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(54) HOIST SYSTEM AND METHOD FOR CONTROLLING THE HOIST SYSTEM

HEBEZUGSYSTEM UND VERFAHREN ZUR STEUERUNG DES HEBEZUGSYSTEMS

SYSTÈME DE LEVAGE ET PROCÉDÉ DE COMMANDE DU SYSTÈME DE LEVAGE

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EP 3 071 505 B1

Description

TECHNICAL FIELD

[0001] The present invention relates to a method for controlling a hoist system, and a hoist system, and specifically relates to a method for controlling a hoist system, and a hoist system, for loading and unloading a conveyance, such as a cage, used in a mine shaft.

BACKGROUND ART

[0002] Shaft hoisting is broadly used in mining process. When the shaft becomes deeper, the rope (such as a steel rope) that drags the conveyance becomes longer, and appears as an elastic body with great elasticity. There are in most cases a significant rope stretch because of the suspended load. This feature renders the conveyance (such as cage or skip) hard to stop precisely when the conveyance reaches a deep working level. Especially, the rope would be severely deformed when the load on the conveyance is heavy, resulting in upwards and downward movements and leftwards and rightwards shake of the conveyance, and thus causing difficulties to obtain a safe operation.

[0003] Up to now, various cage hoist systems used in auxiliary shaft primarily comprise a driving system and a cage stabilizing system. In the process of loading and unloading the hoist, conventional controlling methods may be divided into two types according to their operation principle: one is to fix the conveyance by upper and lower locking arms which can be extended out by hydraulic work station; the other is by overfalling the rope and then pushing conveyance from lower side through hydraulic work station. Both controlling methods use separate driving system and cage stabilizing system, and thus need to frequently operate the hoist and hydraulic work station respectively. This decreases the operation efficiency of the hoist system, and puts a high requirement on the mechanical strength of the upper and lower locking arms and the performance of the hydraulic work station, which increases the system cost without efficiently increasing the stability and safety of the system. In addition, among these methods, no control or optimization is given to the amount of deformation (elongation) of the steel rope, causing the amount of deformation be always large or the same not be effectively controlled. This would shorten the working life of the steel rope and meanwhile decrease the safety of the hoist system. The same problem also exists in skip hoist system in production shaft.

[0004] DE 28 39 160 A1 discloses a method for operating a hoisting gear for mining, in which a conveyance is moved to the insets and locked there. After loading or unloading the conveyance, it is moved vertically until the tension of the hoisting cable is adapted to the load being carried.

SUMMARY

[0005] The object of the present invention is to overcome the defects in the prior art by providing a method for controlling a hoist system, and a hoist system, in which, a controlling system and a supporting device cooperate with each other, to adjust the motor torque automatically, so that the operation efficiency of the hoist system and the working life of the rope are both improved and the safety in the hoisting process is ensured. The above-mentioned problem is solved by the subject-matter of the independent claims.

[0006] To achieve the above object, the present invention provides the following technical solutions.

[0007] A method for controlling a hoist system, the hoist system comprises a hoisting motor for hoisting a conveyance, and a supporting device for supporting the conveyance when the conveyance reaches a predetermined position; the method is characterized in that, when the conveyance moves downward to the supporting device and then is supported (chaired and/or locked) by the supporting device, the hoisting force (and correspondingly driving torque) of the hoisting motor is adjusted to a predetermined value.

[0008] In an embodiment, the supporting device comprises a chairing device for chairing the conveyance and a locking device for locking the conveyance; the method is characterized in that it further comprises the following steps: when the conveyance is chaired by the chairing device, the locking device locks the conveyance.

[0009] In an embodiment, the predetermined value for the hoisting force is larger than zero but smaller than the dead weight of the conveyance. The predetermined value is project specific and calculated to have a safe margin to rope slip.

[0010] In an embodiment, the predetermined value for the hoisting force is in a range of 50% to 80% of dead weight of the conveyance.

[0011] Here is also provided a hoist system, characterized in that it may carry out any one of the methods as mentioned in the above.

[0012] In an embodiment, the supporting device comprises at least four groups of connecting rod mechanisms symmetrically arranged relative to a shaft, each group of the connecting rod mechanism comprises a cage chairing connecting rod, a cage chairing ram and a connecting rod seat; both the supporting end of the cage chairing connecting rod and the cage chairing ram are mounted on the connecting rod seat that is to be fixed on a wall of the shaft; wherein the cage chairing ram is connected with the cage chairing connecting rod, and collapsible to bring the cage chairing connecting rod out of the shaft or into the shaft.

[0013] In an embodiment, each group of the connecting rod mechanism of the supporting device further comprises a cage locking connecting rod and a cage locking ram, both the supporting end of the cage locking connecting rod and the cage locking ram are mounted on

the connecting rod seat, wherein, the cage locking ram is connected with the cage locking connecting rod, and collapsible to bring the cage locking connecting rod to lock or unlock the conveyance.

[0014] In an embodiment, the hoist system further comprises a hoisting control cabinet and a cage stabilizing control cabinet; the cage stabilizing control cabinet may communicate with the hoisting control cabinet, to make the supporting device and hoisting motor cooperate with each other during the process of berthing the cage and releasing the cage.

[0015] In an embodiment, the hoist system further comprises a cage stabilizing hydraulic work station and a local control box; the cage stabilizing control cabinet may communicate with the local control box, to control the cage stabilizing hydraulic work station and the supporting device and provide feedback according to position of platform at which the conveyance stops,.

[0016] According to the claimed invention, the method for controlling the hoist system and the hoist system, on the one hand, lower the requirement on the strength of the supporting device and on the hydraulic clamping system, and hence greatly reduce the cost in connection with the supporting device; on the other hand, the complex processes, such as the tension sensing and the position aligning processes during berthing the cage and releasing the cage, can be simplified, the load on the rope can be effectively controlled and optimized, and thus the operation efficiency of the hoist can be improved and the working life of the rope can be lengthened.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Figure 1 illustrates a topological structure of a hoist system used for a cage;

Figure 2 illustrates a schematic structure diagram of a supporting device;

Figure 3 illustrates a schematic diagram showing the process of berthing the cage moving downward;

Figure 4 illustrates a schematic diagram showing the process of releasing the cage by moving upward;

Figures 5A and 5B illustrate a schematic diagram showing the process of berthing the cage moving upward; and

Figure 6 illustrates a schematic diagram showing the process of releasing the cage by moving downward.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0018] In the following, detailed description of various embodiments of the present invention shall be made with reference to the Drawings. The claimed system and controlling method may be used for hoisting the skip in a production shaft, as well as for hoisting a cage in an auxiliary shaft; however, since the controlling system and method are substantially the same for hoisting a cage and hoisting a skip, for simplicity, the following only describes hoisting of a cage in an auxiliary shaft as an example.

[0019] As shown in Figure 1, the hoist system comprises n cage stabilizing hydraulic work stations, n supporting devices, n local control boxes and a cage stabilizing control cabinet, wherein "n" indicates the number of all the shaft platforms for horizontal loading and unloading.

[0020] In the hoist system, the cage stabilizing hydraulic work station provides driving source for the supporting device, and consists of an oil tank, an oil pump, controlling valves and pipes. It enables proper acting on the corresponding hydraulic ram and connecting rod of the supporting device, and meanwhile provides the state feedback to the controlling system.

[0021] The cage stabilizing mechanic device (hereafter referred to as supporting device) is a device for chairing and locking the cage. Each supporting device consists of at least four identical connecting rod structures, and each connecting rod structure primarily consists of a cage chairing connecting rod, a cage locking connecting rod, a cage chairing ram, a cage locking ram, and a connecting rod seat. The cage chairing connecting rod transfers the load of the cage to the shaft wall via the connecting rod seat, the cage locking connecting rod cooperates with the cage chairing connecting rod to lock the cage, the cage chairing ram is collapsible to put the cage chairing connecting rod in a cage chairing position or in a retracted position, and the cage locking ram is collapsible to put the cage locking connecting rod in a locking position or an unlocking position.

[0022] The local control box can signal operation command to the cage stabilizing hydraulic work station and supporting device, and provides state feedback. There are operation buttons and indicator lights on the control box. The control box interiorly employs Profibus-DP substation communication module and I/O module, to communicate with cage stabilizing control cabinet.

[0023] The cage stabilizing control cabinet, acting as a controlling core of the cage stabilizing system, employs Profibus-DP to communicate with n local controlling boxes, and therefore, according to a position of a platform at which the cage stops, controls the cage stabilizing hydraulic work station and supporting device to stabilize the cage and provides state feedback. Meanwhile, the cage stabilizing control cabinet communicates with hoisting transmission control systems via Module-Bus, to cooperatively operate the cage stabilizing and the hoisting processes, so that the process of berthing and releasing cage can be safely ensured.

[0024] Figure 2 shows a schematic diagram showing the cooperation among a group of connecting rod structures of a supporting device, cage 10, and shaft 11. In

the Figure, the supporting ends of the cage chairing connecting rod 1 and cage locking connecting rod 2 are mounted on the same hinge pedestal, and the cage chairing connecting rod 1 and cage locking connecting rod 2 are driven respectively by the cage chairing ram 5 and cage locking ram 4 to perform the cage chairing and cage locking actions. The hinge pedestals of the cage chairing ram 5 and cage locking ram 4 and the common hinge pedestal of the cage chairing connecting rod 1 and cage locking connecting rod 2 are all mounted on the connecting rod seat 6 which is fixedly mounted on the shaft wall 12. A cradle 3, as a platform device, can be optionally included. The chairing end of the cage chairing connecting rod 1 and the locking end of cage locking connecting rod 2 are respectively provided with slots adapted to the edge of the cage, for chairing and locking the cage.

[0025] The supporting device may be provided at various loading platforms, for supporting the cage when it reaches required positions. The supporting device may always extend to a cage guide, being ready for use, for example, when the supporting device is located at the bottom of the case guide; or the supporting device may usually be in a retracted position, and extend into the case guide only when required for use.

[0026] The method for controlling the hoist system concerns the process of berthing cage and that of releasing cage. As in the present invention the cage is chaired to be positioned, the process of berthing cage employs the upper berthing, i.e., the cage is slowly put in place from the above of the cage chairing connecting rod; while the process of releasing cage employs the upper releasing, i.e., the cage is slowly moved out of the place from the above of the cage chairing connecting rod. The following describes both situations where a cage moving downward from a position higher than the loading platform is berthed and where a cage moving upward from a position lower than the loading platform is berthed.

(1) A cage moving downward from a position higher than the loading platform is berthed:

As shown in Figure 3, it is assumed that the system chairs a load of 11 ton, conveyance weight of 10 ton, and a total weight of 21 ton. When the cage moves downward and near to the supporting device, the cage speed reduces to 0.1m/s, and the cage stabilizing control cabinet sends an operation command for stabilizing the cage. The cage chairing ram extends to push the cage chairing connecting rod out of the shaft and into the cage guide, to get ready for chairing the cage. Once the cage is berthed, the locking ram extends to push out the cage locking connecting rod, to cooperate with the cage chairing connecting rod to fix and lock the cage simultaneously from above and below. After the berthing, the cage stabilizing control cabinet signals the hoisting control cabinet, and the hoisting control cabinet automatically adjusts the torque of the hoisting motor to a value required for a weight of 8 ton, i.e., a torque required for a weight that is 80% of the dead weight of the cage, so that the tension force of the steel rope is decreased from 21 ton to a value lower than the weight of the cage. In this way, in the following process of releasing cage, no excessively large force would be applied onto the steel rope and hoisting motor, which is otherwise applied at the moment of starting the hoisting due to the looseness of steel rope. Meanwhile, the accident that, due to improper adjustment, the cage becomes unstable or suddenly accelerates upwards at the moment of starting the hoisting, can also be avoided, which accident would damage the system and is risky. In addition, through adjusting the tension force of the steel rope to be less than the dead weight of the cage, it can be ensured that the cage would not skip in a large range of position after the weight in the cage is unloaded. It should be appreciated that, the previous numbers are used only for assumption and example purpose, and has no limit on the claimed invention. As to the adjustment amount of the tension force on the steel rope after the berthing, it can be simulated and optimized according to such as characteristics of the steel rope, range of the frequently occupied load, and the use frequency etc., so as to improve the working life of the steel rope while ensuring safety and stability. In a preferred embodiment, after berthing, the torque of the hoisting motor is adjusted to a torque required for a weight of 50% to 80% of the dead weight of the cage, i.e., the hoisting force of the hoisting motor amounts to 50% to 80% of the dead weight of the cage.

[0027] Figure 4 shows the releasing process after the berthing of the cage moving downward. The hoisting control cabinet sends a command for moving upwards, the cage stabilizing control cabinet then immediately sends a command for unlocking, the cage locking ram contracts and withdraws the cage locking connecting rod to unlock the cage. The hoisting control cabinet then sends a starting signal. Since the steel rope maintains a tension of 8 ton when the hoisting motor stops, the 8 ton tension will then be used as the preset torque in the starting process and then the hoisting torque can be gradually increased, so that a potential reversed rotation due to the excessively loose steel rope can be avoided. The cage then leaves the cage chairing device, and the cage chairing ram contracts to withdraw the cage chairing connecting rod out of the case guide, and the releasing process is ended.

[0028] (2) A cage moving upward from a position lower than the loading platform is berthed.

[0029] As shown in Figures 5A and 5B, during the process of berthing a cage moving upward, when the cage is close to the supporting device, the hoisting control cabinet reduces the cage speed to 0.1m/s, at which speed the cage continues to move upward to a position higher than the supporting device, and then the hoisting control

cabinet sends a command for stopping. The cage stabilizing control cabinet then sends an operation command for stabilizing the cage, and the cage chairing ram extends to push the cage chairing connecting rod out of the shaft to the case guide, to get ready for chairing the cage. The hoisting control cabinet forces the cage to change the speed direction of the cage, and to move downwards gradually to be berthed. After berthing, the process of locking cage, stopping, and adjusting the torque of the hoisting motor (i.e., adjusting the tension on the rope) will be similar to those adopted in the process of berthing a cage moving downward as describe above.

[0030] As shown in Figure 6, in the cage releasing process after berthing a cage moving upward, the hoisting control cabinet sends a command for moving downward, and the cage stabilizing control cabinet then immediately sends a command for unlocking so that the cage locking ram contracts and withdraws the cage locking connecting rod to unlock the cage. The hoisting control cabinet then changes the speed direction and forces the cage to move upward at a lower speed for a short while and then stop. The cage chairing ram contracts to withdraw the cage chairing connecting rod out of the cage guide, and then the hoisting control cabinet starts the motor to lower the cage.

[0031] During berthing a cage moving upward and releasing the same, the hoisting control cabinet is required to force the preset speed direction of the cage to be changed, so that the system have to temporally bypass the hoist reversion and hoist running direction protection.

[0032] Though the above description is made by using the steel rope as an example, it should be understood that, the claimed invention is not limited to the case where a steel rope is used, instead any other available rope or cable is also possible.

[0033] Though the claimed invention is described with reference to some preferred embodiments, those skilled in the art would appreciate that, various modifications to the formality or details are possible within the protection scope as defined by the attached claims.

Claims

1. A method for controlling a hoist system, the hoist system comprising a hoisting motor for hoisting a conveyance (10), and a supporting device for supporting the conveyance (10) when the conveyance reaches a predetermined position,
   characterized in that, when the conveyance (10) moves downward to the supporting device and then is supported by the supporting device, hoisting force of the hoisting motor is adjusted to a predetermined value, which is larger than zero but smaller than the dead weight of the conveyance (10).

2. The method for controlling a hoist system according to claim 1, wherein the supporting device comprises a chairing device for chairing the conveyance (10) and a locking device for locking the conveyance (10); and the method further comprises the following steps:
   when the conveyance (10) is chaired by the chairing device, the locking device locks the conveyance (10).

3. The method for controlling a hoist system according to claim 1 or 2, wherein the predetermined value for the hoisting force is in a range of 50% to 80% of the dead weight of the conveyance (10).

4. A hoist system, comprising:

   a hoisting motor for hoisting a conveyance (10);
   a supporting device for supporting the conveyance (10) when the conveyance reaches a predetermined position;
   a controlling system adapted to adjusting the hoisting force of the hoisting motor to a predetermined value, which is larger than zero but smaller than the dead weight of the conveyance (10), wherein the value is adjusted when the conveyance (10) moves downward to the supporting device and then is supported by the supporting device.

5. The hoist system according to claim 4, wherein the supporting device comprises at least four groups of connecting rod structures symmetrically arranged relative to a shaft, each group of the connecting rod structure comprises a cage chairing connecting rod (1), a cage chairing ram (5) and a connecting rod seat (6);
   both the supporting end of the cage chairing connecting rod (1) and the cage chairing ram (5) are mounted on the connecting rod seat (6) that is to be fixed on a wall (12) of the shaft (11),
   wherein the cage chairing ram (5) is connected with the cage chairing connecting rod (1), and collapsible to bring the cage chairing connecting rod (1) out of the shaft (11) or into the shaft (11).

6. The hoist system according to claim 5, wherein each group of the connecting rod structure of the supporting device further comprises a cage locking connecting rod (2) and a cage locking ram (4), and both the supporting end of the cage locking connecting rod (2) and the cage locking ram (4) are mounted on the connecting rod seat (6),
   wherein the cage locking ram (4) is connected with the cage locking connecting rod (2), and collapsible to bring the cage locking connecting rod (2) to lock or unlock the conveyance (10).

7. The hoist system according to claim 5 or 6, wherein the controlling system of the hoist system further

comprises a hoisting control cabinet and a cage stabilizing control cabinet, and the cage stabilizing control cabinet communicates with the hoisting control cabinet to make the supporting device and hoisting motor cooperate with each other during the process of berthing cage and releasing cage.

8. The hoist system according to claim 7, wherein the hoist system further comprises a cage stabilizing hydraulic work station and a local control box, the cage stabilizing control cabinet communicates with the local control box, to control the cage stabilizing hydraulic work station and the supporting device and provide feedback according to position of platform at which the conveyance (10) stops.

9. The hoist system according to claim 4, wherein the controlling system is adapted to carry out the method according to any one of claims 1 to 3.

Patentansprüche

1. Verfahren zur Steuerung eines Hebezugsystems, wobei das Hebezugsystem einen Hubmotor zum Heben eines Beförderungsmittels (10) und eine Lagervorrichtung zum Lagern des Beförderungsmittels (10), wenn das Beförderungsmittel eine festgelegte Position erreicht, umfasst,
dadurch gekennzeichnet, dass, wenn sich das Beförderungsmittel (10) nach unten zur Lagervorrichtung bewegt und dann von der Lagervorrichtung gelagert wird, die Hebekraft des Hubmotors auf einen festgelegten Wert angepasst wird, der größer als Null und kleiner als das Leergewicht des Beförderungsmittels (10) ist.

2. Verfahren zur Steuerung eines Hebezugsystems nach Anspruch 1, wobei die Lagervorrichtung eine Aufnahmevorrichtung zum Aufnehmen des Beförderungsmittels (10) und eine Verriegelungsvorrichtung zum Verriegeln des Beförderungsmittels (10) umfasst; und wobei das Verfahren ferner den folgenden Schritt umfasst:
wenn das Beförderungsmittel (10) von der Aufnahmevorrichtung aufgenommen wird, verriegelt die Verriegelungsvorrichtung das Beförderungsmittel (10).

3. Verfahren zur Steuerung eines Hebezugsystems nach Anspruch 1 oder 2, wobei der festgelegte Wert für die Hebekraft in einem Bereich von 50 % bis 80 % des Leergewichts des Beförderungsmittels (10) liegt.

4. Hebezugsystem, Folgendes umfassend:

einen Hubmotor zum Fördern eines Beförderungsmittels (10) ;
eine Lagervorrichtung zum Lagern des Beförderungsmittels (10), wenn das Beförderungsmittel eine festgelegte Position erreicht;
ein Steuerungssystem, das die Hebekraft des Hubmotors auf einen festgelegten Wert anpassen kann, der größer als Null und kleiner als das Leergewicht des Beförderungsmittels (10) ist, wobei der Wert angepasst wird, wenn sich das Beförderungsmittel (10) nach unten zur Lagervorrichtung bewegt und dann von der Lagervorrichtung gelagert wird.

5. Hebezugsystem nach Anspruch 4, wobei die Lagervorrichtung mindestens vier Gruppen Verbindungsstabstrukturen umfasst, die in Bezug zu einem Schacht symmetrisch angeordnet sind, wobei jede Gruppe der Verbindungsstabstruktur einen Korbaufnahmeverbindungsstab (1), einen Korbaufnahmekolben (5) und einen Verbindungsstabsitz (6) umfasst;
wobei sowohl das lagernde Ende des Korbaufnahmeverbindungsstabs (1) als auch der Korbaufnahmekolben (5) auf dem Verbindungsstabsitz (6) angebracht sind, der an einer Wand (12) des Schachts (11) befestigt wird,
wobei der Korbaufnahmekolben (5) mit dem Korbaufnahmeverbindungsstab (1) verbunden ist und einfahrbar ist, um den Korbaufnahmeverbindungsstab (1) aus dem Schacht (11) heraus oder in den Schacht (11) hinein zu bewegen.

6. Hebezugsystem nach Anspruch 5, wobei jede Gruppe der Verbindungsstabstruktur der Lagervorrichtung ferner einen Korbverriegelungsverbindungsstab (2) und einen Korbverriegelungskolben (4) umfasst, wobei sowohl das lagernde Ende des Korbverriegelungsverbindungsstabs (2) als auch der Korbverriegelungskolben (4) auf dem Verbindungsstabsitz (6) angebracht sind,
wobei der Korbverriegelungskolben (4) mit dem Korbverriegelungsverbindungsstab (2) verbunden ist und einfahrbar ist, um den Korbverriegelungsverbindungsstab (2) dazu zu bewegen, das Beförderungsmittel (10) zu verriegeln oder zu entriegeln.

7. Hebezugsystem nach Anspruch 5 oder 6, wobei das Steuerungssystem des Hebezugsystems ferner einen Hebezugschaltschrank und einen Korbstabilisierungsschaltschrank umfasst und der Korbstabilisierungsschaltschrank mit dem Hebezugschaltschrank kommuniziert, um dafür zu sorgen, dass die Lagervorrichtung und der Hubmotor während des Verankerns und Lösens des Korbs zusammenwirken.

8. Hebezugsystem nach Anspruch 7, wobei das Hebezugsystem ferner eine korbstabilisierende, hydrau-

lische Arbeitsstation und einen lokalen Schaltkasten umfasst, wobei der Korbstabilisierungsschaltschrank mit dem lokalen Schaltkasten kommuniziert, um die korbstabilisierende, hydraulische Arbeitsstation und die Lagervorrichtung zu steuern und Rückmeldung bezüglich der Plattformposition, an der das Beförderungsmittel (10) anhält, zu geben.

9. Hebezugsystem nach Anspruch 4, wobei das Steuerungssystem das Verfahren nach einem der Ansprüche 1 bis 3 ausführen kann.

Revendications

1. Procédé de commande d'un système de levage, le système de levage comprenant un moteur de levage pour lever un moyen de transport (10), et un dispositif de support pour supporter le moyen de transport (10) lorsque le moyen de transport atteint une position prédéfinie,
caractérisé en ce que, lorsque le moyen de transport (10) descend jusqu'au dispositif de support puis est supporté par le dispositif de support, la force de levage du moteur de levage est réglée à une valeur prédéfinie, qui est supérieure à zéro mais inférieure au poids mort du moyen de transport (10).

2. Procédé de commande d'un système de levage selon la revendication 1, le dispositif de support comprenant un dispositif de maintien pour maintenir le moyen de transport (10) et un dispositif de verrouillage pour verrouiller le moyen de transport (10) ; et le procédé comprenant en outre l'étape suivante :
lorsque le moyen de transport (10) est maintenu par le dispositif de maintien, le dispositif de verrouillage verrouille le moyen de transport (10).

3. Procédé de commande d'un système de levage selon la revendication 1 ou 2, la valeur prédéfinie de la force de levage étant dans une plage comprise entre 50 et 80 % du poids mort du moyen de transport (10).

4. Système de levage, comprenant :

un moteur de levage pour lever un moyen de transport (10) ;
un dispositif de support pour supporter le moyen de transport (10) lorsque le moyen de transport atteint une position prédéfinie ;
un système de commande conçu pour régler la force de levage du moteur de levage à une valeur prédéfinie, qui est supérieure à zéro mais inférieure au poids mort du moyen de transport (10), la valeur étant réglée lorsque le moyen de transport (10) descend jusqu'au dispositif de support puis est supporté par le dispositif de support.

5. Système de levage selon la revendication 4, le dispositif de support comprenant au moins quatre groupes de structures de bielle disposées symétriquement par rapport à un arbre, chaque groupe de la structure de bielle comprenant une bielle de maintien de cage (1), un vérin de maintien de cage (5) et un siège de bielle (6) ;
l'extrémité de support de la bielle de maintien de cage (1) et le vérin de maintien de cage (5) étant montés sur le siège de bielle (6) qui doit être fixé sur une paroi (12) de l'arbre (11),
le vérin de maintien de cage (5) étant relié à la bielle de maintien de cage (1), et repliable pour amener la bielle de maintien de cage (1) hors de l'arbre (11) ou dans l'arbre (11).

6. Système de levage selon la revendication 5, chaque groupe de la structure de bielle du dispositif de support comprenant en outre une bielle de verrouillage de cage (2) et un vérin de verrouillage de cage (4), et l'extrémité de support de la bielle de verrouillage de cage (2) et le vérin de verrouillage de cage (4) étant montés sur le siège de bielle (6),
le vérin de verrouillage de cage (4) étant relié à la bielle de verrouillage de cage (2), et repliable pour amener la bielle de verrouillage de cage (2) à verrouiller ou déverrouiller le moyen de transport (10) .

7. Système de levage selon la revendication 5 ou 6, le système de commande du système de levage comprenant en outre une armoire de commande de levage et une armoire de commande de stabilisation de cage, et l'armoire de commande de stabilisation de cage communiquant avec l'armoire de commande de levage pour faire coopérer le dispositif de support et le moteur de levage l'un avec l'autre pendant le processus de mise en place de la cage et de libération de la cage.

8. Système de levage selon la revendication 7, le système de levage comprenant en outre un poste de travail hydraulique de stabilisation de cage et un boîtier de commande local, l'armoire de commande de stabilisation de cage communiquant avec le boîtier de commande local, pour commander le poste de travail hydraulique de stabilisation de cage et le dispositif de support et fournir une rétroaction selon la position de la plate-forme à laquelle s'arrête le moyen de transport (10).

9. Système de levage selon la revendication 4, le système de commande étant conçu pour exécuter le procédé selon l'une quelconque des revendications 1 à 3.

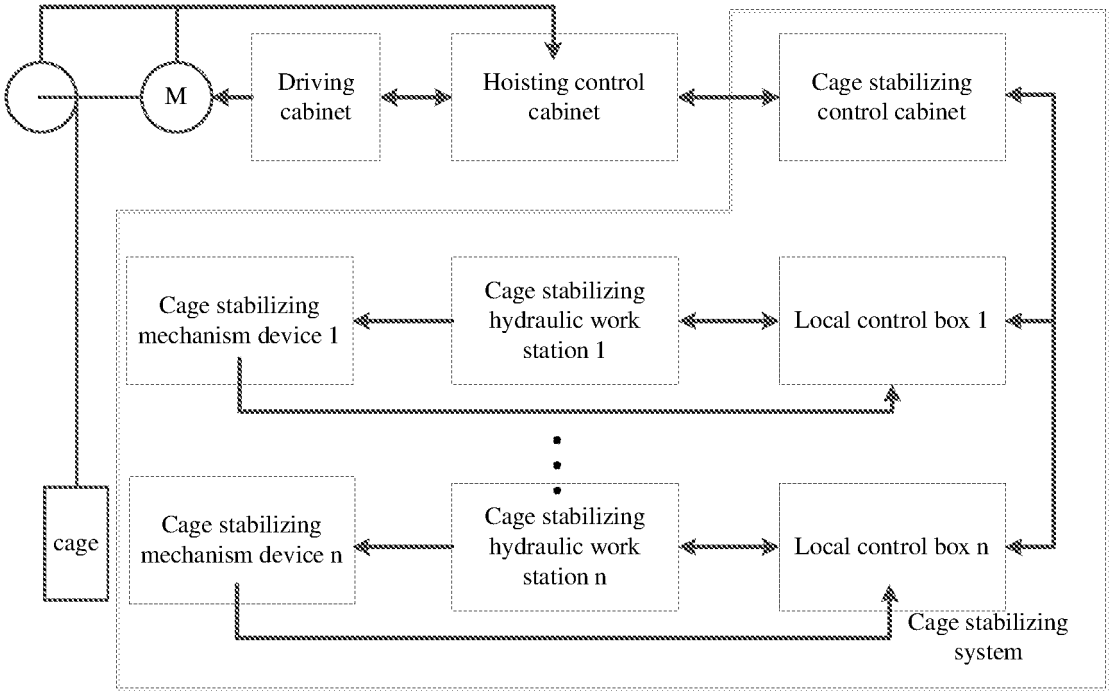
M
Driving cabinet
Hoisting control cabinet
Cage stabilizing control cabinet
Cage stabilizing mechanism device 1
Cage stabilizing hydraulic work station 1
Local control box 1
cage
Cage stabilizing mechanism device n
Cage stabilizing hydraulic work station n
Local control box n
Cage stabilizing system

Figure 1

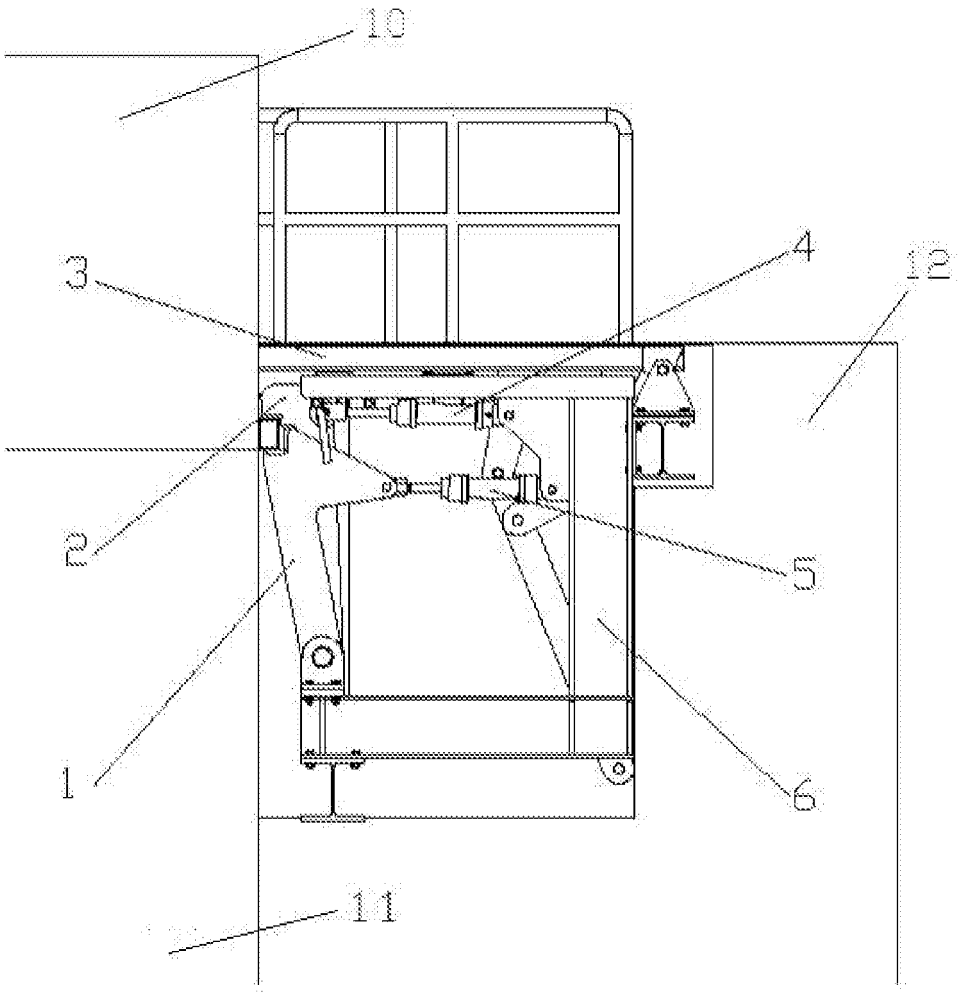

Figure 2

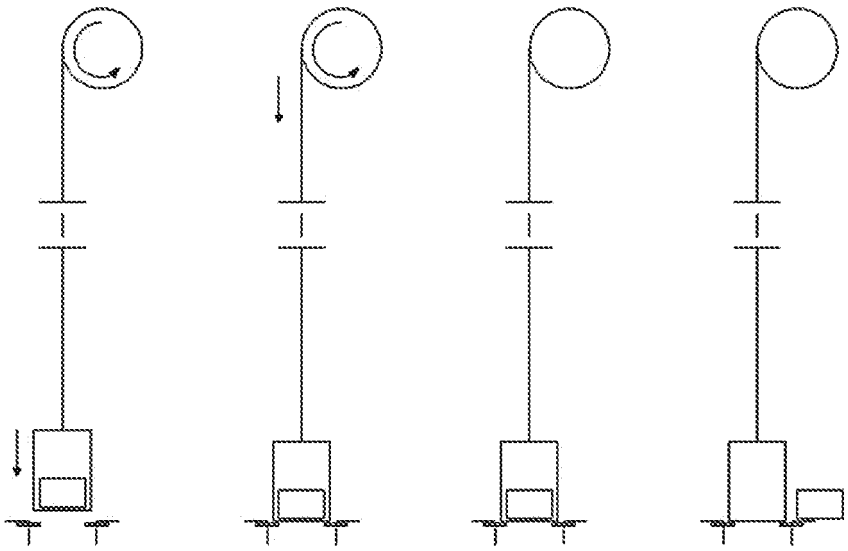

Figure 3

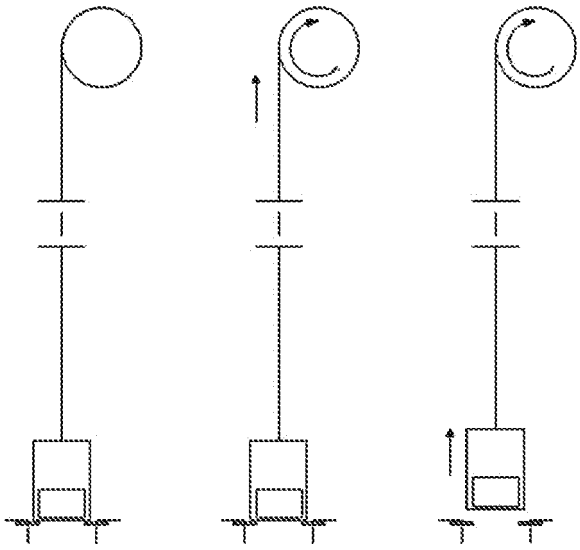

Figure 4

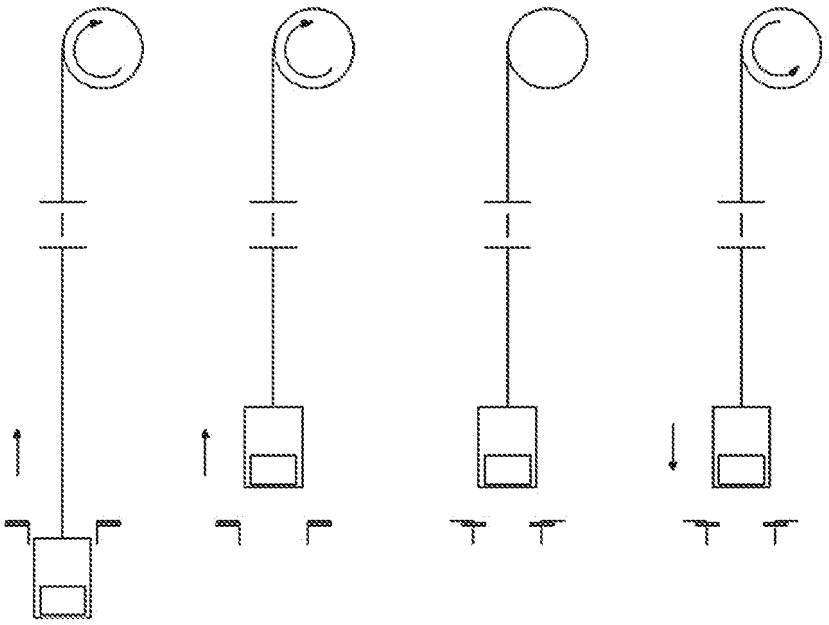

Figure 5A

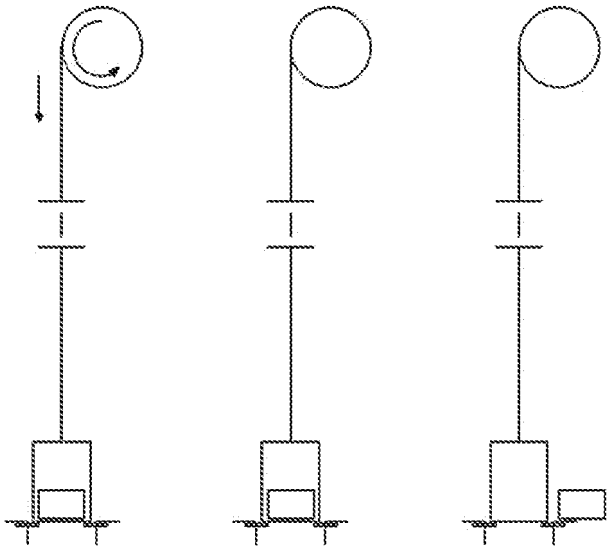

Figure 5B

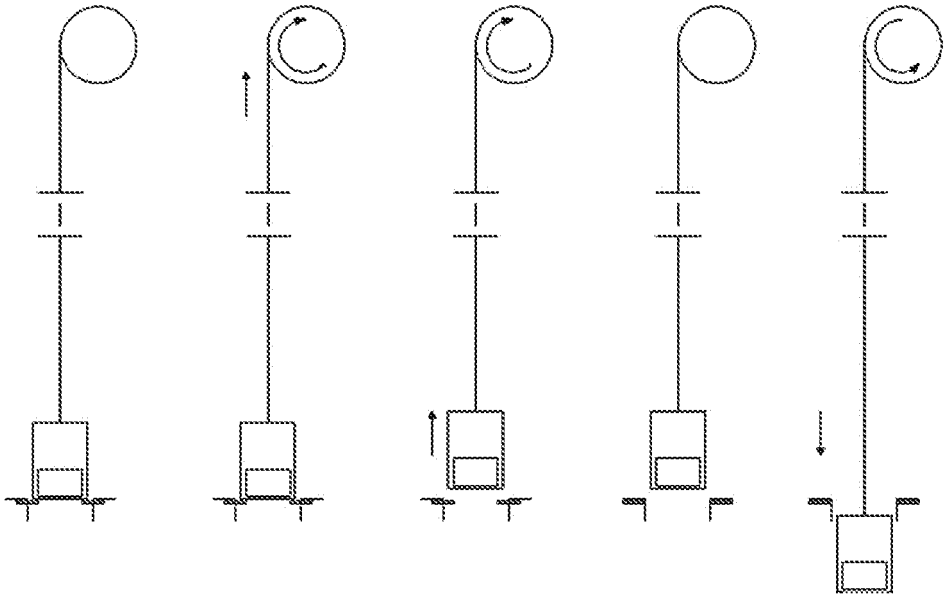

Figure 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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