# CONTROL METHOD AND DEVICE OF SPREADER CABLE REEL, AND CRANE

## TECHNICAL FIELD

[0001] The present application relates to the field of crane technologies, and in particular, to a control method and device of a spreader cable reel, and a crane.

## BACKGROUND

[0002] In related technologies, in an emergency operation mode, a spreader cable reel of a crane does not move synchronously with lifting or lowering of a hoisting mechanism of the crane, and a relevant operator is required to manually operate a spreader cable, thus resulting in relatively low control accuracy, poor reliability, and high labor costs.

## SUMMARY

[0003] In view of this, an objective of the present application is to provide a control method and device of a spreader cable reel, and a crane, to improve control precision and reliability of synchronous movement of a spreader cable and a hoisting mechanism of a crane in an emergency operation mode, and reduce labor costs.

[0004] According to a first aspect, the present application provides a control method of a spreader cable reel. The method is applied to a controller of the spreader cable reel, where the controller is connected to each of a reel motor and a control loop of a hoisting mechanism, the reel motor is connected to the spreader cable reel. The method includes: receiving an emergency signal; and controlling an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter; where the receiving an emergency signal includes: receiving an emergency signal sent by the control loop, where the emergency signal includes a start signal and a direction signal, the preset operating parameter includes a preset speed; and the controlling an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter includes: sending a first motor control signal to the reel motor, and controlling, by the reel motor, the spreader cable reel to operate in a movement direction indicated by the direction signal and at the preset speed, where the first motor control signal is corresponding to the movement direction indicated by the direction signal and the preset speed.

[0005] In an embodiment, the emergency signal includes a stop signal. The controlling an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter includes:

controlling the spreader cable reel to stop operating.

[0006] In an embodiment, the emergency signal includes a stop signal. The controlling, by the reel motor, the operating state of the spreader cable reel based on the emergency signal and the preset operating parameter includes: sending a second motor control signal to the reel motor, and controlling, by the reel motor, the spreader cable reel to stop operating.

[0007] In an embodiment, the method further includes: receiving a speed feedback signal; and sending a first fault signal when a difference between a current operating speed indicated by the speed feedback signal and the preset speed is greater than a preset speed threshold.

[0008] In an embodiment, the control loop is further connected to the hoisting mechanism. The method further includes: receiving a speed feedback signal sent by the reel motor; and when a difference between a current operating speed indicated by the speed feedback signal and the preset speed is greater than a preset speed threshold, sending a first fault signal to the control loop to control, by the control loop, the hoisting mechanism to stop operating.

[0009] According to a second aspect, the present application provides a control method of a spreader cable reel, and the method is applied to a control loop of a hoisting mechanism. The control loop of the hoisting mechanism is connected to a controller. The controller, a reel motor and the spreader cable reel are connected in sequence. The method includes: when receiving an emergency mode instruction, sending an emergency signal to the controller to control, by the controller, an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter, where the emergency signal includes a start signal and a direction signal, the preset operating parameter includes a preset speed, and the sending an emergency signal to the controller to control, by the controller, an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter includes: sending an emergency signal to the controller to send a first motor control signal to the reel motor by the controller, and controlling, by the reel motor, the spreader cable reel to operate in a movement direction indicated by the direction signal and at the preset speed, where the first motor control signal is corresponding to the movement direction indicated by the direction signal and the preset speed.

[0010] In an embodiment, the control loop is further connected to the hoisting mechanism, and the preset operating parameter includes a preset speed. The method further includes: controlling the hoisting mechanism to stop operating when receiving a first fault signal sent by the controller. The first fault signal is sent by the controller after the controller receives a speed feedback signal sent by the reel motor and a difference between a current operating speed indicated by the speed feedback signal and the preset speed is greater than a preset speed threshold.

[0011] In an embodiment, the control loop is further connected to a cable reel detection limit and the hoisting mechanism. The cable reel detection limit is used to detect a slack status of the spreader cable

reel. The method further includes: controlling the hoisting mechanism to stop operating when receiving a second fault signal sent by the cable reel detection limit. The second fault signal is used to indicate that the spreader cable reel is in an over-loose state or an over-tight state.

[0012] According to a third aspect, the present application provides a control device of a spreader cable reel, the device is disposed on a controller of the spreader cable reel and the controller is connected to each of a reel motor and a control loop of a hoisting mechanism, the reel motor is connected to the spreader cable reel. The device includes: a signal receiving module, configured to receive an emergency signal sent by the control loop; and a control module, configured to control an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter, where the emergency signal includes a start signal and a direction signal, the preset operating parameter includes a preset speed; and the control module is further configured to: send a first motor control signal to the reel motor, and control, by the reel motor, the spreader cable reel to operate in a movement direction indicated by the direction signal and at the preset speed, where the first motor control signal is corresponding to the movement direction indicated by the direction signal and the preset speed.

[0013] In an embodiment, the emergency signal includes a stop signal. The control module is configured to control the spreader cable reel to stop operating.

[0014] In an embodiment, the emergency signal includes a stop signal. The control module is configured to: send a second motor control signal to the reel motor, and control, by the reel motor, the spreader cable reel to stop operating.

[0015] In an embodiment, the device further includes: a feedback signal receiving module, configured to receive a speed feedback signal; and a fault signal sending module, configured to send a first fault signal when a difference between a current operating speed indicated by the speed feedback signal and a preset speed is greater than a preset speed threshold.

[0016] In an embodiment, the control loop is further connected to the hoisting mechanism. The device further includes: a feedback signal receiving module, configured to receive a speed feedback signal sent by the reel motor; and a fault signal sending module, configured to: when a difference between a current operating speed indicated by the speed feedback signal and a preset speed is greater than a preset speed threshold, send a first fault signal to the control loop to control, by the control loop, the hoisting mechanism to stop operating.

[0017] According to a fourth aspect, the present application provides a system including a control device and a controller of a spreader cable reel, and the control device is disposed on a control loop of a hoisting mechanism. The control loop of the hoisting mechanism is connected to the controller of the spreader cable reel. The controller, a reel motor and the spreader cable reel are connected in sequence. The device includes: a signal sending module, configured to: when receiving an emergency mode instruction, send an emergency signal to the controller to control, by the controller, an operating state

of the spreader cable reel based on the emergency signal and a preset operating parameter, where the emergency signal includes a start signal and a direction signal, the preset operating parameter includes a preset speed, and the signal sending module is further configured to send the emergency signal to the controller to send, by the controller, a first motor control signal to the reel motor, and control, by the reel motor, the spreader cable reel to operate in a movement direction indicated by the direction signal and at the preset speed, where the first motor control signal is corresponding to the movement direction indicated by the direction signal and the preset speed.

[0018] In an embodiment, the controller, the reel motor and the spreader cable reel are connected in sequence. The signal sending module is configured to control, by the reel motor, the operating state of the spreader cable reel.

[0019] In an embodiment, the control loop is further connected to the hoisting mechanism; and the preset operating parameter includes a preset speed. The device further includes: a first fault control module, configured to: control the hoisting mechanism to stop operating when receiving a first fault signal sent by the controller. The first fault signal is sent by the controller after the controller receives a speed feedback signal sent by the reel motor and a difference between a current operating speed indicated by the speed feedback signal and a preset speed is greater than a preset speed threshold.

[0020] In an embodiment, the control loop is further connected to a cable reel detection limit and the hoisting mechanism. The cable reel detection limit is used to detect a slack status of the spreader cable reel. The device further includes: a second fault control module, configured to: control the hoisting mechanism to stop operating when receiving a second fault signal sent by the cable reel detection limit. The second fault signal is used to indicate that the spreader cable reel is in an over-loose state or an over-tight state.

[0021] According to a fifth aspect, the present application provides a crane. The crane includes a hoisting mechanism, a control loop, a controller, a reel motor and a spreader cable reel that are connected in sequence. The controller includes any one of the control devices disposed on the controller of the spreader cable reel. The control loop includes any one of the control devices disposed on the control loop of the hoisting mechanism.

[0022] According to a sixth aspect, the present application provides a computer-readable storage medium, the computer-readable storage medium stores a computer program, and the computer program is used to perform the method according to any one of the methods described above.

[0023] The embodiments of the present application have the following beneficial effects.

[0024] The embodiments of the present application provides the control method and device of a spreader cable reel, and the crane. After receiving an emergency signal, an operating state of a spreader cable reel is controlled based on the emergency signal and a preset operating parameter. The method improves control precision and reliability of synchronous movement of a spreader cable and a hoisting

mechanism of a crane in an emergency operation mode, and reduces labor costs.

[0025] Other features and advantages of the present application will be described in the following specification, and some of these will become apparent from the specification or be understood by implementing the present application. The objectives and other advantages of the present application are implemented or obtained by structures specifically indicated in the description, claims, and accompanying drawings.

[0026] To make the foregoing objectives, features, and advantages of the present application more obvious and understandable, the following describes optional embodiments below in detail in combination with the accompanying drawings.

## BRIEF DESCRIPTION OF DRAWINGS

[0027] To describe the technical solutions in the specific implementations of the present application or the prior art more clearly, the accompanying drawings required for describing the specific implementations or the prior art are briefly described below. Apparently, the accompanying drawings in the following description show merely some implementations of the present application, and a person of ordinary skill in the art may still derive other accompanying drawings from these accompanying drawings without creative efforts.

[0028] FIG. 1 is a principle diagram of a control method of a spreader cable reel in an emergency operation mode in the related art according to an embodiment of the present application.

[0029] FIG. 2 is a flowchart of a control method of a spreader cable reel according to an embodiment of the present application.

[0030] FIG. 3 is a flowchart of another control method of a spreader cable reel according to another embodiment of the present application.

[0031] FIG. 4 is a flowchart of another control method of a spreader cable reel according to another embodiment of the present application.

[0032] FIG. 5 is a flowchart of another control method of a spreader cable reel according to another embodiment of the present application.

[0033] FIG. 6 is a specific implementation process diagram of a control method of a spreader cable reel according to an embodiment of the present application.

[0034] FIG. 7 is a principle diagram of a control method of a spreader cable reel according to an embodiment of the present application.

[0035] FIG. 8 is a schematic structural diagram of a control device of a spreader cable reel according to an embodiment of the present application.

[0036] FIG. 9 is a schematic structural diagram of another control device of a spreader cable reel according to an embodiment of the present application.

[0037] FIG. 10 is a principle diagram of a structure of a crane according to an embodiment of the present application.

## DETAILED DESCRIPTION

[0038] In order to make the objectives, technical solutions and advantages in the embodiments of the present application clearer, the technical schemes in the embodiments of the present application will be described clearly and completely below in combination with the accompanying drawings in the embodiments of the present application. Obviously, the described embodiments are only a part of the embodiments of the present application, not all of the embodiments. Based on the embodiments in the present application, all other embodiments obtained by those skilled in the art without creative efforts shall fall within the protection scope of the present application.

[0039] At present, a hoisting mechanism of a crane is in a normal operation mode or an emergency operation mode. In the emergency operation mode, a spreader cable reel does not move with lifting or lowering of the hoisting mechanism, and it is easy to cause a spreader cable to be too loose to be hooked, or to be too tight to cause the cable to be pulled and damaged. In the related art, a maintenance operator is usually arranged specifically to stand on a trolley to manually operate the spreader cable. As shown in FIG. 1, an operator 1 sends, by a control loop, a start-stop signal and a direction signal (represented as a start-stop + direction signal in FIG. 1) to an emergency motor, to control lifting and lowering of a hoisting mechanism through the emergency motor (an emergency power supply powers the emergency motor). An operator 2 sends, by a control loop, a start-stop signal and a direction signal (represented as a start-stop + direction signal in FIG. 1) to a reel motor, to control lifting and lowering of an electric saw cable through the reel motor (a power supply of a spreader cable reel powers the reel motor). The two processes are not related to each other. In this method, a spreader cable may not move following an action of the hoisting mechanism automatically. In addition when a maintenance operator performs an operation manually, the operation is easily affected by a human factor, resulting in poor reliability and relatively low control accuracy; and it is easy to cause a following operation to be out of synchronization due to an improper operation, resulting in poor synchronization between the spreader cable and the hoisting mechanism.

[0040] On such a basis, a control method and device of a spreader cable reel, and a crane provided in the embodiments of the present application may be applied to a control process of a spreader cable reel of a crane or another equipment.

[0041] To facilitate understanding of the embodiments, a control method of a spreader cable reel disclosed in the embodiments of the present application is first described in detail.

[0042] An embodiment of the present application provides a control method of a spreader cable reel, and the method is applied to a controller of the spreader cable reel. As shown in FIG. 2, the method

includes the following steps.

[0043] Step S110, receiving an emergency signal.

[0044] Step S120, controlling an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter.

[0045] According to the control method of a spreader cable reel provided in the embodiment of the present application, after an emergency signal is received, an operating state of the spreader cable reel is controlled based on the emergency signal and a preset operating parameter. This method improves control precision and reliability of synchronous movement of a spreader cable and a hoisting mechanism of a crane in an emergency operation mode, and reduces labor costs.

[0046] An embodiment of the present application provides another control method of a spreader cable reel, and the method is applied to a controller. The controller is connected to each of a reel motor and a control loop of a hoisting mechanism, and the reel motor is connected to the spreader cable reel. As shown in FIG. 3, the method includes the following steps.

[0047] Step S200, receiving an emergency signal sent by the control loop.

[0048] The control loop may usually receive a control instruction triggered by an operator of a crane, so as to control an operation of a hoisting mechanism of the crane. When the control loop receives an emergency mode instruction triggered by a user, an emergency signal may be generated. The emergency signal is used to control the hoisting mechanism to operate in an emergency mode, and the emergency signal is also sent to the controller connected to the reel motor, so that the controller controls operation of the spreader cable reel by the reel motor, and then controls operation of a spreader cable.

[0049] The emergency signal is usually a start signal or a stop signal. When the emergency signal is the start signal, the emergency signal may further include a direction signal, which is used to indicate an operating direction of the spreader cable, and the direction is usually the same as an operating direction of the hoisting mechanism.

[0050] Step S202, controlling, by the reel motor, an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter.

[0051] Since in the emergency mode, the spreader cable and the hoisting mechanism need to move synchronously, the preset operating parameter is usually related to an operating parameter of the hoisting mechanism in the emergency mode. For example when the hoisting mechanism adopts a fixed operating speed in the emergency mode, the preset operating parameter further includes a preset speed, and the preset speed may be the same as the operating speed of the hoisting mechanism in the emergency mode. The controller may output a motor control signal matching the preset operating parameter. After receiving the motor control signal, the reel motor may control the spreader cable reel to operate in an operating state indicated by the preset operating parameter, for example, to operate at the preset speed.

[0052] According to the control method of a spreader cable reel provided in the embodiment of the present application, after the emergency signal sent by the control loop is received, the operating state of the spreader cable reel is controlled by the reel motor based on the emergency signal and the preset operating parameter. This method improves control precision and reliability of synchronous movement of a spreader cable and the hoisting mechanism of a crane in the emergency operation mode, and reduces labor costs.

[0053] An embodiment of the present application further provides a control method of a spreader cable reel, and the method is implemented based on the method in the foregoing embodiment. As shown in FIG. 4, the method includes the following steps.

[0054] Step S300, receiving an emergency signal sent by the control loop, where the emergency signal includes a start signal and a direction signal. The start signal is used to instruct the spreader cable reel to start operating. The direction signal is used to indicate an operating direction of the spreader cable reel, and the operating direction is consistent with an operating direction of an emergency mechanism.

[0055] Step S302, sending a first motor control signal to the reel motor, and controlling, by the reel motor, the spreader cable reel to operate in a movement direction indicated by the direction signal and at a preset speed. The first motor control signal is corresponding to the movement direction indicated by the direction signal and the preset speed.

[0056] The preset speed is preset and corresponding to the operating speed of the hoisting mechanism in the emergency mode. When the spreader cable reel is controlled by the reel motor to operate in the movement direction indicated by the direction signal and at the preset speed, the spreader cable reel may drive a spreader cable to move synchronously with the hoisting mechanism. The controller may be a frequency converter, and the preset speed is set in the frequency converter. When receiving the start signal and the direction signal, the frequency converter may send a motor control signal to the reel motor, and control, by the reel motor, the spreader cable reel to operate in the movement direction indicated by the direction signal and at the preset speed. In this case, the reel motor is also a frequency converter.

[0057] The emergency signal may also be a stop signal. When receiving the stop signal, the controller sends a second motor control signal to the reel motor, and controls, by the reel motor, the spreader cable reel to stop operating.

[0058] Step S304, receiving a speed feedback signal sent by the reel motor.

[0059] The speed feedback signal is generated based on a current operating speed of the spreader cable reel, and the current operating speed of the spreader cable reel may be obtained through the speed feedback signal.

[0060] Step S306, determining whether a difference between the current operating speed indicated by the speed feedback signal and the preset speed is greater than a preset speed threshold; if the difference

between the current operating speed indicated by the speed feedback signal and the preset speed is greater than the preset speed threshold, performing Step S308; and if the difference between the current operating speed indicated by the speed feedback signal and the preset speed is less than or equal to the preset speed threshold, performing Step S306.

[0061] The preset speed is corresponding to the operating speed of the hoisting mechanism. When the difference between the current operating speed indicated by the speed feedback signal and the preset speed is greater than the preset speed threshold, it indicates that a speed difference between the spreader cable and the hoisting mechanism is greater than an allowable range (namely, the preset speed threshold), and the operating state of the spreader cable reel is controlled to be in a faulty state.

[0062] Step S308: sending a first fault signal to the control loop to control, by the control loop, the hoisting mechanism to stop operating. Generally, the control loop is connected to the hoisting mechanism, and when receiving the first fault signal sent by the controller, the control loop cuts off power supply to the hoisting mechanism, so that the hoisting mechanism stops operating.

[0063] According to the control method of a spreader cable reel provided in the embodiment of the present application, after the emergency signal sent by the control loop is received, the first motor control signal is sent to the reel motor, and the spreader cable reel is controlled by the reel motor to operate in the movement direction indicated by the direction signal and at the preset speed. In addition, the speed feedback signal sent by the reel motor is received, and when the difference between the current operating speed indicated by the speed feedback signal and the preset speed is greater than the preset speed threshold, the first fault signal is sent to the control loop, so that the control loop controls the hoisting mechanism to stop operating. This method improves control precision and reliability of synchronous movement of a spreader cable and the hoisting mechanism of the crane in the emergency operation mode, and avoids an accident caused by unsynchronization of the spreader cable and the hoisting mechanism.

[0064] An embodiment of the present application further provides another control method of a spreader cable reel, and the method is applied to a control loop of a hoisting mechanism. The control loop of the hoisting mechanism is connected to a controller, and the controller, a reel motor and the spreader cable reel are connected in sequence. As shown in FIG. 5, the method includes the following steps.

[0065] Step S400, when receiving an emergency mode instruction triggered by a user, sending an emergency signal to the controller to control, by the reel motor, an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter.

[0066] The control loop is usually connected to the hoisting mechanism, and the preset operating parameter includes a preset speed. When a first fault signal sent by the controller is received, the hoisting mechanism is controlled to stop operating. The first fault signal is sent by the controller after

the controller receives a speed feedback signal sent by the reel motor and determines that a difference between a current operating speed indicated by the speed feedback signal and a preset speed is greater than a preset speed threshold.

[0067] In addition, the control loop is further connected to a cable reel detection limit. The cable reel detection limit is used to detect a slack status of the spreader cable reel. When receiving a second fault signal sent by the cable reel detection limit, the control loop controls the hoisting mechanism to stop operating. The second fault signal is used to indicate that the spreader cable reel is in an over-loose state or an over-tight state.

[0068] According to the control method of a spreader cable reel provided in the embodiment of the present application when receiving the emergency mode instruction triggered by a user, the emergency signal is sent to the controller, so that the controller controls, by a reel motor, the operating state of the spreader cable reel based on the emergency signal and the preset operating parameter. This method improves control precision and reliability of synchronous movement of a spreader cable and the hoisting mechanism of the crane in the emergency operation mode, and reduces labor costs.

[0069] An embodiment of the present application further provides another control method of a spreader cable reel. The method is mainly applied to an emergency mode of a crane, and mainly resolves the following problems. In the emergency mode, how to automatically control the spreader cable reel (also referred to as "reel"), how to implement synchronous operation of the spreader cable reel and a hoisting mechanism, and how to protect an operating state of the spreader cable reel.

[0070] The method is implemented based on a control loop, an emergency motor, an emergency power supply, a reel motor, a reel frequency converter and a spreader cable reel power supply. A specific implementation process is shown in FIG. 6. A start signal and a direction signal that are only sent to the emergency motor in the related art are simultaneously sent to the reel frequency converter (equivalent to the controller in the foregoing embodiment, also called a frequency converter) by the control loop. The start signal and the direction signal are usually obtained by an operator by triggering the control loop. The frequency converter controls lifting or lowering speed of the reel by presetting a speed output (equivalent to the preset speed in the foregoing embodiment) that is the same as that of a hoisting emergency mechanism, so that the speed of the reel is synchronized with the speed of the hoisting mechanism, reducing control error or misoperation caused by a human operation. When a speed difference between the spreader cable reel and the hoisting mechanism exceeds an allowable range, or when a cable reel detection limit sends a signal indicating that the cable is too tight or too loose, a power supply of the emergency mechanism may be automatically cut off to ensure safe operation.

[0071] In the emergency mode, an operation of the hoisting mechanism is driven by the emergency motor, and directly controlled by a hardware circuit of the control loop. The control loop sends the start

signal and the direction signal (uplink or downlink) of the hoisting mechanism to the frequency converter of the spreader cable reel and uses the two signals as a start signal and a positive and negative signal of the frequency converter, to control start, stop and forward and reverse rotation of the frequency converter, respectively. The frequency converter controls lifting or lowering speed of the reel by presetting a speed output that is the same as that of the hoisting emergency mechanism, so that the operating speed of the reel is synchronized with that of the hoisting mechanism. When the speed difference between the spreader cable reel and the hoisting mechanism exceeds the allowable range (the speed feedback is implemented by the reel motor, and after receiving speed feedback, the reel frequency converter determines a difference between the operating speed of the reel and a preset speed, to obtain the speed difference between the spreader cable reel and the hoisting mechanism), or when a cable reel sends a signal indicating that the cable is too tight or too loose (the fault feedback is sent from the reel to the control loop of the emergency mechanism), the control loop may automatically switch operation of the hoisting mechanism and the spreader cable reel, to prevent the spreader cable from being damaged. The operating principle is shown in FIG. 7.

[0072] Based on a speed preset function of the reel frequency converter, the method implements automatic control of the spreader cable reel and detection of synchronous operation of the mechanism and the reel in the emergency mode, and protection of the spreader cable, reducing a quantity of on-site operators, and reducing labor costs.

[0073] Corresponding to the embodiments of the control method of a spreader cable reel described above, an embodiment of the present application further provides a control device of a spreader cable reel, and the device is disposed on a controller. The controller is connected to each of a reel motor and a control loop of a hoisting mechanism, and the reel motor is connected to the spreader cable reel. As shown in FIG. 8, the device includes the following modules.

[0074] A signal receiving module 700, configured to receive an emergency signal. Specifically, the signal receiving module 700 is configured to receive an emergency signal sent by the control loop.

[0075] A control module 702, configured to control an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter. Specifically, the control module 702 control, by the reel motor, the operating state of the spreader cable reel.

[0076] Further, the emergency signal includes a start signal and a direction signal, and the preset operating parameter includes a preset speed. The control module is further configured to: send a first motor control signal to the reel motor, and control, by the reel motor, the spreader cable reel to operate in a movement direction indicated by the direction signal and at the preset speed. The first motor control signal is corresponding to the movement direction indicated by the direction signal and the preset speed.

[0077] Further, the emergency signal includes a stop signal. The control module is further configured to: send a second motor control signal to the reel motor, and control, by the reel motor, the spreader

cable reel to stop operating.

[0078] Further, the control loop is also connected to the hoisting mechanism. The device further includes: a feedback signal receiving module, configured to receive a speed feedback signal sent by the reel motor; a speed determining module, configured to determine whether a difference between a current operating speed indicated by the speed feedback signal and the preset speed is greater than a preset speed threshold; and a fault signal sending module, configured to: if the difference is greater than the preset speed threshold, send a first fault signal to the control loop to control, by the control loop, the hoisting mechanism to stop operating.

[0079] The control device of a spreader cable reel according to the embodiment of the present application and the control method of a spreader cable reel according to the embodiments of the present application described above have the same technical features, so they may solve the same technical problems and achieve the same technical effects.

[0080] An embodiment of the present application further provides another control device of a spreader cable reel, and the device is disposed on a control loop of a hoisting mechanism. The control loop of the hoisting mechanism is connected to a controller, and the controller, a reel motor and the spreader cable reel are connected in sequence. As shown in FIG. 9, the device includes the following module.

[0081] A signal sending module 800, configured to: when receiving an emergency mode instruction triggered by a user, send an emergency signal to the controller, so that the controller controls, by the reel motor, an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter.

[0082] Further, the control loop is also connected to the hoisting mechanism, and the preset operating parameter includes a preset speed. The device further includes: a first fault control module, configured to: control the hoisting mechanism to stop operating when receiving a first fault signal sent by the controller. The first fault signal is sent by the controller after the controller receives a speed feedback signal sent by the reel motor and a difference between a current operating speed indicated by the speed feedback signal and a preset speed is greater than a preset speed threshold.

[0083] Further, the control loop is further connected to a cable reel detection limit and the hoisting mechanism; and the cable reel detection limit is used to detect a slack status of the spreader cable reel. The device further includes: a second fault control module, configured to: control the hoisting mechanism to stop operating when receiving a second fault signal sent by the cable reel detection limit. The second fault signal is used to indicate that the spreader cable reel is in an over-loose state or an over-tight state.

[0084] The control device of a spreader cable reel according to another embodiment of the present application and the control method of a spreader cable reel according to the embodiments of the present application described above have the same technical features, so they may solve the same technical

problems and achieve the same technical effects.

[0085] Based on the foregoing embodiments, an embodiment of the present application further provides a crane. As shown in FIG. 10, the crane includes a hoisting mechanism 90, a control loop 91, a controller 92, a reel motor 93 and a spreader cable reel 94 that are connected in sequence. The control device of a spreader cable reel is disposed on the controller; and the another control device of a spreader cable reel is disposed on the control loop.

[0086] A computer program product for the control method and device of a spreader cable reel, and the crane provided in the embodiments of the present application includes a computer-readable storage medium storing a program code. The program code includes instructions that may be used to perform the methods described in the foregoing method embodiments. For specific implementation, reference may be made to the method embodiments, which will not be repeated here.

[0087] It may be clearly understood by a person skilled in the art that, for the purpose of convenient and brief description, for a detailed working process of the foregoing system and device, reference may be made to a corresponding process in the foregoing method embodiments, which will not be repeated here.

[0088] In addition, in the description of the embodiments of the present application, unless otherwise clearly specified and limited, meanings of terms “install”, “connected to”, and “connection” should be understood in a board sense. For example, the connection may be a fixed connection, a removable connection, or an integral connection; may be a mechanical connection or an electrical connection; may be a direct connection or an indirect connection by an intermediate medium; or may be intercommunication between two components. A person of ordinary skill in the art may understand specific meanings of the foregoing terms in the present application based on a specific situation.

[0089] When the functions are implemented in a form of a software function unit and sold or used as an independent product, the functions may be stored in a computer-readable storage medium. Based on such understanding, the technical solution in the present application essentially, or the part contributing to the prior art, or some of the technical solutions may be embodied in a form of a software product. The computer software product is stored in a storage medium, and includes several instructions to enable a computer device (which may be a personal computer, a server, a network device, or the like) to perform all or some steps of the methods according to the embodiments of the present application. The foregoing storage medium includes: a USB flash disk, a mobile hard disk, a read-only memory (ROM), a random access memory (RAM), a magnetic disk, or an optical disk, and the like, which may store program codes.

[0090] In the description of the present application, it should be noted that the terms such as “center”, “top”, “bottom”, “left”, “right”, “vertical”, “horizontal”, “inner” and “outer” indicate the orientation or position relationships based on the drawings. These terms are merely intended to facilitate description

of the present application and simplify the description, rather than to indicate or imply that the mentioned device or element must have a specific orientation and must be constructed and operated in a specific orientation. Therefore, these terms should not be construed as a limitation to the present application. Moreover, the terms such as “first”, “second”, and “third” are used only for description and are not intended to indicate or imply relative importance.

[0091] Finally, it should be noted that the foregoing embodiments are merely specific implementations of the present application, and are used to describe rather than limiting the technical solutions of the present application. The protection scope of the present application is not limited thereto. Although the present application is described in detail with reference to the foregoing embodiments, it should be understood that a person of ordinary skill in the art may still make modifications to or readily figure out changes in the technical solutions described in the foregoing embodiments, or make equivalent substitutions on some technical features therein within the technical scope of the present application. These modifications, changes, or substitutions do not make the essence of the corresponding technical solutions depart from the spirit and scope of the technical solutions of the embodiments of the present application, and shall all fall within the protection scope of the present application. Therefore, the protection scope of the present application shall be subject to the protection scope of the claims.

## What is claimed is:

1. A control method of a spreader cable reel, wherein the method is applied to a controller of the spreader cable reel, wherein the controller is connected to each of a reel motor and a control loop of a hoisting mechanism, the reel motor is connected to the spreader cable reel, and the method comprises:

receiving an emergency signal; and

controlling an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter;

wherein the receiving an emergency signal comprises:

receiving an emergency signal sent by the control loop, wherein the emergency signal comprises a start signal and a direction signal, the preset operating parameter comprises a preset speed; and

the controlling an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter comprises:

sending a first motor control signal to the reel motor, and controlling, by the reel motor, the spreader cable reel to operate in a movement direction indicated by the direction signal and at the preset speed, wherein the first motor control signal is corresponding to the movement direction indicated by the direction signal and the preset speed.

2. The method according to claim 1, wherein the emergency signal comprises a stop signal, and

the controlling an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter comprises:

controlling the spreader cable reel to stop operating.

3. The method according to claim 1, wherein the emergency signal comprises a stop signal, and

the controlling, by the reel motor, the operating state of the spreader cable reel based on the emergency signal and the preset operating parameter comprises:

sending a second motor control signal to the reel motor, and controlling, by the reel motor, the spreader cable reel to stop operating.

4. The method according to any one of claims 1 to 3, further comprising:

receiving a speed feedback signal; and

sending a first fault signal when a difference between a current operating speed indicated by the speed feedback signal and the preset speed is greater than a preset speed threshold.

5. The method according to claim 1, wherein the control loop is further connected to the hoisting mechanism, and the method further comprises:

receiving a speed feedback signal sent by the reel motor; and

when a difference between a current operating speed indicated by the speed feedback signal and the preset speed is greater than a preset speed threshold, sending a first fault signal to the control loop to control, by the control loop, the hoisting mechanism to stop operating.

6. A control method of a spreader cable reel, wherein the method is applied to a control loop of a hoisting mechanism, the control loop of the hoisting mechanism is connected to a controller, the controller, a reel motor and the spreader cable reel are connected in sequence, and the method comprises:

when receiving an emergency mode instruction, sending an emergency signal to the controller to control, by the controller, an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter,

wherein the emergency signal comprises a start signal and a direction signal, and the preset operating parameter comprises a preset speed;

the sending an emergency signal to the controller to control, by the controller, an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter comprises: sending an emergency signal to the controller to send a first motor control signal to the reel motor by the controller, and controlling, by the reel motor, the spreader cable reel to operate in a movement direction indicated by the direction signal and at the preset speed, wherein the first motor control signal is corresponding to the movement direction indicated by the direction signal and the preset speed.

7. The method according to claim 6, wherein the control loop is further connected to the hoisting mechanism, and the method further comprises:

controlling the hoisting mechanism to stop operating when receiving a first fault signal sent by the controller; and

wherein the first fault signal is sent by the controller after the controller receives a speed feedback signal sent by the reel motor and a difference between a current operating speed indicated by the speed feedback signal and the preset speed is greater than a preset speed threshold.

8. The method according to claim 6 or 7, wherein the control loop is further connected to a cable reel detection limit and the hoisting mechanism, the cable reel detection limit is used to detect a slack status of the spreader cable reel, and the method further comprises:

controlling the hoisting mechanism to stop operating when receiving a second fault signal sent by the cable reel detection limit, wherein the second fault signal is used to indicate that the

spreader cable reel is in an over-loose state or an over-tight state.

9. A control device of a spreader cable reel, wherein the device is disposed on a controller of the spreader cable reel, the controller is connected to each of a reel motor and a control loop of a hoisting mechanism, the reel motor is connected to the spreader cable reel, and the device comprises:

a signal receiving module, configured to receive an emergency signal sent by the control loop; and

a control module, configured to control an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter, wherein the emergency signal comprises a start signal and a direction signal, the preset operating parameter comprises a preset speed,

wherein the control module is further configured to: send a first motor control signal to the reel motor, and control, by the reel motor, the spreader cable reel to operate in a movement direction indicated by the direction signal and at the preset speed, wherein the first motor control signal is corresponding to the movement direction indicated by the direction signal and the preset speed.

10. The device according to claim 9, wherein the emergency signal comprises a stop signal, and

the control module is configured to control the spreader cable reel to stop operating.

11. The device according to claim 9, wherein the emergency signal comprises a stop signal, and

the control module is configured to: send a second motor control signal to the reel motor, and control, by the reel motor, the spreader cable reel to stop operating.

12. The device according to any one of claims 9 to 11, further comprising:

a feedback signal receiving module, configured to receive a speed feedback signal; and

a fault signal sending module, configured to send a first fault signal when a difference between a current operating speed indicated by the speed feedback signal and the preset speed is greater than a preset speed threshold.

13. A system comprising a control device and a controller of a spreader cable reel, wherein the control device is disposed on a control loop of a hoisting mechanism, the control loop of the hoisting mechanism is connected to the controller, the controller, a reel motor and the spreader cable reel are connected in sequence, and the control device comprises:

a signal sending module, configured to: when receiving an emergency mode instruction, send an emergency signal to the controller to control, by the controller, an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter,

wherein the emergency signal comprises a start signal and a direction signal, and the preset operating parameter comprises a preset speed;

wherein the signal sending module is further configured to send an emergency signal to the controller to send, by the controller, a first motor control signal to the reel motor, and control, by the reel motor, the spreader cable reel to operate in a movement direction indicated by the direction signal and at the preset speed, wherein the first motor control signal is corresponding to the movement direction indicated by the direction signal and the preset speed.

14. A crane, wherein the crane comprises a hoisting mechanism, a control loop, a controller, a reel motor and a spreader cable reel that are connected in sequence, the controller comprises the control device according to any one of claims 9 to 12, and the control loop comprises the control device according to claim 13.

15. A computer-readable storage medium, wherein the computer-readable storage medium stores a computer program, and the computer program is used to perform the method according to any one of claims 1 to 8.