

(19)



(11)

EP 4 200 243 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:

25.12.2024 Bulletin 2024/52

(21) Application number: **21925091.7**

(22) Date of filing: **30.09.2021**

(51) International Patent Classification (IPC):

B66C 1/02 <small>(2006.01)</small>	B66C 11/06 <small>(2006.01)</small>
B66C 13/22 <small>(2006.01)</small>	B66C 13/30 <small>(2006.01)</small>
B66C 13/40 <small>(2006.01)</small>	B66D 1/56 <small>(2006.01)</small>
B66D 3/18 <small>(2006.01)</small>	B66D 1/38 <small>(2006.01)</small>
B66D 1/54 <small>(2006.01)</small>	B66D 3/20 <small>(2006.01)</small>
B66D 3/24 <small>(2006.01)</small>	

(52) Cooperative Patent Classification (CPC):

B66D 3/20; B66D 1/38; B66D 1/54; B66D 3/18; B66D 3/24

(86) International application number:

PCT/TR2021/050997

(87) International publication number:

WO 2023/055309 (06.04.2023 Gazette 2023/14)

(54) **ERGONOMIC LIFTING SYSTEM**

ERGONOMISCHES HUBSYSTEM

SYSTÈME DE LEVAGE ERGONOMIQUE

(84) Designated Contracting States:

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(43) Date of publication of application:

28.06.2023 Bulletin 2023/26

(73) Proprietor: **Guralp Vinc Ve Makina Konstruksiyon Sanayi Ve Ticaret Anonim Sirketi**
Izmir (TR)

(72) Inventors:

- **KURTMEN, Erdem**
Torbali/Izmir (TR)
- **NALBANT, Ugur**
Torbali/Izmir (TR)

(74) Representative: **Yamankaradeniz, Kemal**

Destek Patent Inc.
Maslak Mah.
Büyükdere Cad., No: 243
Kat: 13, Spine Tower, Sarıyer
34485 Istanbul (TR)

(56) References cited:

EP-A2- 0 257 647	EP-A2- 1 666 400
WO-A1-00/69771	WO-A2-2006/016993
WO-A2-2007/084553	WO-A2-2009/011859
CN-A- 101 337 645	CN-A- 111 606 235
CN-A- 111 634 836	JP-A- 2020 158 255
KR-A- 20210 088 972	US-A- 3 545 725

EP 4 200 243 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

Technical Field

[0001] The invention relates to an ergonomic lifting system used to move any load from one position to another by applying a small amount of force with human touch.

[0002] The invention particularly relates to an ergonomic lifting system designed to place the load cell in the lifting interface, which is directly connected to the load with the hook and allows the user to move the load in the direction he wants by moving the handle on the lifting interface up and down, or by touching the lifted load and applying force up and down.

State of the Art

[0003] Unlike cranes, manipulators used to move any load from one location to another by balancing the weight of the load. The main purpose of the manipulators is to ensure that required handling operation is completed by the operator with little effort.

[0004] Manipulators are divided into electrical and pneumatic systems. Pneumatic systems are systems that have been used for a long time in the current art and have a certain reliability and volume. However, since the use of pneumatic systems is difficult, technologically inadequate and high cost, market trending to electrical systems. Electric systems, on the other hand, focus on solving the problems of pneumatic systems and came up with a new handle and rope systems compared to the grippers used in pneumatic systems. Thanks to the new handle design used in electrical systems, sensitive and ergonomic solutions have been achieved.

[0005] The handles used in electrical systems are divided into two as load control can be done by touching and without touching the load. The handles, which load control cannot be archived by touching the load, handle control can be very precise. But they are lacking the ability of ergonomic control achieved by the touching the load. The handles, which allow touching the load, are divided into two as movable and fixed. In fixed handles, the user cannot be given an accurate control sensitivity and ergonomics due to the fact that the handle is not movable. There are incomplete and faulty solutions in systems with movable handles. In the first of these solutions, there is a possibility that the value read on the load cell may not reflect the truth, since the load cell is not in the lifting interface part. In the second solution, since the movement of the system is based on reading the linear movement of the handle with the help of a magnetic core, the system is affected by the magnetic field in the environment in which it is used. In the third solution, different sensitivity and response are encountered in different directions because the movable handle moves in different lengths in the up and down directions. In this case, it is possible for the user to receive false feedback in different

directions. In the fourth solution, as a spring is used in the movable handle, the probability of the system to be diverted from its middle position increases, and since the whole process is carried out with a single spring, the error rate increases as the life of the spring decreases. In the fifth solution, since linear bearings are not used in the bearing systems that provide linear movement, the sliding movement of the handle is not healthy.

[0006] Patents found in the literature related to ergonomic lifting system are provided below.

[0007] ITUD20040226 relates to an apparatus for lifting and carrying loads. Said apparatus basically consists of a beam connected by two rods equipped with a pair of wheels and a pair that can slide along the rails perpendicular to each beam. There is a motor on the rods that turns the wheels. A slider, which is moved along the beam in two directions by means of a reversing motor, is connected to the beam. The slider is associated with a control device which is equipped with a crane-like lifting element associated with a cable containing a hook and can be managed by the operator via the cable. The control device is connected to an electronic control unit that can selectively operate the motor and reversing motor to slide the beam along the rails and the slider. Thus, the horizontal movement of the lifting element and therefore the load connected to the cable is ensured. Said control device comprises a housing body through which the cable passes vertically and in which four wheels are mounted at an angle of 90° to each other. The pins or shafts of said wheels are mounted at the end of the load cells fixed inside the housing body. Each load cell senses the force transmitted to the corresponding wheel by the cable moved to an inclined position and sends an electrical output signal proportional to the said force to the management and control unit of the motors. The lower end of the cable has a handle for the operator to manage the controller. When the operator, holding the hand on the handle, pushes the cable in the direction in which the object is to be moved, the load cells inside the control device transmit a relative signal to the management and control unit of the motors, and the movement of the beam and/or slider to relocate the object can be done. In the invention in question, since the load cells that sense the load force are not in the handle, there is a possibility that the value read in the load cell may not reflect the real value. In addition, since the handle system is not movable, manual control is not ergonomic. This leads to the inadequacy to obtain a stable system with the desired sensitivity.

[0008] US6386513 relates to a human power amplifier for lifting load. In the present invention, it includes an end effector that is gripped by the operator and attached to the load. The end effector is connected by a rope, wire, cable, belt to a pulley or a drum driven by an actuator to raise or lower the load. The end effector includes a force sensor that measures the vertical force exerted by the operator on the end effector and transmits a signal to a controller. The controller and actuator are configured so

that a predetermined percentage of the force required to raise or lower the load is applied by the actuator and the remaining force is provided by the operator. In the present invention, the controller controlling the operation of the actuator is programmed to respond to the first signal from the sensor representing the force exerted by the operator and the second signal representing the pulling force on the line, causing the actuator to rotate the pulley to raise and lower the line. However, in the invention in question, the possibility of the system to be incorrectly in the middle position increases due to the use of one spring in the end effector, and since the whole process is carried out with a single spring, the error rate increases as the life of the spring decreases.

[0009] US6622990 relates to a human power amplifier for lifting load. In the present invention, it includes an end effector that is gripped by the operator and attached to the load. The end effector is connected by a rope, wire, cable, belt to a pulley or a drum driven by an actuator to raise or lower the load. The end effector includes a force sensor that measures the vertical force exerted by the operator on the end effector and transmits a signal to a controller. The controller and actuator are configured so that a predetermined percentage of the force required to raise or lower the load is applied by the actuator and the remaining force is provided by the operator. The controller of the present invention is designed to have an output terminal for controlling the rotational speed of the pulley as a function of the first and second signals. However, in the invention in question, the possibility of the system to be incorrectly in the middle position increases due to the use of one spring in the end effector, and since the whole process is carried out with a single spring, the error rate increases as the life of the spring decreases.

[0010] US6886812 relates to a human power amplifier for lifting load. In the present invention, it includes an end effector that is gripped by the operator and attached to the load. The end effector is connected by a rope, wire, cable, belt to a pulley or a drum driven by an actuator to raise or lower the load. The end effector includes a force sensor that measures the vertical force exerted by the operator on the end effector and transmits a signal to a controller. The controller and actuator are configured so that a predetermined percentage of the force required to raise or lower the load is applied by the actuator and the remaining force is provided by the operator. In the present invention, along with a sensor located close to the end effector, a load force estimator is used to estimate the operator input not close to the end effector, which sends a signal to the controller to estimate the force applied by the operator, and the controller's estimated load force signal and the force signal applied by the operator are used. It is provided to control the actuator as a function. However, in the invention in question, the possibility of the system to be inaccurate to the middle position increases due to the use of one spring in the end effector, and since the whole process is carried out with a single spring, the error rate increases as the life of the spring

decreases.

[0011] US7559533 relates to a lifting actuator. Said lift actuator basically comprises a controller and a pulley with a cable wound on the actuator to support a load at the free end of a cable. Said pulley is driven by a motor and a related transmission. A load interface that generates a signal to the controller is connected to the end of said cable. The controller allows the actuator to raise and lower the load. A load cell was used to sense only a compression force in response to the load applied to the cable. Said load cell transmits a load signal to the controller. The controller enables actuator operation as a function of the load signal. However, in the present invention, since the load cell is positioned in the actuator, there is a possibility that the value read on the load cell may not reflect the real value. This leads to the inability to obtain a stable system with the desired sensitivity. In addition, since the mechanical construction made for the load sensor located in the actuator to read the suspended load in the system is rotatable, the possibility of ruptures in the construction due to fatigue will be high, and it contains a risk in terms of human safety. Apart from this, since the handle on the load interface measures the movement with the magnetic field, there is a risk of being affected by the magnetic field coming from the external environments and there is a possibility of undesired motions in terms of control sensitivity.

[0012] Further, the document KR20210088972A discloses a an ergonomic lifting system according to the preamble of claim 1.

[0013] As a result, due to the abovementioned disadvantages and insufficiency of the current solutions regarding the subject matter, development is required to be made in the relevant technical field.

Purpose of the Invention

[0014] The present invention relates to an ergonomic lifting system that eliminates the disadvantages mentioned above and brings new advantages to the related technical field.

[0015] The main object of the invention is to enable the user to move the load in the desired direction by moving the handle up and down on the lifting interface, or by touching the load and applying force in the up and down direction.

[0016] An object of the invention is to obtain an ergonomic lifting system that contains the load cell in the load interface so that load and the load cell are directly connected.

[0017] Another object of the invention is to obtain ergonomic lifting system that detects linear movement of the handle on the lifting interface with linear potentiometer instead of measuring it with magnetic so that system has a higher resolution with 0.01 mm resolution and is not affected by the magnetic field coming from the external environment.

[0018] Another object of the invention is to obtain a

sensitive and safe ergonomic lifting system that allows touching the load and is not magnetically affected by external environments.

[0019] Another object of the invention is to obtain a mechanically long-lasting, stable and reliable ergonomic lifting system by means of linear bearings and springs in the handle.

[0020] In order to fulfill all the purposes stated above and which may arise from the detailed explanation, the invention, according to claim 1, respectively the ergonomic lifting system, comprises a lifting unit containing a motor that controls the up and down movements of the load, a gearbox that increases the amount of torque transmitted from the motor on the motor, and a drum that the wire rope on which the load is carried is wound. Further, the lifting system includes a lifting interface comprising, among others,

- a lower connection apparatus,
- a rope connection apparatus connected to the rope which is wound on the drum in the lifting interface to enable the user to control the load and carried by the lifting unit,
- the shell, which is connected to the wire rope wound on the drum by means of the rope connection apparatus on the upper side and with the lower connection apparatus on the lower part, where the apparatuses carrying the load are connected,
- a load cell that connects to the rope connection apparatus from its upper end, passes through the shell on the vertical axis and measures the weight of the lifted load and the force exerted by the user on the load and transmits it to the controller so that enables the load to be moved up or down by the help of the motor,
- the handle which is mounted under the shell and enables the load to be moved up and down by moving it under the load cell by the user's hand moving the handle up and down,
- linear bearing bedding the handle so that it can move up and down under the shell,
- the upper spring, that is connected to the upper end of the handle which is moved up or down, brings the handle to its middle position under the shell after the user is released, and creates a reaction force for the user during these movements,
- the lower spring, that is connected to the lower end of the handle which is moved up or down, brings the handle to its middle position under the shell after the user is released, and creates a reaction force for the user during these movements,
- an object sensor located on the shell and detecting whether the user's hand is on the handle,
- a lifting interface linear potentiometer, which is connected with the shell and the handle, and which detects the up and down movement of the handle and transmits it to the controller so that load can be moved up or down by the motor.

[0021] The structural and characteristic features of the present invention will be understood clearly by the following drawings and the detailed description made with reference to these drawings and therefore the evaluation shall be made by taking these figures and the detailed description into consideration.

Figures for a Better Understanding of the Invention

[0022]

Figure 1 is the general perspective view of the ergonomic lifting system according to the invention.

Figure 2 is the view of the lifting unit of the ergonomic lifting system according to the invention.

Figure 3a is the rear respective view of the lifting interface of the ergonomic lifting system according to the invention.

Figure 3b is the front respective view of the lifting interface of the ergonomic lifting system according to the invention.

Figure 4a is the cross-sectional view of the lifting interface of the ergonomic lifting system according to the invention.

Figure 4b is the front view of the lifting interface of the ergonomic lifting system according to the invention.

Figure 4c is the side view of the lifting interface of the ergonomic lifting system according to the invention.

Figure 5a is the front general perspective view of the ergonomic lifting system according to the invention.

Figure 5b is the rear general perspective view of the ergonomic lifting system according to the invention.

Description of the References

[0023]

100. Lifting interface

101. Motor

102. Gearbox

103. Drum

104. Wire rope guide

- 105. Turn counter
- 106. Linear potentiometer
- 200. Lifting interface
- 201. Shell
- 202. Rope connection apparatus
- 203. Load cell
- 204. Handle
- 205. Linear bearing
- 206. Upper spring
- 207. Lower spring
- 208. Object sensor
- 209. interface linear potentiometer
- 210. Lower connection apparatus
- 211. Speed adjustment button
- 212. Emergency button
- 213. Float mode button

Detailed Description of the Invention

[0024] In this detailed description, the preferred alternatives of the ergonomic lifting system of the invention is described only for clarifying the subject matter in a manner such that no limiting effect is created.

[0025] In Figure 1, the general view of the ergonomic lifting system, which is the subject of the invention, is given. Accordingly, the ergonomic lifting system in its most basic form; It consists of two parts, the lifting unit (100) and the lifting interface (200), which are connected to each other with a wire rope.

[0026] As seen in Figure 2, the lifting unit (100) is basically includes, the motor (101) that controls the up and down moment of the load, the gearbox (102) that increases the torque from the motor (101) on the motor (101), the drum (103) which the load carrying wire rope wrapped that is on the gearbox (102), the turn counter (105) which measures the amount of rope wrapped around the drum or unwrapped from the drum (103) next to the drum (103), and sends a signal to the controller to stop the ergonomic lifting system when the rope reaches the lower and upper limits, the wire rope guide (104), which ensures smooth winding or unwinding of the wire rope during the winding or unwinding of the wire rope on the drum (103), a linear potentiometer (106), which is connected to the wire rope

guide (104) and to the drum (103), and provides the measurement of the amount of rope wrapped or released from the drum (103) by measuring the lateral movement of the wire rope guide (104) on the drum (103) in the direction of the drum (103) length.

[0027] In the ergonomic lifting system, which is the subject of the invention, the load is carried on the lifting unit (100). The lifting unit (100) is mounted in different orientations in different places to carry out the lifting and transporting process.

[0028] The motor (101) in the lifting unit (100) provides control of the up and down movement of the load. There is a gearbox (102) on the motor (101) to increase the amount of torque transmitted from the motor (101), a drum (103) on which the rope is wrapped that is connected to the gearbox (102), and a turn counter (105) next to the drum (103). The turn counter (105) provides the measurement of the amount of rope wound around the drum (103) or released from the drum (103) and sending the signal to the controller, which stops the ergonomic lifting system when it reaches the lower or upper lifting limit of the ergonomic lifting system.

[0029] A linear potentiometer (106) is connected to the abovementioned drum (103) and the wire rope guide (104) that provide safe and controlled winding or releasing of the rope that is wound on or released from the drum (103). During these movements, the displacement movements of the wire rope guide (104) are measured by the linear potentiometer (106), and thus the amount of rope wound from the drum (103) or released from the drum (103) can be calculated.

[0030] Figures 3a and 3b show the lifting interface (200). The lifting interface (200) helps the user to control the load that lifted and transported by the lifting unit (100). The lifting interface (200) is consist of, the rope connection apparatus (202) that provides the connection of the lifting interface (200) to the lifting unit (100) with the wire rope that wounds on the drum (103), the shell (201) with the rope connection apparatus (202) on the top, the load cell (203), which is connected to the rope connection apparatus (202) from its upper end, passes through the shell (201) on the vertical axis and measures the weight of the lifted load and the force applied by the user to the load and transmits it to the controller, a handle (204) that enables the load to be moved up and down by moving up and down that located under the load cell (203), a linear bearing (205) that supports the handle so that it can move up and down under the load cell (203), the upper spring (206), which brings the handle (204) to its middle position under the load cell (203) after the handle (204), which is moved up or down, is released by the user, and creates a reaction force for the user during these movements, the lower spring (207), which brings the handle (204) to its middle position under the load cell (203) after the handle (204), which is moved up or down, is released by the user, and creates a reaction force for the user during these movements, the object sensor (208) that detects whether the user's hand is on the han-

dle (204), the interface linear potentiometer (209) that detects the up-down movement of the handle (204) and transmits it to the controller, the lower connection apparatus (210) to which the apparatus carrying the load is connected by connecting under the handle (204), a

speed adjustment button (211) that allows the operating speed of the motor (101) to be adjusted, an emergency stop button (212) that allows the ergonomic lifting system to stop in an emergency, and a floating mode button (213) that allows the ergonomic lifting system to switch to floating mode.

[0031] Figures 4a, 4b and 4c show the shell (201) which has a rope connection apparatus (202) on its upper side. Said rope connection apparatus (202) provides connection with the lifting interface (200) to the lifting unit (100) by the help of the wire rope that wound on the drum (103).

[0032] A load cell (203) is passed through the shell (201) on the vertical axis and said load cell (203) is connected to the rope connection apparatus (202) from its upper end. The load cell (203) measures that the weight of the lifted load and the force applied by the user to the load, and transmit the data to the controller. Thus, the load is moved up or down by the motor (101). The handle (204) is supported by a linear bearing (205) located under the shell (201) so that it can move up and down. Said handle (204) moves up and down under the load cell (203), so that the load can be moved up and down.

[0033] An upper spring (206) is attached to the upper end of the handle (204), which brings the handle (204) to its middle position under the load cell (203) after the user releases the handle (204), which is moved up or down manually by the user, and creates a reaction force for the user during these movements. A lower spring (207) is attached to the lower end of the handle (204), which brings the handle (204) to its middle position under the load cell (203) after the user releases the handle (204), which is moved up or down manually by the user, and creates a reaction force for the user during these movements.

[0034] An object sensor (208) located on the shell (201) that detects whether the user's hand is on the handle (204). The up and down movement of the handle (204) is detected and transmitted to the controller by means of the interface linear potentiometer (209) connected with the shell (201) and the handle (204).

[0035] In order to carry the load in the ergonomic lifting system, a lower connection apparatus (210) is connected to the bottom of the shell (201), to which apparatus such as hooks carrying the load are attached.

[0036] A speed adjustment button (211) located on the shell (201) that allows the speed of the ergonomic lifting system to be adjusted, an emergency stop button (212) that allows the ergonomic lifting system to stop in an emergency, and a floating mode button (213) that allows the ergonomic lifting system to switch to floating mode.

[0037] *The working principle of the ergonomic lifting system is as follows;*

To lift the load for the first, the user connects the load to the lower connection apparatus (210) then holds and moves the handle (204) upward direction. The upward movement of the handle under the load cell (203) is detected by the interface linear potentiometer (209) and transmitted to the controller, and the load is lifted upwards on the ergonomic lifting system by winding the wire rope on the drum (103). While the user's hand is on the handle (204), it is detected by the object sensor (208). The ergonomic lifting system does not move without the user's hand presence.

[0038] The farther the user pulls the handle (204) from its middle position under the load cell (203), the faster the ergonomic lifting system moves the load. During the movements of the handle (204), the upper spring (206) and the lower spring (207) create a reaction force to the user and ensure that the handle (204) is brought to its middle position under the load cell (203). Since the handle (204) is moved by a linear bearing (205) under the load cell (203), the forces of the upper spring (206) and lower spring (207) are transmitted to the user in a proper way.

[0039] After the user lifts the load by moving the handle (204), the user activates the floating mode by pressing the floating mode button (2013). When the floating mode is activated, the load cell (203) reads the weight of the lifted load and transmits it to the controller. By touching the load, the user changes the weight data read on the load cell and thus the lifted load moves. The upward or downward movement of the load determined by the direction of the applied force which read by the load cell (203) that transmitted to controller, by using the motor (101). The lifting speed of the load varies as much as the amount of force applied by the user. At the same time, the speed adjustment of the ergonomic lifting system can be done with the speed adjustment button (211).

Claims

1. An ergonomic lifting system for lift and carry any load by applying a low force with human touch, controls the up and down movements of the lifted load, **comprising;**

- a lifting unit (100) comprises:

- a motor (101) that provides torque,
- a gearbox (102) that increases the torque from the motor (101),
- a drum (103) which a wire rope is wrapped on,
- a wire rope guide (104) that ensures that the wire rope is wrapped in or released from the drum (103) in a controlled and safe manner during the winding or unwinding of the wire rope on the drum (103),

- a lifting interface (200) which is connected to the lifting unit (100) and comprises:

- a lower connection apparatus (210) which is connected to the bottom of a shell (201) wherein the load is attached,
- a rope connection apparatus (202) connected to the rope wound on the drum (103) in the lifting interface (200) to enable the user to control the load lifted and carried by the lifting unit (100),
- said shell (201), which is connected to the wire rope wound on the drum (103) by means of the rope connection apparatus (202) on the upper side and with the lower connection apparatus (210) on the lower part, where the apparatuses carrying the load are connected,
- a load cell (203) that connects to the rope connection apparatus (202) from its upper end, passes through the shell (201) on the vertical axis and measures the weight of the lifted load and the force exerted by the user on the load, transmits it to the controller and enables the load to be moved up or down by the help of the motor (101),
- a handle (204), which is mounted under the shell (201) and enables the load to be moved up and down by the user as the user's hand holds and moves the handle (204) up and down located under the load cell (203).
- an upper spring (206), which is connected to the upper end of the handle (204) that can be moved up or down, brings the handle (204) to its middle position under the shell (201) after the user is released the handle (204), and creates a reaction force for the user during these movements,
- a lower spring (207), which is connected to the lower end of the handle (204) that can be moved up or down, brings the handle (204) to its middle position under the shell (201) after the user is released the handle (204), and creates a reaction force for the user during these movements,

the lifting system being **characterized in that** the lifting interface further comprises

- an interface linear potentiometer (209), which is associated with the shell (201) and the handle (204) located inside the load interface (200), detects the up and down movement of the handle (204) and transmits it to the controller and enables the load to be moved up or down by the motor (101),
- an object sensor (208) located on the said shell

(201) and detecting whether the user's hand is on the handle (204).

2. The ergonomic lifting system according to claim 1, **characterized in that** said lifting interface (200) includes the load cell (203) that reads the force applied by the user by means of touching the load and the weight of the lifted load, transmits it to the controller wherein the up and down movement speed of the ergonomic lifting system changes according to the force applied by the user to the load.
3. The ergonomic lifting system according to claim 1, **characterized by comprising** a linear potentiometer (106) that is connected to the said wire rope guide (104) and provides the calculation of the amount of rope wound on or released from the drum (103) by measuring the lateral slip of the wire rope guide (104) on the drum (103) in the direction of the drum (103) length.
4. The ergonomic lifting system according to claim 1, **characterized in that** said lifting interface (200) includes a speed adjustment button (211) located on the shell (201) and allowing the speed of the ergonomic lifting system to be adjusted.
5. The ergonomic lifting system according to claim 1, **characterized in that** said lifting interface (200) includes an emergency stop button (212) located on the shell (201) and enabling the ergonomic lifting system to stop in case of emergency.
6. The ergonomic lifting system according to claim 1, **characterized in that** said lifting interface (200) includes a floating mode button (213) located on the shell (201) and enabling the ergonomic lifting system to switch to floating mode.
7. The ergonomic lifting system according to claim 1, **characterized in that** said lifting unit (100) includes a turn counter (105), which is located next to the drum (103) and connected to the drum (103) thus it can measure the rotation of the drum (103), so that the amount of wire rope wrapped around or released from the drum (103) can be calculated, and when the ergonomic lifting system reaches the lower or upper lifting limit, it sends a signal to the controller to stop the ergonomic lifting system.
8. The ergonomic lifting system according to claim 1, **characterized by comprising** a linear bearing (205) that supports the said handle (204) under the shell (201) so that it can move up and down.

Patentansprüche

1. Ergonomisches Hubsystem zum Heben und Tragen beliebiger Lasten durch Anwenden einer geringen Kraft mit menschlicher Berührung, das die Auf- und Ab-Bewegungen der angehobenen Last steuert, **umfassend**;

- eine Hubeinheit (100), die umfasst:

- einen Motor (101), der Drehmoment bereitstellt,
- ein Getriebe (102), das das Drehmoment vom Motor (101) erhöht,
- eine Trommel (103), auf die ein Drahtseil gewickelt ist,
- eine Drahtseilführung (104), die sicherstellt, dass das Drahtseil während des Aufwickelns oder Abwickelns des Drahtseils auf der Trommel (103) auf kontrollierte und sichere Weise in die Trommel (103) gewickelt oder von dieser freigegeben wird,

- eine Hubschnittstelle (200), die mit der Hubeinheit (100) verbunden ist und umfasst:

- eine untere Verbindungsvorrichtung (210), die mit der Unterseite eines Gehäuses (201) verbunden ist, wobei die Last befestigt ist,
- eine Seilverbindungsvorrichtung (202), die mit dem auf der Trommel (103) in der Hubschnittstelle (200) aufgewickelten Seil verbunden ist, um dem Benutzer zu ermöglichen, die von der Hubeinheit (100) angehobene und getragene Last zu steuern,
- das Gehäuse (201), das mit dem auf der Trommel (103) aufgewickelten Drahtseil mittels der Seilverbindungsvorrichtung (202) auf der Oberseite und mit der unteren Verbindungsvorrichtung (210) auf der Unterseite verbunden ist, wo die die Last tragenden Vorrichtungen verbunden sind,
- eine Wägezelle (203), die von ihrem oberen Ende her mit der Seilverbindungsvorrichtung (202) verbunden ist, auf der vertikalen Achse durch das Gehäuse (201) verläuft und das Gewicht der angehobenen Last und die vom Benutzer auf die Last ausgeübte Kraft misst, diese an das Steuergerät überträgt und es ermöglicht, die Last mit Hilfe des Motors (101) auf oder ab zu bewegen,
- einen Griff (204), der unter dem Gehäuse (201) montiert ist und es ermöglicht, die Last durch den Benutzer auf und ab zu bewegen, wenn die Hand des Benutzers den Griff (204), der sich unter der Wägezelle (203)

befindet, hält und auf und ab bewegt

- eine obere Feder (206), die mit dem oberen Ende des Griffs (204) verbunden ist, der auf oder ab bewegt werden kann, bringt den Griff (204) in seine Mittelstellung unter dem Gehäuse (201), nachdem der Benutzer den Griff (204) losgelassen hat, und erzeugt während dieser Bewegungen eine Reaktionskraft für den Benutzer,
- eine untere Feder (207), die mit dem unteren Ende des Griffs (204) verbunden ist, der auf oder ab bewegt werden kann, bringt den Griff (204) in seine Mittelstellung unter dem Gehäuse (201), nachdem der Benutzer den Griff (204) losgelassen hat, und erzeugt während dieser Bewegungen eine Reaktionskraft für den Benutzer, wobei das Hubsystem **dadurch gekennzeichnet ist, dass** die Hubschnittstelle ferner umfasst
 - ein Schnittstellenlinearpotentiometer (209), das mit dem Gehäuse (201) und dem Griff (204) in Verbindung steht, der sich im Inneren der Lastschnittstelle (200) befindet, erfasst die Auf- und Ab-Bewegung des Griffs (204) und überträgt sie an das Steuergerät und ermöglicht es, die Last durch den Motor (101) auf oder ab zu bewegen,
 - einen Objektsensor (208), der sich am Gehäuse (201) befindet und erfasst, ob sich die Hand des Benutzers am Griff (204) befindet.

2. Ergonomisches Hubsystem gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Hubschnittstelle (200) die Wägezelle (203) beinhaltet, die die vom Benutzer durch Berühren der Last ausgeübte Kraft und das Gewicht der angehobenen Last liest und an das Steuergerät überträgt, wobei sich die Auf- und Ab-Bewegungsgeschwindigkeit des ergonomischen Hubsystems gemäß der vom Benutzer auf die Last ausgeübten Kraft ändert.

3. Ergonomisches Hubsystem gemäß Anspruch 1, **gekennzeichnet durch das Umfassen** eines Linearpotentiometers (106), das mit der Drahtseilführung (104) verbunden ist und die Berechnung der auf die Trommel (103) aufgewickelten oder von ihr freigegebenen Seilmenge durch Messen des seitlichen Schlupfs der Drahtseilführung (104) auf der Trommel (103) in Richtung der Länge der Trommel (103) bereitstellt.

4. Ergonomisches Hubsystem gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Hubschnittstelle (200) einen Geschwindigkeitseinstell-Knopf (211) beinhaltet, der sich am Gehäuse (201) befindet und es ermöglicht, die Geschwindigkeit des ergonomischen Hubsystems einzustellen.

5. Ergonomisches Hubsystem gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Hubschnittstelle (200) einen Not-Aus-Knopf (212) beinhaltet, der sich am Gehäuse (201) befindet und im Notfall ein Anhalten des ergonomischen Hubsystems ermöglicht. 5
6. Ergonomisches Hubsystem gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Hubschnittstelle (200) einen Schwebemodus-Knopf (213) beinhaltet, der sich am Gehäuse (201) befindet und ein Umschalten des ergonomischen Hubsystems in den Schwebemodus ermöglicht. 10
7. Ergonomisches Hubsystem gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Hubeinheit (100) einen Umdrehungszähler (105) beinhaltet, der sich neben der Trommel (103) befindet und mit der Trommel (103) verbunden ist und somit die Drehung der Trommel (103) messen kann, sodass die Menge des um die Trommel (103) gewickelten oder von ihr freigegebenen Drahtseils berechnet werden kann, und, wenn das ergonomische Hubsystem die untere oder obere Hubgrenze erreicht, es ein Signal an das Steuergerät sendet, um das ergonomische Hubsystem anzuhalten. 15
20
25
8. Ergonomisches Hubsystem gemäß Anspruch 1, **gekennzeichnet durch das Umfassen** eines Linearlagers (205), das den Griff (204) unter dem Gehäuse (201) trägt, sodass er sich auf und ab bewegen kann. 30

Revendications

1. Système de levage ergonomique pour lever et transporter n'importe quelle charge en appliquant une faible force par contact humain, qui commande des mouvements haut et bas de la charge levée, **comprenant** : 35
40
- une unité de levage (100) qui comprend :
- un moteur (101) qui fournit un couple,
 - un multiplicateur (102) qui augmente le couple du moteur (101), 45
 - un tambour (103) sur lequel est enroulé un câble métallique,
 - un guide-câble métallique (104) qui assure que le câble métallique soit enroulé dans le tambour (103) ou libéré de celui-ci de manière contrôlée et sûre pendant l'enroulement ou le déroulement du câble métallique sur le tambour (103), 50
- une interface de levage (200) qui est connectée à l'unité de levage (100) et comprend : 55
- un appareil de connexion inférieur (210)

qui est connecté au fond d'une coque (201) dans laquelle la charge est fixée,

- un appareil de connexion de câble (202) connecté au câble enroulé sur le tambour (103) dans l'interface de levage (200) pour permettre à l'utilisateur de commander la charge levée et transportée par l'unité de levage (100),

- ladite coque (201), qui est connectée au câble métallique enroulé sur le tambour (103) au moyen de l'appareil de connexion de câble (202) sur le côté supérieur et avec l'appareil de connexion inférieur (210) sur la partie inférieure, où les appareils portant la charge sont connectés,

- une cellule de charge (203) qui se connecte à l'appareil de connexion de câble (202) depuis son extrémité supérieure, traverse la coque (201) sur l'axe vertical et mesure le poids de la charge levée et la force exercée par l'utilisateur sur la charge, transmet cette mesure au contrôleur et permet de déplacer la charge vers le haut ou vers le bas à l'aide du moteur (101),

- une poignée (204), qui est montée sous la coque (201) et permet à la charge d'être déplacée de haut en bas par l'utilisateur lorsque la main de l'utilisateur tient et déplace la poignée (204) de haut en bas, située sous la cellule de charge (203),

- un ressort supérieur (206), qui est connecté à l'extrémité supérieure de la poignée (204) qui peut être déplacée vers le haut ou vers le bas, amène la poignée (204) à sa position médiane sous la coque (201) après que l'utilisateur a relâché la poignée (204), et crée une force de réaction pour l'utilisateur lors de ces mouvements,

- un ressort inférieur (207), qui est connecté à l'extrémité inférieure de la poignée (204) qui peut être déplacée vers le haut ou vers le bas, amène la poignée (204) à sa position médiane sous la coque (201) après que l'utilisateur a relâché la poignée (204), et crée une force de réaction pour l'utilisateur lors de ces mouvements,

le système de levage étant **caractérisé en ce que** l'interface de levage comprend en outre

- un potentiomètre linéaire d'interface (209), qui est associé à la coque (201) et à la poignée (204) située à l'intérieur de l'interface de charge (200), détecte le mouvement de haut en bas de la poignée (204) et le transmet au contrôleur et permet à la charge d'être déplacée vers le haut ou vers le bas par le moteur (101),

- un capteur d'objet (208) situé sur ladite

coque (201) et détectant si la main de l'utilisateur est sur la poignée (204).

sous la coque (201) de sorte qu'elle puisse se déplacer de haut en bas.

2. Système de levage ergonomique selon la revendication 1, **caractérisé en ce que** ladite interface de levage (200) comprend la cellule de charge (203) qui lit la force appliquée par l'utilisateur via le contact avec la charge et le poids de la charge soulevée, transmet celle-ci au contrôleur dans lequel la vitesse de mouvement de haut en bas du système de levage ergonomique change en fonction de la force appliquée par l'utilisateur à la charge. 5
10
3. Système de levage ergonomique selon la revendication 1, **caractérisé en ce qu'il comprend** un potentiomètre linéaire (106) qui est connecté audit guide-câble métallique (104) et fournit le calcul de la quantité de câble enroulé sur ou libéré du tambour (103) en mesurant le glissement latéral du guide-câble métallique (104) sur le tambour (103) dans le sens de la longueur du tambour (103). 15
20
4. Système de levage ergonomique selon la revendication 1, **caractérisé en ce que** ladite interface de levage (200) comprend un bouton de réglage de vitesse (211) situé sur la coque (201) et permettant de régler la vitesse du système de levage ergonomique. 25
5. Système de levage ergonomique selon la revendication 1, **caractérisé en ce que** ladite interface de levage (200) comprend un bouton d'arrêt d'urgence (212) situé sur la coque (201) et permettant l'arrêt du système de levage ergonomique en cas d'urgence. 30
35
6. Système de levage ergonomique selon la revendication 1, **caractérisé en ce que** ladite interface de levage (200) comprend un bouton de mode flottant (213) situé sur la coque (201) et permettant au système de levage ergonomique de passer en mode flottant. 40
7. Système de levage ergonomique selon la revendication 1, **caractérisé en ce que** ladite unité de levage (100) comprend un compte-tours (105), qui est situé à côté du tambour (103) et connecté au tambour (103), ainsi il peut mesurer la rotation du tambour (103), de sorte que la quantité de câble métallique enroulé autour ou libéré du tambour (103) puisse être calculée, et lorsque le système de levage ergonomique atteint la limite de levage inférieure ou supérieure, il envoie un signal au contrôleur pour arrêter le système de levage ergonomique. 45
50
55
8. Système de levage ergonomique selon la revendication 1, **caractérisé en ce qu'il comprend** un palier linéaire (205) qui supporte ladite poignée (204)

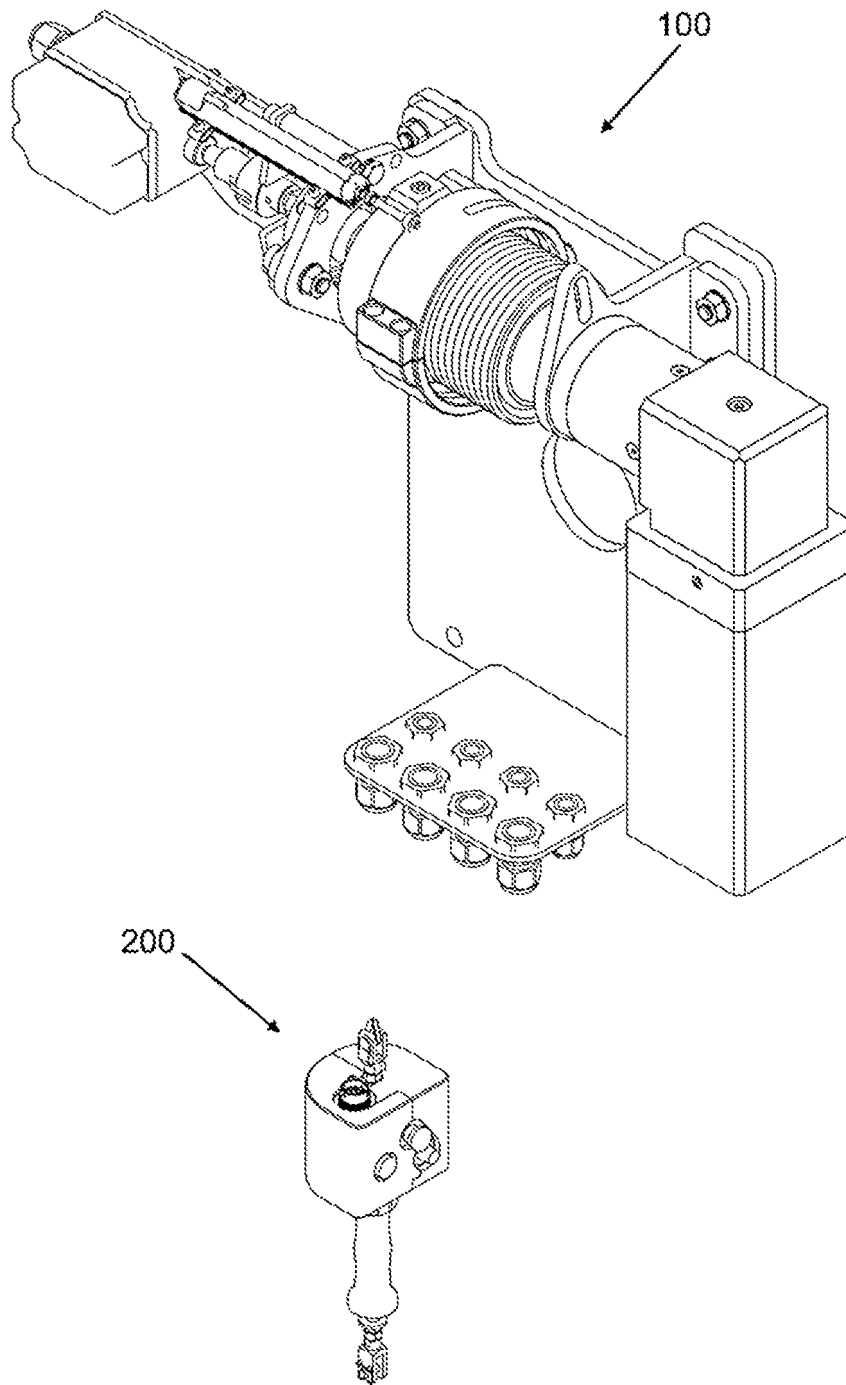


Figure 1

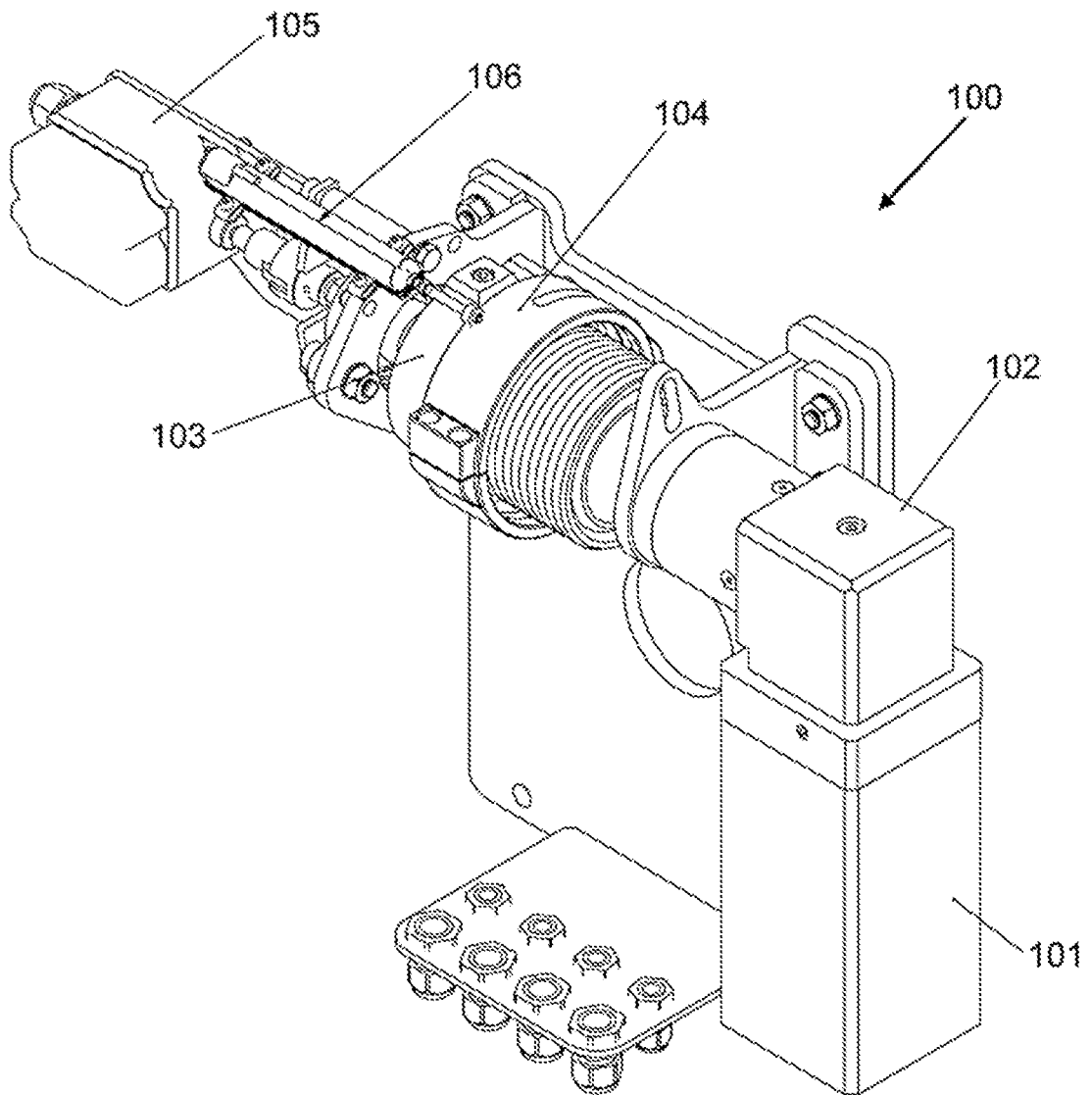


Figure 2

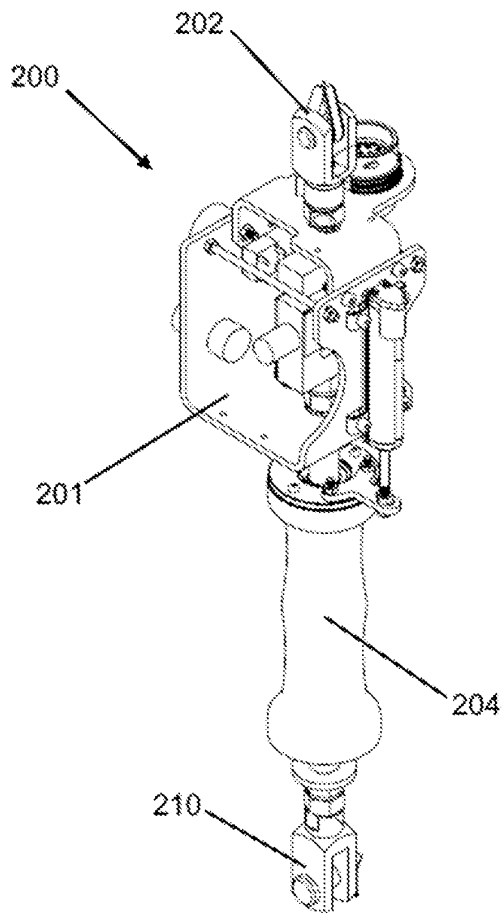


Figure 3a

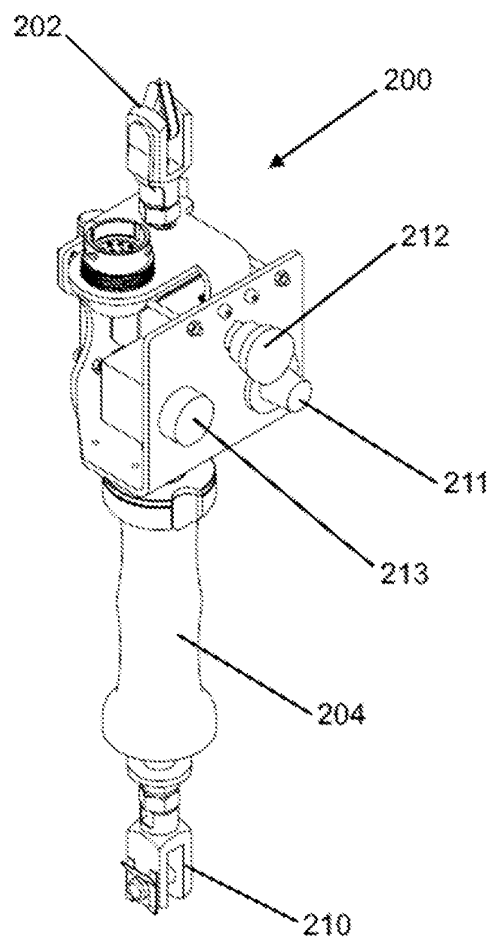


Figure 3b

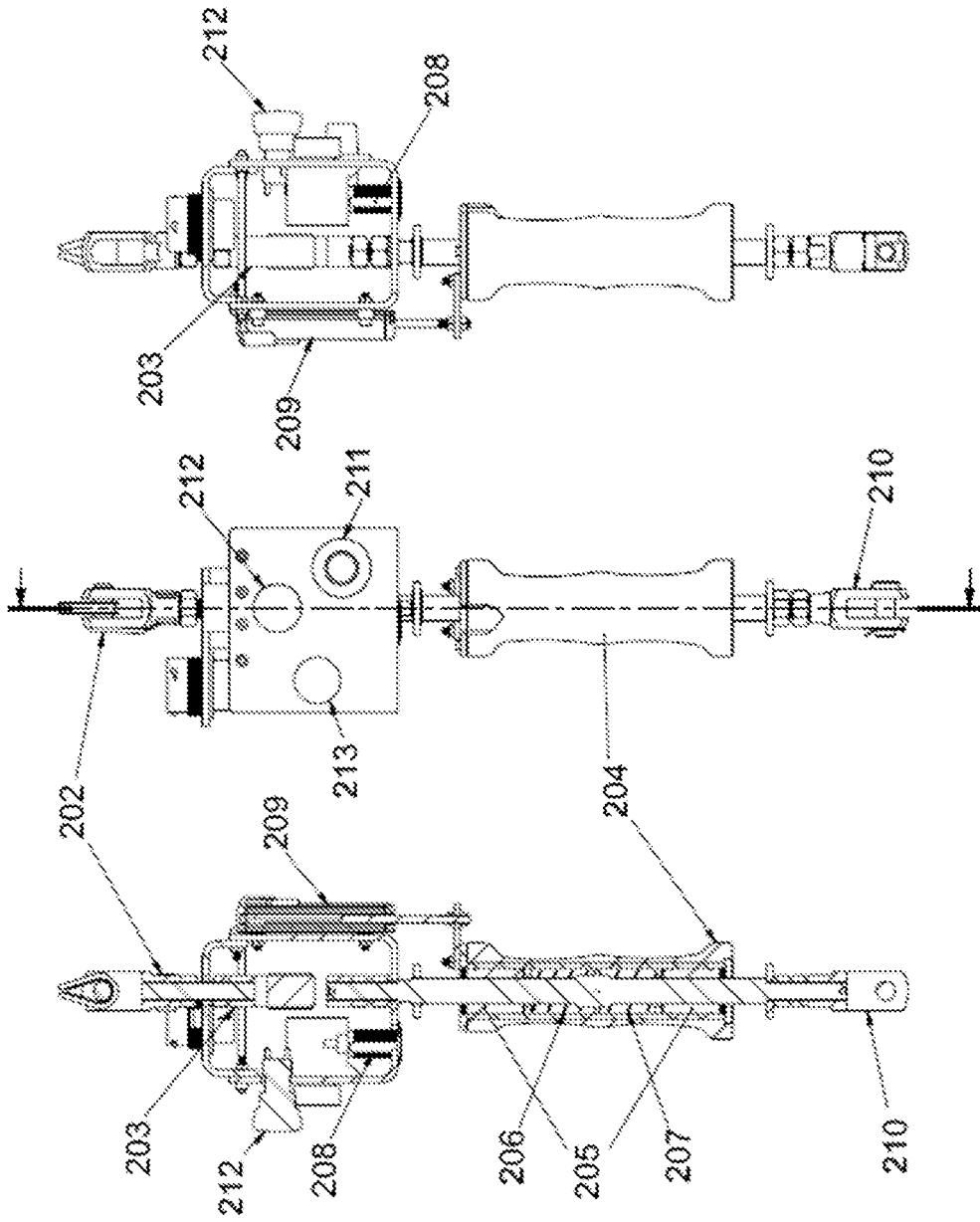


Figure 4c

Figure 4b

Figure 4a

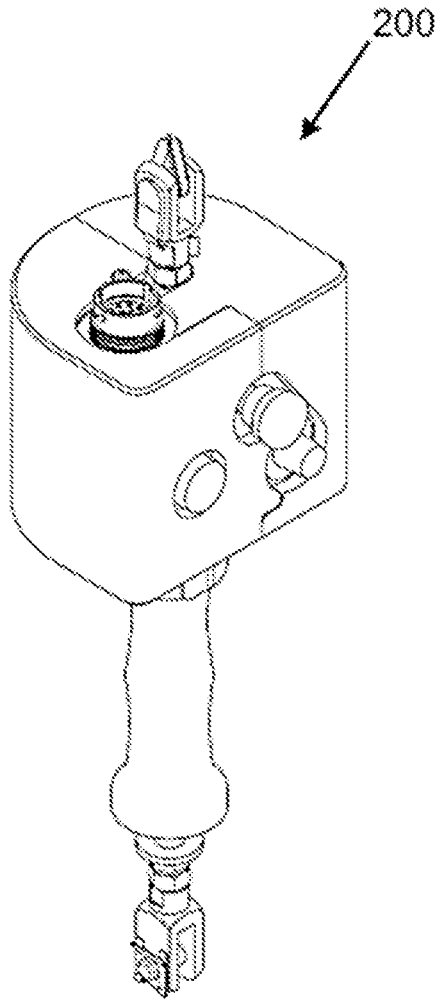


Figure 5a

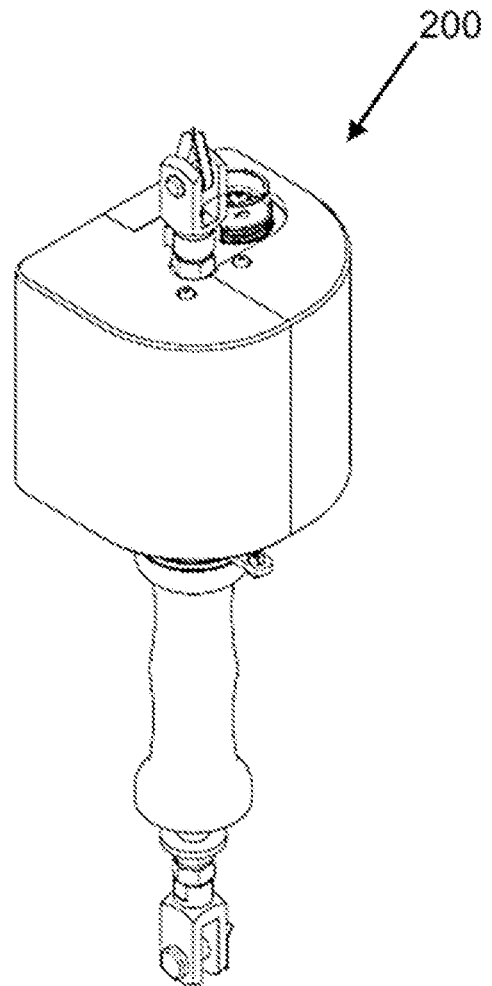


Figure 5b

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

- US 6386513 B [0008]
- US 6622990 B [0009]
- US 6886812 B [0010]
- US 7559533 B [0011]
- KR 20210088972 A [0012]