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

(11) **EP 4 458 430 A1**

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

(43) Date of publication:
06.11.2024 Bulletin 2024/45

(21) Application number: **22913396.2**

(22) Date of filing: **16.08.2022**

(51) International Patent Classification (IPC):
A63B 21/005 *(2006.01)* ***A63B 69/06*** *(2006.01)*
A63B 22/08 *(2006.01)*

(86) International application number:
PCT/CN2022/112702

(87) International publication number:
WO 2023/124111 (06.07.2023 Gazette 2023/27)

(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
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **30.12.2021 CN 202111648181**

(71) Applicant: **Zhejiang Merach Supply Chain Management Co., Ltd.**
Hangzhou, Zhejiang 310000 (CN)

(72) Inventor: **LUO, Weibo**
Hangzhou, Zhejiang 310000 (CN)

(74) Representative: **Hofmann, Andreas**
RGTH
Patentanwälte PartGmbB
Postfach 33 02 11
80062 München (DE)

(54) **RESISTANCE ADJUSTING BRAKE DEVICE AND METHOD FOR USE THEREOF**

(57) The present invention relates to a resistance regulation braking device and a using method thereof. The resistance regulation braking device is not only wide in resistance regulation range, but also high in resistance regulation precision, and has various resistance regulation means. A wire grip and a rotary mandrel assembly are mounted on a frame. A stationary shaft is arranged on the frame and is arranged parallel to a mandrel in the rotary mandrel assembly. A rotary sleeve is mounted at an upper end of the stationary shaft. A driving member is arranged between the rotary sleeve and the mandrel. When the mandrel rotates, the driving member is capable to drive the rotary sleeve to rotate around the stationary shaft. An elastic slider is arranged on a shaft body of the stationary shaft, and is located below the rotary sleeve. A lower magnetic part is arranged on the elastic slider. An upper magnetic part arranged opposite to the lower magnetic part is arranged on the rotary sleeve. When pulled by the wire grip, the elastic slider is capable to drive the lower magnetic part to move downwards, and an elastic body in the elastic slider is compressed. The device has the advantages that the device is not only wide in resistance regulation range, but also high in resistance regulation precision, and has various resistance regulation means.

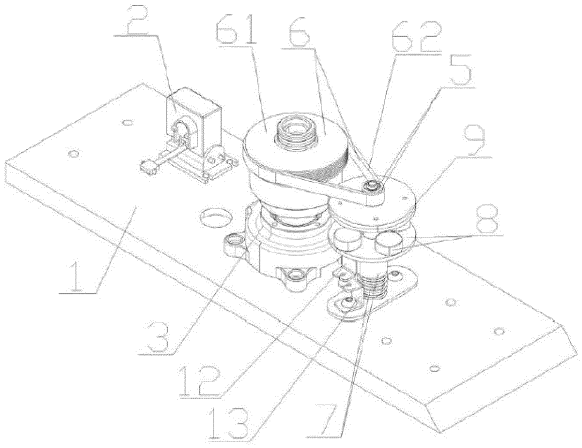

FIG. 1

EP 4 458 430 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a resistance regulation braking device and a using method thereof. The resistance regulation braking device is not only wide in resistance regulation range, but also high in resistance regulation precision, has various resistance regulation means, and features a simple structure and good using stability. The present invention belongs to the technical field of fitness equipment.

BACKGROUND TECHNOLOGY

[0002] An existing damping regulating mechanism is complicated in structure, and has the defects of small resistance regulation range, poor precision, single means, and the like. For example, a patent, titled "a double-scull rowing machine capable of magnetically regulating resistance", with the Publication No. CN 210845130 U includes a main frame, a seat cushion, a damping mechanism, and grip potions for hands of an exerciser to hold. The main frame has a slide rail, and the seat cushion slidably matches with the slide rail. The double-scull rowing machine further includes a double pull rope coil spring take-up device and a magnetic control regulation mechanism. The double pull rope coil spring take-up device has a rotatable belt pulley. When at least one pull rope in the double pull rope coil spring take-up device is pulled, it drives the pulley belt to rotate. The double pull rope coil spring take-up device and the damping mechanism are respectively mounted on the main frame. The belt pulley of the double pull rope coil spring take-up device is linked with the damping mechanism, so that when the belt pulley of the double pull rope coil spring take-up device rotates, it can drive the damping mechanism to rotate. Free end portions of the two pull ropes are fixedly connected to two grip portions, respectively. The magnetic control regulation mechanism is mounted at the damping mechanism to regulate the resistance. The double-scull rowing machine includes left and right grip rings, and the grip portions are the left and right grip rings. The double-scull rowing machine includes left and right rowing bars. Bottoms of the left and right rowing bars are universally and rotatably mounted on the main frame and are located on both sides of the slide rail, respectively. The two grip portions are respectively arranged on upper portions of the left and right rowing bars. The slide rail is obliquely arranged. The damping mechanism includes a wind wheel and a center shaft. The center shaft is rotatably mounted on the main frame through a bearing. The wind wheel is fixed on the center shaft and is further in driving connection to the belt pulley through a belt, so as to provide wind resistance when the belt pulley rotates to drive the wind wheel to rotate. The damping mechanism further includes a water tank fixed on the main frame. The water tank is coated by the wind wheel to provide water resistance when the belt pulley drives the wind wheel to rotate. The magnetic control regulation mechanism includes an aluminum plate, a magnetic plate assembly, a fine tuning rotary knob, and a fine tuning wire. The aluminum plate is fixed to the center shaft. The magnetic plate assembly is mounted on the main frame and is adapted at a periphery of the aluminum plate. The fine tuning rotary knob is mounted on the main frame. One end of the fine tuning wire is connected to the fine tuning rotary knob and the other end of the fine tuning wire is connected to the magnetic plate assembly. The magnetic plate assembly includes a plurality of magnetic blocks. The double pull rope coil spring take-up device further includes a webbing wheel shaft, two take-up devices, and two unilateral bearings. The webbing wheel shaft is mounted on the main frame. The two take-up devices are bidirectionally and rotatably mounted on the webbing wheel shaft respectively and are symmetrically located on both sides of the belt pulley. The two take-up devices are respectively linked with the belt pulley through the two unilateral bearings on both sides of the belt pulley to unilaterally drive the belt pulley to rotate. The belt pulley is provided with a first shaft sleeve. A first shaft of the belt pulley is mounted in each of the take-up device though each of the unilateral bearings. The pull rope is mounted on one side of the take-up device, and a volute spiral spring is arranged on the other side of the take-up device. The pull rope of the take-up device is distributed in the side close to the belt pulley. The double pull rope coil spring take-up device further includes a webbing wheel and a webbing wheel cap. The webbing wheel is mounted on the webbing wheel shaft through a bearing to bidirectionally rotate relative to the webbing wheel shaft. The volute spiral spring is mounted in the webbing wheel. The webbing wheel cap is fixed on the webbing wheel and encircles the volute spiral spring therein. The webbing wheel is provided with a mounting groove. The pull rope is mounted in the mounting groove of the webbing wheel. The webbing wheel is provided with a second shaft sleeve. A first shaft sleeve of the belt pulley is mounted in a second shaft sleeve of the webbing wheel through the unilateral bearing. The webbing wheel shaft is provided with a webbing wheel positioning sleeve matched within a space encircled by the webbing wheel and the webbing wheel cap. One end of the volute spiral spring is clamped on the webbing wheel positioning sleeve and the other end of the volute spiral spring is clamped at a wheel rim of the webbing wheel. The device capable of magnetically regulating resistance therein has the problems.

DISCLOSURE OF THE INVENTION

[0003] To overcome defects in the background art, the present invention designs a resistance regulation braking device and a using method thereof. The resistance regulation braking device is not only wide in resistance regulation range, but also high in resistance regulation

precision, has various resistance regulation means, and features a simple structure and good using stability.

[0004] A design solution is to achieve the above design object.

1. A design is the first technical feature of the present invention. The design is as follows: a stationary shaft is arranged on the frame and is arranged parallel to a mandrel in the rotary mandrel assembly; a rotary sleeve is mounted at an upper end of the stationary shaft; a driving member is arranged between the rotary sleeve and the mandrel; when the mandrel rotates, the driving member is capable to drive the rotary sleeve to rotate around the stationary shaft; an elastic slider is arranged on a shaft body of the stationary shaft, and is located below the rotary sleeve; a lower magnetic part is arranged on the elastic slider; an upper magnetic part arranged opposite to the lower magnetic part is arranged on the rotary sleeve; and when pulled by the wire grip, the elastic slider is capable to drive the lower magnetic part to move downwards, and an elastic body in the elastic slider is compressed. The object of such a design is as follows: a user rotates the rotary knob to give an instruction to the controller; the controller controls a wire grip to work according to the instruction; and the controller controls a motor in the wire grip to further wind or unwind a guy wire, where when the guy wire is further wound, a sliding sleeve in an elastic slider moves downwards along a stationary shaft under an action of a tensile force of the guy wire, and at this time, the sliding sleeve drives a lower magnetic part to move downwards to achieve a resistance reducing operation, and at the same time, an elastic body in the elastic slider is compressed; and when the guy wire is further unwound, the sliding sleeve in the elastic slider moves upwards along the stationary shaft under an action of a restoring force of the elastic body, and at this time, the sliding sleeve drives a lower magnetic part to move upwards to achieve a resistance increasing operation. Thus, the device is not only convenient to use and operate (good man-machine interaction), but also simple and reliable (not only lowers the production cost, but also reduces the probability of failures). Meanwhile, the device features a large magnetic resistance regulation range (the number of magnets on the upper magnetic part and/or the lower magnetic part can be increased or decreased to change the attraction between the upper magnetic part and the lower magnetic part, so as to regulate the magnetic resistance to a great extent), and a good precision (under a condition that the attraction between the upper magnetic part and the lower magnetic part is determined, the user can precisely and finely regulate the magnetic resistance to a small extent by regulating the gap between the upper magnetic part and the lower magnetic part).

2. A non-magnetic metal plate is mounted on a lower end surface of the annular plate, or a non-magnetic metal plate is mounted on an upper end surface of the annular mounting plate, which is the second technical feature of the present invention. The object of such a design is as follows: the non-magnetic metal plate is mounted on the lower end surface of the annular plate, or the non-magnetic metal plate is mounted on the upper end surface of the annular mounting plate. The non-magnetic metal plate is capable to prevent contact attraction between the annular plate and the annular mounting plate, so as to avoid the condition that the resistance regulation braking device cannot work and is even destroyed.

3. A design that a limiting barrier is arranged on the stationary shaft and is located between the rotary sleeve and the elastic slider is the third technical feature of the present invention. The object of such a design is as follows: the limiting barrier is arranged to prevent contact attraction between the annular plate and the annular mounting plate.

4. A design is the fourth technical feature of the present invention. The design is as follows: the elastic slider includes a sliding sleeve and an elastic body, a through hole of the sliding sleeve is in a shape of a Chinese character "凸" and a diameter of a narrow hole in the through hole in the shape of the Chinese character "凸" matches with a diameter of the stationary shaft, and a diameter of a wide hole in the through hole in the shape of the Chinese character "凸" matches with an outer diameter of the elastic body, and an inner hole diameter of the elastic body matches with the diameter of the stationary shaft; the sliding sleeve and the elastic body are respectively sleeved on the stationary shaft and the elastic body is located below the sliding sleeve; a lower end surface of the elastic body contacts with an upper end surface of a bottom plate of the frame, and an upper end surface of the elastic body contacts with a top surface of the wide hole, and at this time, the elastic body supports the sliding sleeve in a vertical direction; and the lower magnetic part is arranged at an upper end of the sliding sleeve. The object of such a design is as follows: as the diameter of the narrow hole in the through hole in the shape of the Chinese character "凸" matches with a diameter of the stationary shaft, it can be ensured that the sliding sleeve is capable to move up and down stably along the stationary shaft (the sliding sleeve, when pulled by the wire grip, moves downwards along the stationary shaft, and moves upwards along the stationary shaft under the action of the restoring force of the elastic body). In addition, the diameter of a wide hole in the through hole in the shape of the Chinese character "凸" matches with an outer diameter of the elastic body, and the lower end surface of the elastic body contacts with the upper end surface of the bottom plate of the frame,

and the upper end surface of the elastic body contacts with the top surface of the wide hole, and at this time, the elastic body supports the sliding sleeve in the vertical direction, and thus, the sliding sleeve and the elastic body are not mechanically clamped in the processes that the sliding sleeve moves up and down along the stationary shaft, thereby ensuring repeated use for tens of thousands of times.

5. A design that a guy wire fixator is arranged on an outer side surface of the sliding sleeve, and a stopper is arranged on the bottom plate of the frame and is located right below the guy wire fixator is the fifth technical feature of the present invention. The object of such a design is as follows: by arranging the through hole in the stopper and the wire hole in the guy wire fixator, when the wire grip winds the guy wire, it is ensured that the guy wire is capable to pull the sliding sleeve vertically downwards. As the tensile force is small, the output power of the motor can be reduced. Moreover, the vertically downward tensile force will not form a component force in the horizontal direction, so that the service life of the elastic body is ensured. The guy wire fixator and the stopper both are simple in structure, reasonable in layout, good in using reliability, and low in production cost. In the process that the sliding sleeve moves downwards, a barrier plate in the stopper is capable to limit the sliding sleeve to prevent shortening of the service life of the elastic body and even damage of the sliding sleeve and the elastic body because the sliding sleeve moves downwards excessively.

6. A design is the sixth technical feature of the present invention. The design is as follows: a linear bearing is fixedly mounted at an upper port of the through hole of the sliding sleeve and is located in the through hole; a through hole of the linear bearing and a through hole section at a lower portion of the connected through hole form a through hole in a shape of a Chinese character "凸"; a hole diameter of the through hole of the linear bearing matches with the diameter of the stationary shaft; and a lower end surface of the linear bearing contacts with an upper end surface of the elastic body after the sliding sleeve is mounted on the stationary shaft. The object of such a design is as follows: by arranging the linear bearing, when the stationary shaft and the linear bearing are matched in a plugged manner and slide relatively, the friction therebetween is rolling friction, which cannot only reduce the frictional resistance therebetween (the output power of the motor in the wire grip), but also reduce the noise level when the sliding sleeve moves and improve the moving smoothness of the sliding sleeve.

7. A design that the driving member includes a first flywheel and a conveyor belt, the first flywheel is fixedly mounted at an upper end of the mandrel and is in driving connection to the second flywheel in the rotary sleeve through the conveyor belt, and a diameter of the second flywheel is less than a diameter of the first flywheel is the seventh technical feature of the present invention. The object of such a design is as follows: the driving member includes the first flywheel and the conveyor belt, the first flywheel is fixedly mounted at the upper end of the mandrel and is in driving connection to the second flywheel in the rotary sleeve through the conveyor belt, the diameter of the second flywheel is less than the diameter of the first flywheel, and the first flywheel is large and the second flywheel is small. Thus, the output of the magnetic resistance can be improved, so that the resistance can be regulated by multiple means (the resistance is regulated by changing the number of the magnets on the upper magnetic part and/or the lower magnetic part, changing the gap between the upper magnetic part and the lower magnetic part, and changing the ratio of the diameters of the first and second flywheels; one of the means can be selected for regulation, two of the means can be selected in a matched manner for regulation, and even the three means can be selected for regulation).

[0005] Technical solution 1. A resistance regulation braking device, including a frame, a wire grip, and a rotary mandrel assembly, the wire grip and the rotary mandrel assembly being mounted on the frame, where a stationary shaft is arranged on the frame and is arranged parallel to a mandrel in the rotary mandrel assembly; a rotary sleeve is mounted at an upper end of the stationary shaft; a driving member is arranged between the rotary sleeve and the mandrel; when the mandrel rotates, the driving member is capable to drive the rotary sleeve to rotate around the rotary sleeve; an elastic slider is arranged on a shaft body of the stationary shaft, and is located below the rotary sleeve; a lower magnetic part is arranged on the elastic slider; an upper magnetic part arranged opposite to the lower magnetic part is arranged on the rotary sleeve; and when pulled by the wire grip, the elastic slider is capable to drive the lower magnetic part to move downwards, and an elastic body in the elastic slider is compressed.

[0006] Technical solution 2: A using method of a resistance regulation braking device, involving a rotary knob and a controller, including the following steps: rotating, by a user, the rotary knob to give an instruction to the controller; controlling, by the controller, a wire grip to work according to the instruction; and controlling, by the controller, a motor in the wire grip to further wind or unwind a guy wire, where when the guy wire is further wound, a sliding sleeve in an elastic slider moves downwards along a stationary shaft under an action of a tensile force of the guy wire, and at this time, the sliding sleeve drives a lower magnetic part to move downwards to achieve a resistance reducing operation, and at the same time, an elastic body in the elastic slider is compressed; and when the guy wire is further unwound, the sliding sleeve in the

elastic slider moves upwards along the stationary shaft under an action of a restoring force of the elastic body, and at this time, the sliding sleeve drives the lower magnetic part to move upwards to achieve a resistance increasing operation.

[0007] Compared with the prior art, the present invention has the following advantages: I, the resistance regulation braking device is not only large in resistance regulation range, but also high in resistance regulation precision, and has various resistance regulation means; and II, the resistance regulation braking device is not only simple in structure and low in production cost, but also good in using stability.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

FIG. 1 is a schematic diagram of a three-dimensional structure of a resistance regulation braking device (a guy wire is not drawn).

FIG. 2 is a structural schematic diagram of a front view of the three-dimensional structure of the resistance regulation braking device (the guy wire is not drawn).

FIG. 3 is a schematic diagram of a three-dimensional structure after a stationary shaft, a rotary sleeve, and an elastic slider are assembled.

FIG. 4 is a structural schematic diagram of a front view after the stationary shaft, the rotary sleeve, and the elastic slider are assembled.

In the drawings, 1 frame; 2 wire grip; 3 rotary mandrel assembly; 31 mandrel; 4 stationary shaft; 5 rotary sleeve; 51 second flywheel; 52 two bearings; 6 driving member; 61 first flywheel; 62 conveyor belt; 7 elastic slider; 71 sliding sleeve; 72 elastic body; 8 lower magnetic part; 9 upper magnetic part; 10 non-magnetic metal plate; 11 limiting stopper; 12 guy wire fixator; 121 wire hole; 122 gap; 13 stopper; 131 barrier plate; 132 through hole; 133 gap I.

DESCRIPTION OF EMBODIMENTS

[0009] Embodiment 1: referring to FIG. 1 to FIG. 4, a resistance regulation braking device, including a frame 1, a wire grip 2, and a rotary mandrel assembly 3. The wire grip 2 and the rotary mandrel assembly 3 belong to the prior art, which are not repeatedly described here. The wire grip 2 and the rotary mandrel assembly 3 are mounted on the frame 1, where a stationary shaft 4 is arranged on the frame 1 and is arranged parallel to a mandrel 31 in the rotary mandrel assembly 3; the stationary shaft 4 is vertically mounted on a bottom plate of the frame 1 through a fixing part; a rotary sleeve 5 is mounted at an upper end of the stationary shaft 4; a driving member 6 is arranged between the rotary sleeve 5 and the mandrel 31; when the mandrel 31 rotates, the driving member 6 is capable to drive the rotary sleeve 5 to rotate around the stationary shaft 4; an elastic slider 7 is arranged on a shaft body of the stationary shaft 4, and is located below the rotary sleeve 5; a lower magnetic part 8 is arranged on the elastic slider 7; an upper magnetic part 9 arranged opposite to the lower magnetic part 8 is arranged on the rotary sleeve 5; and when pulled by the wire grip 2, the elastic slider 7 is capable to drive the lower magnetic part 8 to move downwards, and an elastic body 72 in the elastic slider 7 is compressed.

[0010] The upper magnetic part 9 is an annular plate and the annular plate is a magnetic metal plate, and the lower magnetic part 8 is an annular mounting plate and the annular mounting plate is made of a magnet; or the upper magnetic part 9 is an annular plate and the annular plate is made of a magnet, and the lower magnetic part 8 is an annular mounting plate and the annular mounting plate is an iron plate; or the upper magnetic part 9 is an annular plate and the annular plate is made of a magnet, and the lower magnetic part 8 is an annular mounting plate and the annular mounting plate is made of a magnet. When the upper magnetic part 9 is made of the magnet, it can be either directly made of the magnet or formed by mounting a plurality of magnetic blocks on a mounting plate. When the lower magnetic part 8 is made of the magnet, it can be either directly made of the magnet or formed by mounting a plurality of magnetic blocks on a mounting plate. The advantage that the lower magnetic part 8 or the upper magnetic part 9 is formed by mounting the plurality of magnetic blocks on the mounting plate is that such a structure is low in production cost, and a user can regulate the attraction of the magnetic part by increasing or decreasing the number of the magnetic blocks. A non-magnetic metal plate 10 is mounted on a lower end surface of the annular plate, or a non-magnetic metal plate 10 is mounted on an upper end surface of the annular mounting plate. The non-magnetic metal plate 10 is an aluminum plate. A limiting barrier 11 is arranged on the stationary shaft 4 and is located between the rotary sleeve 5 and the elastic slider 7. The limiting barrier 11 is a snap ring. By arranging the snap ring, contact adsorption of the lower magnetic part 8 or the upper magnetic part 9 can be avoided.

[0011] The rotary sleeve 5 includes a second flywheel 51 and two bearings 52; the second flywheel 51 is mounted at the upper end of the stationary shaft 4 through the two bearings 52; the upper magnetic part 9 is fixedly mounted at a lower end of the second flywheel 52; and when the second flywheel 52 rotates, the upper magnetic part 9 rotates along with the second flywheel 51 around the stationary shaft 4. The second flywheel 51 and the first flywheel 61 are consistent in horizontal height.

[0012] The elastic slider 7 includes a sliding sleeve 71 and an elastic body 72, a through hole of the sliding sleeve 71 is in a shape of a Chinese character " 凸" and a diameter of a narrow hole in the through hole in the shape of the Chinese character " 凸" matches with a diameter of the stationary shaft 4, and a diameter of a

wide hole in the through hole in the shape of the Chinese character " 凸" matches with an outer diameter of the elastic body 72, and an inner hole diameter of the elastic body 72 matches with the diameter of the stationary shaft 4; the sliding sleeve 71 and the elastic body 72 are respectively sleeved on the stationary shaft 4 and the elastic body 72 is located below the sliding sleeve 71; a lower end surface of the elastic body 72 contacts with an upper end surface of a bottom plate of the frame 1, and an upper end surface of the elastic body contacts with a top surface of the wide hole, and at this time, the elastic body 72 supports the sliding sleeve 71 in a vertical direction; and the lower magnetic part 8 is arranged at an upper end of the sliding sleeve 71. The elastic body 72 is a spring.

[0013] A guy wire fixator 12 is arranged on an outer side surface of the sliding sleeve 71, and a stopper 13 is arranged on the bottom plate of the frame 1 and is located right below the guy wire fixator 12. The guy wire fixator 12 is a Z-shaped plate. The Z-shaped plate is fixedly mounted on the sliding sleeve 72 through screws. A wire hole 121 is formed on an upper end surface of a lower transverse plate in the Z-shaped plate and penetrates through upper and lower end surfaces of the lower transverse plate. A gap 122 is arranged on an outer side of the lower transverse plate, and the gap 122 and the wire hole 121 interpenetrate each other. The stopper 13 is an L-shaped plate, and a transverse plate in the L-shaped plate is fixedly connected to the bottom plate of the frame 1 through screws. A barrier plate 131 is fixedly mounted at an upper end of a vertical plate in the L-shaped plate. A through hole 132 is formed in an upper end surface of the barrier plate 131 and penetrates through upper and lower end surfaces of the barrier plate 131. A gap I 133 is arranged on an outer side of the barrier plate 131, and the gap I 133 and the through hole 132 interpenetrate each other. The Z-shaped plate is located above the barrier plate 131, and the through hole 132 and the gap I 133 directly face the wire hole 121 and the gap 122. One end of the guy wire is fixed on the guy wire fixator 12, and the other end of the guy wire successively passing through the wire hole 121 and the through hole 132 vertically downwards is fixedly mounted on the wire grip 2. The wire grip 2 is capable to wind and unwind the guy wire (the motor in the wire grip 2 rotates forwards or backwards). By arranging the through hole 131 and the wire hole 121, when the wire grip 2 winds the guy wire, it is ensured that the guy wire is capable to pull the sliding sleeve 71 vertically downwards. As a result of a small tensile force, the output power of the motor can be reduced. Moreover, the vertically downwards tensile force will not form a component force in the horizontal direction, the component force in the horizontal direction forms stress in the horizontal direction to the elastic body 72 (i.e., the spring), so that the service life of the elastic body 72 (i.e., the spring) will be shortened in an accelerated manner. By arranging the gap I 133 and the gap 122, the guy wire may pass through the gap I 133 and the gap 122 and enters the through hole 132 and the wire hole 121 from a side surface, so that it is convenient to mount and maintain the guy wire. Meanwhile, the guy wire fixator 12 and the stopper 13 both are simple in structure, reasonable in layout, and are not only good in using reliability, but also low in production cost. In addition, in the process that the sliding sleeve 71 moves downwards, the barrier plate 131 is capable to limit the sliding sleeve 71 (when the barrier plate 131 contacts with the lower end surface of the lower transverse plate in the Z-shaped plate), to prevent shortening of the service life of the elastic body 72 and even damage of the sliding sleeve 71 and the elastic body 72 because the sliding sleeve 71 moves downwards excessively. A plurality of transition wheels for turning and supporting the guy wire can also be arranged between the stopper 13 and the wire grip 2 to ensure smooth feeding of the guy wire.

[0014] A linear bearing is fixedly mounted at an upper port of the through hole of the sliding sleeve 71 and is located in the through hole; a through hole of the linear bearing and a through hole section at a lower portion of the connected through hole form a through hole in a shape of a Chinese character " 凸"; a hole diameter of the through hole of the linear bearing matches with the diameter of the stationary shaft 4; and a lower end surface of the linear bearing contacts with an upper end surface of the elastic body 72 after the sliding sleeve 71 is mounted on the stationary shaft 4.

[0015] The driving member 6 includes a first flywheel 61 and a conveyor belt 62; the first flywheel 61 is fixedly mounted at an upper end of the mandrel 31 and is in driving connection to the second flywheel 51 in the rotary sleeve 5 through the conveyor belt 62. The conveyor belt 62 is a belt. A diameter of the second flywheel 51 is less than a diameter of the first flywheel 61.

[0016] Embodiment 2 is based on the embodiment 1. A using method of a resistance regulation braking device, involving a rotary knob and a controller. A user can instruct the controller to regulate the magnetic resistance in different levels by rotating the rotary knob. The controller can be an existing PLC or an existing singlechip microcomputer controller. The using method includes the following steps: rotating, by the user, the rotary knob to give an instruction to the controller; controlling, by the controller, a wire grip 2 to work according to the instruction; and controlling, by the controller, a motor in the wire grip 2 to further wind or unwind a guy wire, where when the guy wire is further wound, a sliding sleeve 71 in an elastic slider 7 moves downwards along a stationary shaft 4 under an action of a tensile force of the guy wire, and at this time, the sliding sleeve 71 drives the lower magnetic part 8 to move downwards to achieve a resistance reducing operation, and at the same time, an elastic body 72 in the elastic slider 7 is compressed; and when the guy wire is further unwound, the sliding sleeve 71 in the elastic slider 7 moves upwards along the stationary shaft 4 under an action of a restoring force of the elastic body 72, and at this time, the sliding sleeve 71 drives a lower magnetic part 8 to move upwards to

achieve a resistance increasing operation.

[0017] It is to be understood that although the design thought of the present invention is literally described in further detail in the above embodiments, the literal descriptions are merely simple literal descriptions of the design thought of the present invention rather than limiting the design thought of the present invention. Any combination, addition or modification within the design thought of the present invention all fall into the protection scope of the present invention.

Claims

1. A resistance regulation braking device, comprising a frame, a wire grip, and a rotary mandrel assembly, the wire grip and the rotary mandrel assembly being mounted on the frame, **characterized in that** a stationary shaft is arranged on the frame and is arranged parallel to a mandrel in the rotary mandrel assembly; a rotary sleeve is mounted at an upper end of the stationary shaft; a driving member is arranged between the rotary sleeve and the mandrel; when the mandrel rotates, the driving member is capable to drive the rotary sleeve to rotate around the stationary shaft; an elastic slider is arranged on a shaft body of the stationary shaft, and is located below the rotary sleeve; a lower magnetic part is arranged on the elastic slider; an upper magnetic part arranged opposite to the lower magnetic part is arranged on the rotary sleeve; and when pulled by the wire grip, the elastic slider is capable to drive the lower magnetic part to move downwards, and an elastic body in the elastic slider is compressed.

2. The resistance regulation braking device according to claim 1, **characterized in that** the upper magnetic part is an annular plate and the annular plate is a magnetic metal plate, and the lower magnetic part is an annular mounting plate and the annular mounting plate is made of a magnet; or the upper magnetic part is an annular plate and the annular plate is made of a magnet, and the lower magnetic part is an annular mounting plate and the annular mounting plate is a magnetic metal plate; or the upper magnetic part is an annular plate and the annular plate is made of a magnet, and the lower magnetic part is an annular mounting plate and the annular mounting plate is made of a magnet.

3. The resistance regulation braking device according to claim 2, **characterized in that** a non-magnetic metal plate is mounted on a lower end surface of the annular plate, or a non-magnetic metal plate is mounted on an upper end surface of the annular mounting plate.

4. The resistance regulation braking device according to claim 1, **characterized in that** a limiting barrier is arranged on the stationary shaft and is located between the rotary sleeve and the elastic slider.

5. The resistance regulation braking device according to claim 1, **characterized in that** the rotary sleeve comprises a second flywheel and two bearings; the second flywheel is mounted at the upper end of the stationary shaft through the two bearings; the upper magnetic part is fixedly mounted at a lower end of the second flywheel; and when the second flywheel rotates, the upper magnetic part rotates along with the second flywheel around the stationary shaft.

6. The resistance regulation braking device according to claim 1, **characterized in that** the elastic slider comprises a sliding sleeve and the elastic body, a through hole of the sliding sleeve is in a shape of a Chinese character "凸" and a diameter of a narrow hole in the through hole in the shape of the Chinese character "凸" matches with a diameter of the stationary shaft, and a diameter of a wide hole in the through hole in the shape of the Chinese character "凸" matches with an outer diameter of the elastic body, and an inner hole diameter of the elastic body matches with the diameter of the stationary shaft; the sliding sleeve and the elastic body are respectively sleeved on the stationary shaft and the elastic body is located below the sliding sleeve; a lower end surface of the elastic body contacts with an upper end surface of a bottom plate of the frame, and an upper end surface of the elastic body contacts with a top surface of the wide hole, and at this time, the elastic body supports the sliding sleeve in a vertical direction; and the lower magnetic part is arranged at an upper end of the sliding sleeve.

7. The resistance regulation braking device according to claim 6, **characterized in that** a guy wire fixator is arranged on an outer side surface of the sliding sleeve, and a stopper is arranged on the bottom plate of the frame and is located right below the guy wire fixator.

8. The resistance regulation braking device according to claim 6, **characterized in that** a linear bearing is fixedly mounted at an upper port of the through hole of the sliding sleeve and is located in the through hole; a through hole of the linear bearing and a through hole section at a lower portion of the connected through hole form a through hole in a shape of a Chinese character "凸"; a hole diameter of the through hole of the linear bearing matches with the diameter of the stationary shaft; and a lower end surface of the linear bearing contacts with an upper end surface of the elastic body after the sliding sleeve is mounted on the stationary shaft.

9. The resistance regulation braking device according to claim 1, **characterized in that** the driving member comprises a first flywheel and a conveyor belt; the first flywheel is fixedly mounted at an upper end of the mandrel and is in driving connection to the second flywheel in the rotary sleeve through the conveyor belt; and a diameter of the second flywheel is less than a diameter of the first flywheel.

10. A using method of a resistance regulation braking device, involving a rotary knob and a controller, **characterized by** comprising the following steps: rotating, by a user, the rotary knob to give an instruction to the controller; controlling, by the controller, a wire grip to work according to the instruction; and controlling, by the controller, a motor in the wire grip to further wind or unwind a guy wire, wherein when the guy wire is further wound, a sliding sleeve in an elastic slider moves downwards along a stationary shaft under an action of a tensile force of the guy wire, and at this time, the sliding sleeve drives a lower magnetic part to move downwards to achieve a resistance reducing operation, and at the same time, an elastic body in the elastic slider is compressed; and when the guy wire is further unwound, the sliding sleeve in the elastic slider moves upwards along the stationary shaft under an action of a restoring force of the elastic body, and at this time, the sliding sleeve drives the lower magnetic part to move upwards to achieve a resistance increasing operation.

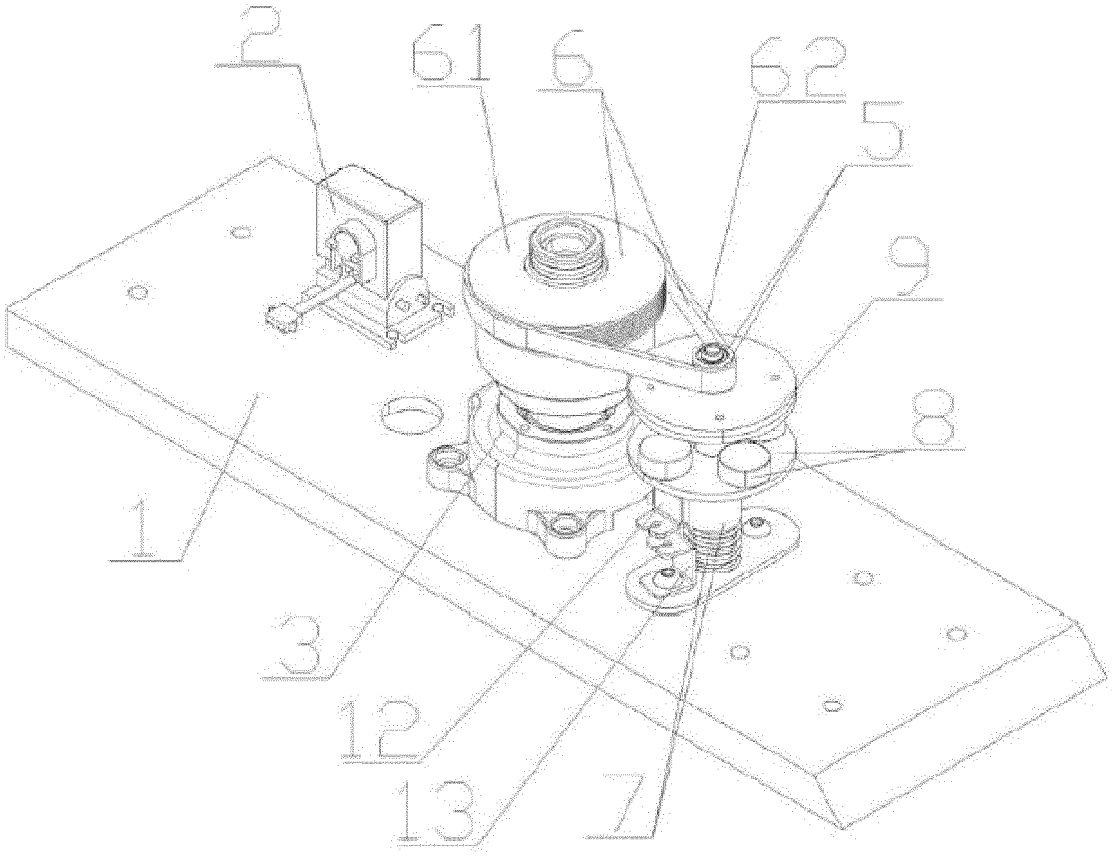

FIG. 1

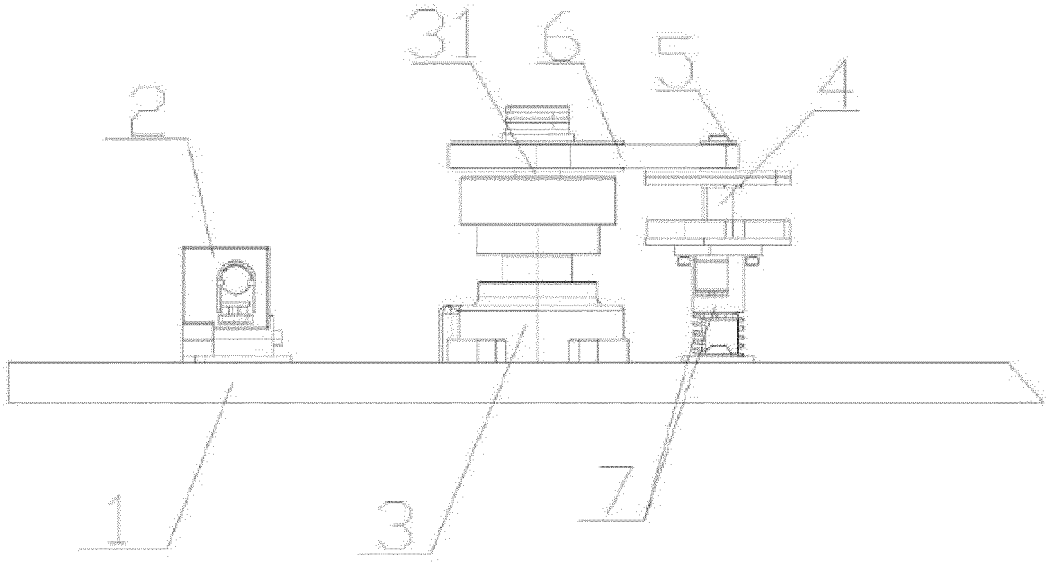

FIG. 2

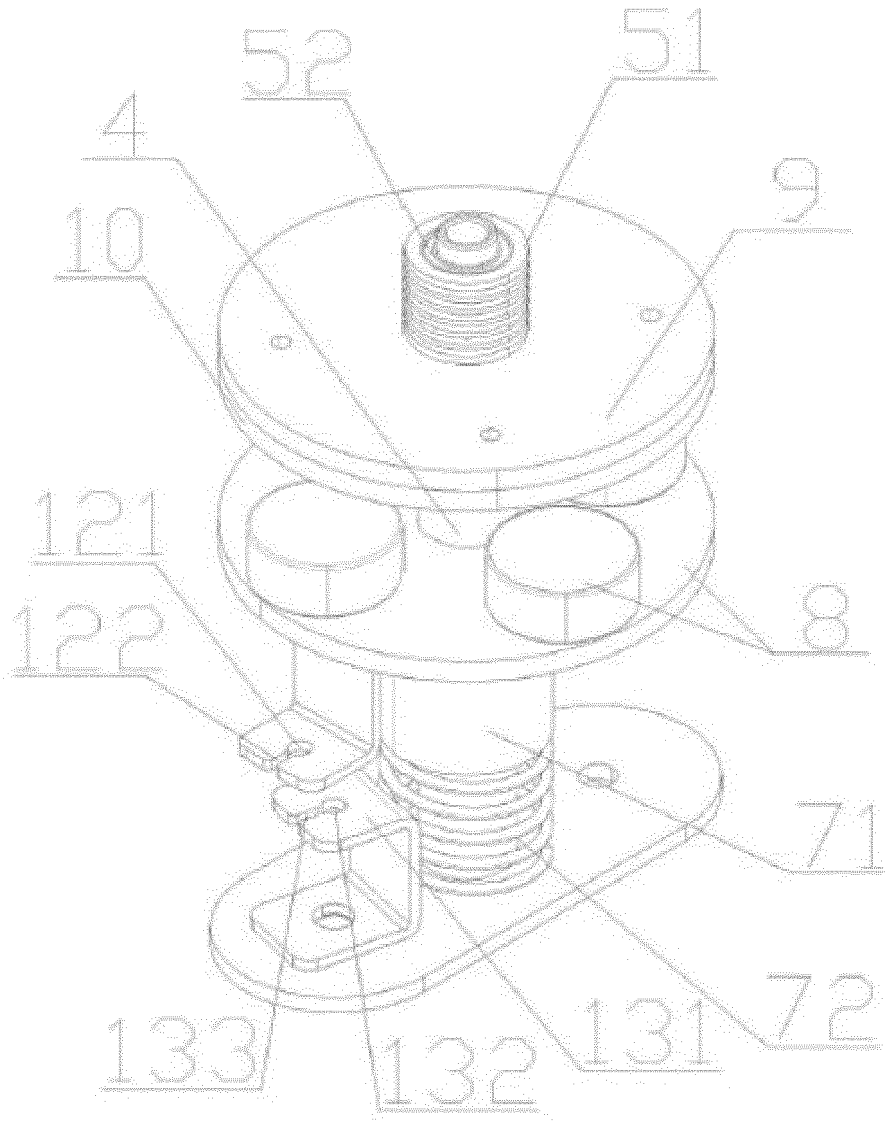

FIG. 3

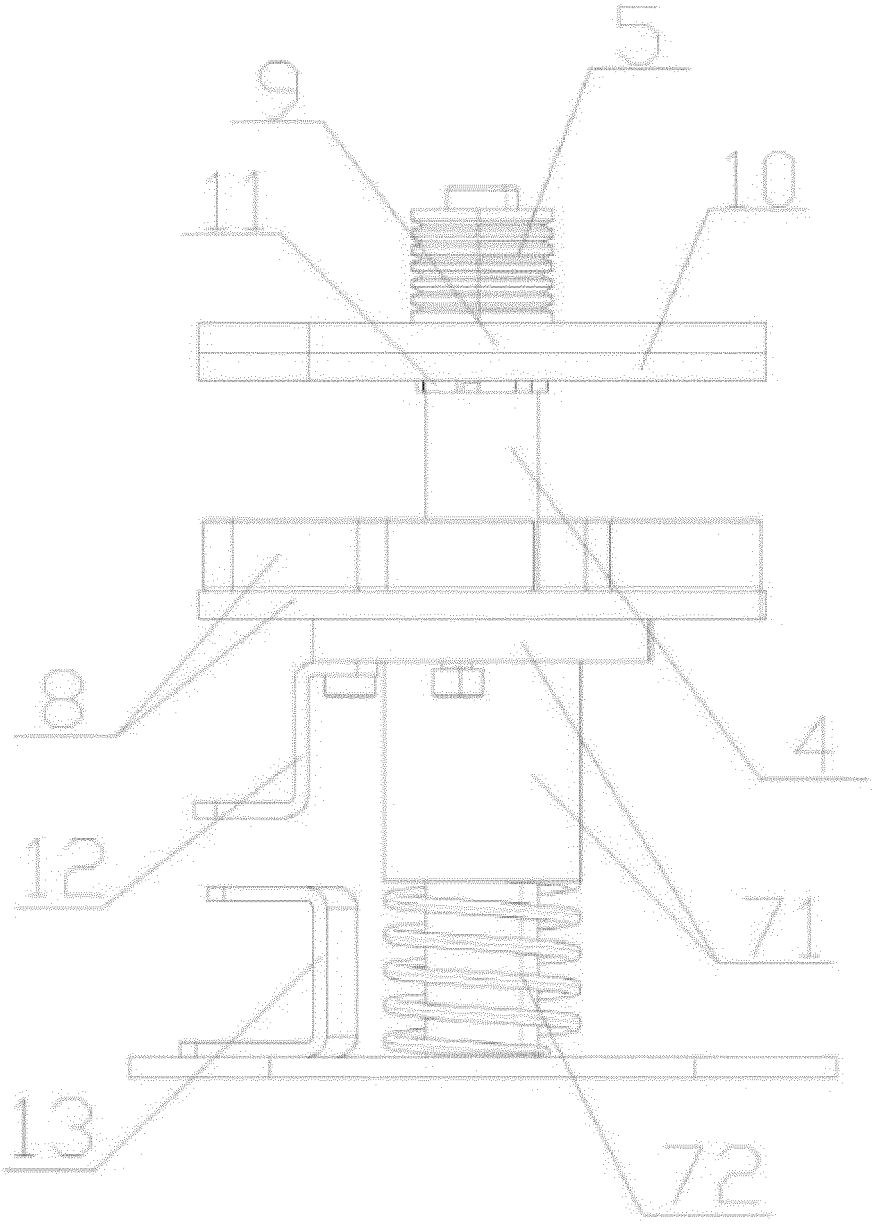

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/112702

A. CLASSIFICATION OF SUBJECT MATTER

A63B 21/005(2006.01)i; A63B 69/06(2006.01)i; A63B 22/08(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A63B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNTXT; ENTXTC; CNKI: 阻力, 阻尼, 调节, 拉线, 磁吸, 弹簧, 弹性体, 磁控, 压缩, 飞轮, 金属板; ENTXT; VEN; DWPI: rowing, braking, freewheel, resistance, damp, adjust, pull, magnetic, spring, compress, plate.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 114225300 A (ZHEJIANG ROYAL DEER ELECTRONIC TECHNOLOGY LIMITED COMPANY) 25 March 2022 (2022-03-25) claims 1-10	1-10
Y	CN 2705194 Y (LIAOLAI SHUQIONG) 22 June 2005 (2005-06-22) description, page 2, paragraph 3 to page 3, paragraph 3, and figures 1-9	1-9
Y	CN 2486177 Y (DASHENG SPORT EQUIPMENT CO., LTD., QINGDAO) 17 April 2002 (2002-04-17) description, page 1, paragraph 4 to page 2, paragraph 8, and figure 1	2-9
Y	CN 2383541 Y (CHEN YUPENG) 21 June 2000 (2000-06-21) description, page 4, paragraph 1 to page 6, paragraph 1, and figures 1-8	2-9
Y	CN 2642357 Y (HANYANG DEVELOPMENT CO., LTD.) 22 September 2004 (2004-09-22) description, page 3, paragraph 3 to page 4, paragraph 6, and figures 1-8	2-9
X	CN 2486177 Y (DASHENG SPORT EQUIPMENT CO., LTD., QINGDAO) 17 April 2002 (2002-04-17) description, page 1, paragraph 4 to page 2, paragraph 8, and figure 1	10

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 October 2022	**09 November 2022**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/112702

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 109464773 A (JOHNSON INDUSTRIES (SHANGHAI) CO., LTD.) 15 March 2019 (2019-03-15) entire document	1-10

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/112702

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 114225300 A	25 March 2022	CN 216909019 U	08 July 2022
CN 2705194 Y	22 June 2005	None	
CN 2486177 Y	17 April 2002	None	
CN 2383541 Y	21 June 2000	None	
CN 2642357 Y	22 September 2004	None	
CN 109464773 A	15 March 2019	CN 109464773 B	19 May 2020

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

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- CN 210845130 U **[0002]**