181, speed encoder 182 shall be equipped. Both the speed encoder 182 and the altimeter encoder 183 shall be connected with PLC by the telecommunication wires. Fix the rotation axis 21 on the ground at one side of the guide frame 1, connecting the rotation platform 2 with the rotation axis, meantime, the rotating platform 2 will rotate around the rotation axis 21. The hydraulic brake 24 which is connected by pressure sensor and PLC is equipped in the rotation axis 21. During the rotation of the rotating platform 2, release the hydraulic brake 24. When the rotating platform stops, the hydraulic brake 24 is always imposing friction on the rotating platform 2, thus applying portion of reverse compression to prevent against rotating platform 2 continually rotating, bring about cable strand dropped out and injury when dragging forces temporarily stop.

[0018] The inner module 4 is composed by at least four support plates 41 and the support rod 42. The number of support plate 41 in this embodiment is selected as 4. The four support plates 41 are aligned uniformly in the ring shape. The gaps shall be retained between the adjacent support plates 41, the gap length shall be the width of the support plate 41 of 80% to 150% (in this embodiment, 150%). The bottoms of the support plates 41 are connected by the hinge with the rotating platform 2, all the 4 pieces support plates 41 will lean inward. In the middle of the 4 pieces support plates 41, a hydraulic jack 6 is equipped. The support rod of the hydraulic jack 6 is connected with four pieces push rods 61, and each push rod 61 shall withstand a piece of support plate 41.

[0019] Remove the waterproof film cover from the strand 10, lift the strand 10 wire strands together with the tray 5 onto the rotating platform 2, meantime, set the strand 10 wire strands over the inner module 4. Actuate the hydraulic jack 6, with the force of the support rod applied to the push rod, the 4 pieces support plates 41 will push outward by the push rod 61 which will fix the strand wire strands.

[0020] Pull one leading end of the strand 10 through out of the guide roller 11, then pull the strand 10 to drive the inner module 4 and the tray 5 to rotate, thus to drive the rotating platform 2 to rotate around the rotation axis. Along with this operation, the strand 10 shall be released and will become straight status.

[0021] During the downward winding procedure, the PLC will control the electric hoist 13 to pull to steel wire rope, thus to pull down the lifting mechanism 16 which will enable the guide roller 11 move downward with the distance which is equivalent to the strand 10 diameter

during each circle. During the upward winding procedure, the PLC will control the electric hoist 13 to pull the steel wire rope 15, thus to lift the lifting mechanism 16 which will enable the guide roller 11 move upward with the distance which is equivalent to the strand 10 diameter during each circle. Repeat these operations back and forth till the wire strands strand become straight status, and fulfill the whole unwinding operation.

[0022] Under the controlling action of the PLC, the unwinding of cable strand is restricted to prevent against out of control for strand, avoiding cable strand damage or injury or loss; in unwinding strand operation, can keep line shape relatively straight and level to protect strand and prevent binding band breakdown, when the speed of unwinding strand is slowed down or stop, gradually control hydraulic brake 24 to lock turning axle; the introduction of pressure sensor furthermore facilitate PLC to control hydraulic brake 24 smoothly.

Embodiment 2

[0023] It is a method for horizontally winding and horizontally unwinding a parallel wire strand. The method includes winding strand and unwinding strand operations. During the winding strand the container 4 is composed by 6 support plates 41 and the top support rod 42. The six support plates 41 are aligned uniformly in the ring shape. There is a gap between the adjacent support plates 41, and the gap length is 100 percent of the width of support plate 41. The rest structure and method are the same to embodiment 1.

Embodiment 3

[0024] It is a method for horizontally winding and horizontally unwinding a parallel wire strand. The method includes winding strand and unwinding strand operations. During the winding strand the container 4 is composed by 10 support plates 41 and the top support rod 42. The ten support plates 41 are aligned uniformly in the ring shape. There is a gap between the adjacent support plates 41, and the gap length is 80 percent of the width of support plate 41. The rest structure and method are the same to embodiment 1.

Claims

1. A method for horizontally winding and horizontally unwinding a parallel wire strand upon a base of a cable reel for transport, storage or installation, a parallel wire strand made up of a plurality of tightly adjacent vertically and horizontally arranged parallel wires, the strand including at least a leading end fitting securing the ends of the wires together, the method is **characterized in that** it comprises the steps of:

(a) Performing the winding operation, the operation procedure is as follows:

Fix a guide frame (1) on the ground, the guide frame (1) is composed by a base (11), a support frame (12), an electric hoist (13), a fixed pulley (14), a steel wire rope (15), a lifting mechanism (16), rollers (17), pressure sensors (181), speed encoders (182), an altimeter encoder (183) and a limit roller (19); fix the base (11) on the ground and fix the support frame (12) and electric hoist (13) on the base (11); the fixed pulley (14) is equipped at the top of the support frame, also the steel wire rope (15) which one end is connected with the electric hoist (13) and the other end is connected with the lifting mechanism (16) is wound on the fixed pulley (14); the lifting mechanism (16) is equipped with three rollers (17), two pressure sensors (181) and a speed encoder (182), the three rollers (17) are arranged in a "triangle" shape, that is, three straight lines connecting the circle center points of three rollers make up of a triangle, whereby the two pressure sensors (181) and the speed encoder (182) are equipped at one side of the three rollers, and whereby at the side of the fixed pulley (14), the altimeter encoder (183), the electric hoist (13), a pressure sensor (181), a speed encoder (182) are equipped, whereby both the speed encoder (182) and the altimeter encoder (183) are connected with a programmable logical controller (PLC) by telecommunication wires; fix a rotation axis (21) on the ground at one side of the guide frame (1), connecting a rotation platform (2) with the rotation axis (21), the rotating platform (2) will rotate about the rotation axis (21), whereby the upper surface of the rotation platform (2) shall be flush with the ground, a platform rail (22) is paved on the rotation platform and a railcar (3) is located on the rail (22), whereby the rotation platform facilitate the railcar easy to select multi-directions and link up with workshop rails; an inner module (4) is composed by at least four support plates (41) and support rods (42) at the top section of each support plate (41), the four support plates (41) are aligned uniformly in a ring shape with gaps between the adjacent support plates (41), the gap length shall be the width of the support plate (41) of 80% to 150%, whereby an operator can get into the inner module to operate through gaps between support plates, whereby the support rods (42) shall be fixed by a hinge at the top of the support plates (41), whereby each support plate (41) shall be fixed by two support rods and the two top of the rod (42) shall be symmetrically fixed on the support plate (41) at left and right sides, whereby the supporting plate (41) and the railcar (3) are connected by a bolt, the top of the

support plates (41) will lean outward, whereby after fixing the support plates (41) with the railcar (3), the centers of gravity of four support plates should be located outside of each hinge, put a ring shape tray (5) onto the railcar (3) and hitch it outside the inner module (4), whereby lifting points which are used for lifting the tray and looped cable strands which are wound on the tray shall be set at the tray edges, and lay a water proof film cover on the surface of the tray (5); put one end of strand (10) through the guide rollers (11) and fix it onto the inner module (4), then drive rotation platform (2) to rotate, which will drive the railcar (3) and inner module (4) to rotate together, along with the rotation, the strand (10) will be wound on the inner module (4) one circle by another from the bottom end of the inner module (4) till to the top of the inner module (4), and then wind the strand (10) from the top of the inner module (4) to the bottom; this operation is repeated until all the strands (10) are wrapped into wire strands, whereby during the upward winding procedure, the PLC will control the electric hoist (13) to pull the steel wire rope, thus to lift the lifting mechanism (16) which will enable the guide roller (11) move upward with the distance which is equivalent to the strand (10) diameter during each circle, and whereby during the downward winding procedure, the PLC will control the electric hoist (13) to pull to steel wire rope (15), thus to pull down the lifting mechanism (16) which will enable the guide roller (11) move downward with the distance which is equivalent to the strand (10) diameter during each circle, therefore guarantee that strands are capable of arranging on the inner module (2) regularly and compactly; after all the strands (10) are wound into wire strands, dismantle the bolts between the bottom of the inner module (4) and the railcar (3); lift the support rods (42) on the inner module (4) which will make the 4 pieces support plates (41) gather together inward, and then extract the inner module (2) from the wire strand; after this, use the prepared waterproof film on the tray (5) to cover the whole outside surface of the wire strand (10); connect the platform track (22) on the rotating platform (2) with a track on the ground, pull the railcar (3) to move the wire strand (10), until this winding operation is finished;

(b) Performing the unwinding operation, the operation procedure is as follows:

Fix said guide frame (1) on the ground, the guide frame (1) is composed by the base (11), support frame (12), electric hoist (13), fixed pulley (14), steel wire rope (15), lifting mechanism (16), rollers (17), pressure sensors (181), speed encoders (182), altimeter encoder (183) and limit roller

(19); fix the base (11) on the ground and fix the support frame (12) and electric hoist (13) on the base (11), whereby the fixed pulley (14) is equipped at the top of the support frame (12), also the steel wire rope (15) whose one end is connected with the electric hoist (13) and the other end is connected with the lifting mechanism (16) is wound on the fixed pulley (14); the lifting mechanism (16) equipped with the three rollers (17), the two pressure sensors (181) and the speed encoder (182), whereby the three rollers (17) are arranged in a "triangle" shape, that is, three straight lines connecting the circle center points of the three rollers make up of a triangle; where by the two pressure sensors (181) and the speed encoder (182) are equipped at one side of the three rollers, and whereby at the side of the fixed pulley (14), the altimeter encoder (183), the electric hoist (13), a pressure sensor (181), the speed encoder (182) are equipped; whereby both the speed encoder (182) and the altimeter encoder (183) are connected with the PLC by the telecommunication wires; fix the rotation axis (21) on the ground at one side of the guide frame (1), connecting the rotation platform (2) with the rotation axis, whereby the rotating platform (2) will rotate around the rotation axis (21); a hydraulic brake (24) which is connected with the pressure sensors and the PLC is equipped in the rotation axis (21); during the rotation of the rotating platform (2), release the hydraulic brake (24); when the rotating platform stops, the hydraulic brake (24) is always imposing friction on the rotating platform (2), thus applying portion of reverse compression to prevent against rotating platform (2) continually rotating, bring about cable strand dropped out and damaged when dragging forces temporarily stop; said inner module (4) composed by the at least four support plates (41) and the support rods (42); whereby the four support plates (41) are aligned uniformly in the ring shape, the gaps shall be retained between the adjacent support plates (41), the gap length shall be the width of the support plate (41) of 80% to 150%; the bottoms of the support plates (41) are connected by the hinge with the rotating platform (2), all the four support plates (41) will lean inward; in the middle of the four support plates (41), a hydraulic jack (6) is equipped; whereby a support rod of the hydraulic jack (6) is connected with four push rods (61), and each push rod (61) supports a piece of support plate (41), remove the waterproof film cover from the strand (10), lift the strand (10) wire strands together with the tray (5) onto the rotating platform (2), meantime, set the strand (10) wire strands over the inner module (4); Actuat the hydraulic jack

(6), with the force of the support rod applied to the push rod, the four support plates (41) will push outward by the push rod (61) which will fix the strand wire strands; pull one leading end of the strand (10) through out of the guide roller (11), then pull the strand (10) to drive the inner module (4) and the tray (5) to rotate, thus to drive the rotating platform (2) to rotate around the rotation axis; whereby with this operation, the strand (10) shall be released and will become the straight status; whereby during the downward winding procedure, the PLC will control the electric hoist(13) to pull to steel wire rope, thus to pull down the lifting mechanism (16) which will enable the guide roller (11) move downward with the distance which is equivalent to the strand(10) diameter during each circle, and whereby during the upward winding procedure, the PLC will control the electric hoist (13) to pull the steel wire rope (15), thus to lift the lifting mechanism (16) which will enable the guide roller (11) move upward with the distance which is equivalent to the strand(10) diameter during each circle; repeat these operations back and forth till the wire strands strand become straight status, and fulfill the whole unwinding operation.

2. The method according to claim 1, wherein the rotation axis (21) is vertical to the ground at the side of the guide frame (1).
3. The method according to claim 1 or 2, wherein in horizontal winding operation the bottom of the support plate (41) is connected with the railcar (3) by bolts, the top of the support plate (41) shall lean outward and the angle between the support plate (41) and upper surface of railcar is between $60^{\circ} \sim 85^{\circ}$.
4. The method according to claim 1 or 2, wherein in horizontal unwinding operation the bottom of the support plate (41) is connected with the rotating platform (2) by the hinge, all the four support plates (41) will lean inward and the angle between a support plate (41) and upper surface of railcar is between $60^{\circ} \sim 85^{\circ}$.

Patentansprüche

1. Verfahren zum horizontalen Auf- und Abwickeln einer parallelen Drahtlitze auf einer Basis einer Kabelrolle für den Transport, die Lagerung oder Installation, wobei eine parallele Drahtlitze aus mehreren dicht benachbarten vertikal und horizontal angeordneten parallelen Drähten zusammengesetzt ist, wobei die Litze wenigstens ein führendes Endstück aufweist, das die Enden der Drähte aneinander befestigt, wobei das Verfahren **dadurch gekennzeichnet**

ist, dass es die folgenden Schritte aufweist:

(a) Durchführen des Wicklungsvorgangs, wobei der Wicklungsvorgang wie folgt ist:

5 Befestigen eines Führungsrahmens (1) auf dem Boden, wobei der Führungsrahmen (1) aus einer Basis (11), einem Halterahmen (12), einem elektrischen Aufzug (13), einer festen Seilscheibe (14), einem Stahldrahtseil (15), einem Hebemechanismus (16), Rollen (17), Drucksensoren (181), Drehzahlgebern (182), einem Höhenmessgeber (183) und einer Grenzrolle (19) zusammen-
10 gesetzt ist;
15 Befestigen der Basis (11) auf dem Boden und Befestigen des Halterahmens (12) und des elektrischen Aufzugs (13) auf der Basis (11);
20 wobei die feste Seilscheibe (14) an der Oberseite des Halterahmens eingerichtet ist, wobei auch das Stahldrahtseil (15), dessen eines Ende mit dem elektrischen Aufzug (13) verbunden ist und dessen anderes Ende mit dem Hebemechanismus (16) verbunden ist, auf die feste Seilscheibe (14) gewickelt wird;
25 wobei der Hebemechanismus (16) mit drei Rollen (17), zwei Drucksensoren (181) und einem Drehzahlgeber (182) eingerichtet ist, wobei die drei Rollen (17) in einer "Dreieck"-Form angeordnet sind, das heißt, drei ge-
30 rade Linien, welche die Kreismittelpunkte der drei Rollen verbinden, bilden ein Dreieck, wobei die zwei Drucksensoren (181) und der Drehzahlgeber (182) auf einer Seite der drei Rollen eingerichtet sind und wobei auf der Seite der festen Seilscheibe (14) der Höhenmessgeber (183), der elektrische Aufzug (13), ein Drucksensor (181), ein
35 Drehzahlgeber (182) eingerichtet sind, wobei sowohl der Drehzahlgeber (182) als auch der Höhenmessgeber (183) durch Telekommunikationsdrähte mit einer programmierbaren Logiksteuerung (PLC) ver-
40 bunden sind;
45 Befestigen einer Drehachse (21) auf einer Seite des Führungsrahmens (1) auf dem Boden, Verbinden einer Drehplattform (2) mit der Drehachse (21), wobei die Dreh-
50 plattform (2) sich um die Drehachse (21) dreht, wobei die obere Oberfläche der Drehplattform (2) bündig mit dem Boden sein soll, eine Plattformschiene (22) auf die Drehplattform gepflastert ist und ein Schie-
55 nenwagen (3) auf der Schiene (22) angeordnet ist, wobei die Drehplattform erleichtert, dass der

Schienenwagen leicht mehrere Richtungen auswählt und mit den Betriebsschienen koppelt;

ein inneres Modul (4) aus wenigstens vier Halteplatten (41) und Haltestangen (42) an dem oberen Abschnitt jeder Halteplatte (41) zusammengesetzt ist,

die vier Halteplatten (41) gleichmäßig in einer Ringform mit Lücken zwischen den benachbarten Halteplatten (41) ausgerichtet sind, wobei die Lückenlänge 80% bis 150% der Breite der Halteplatte (41) sein soll,

wobei ein Bediener in das innere Modul steigen kann, um durch die Lücken zwischen Halteplatten zu arbeiten, wobei die Haltestangen (42) durch ein Gelenk (41) an der Oberseite der Halteplatten (41) befestigt sein sollen, wobei jede Halteplatte (41) durch zwei Haltestangen befestigt sein soll und die zwei Oberseiten der Stange (42) auf der Halteplatte (41) auf linken und rechten Seiten symmetrisch befestigt sein sollen, wobei die Halteplatte (41) und der Schienenwagen (3) durch einen Bolzen ver-

bunden sind, wobei die Oberseite der Halteplatten (41) sich nach außen neigt, wobei die Schwerpunkte von vier Halteplatten nach dem Befestigen der Halteplatten (41) an dem Schienenwagen (3) außerhalb jedes Gelenks angeordnet sein sollten,

Setzen einer ringförmigen Ablage (5) auf den Schienenwagen und Ankuppeln von diesem außerhalb des inneren Moduls (4), wobei Hebepunkte, die verwendet werden, um die Ablage zu heben, und geschlungene Kabellitzen, die auf die Ablage gewickelt sind, an Ablagerändern festgelegt werden sollen, und Legen einer wasserdichten Dünnschichtabdeckung auf die Oberfläche der Ablage (5);

Legen eines Endes der Litze (10) durch die Führungsrollen (11) und Befestigen auf dem inneren Modul (4), dann Antreiben der Drehplattform (2), so dass sie sich dreht, was den Schienenwagen (3) und das innere Modul (4) antreiben wird, so dass sie sich zusammen drehen, wobei die Litze (10) einhergehend mit der Drehung eine Runde nach der anderen von dem unteren Ende des inneren Moduls (4) bis zu der Oberseite des inneren Moduls (4) auf das innere Modul (4) gewickelt wird, und dann Wickeln der Litze (10) von der Oberseite des inneren Moduls (4) zu der Unterseite;

dieser Vorgang wird wiederholt, bis alle Litzen (10) in Drahtlitzen eingewickelt sind, wobei die PLC während des Aufwärtswickelverfahrens den elektrischen Aufzug

(13) steuern wird, um das Strahldrahtseil zu ziehen, um somit den Hebemechanismus (16) zu heben, was ermöglichen wird, dass die Führungsrolle (11) sich um die Strecke aufwärts bewegt, die äquivalent zu dem Litzendurchmesser (10) während jeder Runde ist, und wobei die PLC während des Abwärtswickelverfahrens den elektrischen Aufzug (13) steuern wird, um das Strahldrahtseil (15) zu ziehen, um den Hebemechanismus (16) auf diese Weise nach unten zu ziehen, was ermöglichen wird, dass die Führungsrolle (11) sich während jeder Runde um die Strecke abwärts bewegt, die äquivalent zu dem Durchmesser der Litze (10) ist, daher wird sichergestellt, dass Litzen fähig sind, sich auf dem inneren Modul (2) regelmäßig und kompakt anzuordnen; nachdem alle Litzen (10) zu Drahtlitzen gewickelt sind, Abmontieren der Bolzen zwischen der Unterseite des inneren Moduls (4) und dem Schienenwagen (3); Heben der Haltestangen (42) auf dem inneren Modul (4), was die 4 teiligen Halteplatten (41) sich einwärts sammeln lässt, und dann Extrahieren des inneren Moduls (2) von der Drahtlitze; danach Verwenden der vorbereiteten waserdichten Dünnschicht auf der Ablage (5), um die gesamte Außenoberfläche der Drahtlitze (10) zu bedecken; Verbinden der Plattformschiene (22) auf der Drehplattform (2) mit einer Schiene auf dem Boden, Ziehen des Schienenwagens (3), um die Drahtlitze (10) zu bewegen, bis dieser Wicklungsvorgang beendet wird;

(b) Durchführen des Abwickelbetriebs, wobei das Abwickelverfahren wie folgt ist:

Befestigen des Führungsrahmens (1) auf dem Boden, wobei der Führungsrahmen (1) aus der Basis (11), dem Halterahmen (12), dem elektrischen Aufzug (13), der festen Seilscheibe (14), dem Strahldrahtseil (15), dem Hebemechanismus (16), Rollen (17), Drucksensoren (181), Drehzahlgebern (182), dem Höhenmessgeber (183) und der Grenzrolle (19) zusammengesetzt ist; Befestigen der Basis (11) auf dem Boden und Befestigen des Halterahmens (12) und des elektrischen Aufzugs (13) auf der Basis (11), wobei die feste Seilscheibe (14) an der Oberseite des Halterahmens (12) eingerichtet ist, wobei auch das Strahldrahtseil (15), dessen eines Ende mit dem elektrischen Aufzug (13) verbunden ist und des-

sen anderes Ende mit dem Hebemechanismus (16) verbunden ist, auf die feste Seilscheibe (14) gewickelt wird; wobei der Hebemechanismus (16) mit den drei Rollen (17), den zwei Drucksensoren (181) und dem Drehzahlgeber (182) eingerichtet ist, wobei die drei Rollen (17) in einer "Dreieck"-Form angeordnet sind, das heißt, drei gerade Linien, welche die Kreismittelpunkte der drei Rollen verbinden, bilden ein Dreieck, wobei die zwei Drucksensoren (181) und der Drehzahlgeber (182) auf einer Seite der drei Rollen eingerichtet sind und wobei auf der Seite der festen Seilscheibe (14) der Höhenmessgeber (183), der elektrische Aufzug (13), ein Drucksensor (181), der Drehzahlgeber (182) eingerichtet sind, wobei sowohl der Drehzahlgeber (182) als auch der Höhenmessgeber (183) durch Telekommunikationsdrähte mit der PLC verbunden sind;

Befestigen der Drehachse (21) auf einer Seite des Führungsrahmens (1) auf dem Boden, Verbinden der Drehplattform (2) mit der Drehachse (21), wobei die Drehplattform (2) sich um die Drehachse dreht; wobei eine Hydraulikbremse (24), die mit den Drucksensoren und der PLC verbunden ist, in der Drehachse (21) eingerichtet ist;

Lösen der Hydraulikbremse (24) während der Drehung der Drehplattform (2); wobei die Hydraulikbremse (24), wenn die Drehplattform stoppt, der Drehplattform (2) immer Reibung auferlegt, wobei auf diese Weise ein Rückwärtskompressionsanteil angewendet wird, um zu verhindern, dass die Drehplattform (2) sich kontinuierlich dreht und zur Folge hat, dass eine Kabellitze herausfällt und beschädigt wird, wenn Zugkräfte vorübergehend stoppen;

wobei das innere Modul (4) aus den wenigstens vier Halteplatten (41) und den Haltestangen (42) zusammengesetzt ist; wobei die vier Halteplatten (41) gleichmäßig in der Ringform ausgerichtet sind, wobei die Lücken zwischen den benachbarten Halteplatten (41) gehalten werden sollen, wobei die Lückenlänge 80% bis 150% der Breite der Halteplatte (41) sein soll; wobei die Unterseiten der Halteplatten (41) durch das Gelenk mit der Drehplattform (2) verbunden sind, wobei alle vier der Halteplatten (41) nach innen geneigt sind; wobei in der Mitte der vier Halteplatten (41) ein hydraulischer Heber (6) eingerichtet ist;

wobei eine Haltestange des hydraulischen Hebers (6) mit vier Schubstangen (61) ver-

- bunden ist und jede Schubstange (61) ein Stück der Halteplatte (41) hält,
Entfernen der wasserdichten Dünnschichtabdeckung von der Litze (10), Heben der Drahtlitzen der Litze (10) zusammen mit der Ablage (5) auf die Drehplattform (2), in der Zwischenzeit Legen der Drahtlitzen der Litze (10) über das innere Modul (4);
Betätigen des hydraulischen Hebers (6) mit der Kraft der Haltestange, die auf die Schubstange angewendet wird, wobei die vier Halteplatten die Schubstange (61) auswärts drücken, was die Litzen des Litzen-drahts befestigen wird;
Herausziehen eines führenden Endes der Litze (10) durch die Führungsrolle (11), dann Ziehen der Litze (10), um das innere Modul (4) und die Ablage (5) anzutreiben, so dass sie sich drehen, um auf diese Weise die Drehplattform (2) anzutreiben, so dass sie sich um die Drehachse dreht; wobei die Litze (10) mit diesem Vorgang gelöst wird und in den geraden Zustand kommt; wobei die PLC während des Abwärtswickelverfahrens den elektrischen Aufzug (13) steuern wird, um das Stahldrahtseil zu ziehen, um auf diese Weise den Hebemechanismus (16) nach unten zu ziehen, was ermöglichen wird, dass die Führungsrolle (11) sich während jeder Runde um die Strecke nach unten bewegt, die dem Durchmesser der Litze (10) entspricht, und wobei die PLC den elektrischen Aufzug (13) während des Aufwärtswickelverfahrens steuern wird, um das Stahldrahtseil (15) zu ziehen, um auf diese Weise den Hebemechanismus (16) zu heben, was ermöglicht, dass sich die Führungsrolle (11) während jeder Runde um die Strecke aufwärts bewegt, die äquivalent zu dem Durchmesser der Litze (10) ist;
Wiederholen dieser Vorgänge hin und her, bis die Litze der Drahtlitzen einen geraden Zustand hat, und Ausführen des gesamten Abwickelvorgangs.
2. Verfahren nach Anspruch 1, wobei die Drehachse (21) auf der Seite des Führungsrahmens (1) vertikal zu dem Boden ist.
 3. Verfahren nach Anspruch 1 oder 2, wobei die Unterseite der Halteplatte (41) in dem horizontalen Wickelvorgang durch Bolzen mit dem Schienenwagen (3) verbunden ist, wobei die Oberseite der Halteplatte (41) nach außen geneigt sein soll und der Winkel zwischen der Halteplatte (41) und der oberen Oberfläche des Schienenwagens zwischen 60° und 85°

liegt.

4. Verfahren nach Anspruch 1 oder 2, wobei die Unterseite der Halteplatte (41) in dem horizontalen Abwickelvorgang durch das Gelenk mit der Drehplattform (2) verbunden ist, alle vier Halteplatten (41) nach innen geneigt sind und der Winkel zwischen einer Halteplatte (41) und der oberen Oberfläche des Schienenwagens zwischen 60° und 85° liegt.

Revendications

1. Procédé pour l'enroulement horizontal et le déroulement horizontal d'un toron de fils métalliques parallèles sur une base d'une bobine de câble pour le transport, le stockage ou l'installation, un toron de fils métalliques parallèles étant composé d'une pluralité de fils métalliques agencés verticalement et horizontalement, parallèles, adjacents de façon serrée, le toron incluant au moins un raccord d'extrémité avant fixant les extrémités des fils métalliques ensemble, le procédé est **caractérisé en ce qu'il** comprend les étapes de :

(a) la réalisation de l'opération d'enroulement, la procédure d'opération est comme suit :

la fixation d'un cadre de guidage (1) sur le sol, le cadre de guidage (1) est composé d'une base (11), d'un cadre de support (12), d'un appareil de levage électrique (13), d'une poulie fixe (14), d'une corde de fils d'acier (15), d'un mécanisme de levage (16), de rouleaux (17), de capteurs de pression (181), d'encodeurs de vitesse (182), d'un encodeur d'altimètre (183) et d'un rouleau de limite (19) ; la fixation de la base (11) sur le sol et la fixation du cadre de support (12) et de l'appareil de levage électrique (13) sur la base (11) ; la poulie fixe (14) est prévue en haut du cadre de support, également la corde de fils d'acier (15), dont une extrémité est raccordée à l'appareil de levage électrique (13) et l'autre extrémité est raccordée au mécanisme de levage (16), est enroulée sur la poulie fixe (14) ; le mécanisme de levage (16) est pourvu de trois rouleaux (17), de deux capteurs de pression (181) et d'un encodeur de vitesse (182), les trois rouleaux (17) sont agencés en une forme de « triangle », à savoir, trois lignes droites raccordant les points centraux de cercle de trois rouleaux composant un triangle, moyennant quoi les deux capteurs de pression (181) et l'encodeur de vitesse (182) sont prévus sur un côté des trois rouleaux, et moyennant quoi, sur le côté de la poulie fixe (14), l'encodeur d'altimètre (183), l'appareil de levage électrique (13), un capteur de pression (181), un encodeur de vitesse (182) sont prévus, moyennant quoi à la

fois l'encodeur de vitesse (182) et l'encodeur d'altimètre (183) sont connectés à un automate programmable industriel (PLC) par des fils métalliques de télécommunication ; la fixation d'un axe de rotation (21) sur le sol sur un côté du cadre de guidage (1), le raccordement d'une plateforme rotative (2) avec l'axe de rotation (21), la plateforme rotative (2) entrera en rotation autour de l'axe de rotation (21), moyennant quoi la surface supérieure de la plateforme rotative (2) sera au ras du sol, un rail de plateforme (22) est formé sur la plateforme rotative et un véhicule sur rail (3) est situé sur le rail (22), moyennant quoi la plateforme rotative permet au véhicule sur rail de facilement sélectionner des multidirections et se relier à des rails d'atelier ; un module intérieur (4) est composé d'au moins quatre plaques de support (41) et tiges de support (42) sur la section haute de chaque plaque de support (41), les quatre plaques de support (41) sont alignées uniformément en une forme annulaire avec des espaces entre les plaques de support adjacentes (41), la longueur d'espace sera la largeur de la plaque de support (41) de 80 % à 150 %, moyennant quoi un opérateur peut entrer dans le module intérieur, pour l'utilisation, à travers des espaces entre des plaques de support, moyennant quoi les tiges de support (42) seront fixées par une articulation en haut des plaques de support (41), moyennant quoi chaque plaque de support (41) sera fixée par deux tiges de support et les deux haut de la tige (42) seront symétriquement fixés sur la plaque de support (41) sur les côtés gauche et droit, moyennant quoi la plaque de support (41) et le véhicule sur rail (3) sont raccordés par un boulon, le haut des plaques de support (41) s'inclinera vers l'extérieur, moyennant quoi, après la fixation des plaques de support (41) au véhicule sur rail (3), les centres de gravité de quatre plaques de support doivent être situés à l'extérieur de chaque articulation, le placement d'un plateau de forme annulaire (5) sur le véhicule sur rail (3) et son attelage à l'extérieur du module intérieur (4), moyennant quoi des points de levage qui sont utilisés pour lever le plateau et des torons de câble en boucle qui sont enroulés sur le plateau seront placés sur les bords de plateau, et le dépôt d'une couverture en film étanche à l'eau sur la surface du plateau (5) ; le placement d'une extrémité de toron (10) à travers les rouleaux de guidage (11) et sa fixation sur le module intérieur (4), puis l'entraînement de rotation de la plateforme rotative (2), qui entraînera la rotation conjointe du véhicule sur rail (3) et du module intérieur (4), conjointement avec la rotation, le toron (10) sera enroulé sur le module intérieur (4), un tour à côté d'un autre,

à partir de l'extrémité basse du module intérieur (4) jusqu'en haut du module intérieur (4), et puis l'enroulement du toron (10) du haut du module intérieur (4) au bas ; cette opération est répétée jusqu'à ce que tous les torons (10) soient enroulés en torons de fils métalliques, moyennant quoi, durant la procédure d'enroulement ascendante, le PLC commandera l'appareil de levage électrique (13) pour tirer la corde de fils d'acier, ainsi pour lever le mécanisme de levage (16) ce qui permettra au rouleau de guidage (11) de se déplacer vers le haut avec la distance qui est équivalente au diamètre du toron (10) durant chaque tour, et moyennant quoi, durant la procédure d'enroulement descendante, le PLC commandera l'appareil de levage électrique (13) pour tirer sur la corde de fils d'acier (15), ainsi pour tirer vers le bas le mécanisme de levage (16) ce qui permettra au rouleau de guidage (11) de se déplacer vers le bas avec la distance qui est équivalente au diamètre du toron (10) durant chaque tour, donc garantir que des torons sont capables de s'agencer sur le module intérieur (2) régulièrement et de façon compacte ; après que tous les torons (10) sont enroulés en torons de fils métalliques, le démontage des boulons entre le fond du module intérieur (4) et le véhicule sur rail (3) ; le levage des tiges de support (42) sur le module intérieur (4) qui fera en sorte que les 4 pièces de plaques de support (41) se regroupent ensemble vers l'intérieur, et alors l'extraction du module intérieur (2) à partir du toron de fils métallique ; après ceci, l'utilisation du fil étanche à l'eau préparé sur le plateau (5) pour couvrir la surface extérieure entière du toron de fils métallique (10) ; le raccordement de la piste de plateforme (22) sur la plateforme rotative (2) avec une piste sur le sol, le tirage du véhicule sur rail (3) pour déplacer le toron de fils métallique (10), jusqu'à ce que cette opération d'enroulement soit finie ; (b) la réalisation de l'opération de déroulement, la procédure d'opération est comme suit la fixation dudit cadre de guidage (1) sur le sol, le cadre de guidage (1) est composé de la base (11), du cadre de support (12), de l'appareil de levage électrique (13), de la poulie fixe (14), de la corde de fils d'acier (15), du mécanisme de levage (16), des rouleaux (17), des capteurs de pression (181), des encodeurs de vitesse (182), de l'encodeur d'altimètre (183) et du rouleau de limite (19) ; la fixation de la base (11) sur le sol et la fixation du cadre de support (12) et de l'appareil de levage électrique (13) sur la base (11), moyennant quoi la poulie fixe (14) est prévue en haut du cadre de support (12), également la corde de fils d'acier (15), dont une extrémité est raccordée à l'appareil de levage électrique (13)

et l'autre extrémité est raccordée au mécanisme de levage (16), est enroulée sur la poulie fixe (14) ; le mécanisme de levage (16) est pourvu des trois rouleaux (17), des deux capteurs de pression (181) et de l'encodeur de vitesse (182), moyennant quoi les trois rouleaux (17) sont agencés en une forme de « triangle », à savoir, trois lignes droites raccordant les points centraux de cercle des trois rouleaux composent un triangle ; moyennant quoi les deux capteurs de pression (181) et l'encodeur de vitesse (182) sont prévus sur un côté des trois rouleaux, et moyennant quoi, sur le côté de la poulie fixe (14), l'encodeur d'altimètre (183), l'appareil de levage électrique (13), un capteur de pression (181), l'encodeur de vitesse (182) sont prévus ; moyennant quoi à la fois l'encodeur de vitesse (182) et l'encodeur d'altimètre (183) sont raccordés au PLC par les fils métalliques de télécommunication ; la fixation de l'axe de rotation (21) sur le sol sur un côté du cadre de guidage (1), le raccordement de la plateforme rotative (2) à l'axe de rotation, moyennant quoi la plateforme rotative (2) entrera en rotation autour de l'axe de rotation (21) ; un frein hydraulique (24) qui est raccordé aux capteurs de pression et au PLC est prévu dans l'axe de rotation (21) ; durant la rotation de la plateforme rotative (2), la libération du frein hydraulique (24) ; lorsque la plateforme rotative s'arrête, le frein hydraulique (24) impose toujours une friction sur la plateforme rotative (2), ainsi appliquant la portion de compression inverse pour empêcher, contre la rotation continue de la plateforme rotative (2), qu'un toron de câble soit lâché et endommagé lorsque des forces de traînée s'arrêtent temporairement ; ledit module intérieur (4) étant composé par les au moins quatre plaques de support (41) et les tiges de support (42) ; moyennant quoi les quatre plaques de support (41) sont alignées uniformément en la forme annulaire, les espaces seront maintenus entre les plaques de support adjacentes (41), la longueur d'espace sera la largeur de la plaque de support (41) de 80 % à 150 % ; les bas des plaques de support (41) sont raccordés par l'articulation à la plateforme rotative (2), toutes les quatre plaques de support (41) s'inclineront vers l'intérieur ; au milieu des quatre plaques de support (41), un vérin hydraulique (6) est prévu ; moyennant quoi une tige de support du vérin hydraulique (6) est raccordée à quatre tiges de poussée (61), et chaque tige de poussée (61) supporte une pièce de plaque de support (41), l'enlèvement de la couverture en film étanche à l'eau à partir du toron (10), le levage des torons de fils métalliques du toron (10) conjointement avec le plateau (5) sur la plateforme rotative (2),

pendant ce temps, la mise des torons de fils métalliques du toron (10) par-dessus le module intérieur (4) ; l'actionnement du vérin hydraulique (6), avec la force de la tige de support appliquée sur la tige de poussée, les quatre plaques de support (41) pousseront vers l'extérieur par l'intermédiaire de la tige de poussée (61) qui fixera les torons de fils métalliques du toron ; le tirage à l'extérieur d'une extrémité avant du toron (10) à travers le rouleau de guidage (11), puis le tirage du toron (10) pour entraîner la rotation du module intérieur (4) et du plateau (5), ainsi pour entraîner la rotation de la plateforme rotative (2) autour de l'axe de rotation ; moyennant quoi, avec cette opération, le toron (10) sera libéré et adoptera l'état droit ; moyennant quoi, durant la procédure d'enroulement descendante, le PLC commandera l'appareil de levage électrique (13) pour tirer sur la corde de fils d'acier, ainsi pour tirer vers le bas le mécanisme de levage (16) ce qui permettra au rouleau de guidage (11) de se déplacer vers le bas avec la distance qui est équivalente au diamètre du toron (10) durant chaque tour, et moyennant quoi, durant la procédure d'enroulement ascendante, le PLC commandera l'appareil de levage électrique (13) pour tirer la corde de fils d'acier (15), ainsi pour lever le mécanisme de levage (16) ce qui permettra au rouleau de guidage (11) de se déplacer vers le haut avec la distance qui est équivalente au diamètre du toron (10) durant chaque tour ; la répétition de ces opérations en va-et-vient jusqu'à ce que le toron des torons de fils métalliques adopte l'état droit, et l'accomplissement de l'opération entière de déroulement.

2. Procédé selon la revendication 1, dans lequel l'axe de rotation (21) est vertical au sol sur le côté du cadre de guidage (1).
3. Procédé selon la revendication 1 ou 2, dans lequel, dans l'opération d'enroulement horizontal, le bas de la plaque de support (41) est raccordé au véhicule sur rail (3) par des boulons, le haut de la plaque de support (41) s'inclinera vers l'extérieur et l'angle entre la plaque de support (41) et la surface supérieure du véhicule sur rail est entre 60° ~ 85°.
4. Procédé selon la revendication 1 ou 2, dans lequel, dans l'opération de déroulement horizontal, le bas de la plaque de support (41) est raccordé à la plateforme rotative (2) par l'articulation, toutes les quatre plaques de support (41) s'inclineront vers l'intérieur et l'angle entre une plaque de support (41) et la surface supérieure du véhicule sur rail est entre 60° ~ 85°.

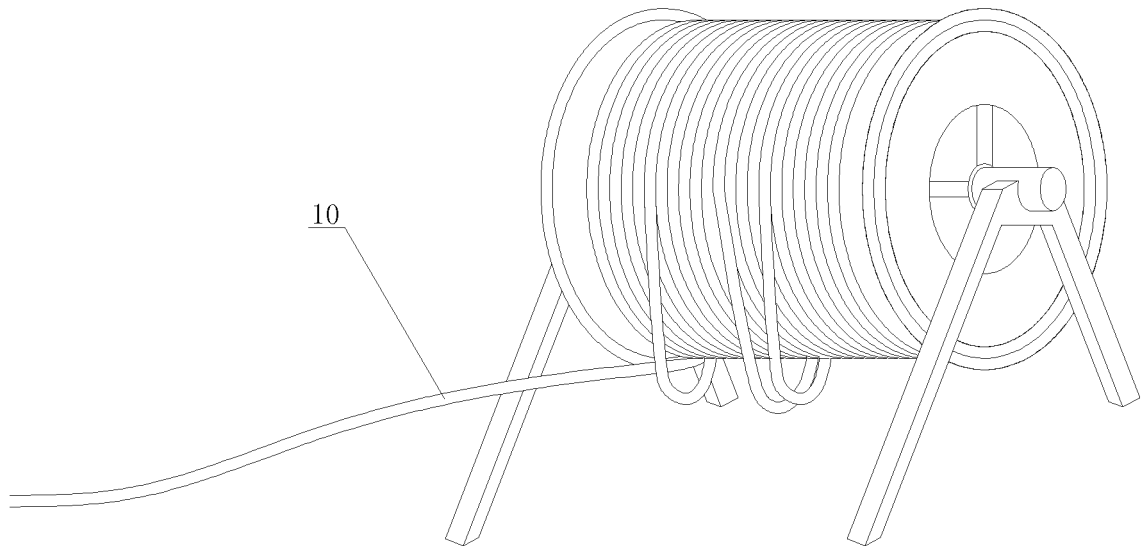


Fig 1

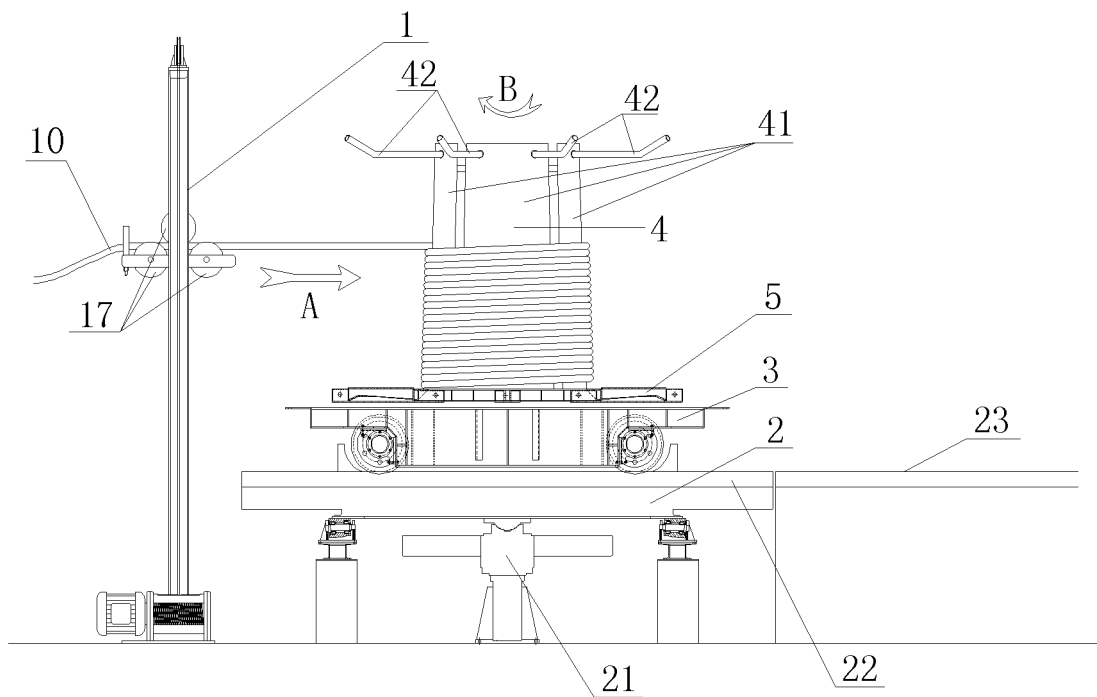


Fig 2

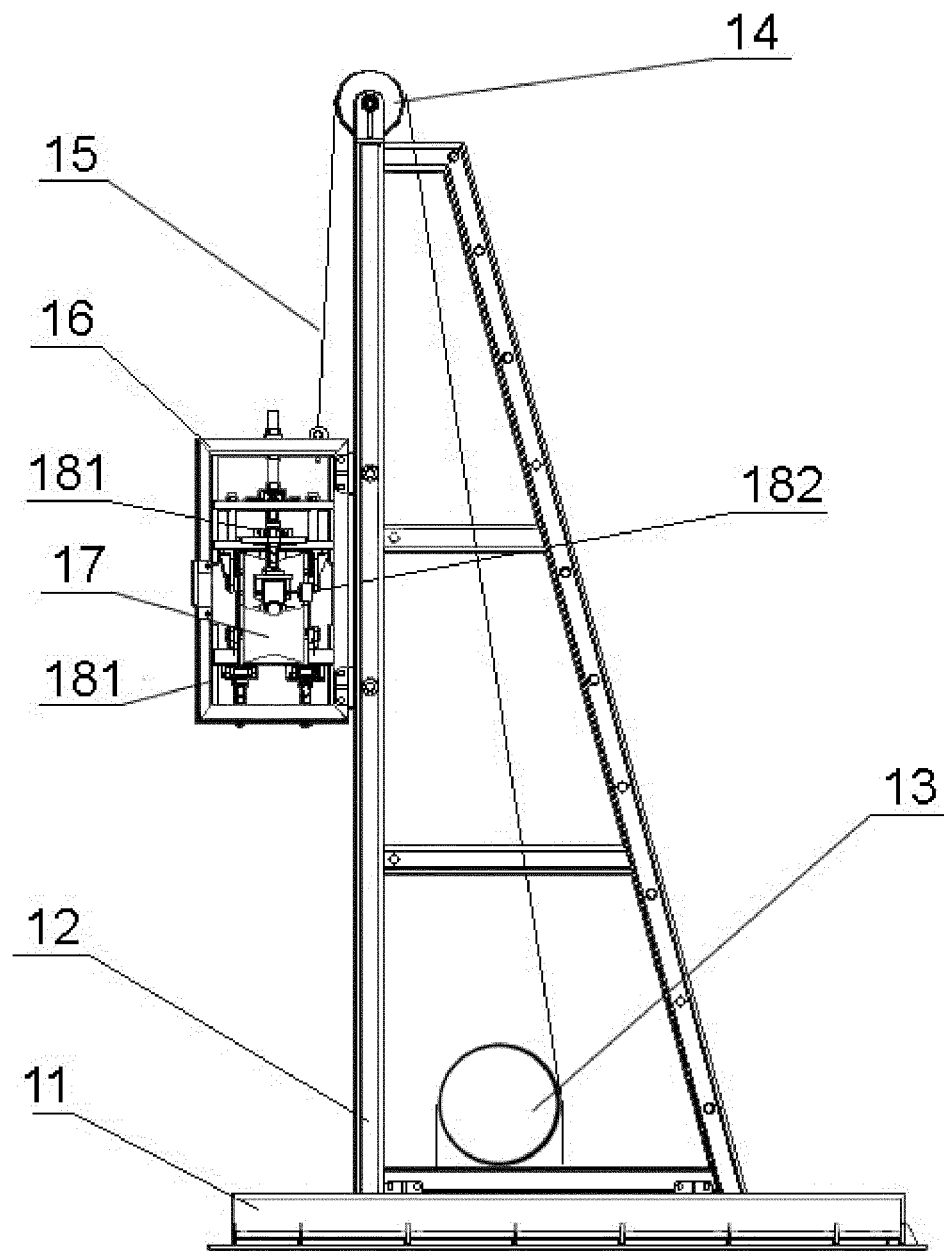


Fig 3

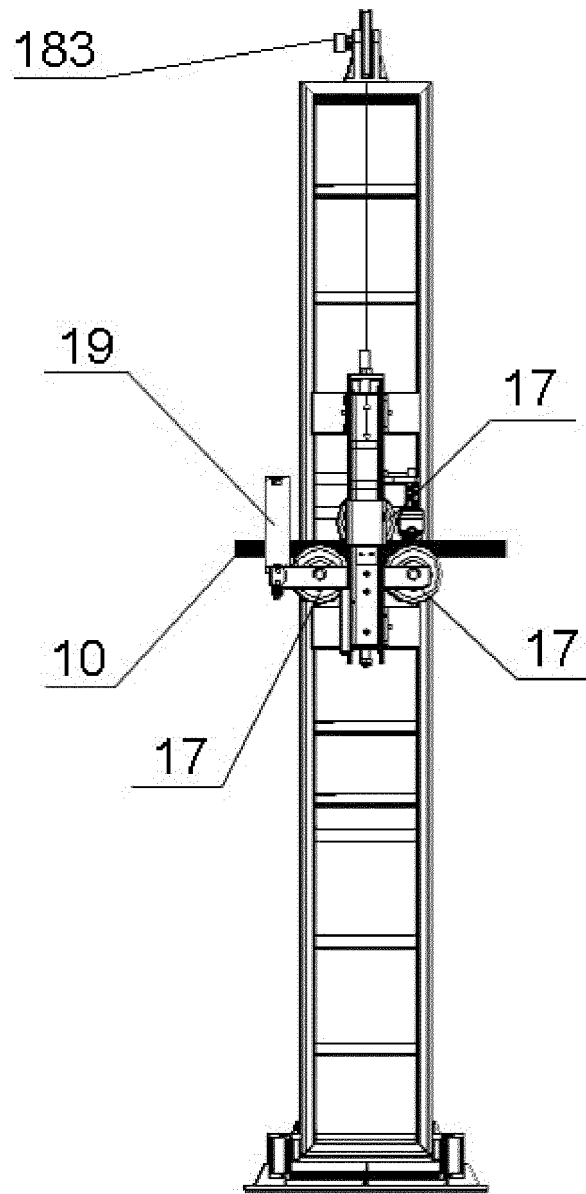


Fig 4

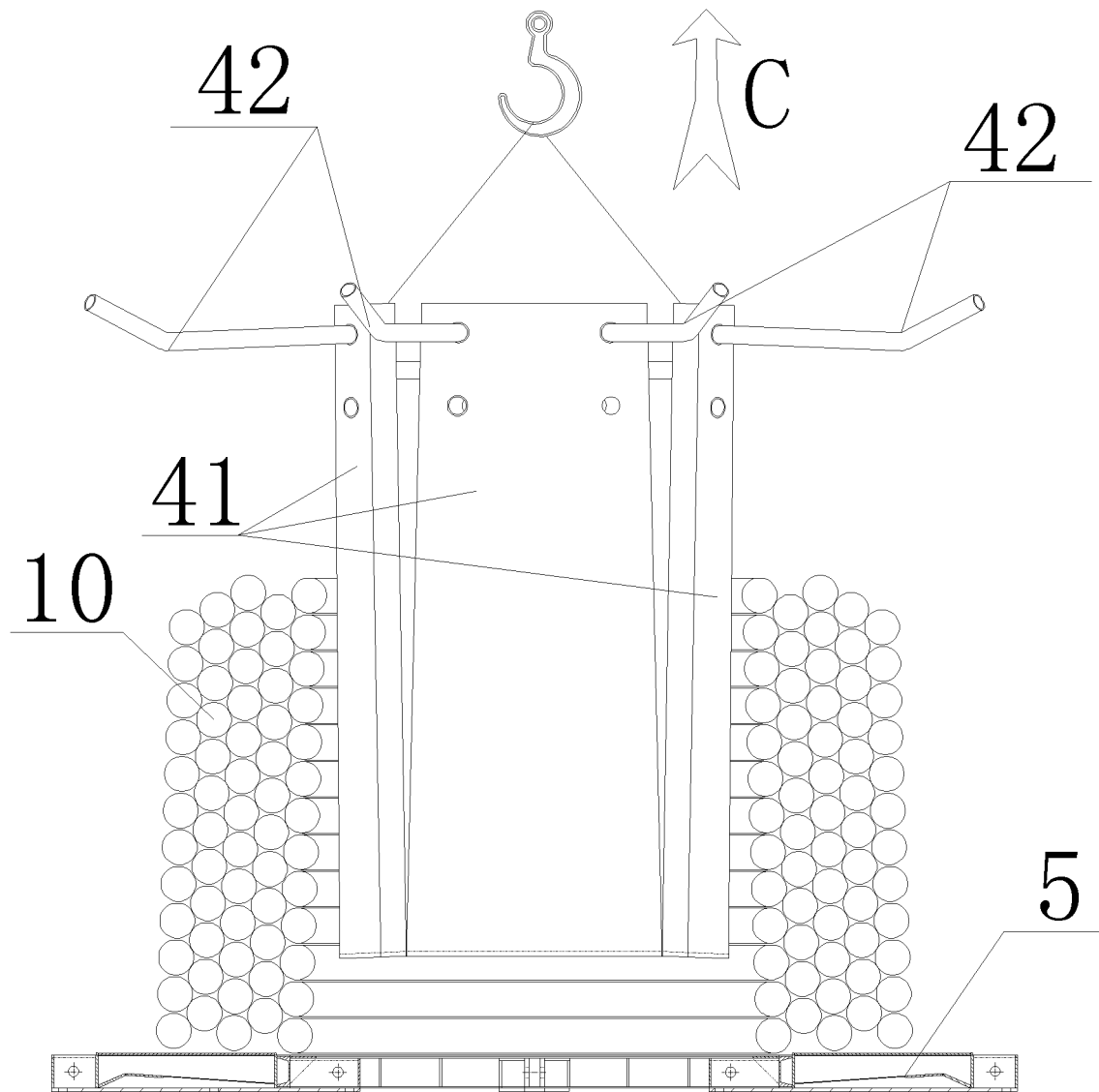


Fig 5

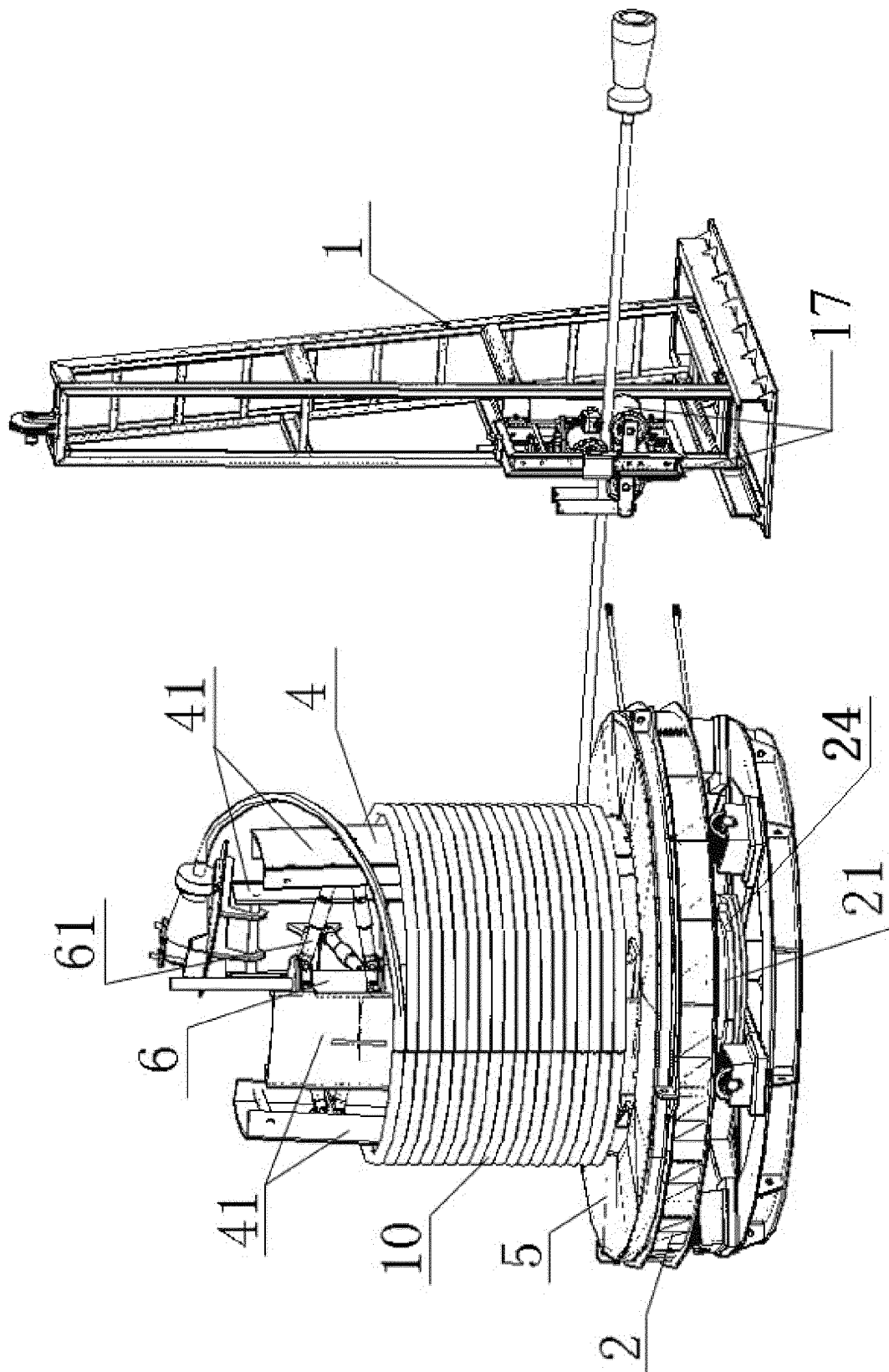


Fig 6

REFERENCES CITED IN THE DESCRIPTION

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