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Energy-saving elevator

Abstract

An energy-saving elevator. The energy-saving elevator includes an elevator car, a counterweight, a lift cable, and a hoist-type lifting mechanism. The hoist-type lifting mechanism includes a first adjustable pulley, a second adjustable pulley, and an adjustable cable interconnected between the first adjustable pulley and the second adjustable pulley. The first adjustable pulley includes a first fixed conical member with a first conical surface and a first moveable conical member with a second conical surface. The first conical surface and the second conical surface form a first trapezoid-shape groove between the first fixed conical member and the first moveable conical member. The first trapezoid-shape groove is configured to receive the adjusting cable. The first conical surface and the second conical surface are configured to hold the adjusting cable inside the first trapezoid-shape groove.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION (1) This application claims the benefit of priority from U.S. Provisional Patent Application Ser. No. 62/966,564, filed on Jan. 28, 2020, and entitled “REDUCING POWER CONSUMPTION IN AN ELEVATOR” which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

(1) The present disclosure generally relates to energy-saving systems, and particularly relates to energy saving in an elevator. The present disclosure more particularly relates to an energy-saving traction-type elevator.

BACKGROUND

(2) During operation of an elevator, such as a traction-type elevator, the elevator may carry approximately the same mass upward and downward, and in terms of energy conservation, a power loss of an elevator may only lead to friction heating. In terms of mechanical energy, an elevator may be in an ideal status if the elevator car (load) is equal to a counterweight. Usually, a ratio of a counterweight to a car weight may be 1.5:1. However, a load may vary frequently, so it may be difficult for an elevator to get in the ideal status of weight to counterweight ratio.

(3) A function of a counterbalance system of an elevator may be to drive a counterbalance unit and a car (load) to reach relative balance. During operation of an elevator, the elevator may make sure

that a difference between a counterbalance unit and a car (load) stays at a such small value that the elevator is in a relative ideal status even if the load changes. On the contrary, if a counterbalance unit and a car of an elevator have a weight difference greater than a specific amount, the working of the elevator may inevitably result in accumulation and release of mechanical potential energy, thereby causing waste of energy.

(4) Currently, various energy-saving traction-type elevators with a variable counterbalancing mass are available. In these energy-saving traction-type elevators, a mass of a counterbalance unit may vary by assembling and dismantling a counterbalance unit. However, these elevators may have some drawbacks. For example, existing variable counterbalancing elevators may reduce a drive moment and power of a traction machine and fulfill the aim of saving energy by decreasing a weight difference between a counterbalance unit and a car of an elevator by assembling and/or dismantling the counterbalance unit. However, the assembling and/or dismantling of the counterbalance unit may inevitably result in power loss. For example, if a weight of a car of an elevator changes significantly, many counterbalance units have to be assembled and/or dismantled which may lead to waste of time. There is, therefore, a need for an energy-saving elevator which has a simple and rational structure and is able to effectively realize elevator energy saving.

SUMMARY

(5) This summary is intended to provide an overview of the subject matter of the present disclosure, and is not intended to identify essential elements or key elements of the subject matter, nor is it intended to be used to determine the scope of the claimed implementations. The proper scope of the present disclosure may be ascertained from the claims set forth below in view of the detailed description below and the drawings.

(6) In one general aspect, the present disclosure describes an exemplary energy-saving elevator. In an exemplary embodiment, an exemplary energy-saving elevator may include an elevator, a counterweight, a lift cable, and a hoist-type lifting mechanism. In an exemplary embodiment, the lift cable may be interconnected between the elevator car and the counterweight. In an exemplary embodiment, a first end of the lift cable may be connected to the elevator car. In an exemplary embodiment, a second end of the lift cable may be connected to the counterweight.

(7) In an exemplary embodiment, the lift cable may be connected to the hoist-type lifting mechanism. In an exemplary embodiment, the hoist-type lifting mechanism may include a first adjustable pulley, a second adjustable pulley, and an adjusting cable. In an exemplary embodiment, the hoist-type lifting mechanism may be configured to lift the elevator car by pulling up the first end of the lift cable by rotating the first adjustable pulley in a first rotational direction.

(8) In an exemplary embodiment, the hoist-type lifting mechanism may be configured to lift the counterweight by pulling up the second end of the lift cable by rotating the second adjustable pulley in a second rotational direction. In an exemplary embodiment, the adjusting cable may be interconnected between the first adjustable pulley and the second adjustable pulley. In an exemplary embodiment, the first adjustable pulley and the second adjustable pulley may be configured to hold the adjusting cable.

(9) In an exemplary embodiment, the first adjustable pulley may include a first fixed conical member and a first moveable conical member. In an exemplary embodiment, the first fixed conical member may include a first conical surface. In an exemplary embodiment, the first moveable conical member may include a second conical surface.

(10) In an exemplary embodiment, the first moveable conical member may be configured to move linearly along a first axis. In an exemplary embodiment, the first conical surface and the second conical surface may face each other. In an exemplary embodiment, the first conical surface and the second conical surface may form a first trapezoid-shape groove between the first fixed conical member and the first moveable conical member. In an exemplary embodiment, the first trapezoid-shape groove may be configured to receive the adjusting cable. In an exemplary embodiment, the first conical surface and the second conical surface may be configured to hold the adjusting cable

inside the first trapezoid-shape groove.

(11) In an exemplary embodiment, the adjusting cable may be configured to move away from the first axis inside the first trapezoid-shape groove responsive to moving the first moveable conical member towards the first fixed conical member along the first axis. In an exemplary embodiment, the adjusting cable may be configured to move towards the first axis inside the first trapezoid-shape groove responsive to moving the first moveable conical member away from the first fixed conical member along the first axis.

(12) In an exemplary embodiment, the second adjustable pulley may include a second fixed conical member and a second moveable conical member. In an exemplary embodiment, the second fixed conical member may include a third conical surface. In an exemplary embodiment, the second moveable conical member may include a fourth conical surface.

(13) In an exemplary embodiment, the second moveable conical member may be configured to move linearly along a second axis. In an exemplary embodiment, the third conical surface and the fourth conical surface may face each other. In an exemplary embodiment, the third conical surface and the fourth conical surface may form a second trapezoid-shape groove between the second fixed conical member and the second moveable conical member.

(14) In an exemplary embodiment, the second trapezoid-shape groove may be configured to receive the adjusting cable. In an exemplary embodiment, the adjusting cable may be configured to move away from the second axis inside the second trapezoid-shape groove responsive to moving the second moveable conical member toward the second fixed conical member along the second axis. In an exemplary embodiment, the adjusting cable may be configured to move toward the second axis inside the second trapezoid-shape groove responsive to moving the second moveable conical member away from the second fixed conical member along the second axis.

(15) In an exemplary embodiment, the first conical surface may be formed by revolving a first inclined line around the first axis. In an exemplary embodiment, the second conical surface may be formed by revolving a second inclined line around the first axis. In an exemplary embodiment, the third conical surface may be formed by revolving a third inclined line around the second axis. In an exemplary embodiment, the fourth conical surface may be formed by revolving a fourth inclined line around the second axis.

(16) In an exemplary embodiment, the first conical surface may be bounded between a first smaller circle of the first fixed conical member and a first larger circle of the first fixed conical member. In an exemplary embodiment, a diameter of the first smaller circle may be smaller than a diameter of the first larger circle. In an exemplary embodiment, the second conical surface may be bounded between a second smaller circle of the first moveable conical member and a second larger circle of the first moveable conical member. In an exemplary embodiment, a diameter of the second smaller circle may be smaller than a diameter of the second larger circle.

(17) In an exemplary embodiment, the third conical surface may be bounded between a third smaller circle of the second fixed conical member and a third larger circle of the second fixed conical member. In an exemplary embodiment, a diameter of the third smaller circle may be smaller than a diameter of the third larger circle. In an exemplary embodiment, the fourth conical surface may be bounded between a fourth smaller circle of the second moveable conical member and a fourth larger circle of the second moveable conical member. In an exemplary embodiment, a diameter of the fourth smaller circle may be smaller than a diameter of the fourth larger circle.

(18) In an exemplary embodiment, the first fixed conical member may include a first front surface. In an exemplary embodiment, the first front surface may include a circular shape. In an exemplary embodiment, an outer circle of the first front surface may coincide with the first smaller circle. In an exemplary embodiment, the first moveable conical member may include a second front surface. In an exemplary embodiment, the second front surface may include a circular shape. In an exemplary embodiment, an outer circle of the second front surface may coincide with the second smaller circle.

(19) In an exemplary embodiment, the second fixed conical member may include a third front surface. In an exemplary embodiment, the third front surface may include a circular shape. In an exemplary embodiment, an outer circle of the third front surface may coincide with the third smaller circle. In an exemplary embodiment, the second moveable conical member may include a fourth front surface. In an exemplary embodiment, the fourth front surface may include a circular shape. In an exemplary embodiment, an outer circle of the fourth front surface may coincide with the fourth smaller circle. In an exemplary embodiment, the first front surface may face the second front surface. In an exemplary embodiment, the third front surface may face the fourth front surface.

(20) In an exemplary embodiment, the energy-saving elevator may further include a first rod and a second rod. In an exemplary embodiment, a main axis of the first rod may coincide with the first axis. In an exemplary embodiment, the first fixed conical member may be mounted fixedly on the first rod. In an exemplary embodiment, the first moveable conical member may be mounted slidably on the first rod.

(21) In an exemplary embodiment, a main axis of the second rod may coincide with the second axis. In an exemplary embodiment, the second fixed conical member may be mounted fixedly. In an exemplary embodiment, the second moveable conical member may be mounted slidably on the second rod.

(22) In an exemplary embodiment, the energy-saving elevator may further include a first sheave and a second sheave. In an exemplary embodiment, the first sheave may be mounted on the first rod by utilizing a first idler bearing. In an exemplary embodiment, the first idler bearing may be disposed between the first sheave and the first rod. In an exemplary embodiment, the first idler bearing may be configured to urge the first sheave to rotate around the first axis synchronously with the first rod responsive to clockwise rotation of the first rod around the first axis. In an exemplary embodiment, the first rod may remain stationary responsive to counterclockwise rotation of the first rod around the first axis.

(23) In an exemplary embodiment, the second sheave may be mounted on the second rod by utilizing a second idler bearing. In an exemplary embodiment, the second idler bearing may be disposed between the second sheave and the second rod. In an exemplary embodiment, the second idler bearing may be configured to urge the second sheave to rotate around the second axis synchronously with the second rod responsive to counterclockwise rotation of the second rod around the second axis. In an exemplary embodiment, the second rod may remain stationary responsive to clockwise rotation of the second sheave around the second axis. In an exemplary embodiment, the first sheave and the second sheave may be configured to hold the lift cable. In an exemplary embodiment, the lift cable may be wrapped around the first sheave and the second sheave.

(24) In an exemplary embodiment, the energy-saving elevator may include a first actuator and a second actuator. In an exemplary embodiment, the first actuator may be attached to the first moveable conical member. In an exemplary embodiment, the first actuator may be configured to move the first moveable conical member along the first axis. In an exemplary embodiment, the second actuator may be attached to the second moveable conical member. In an exemplary embodiment, the second actuator may be configured to move the second moveable conical member along the second axis.

(25) In an exemplary embodiment, the first adjustable pulley may be configured to rotate around the first axis. In an exemplary embodiment, the second adjustable pulley may be configured to rotate around the second axis. In an exemplary embodiment, the first axis may be parallel to the second axis. In an exemplary embodiment, the energy-saving elevator may further include an electromotor. In an exemplary embodiment, the electromotor may be configured to rotate the first adjustable pulley around the first axis and rotate the second adjustable pulley around the second axis.

- (26) In an exemplary embodiment, the electromotor may include a drive gear. In an exemplary embodiment, the drive gear configured to move along a third axis, the third axis parallel to the first axis and the second axis.
- (27) In an exemplary embodiment, the energy-saving elevator may further include a first gear and a second gear. In an exemplary embodiment, the first gear may be connected to the first adjustable pulley. In an exemplary embodiment, the electromotor may be configured to be engaged with the first gear responsive to the drive gear being in a first position along the third axis. In an exemplary embodiment, the second gear may be connected to the second adjustable pulley. In an exemplary embodiment, the electromotor may be configured to be engaged with the second gear responsive to the drive gear being in a second position along the third axis.
- (28) In an exemplary embodiment, the electromotor may be configured to rotate the first adjustable pulley around the first axis responsive to the electromotor being engaged with the first gear. In an exemplary embodiment, the electromotor may be configured to rotate the second adjustable pulley around the second axis responsive to the electromotor being engaged with the second gear.
- (29) In an exemplary embodiment, the energy-saving elevator may further include a first weight sensor and a second weight sensor. In an exemplary embodiment, the first weight sensor may be associated with the elevator car. In an exemplary embodiment, the first weight sensor may be configured to measure a weight of the elevator car. In an exemplary embodiment, the second weight sensor may be associated with the counterweight. In an exemplary embodiment, the second weight sensor may be configured to measure a weight of the counterweight.
- (30) In an exemplary embodiment, the energy-saving elevator may further include one or more processors. In an exemplary embodiment, the one or more processors may be configured to receive a first set of data associated with the weight of the elevator car from the first weight sensor, receive a second set of data associated with the weight of the counterweight from the second weight sensor, control the first actuator and the second actuator based on the first set of data and the second set of data, and control a position of the electromotor along the third axis based on the first set of data and the second set of data.
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Description

BRIEF DESCRIPTION OF THE DRAWINGS

- (1) The drawing figures depict one or more implementations in accord with the present teachings, by way of example only, not by way of limitation. In the figures, like reference numerals refer to the same or similar elements.
- (2) FIG. 1A illustrates a perspective view of an exemplary energy-saving elevator, consistent with one or more exemplary embodiments of the present disclosure.
- (3) FIG. 1B illustrates an exploded view of an energy-saving elevator, consistent with one or more exemplary embodiments of the present disclosure.
- (4) FIG. 2A illustrates a first adjustable pulley, consistent with one or more exemplary embodiments of the present disclosure.
- (5) FIG. 2B illustrates a side view of a first adjustable pulley, consistent with one or more exemplary embodiments of the present disclosure.
- (6) FIG. 3A illustrates a second adjustable pulley, consistent with one or more exemplary embodiments of the present disclosure.
- (7) FIG. 3B illustrates a side view of a second adjustable pulley, consistent with one or more exemplary embodiments of the present disclosure.
- (8) FIG. 3C illustrates a perspective view of a first sheave and a second sheave when an adjustable cable is inserted into a first trapezoid-shape groove and a second trapezoid-shape groove, consistent with one or more exemplary embodiments of the present disclosure.

- (9) FIG. 3D illustrates a side view and a top view of a first sheave, a second sheave, and an adjustable cable in a first scenario in which a first moveable conical member is close to a first fixed conical member and a second moveable conical member is far from a second fixed conical member, consistent with one or more exemplary embodiments of the present disclosure.
- (10) FIG. 3E shows a side view and a top view of first sheave, second sheave, and adjustable cable in a second scenario in which first moveable conical member is relatively far from first fixed conical member and second moveable conical member is relatively close to second fixed conical member, consistent with one or more exemplary embodiments.
- (11) FIG. 4A illustrates a top view of an energy-saving elevator, consistent with one or more exemplary embodiments of the present disclosure.
- (12) FIG. 4B illustrates a top view of an energy-saving elevator in a scenario in which a drive gear is engaged with a first gear, consistent with one or more exemplary embodiments of the present disclosure.
- (13) FIG. 5 illustrates an example computer system in which an embodiment of the present disclosure, or portions thereof, may be implemented as computer-readable code, consistent with exemplary embodiments of the present disclosure.

DETAILED DESCRIPTION

- (14) In the following detailed description, numerous specific details are set forth by way of examples in order to provide a thorough understanding of the relevant teachings. However, it should be apparent that the present teachings may be practiced without such details. In other instances, well known methods, procedures, components, and/or circuitry have been described at a relatively high-level, without detail, in order to avoid unnecessarily obscuring aspects of the present teachings.
- (15) The following detailed description is presented to enable a person skilled in the art to make and use the methods and devices disclosed in exemplary embodiments of the present disclosure. For purposes of explanation, specific nomenclature is set forth to provide a thorough understanding of the present disclosure. However, it will be apparent to one skilled in the art that these specific details are not required to practice the disclosed exemplary embodiments. Descriptions of specific exemplary embodiments are provided only as representative examples. Various modifications to the exemplary implementations will be readily apparent to one skilled in the art, and the general principles defined herein may be applied to other implementations and applications without departing from the scope of the present disclosure. The present disclosure is not intended to be limited to the implementations shown, but is to be accorded the widest possible scope consistent with the principles and features disclosed herein.
- (16) Herein is disclosed an exemplary energy-saving elevator. An exemplary energy-saving elevator may include an elevator car with a first adjustable pulley, a counterweight with a second adjustable pulley, and an electromotor. The electromotor may rotate the first adjustable pulley and/or the second adjustable pulley to raise and/or lower the elevator car and the counterweight. The first adjustable pulley may include a first moveable conical member and a first fixed conical member which may form a first trapezoid-shaped groove between the first moveable conical member and the first fixed conical member. The second adjustable pulley may include a second moveable conical member and a second fixed conical member which may form a second trapezoid-shaped groove between the second moveable conical member and the second fixed conical member. The first adjustable pulley and the second adjustable pulley may hold an adjustable cable in the first trapezoid-shaped groove and the second trapezoid-shaped groove.
- (17) By moving the first moveable conical member toward or away from the first fixed conical member, a rotation radius of the adjustable cable inside the first trapezoid-shaped groove may increase or decrease. Also, by moving the second moveable conical member toward or away from the second fixed conical member, a rotation radius of the adjustable cable inside the second trapezoid-shaped groove may increase or decrease. Depending on a weight of the elevator car and a

weight of the counterweight, a user may adjust a rotation radius of the adjustable cable inside the first trapezoid-shaped groove and a rotation radius of the adjustable cable inside the second trapezoid-shaped groove to reduce the energy consumption by the electromotor to raise and/or lower the elevator car. A user may adjust a rotation radius of the adjustable cable inside the first trapezoid-shaped groove by moving the first moveable conical member toward or away from the first fixed conical member. A user may also adjust a rotation radius of the adjustable cable inside the second trapezoid-shaped groove by moving the second moveable conical member toward or away from the second fixed conical member.

(18) FIG. 1A shows a perspective view of an exemplary energy-saving elevator **100**, consistent with one or more exemplary embodiments of the present disclosure. FIG. 1B shows an exploded view of energy-saving elevator **100**, consistent with one or more exemplary embodiments of the present disclosure. As shown in FIG. 1A and FIG. 1B, in an exemplary embodiment, energy-saving elevator **100** may include an elevator car **102** and a counterweight **104**. In an exemplary embodiment, elevator car **102** and counterweight **104** may be connected to each other by utilizing a lift cable **106**. In an exemplary embodiment, a first end **162** of lift cable **106** may be attached to elevator car **102**. In an exemplary embodiment, a second end **164** of lift cable **106** may be attached to elevator car **102**. In an exemplary embodiment, energy-saving elevator **100** may further include a first sheave **103** and a second sheave **105**. In an exemplary embodiment, first sheave **103** and second sheave **105** may hold lift cable **106**. In an exemplary embodiment, first sheave **103** may be mounted on a first rod **137**. In an exemplary embodiment, first sheave **103** may be configured to rotate around a first axis **136**. In an exemplary embodiment, first sheave **103** may be mounted on first rod **137**. In an exemplary embodiment, first sheave **103** may be mounted on first rod **137** by utilizing a first idler bearing **1372**. In an exemplary embodiment, first idler bearing **1372** may be disposed between first sheave **103** and first rod **137**. In an exemplary embodiment, when first rod **137** rotates around first axis **136** in a clockwise direction, first idler bearing **1372** may urge first sheave **103** to rotate synchronously with first rod **137** around first axis **136**. In an exemplary embodiment, synchronous rotation of a first element with a second element, may refer to a rotation of the first element with a same rotational speed and in a same direction as a rotation of the second element. In an exemplary embodiment, when first sheave **103** rotates around first axis **136** in a counterclockwise direction, first idler bearing **1372** may not urge first rod **137** to rotate. In an exemplary embodiment, second sheave **105** may be mounted on a second rod **157**. In an exemplary embodiment, second sheave **105** may be configured to rotate around a second axis **156**. In an exemplary embodiment, second sheave **105** may be mounted on second rod **157**. In an exemplary embodiment, second sheave **105** may be mounted on second rod **157** by utilizing a second idler bearing **1572**. In an exemplary embodiment, second idler bearing **1572** may be disposed between second sheave **105** and second rod **157**. In an exemplary embodiment, when second rod **157** rotates around second axis **156** in a counterclockwise direction, second idler bearing **1572** may urge second sheave **105** to rotate synchronously with second rod **157** around second axis **136**. In an exemplary embodiment, when second sheave **105** rotates around second axis **156** in a clockwise direction, second idler bearing **1572** may not urge second rod **157** to rotate. In an exemplary embodiment, first axis **136** and second axis **156** may be parallel to each other. In an exemplary embodiment, lift cable **106** may be wound around first sheave **103** and second sheave **105**. In an exemplary embodiment, when first sheave **103** and second sheave **105** rotate, friction forces between a grooved surface of first sheave **103** and lift cable **106** and also friction forces between a grooved surface of second sheave **105** and lift cable **106** may move lift cable **106** and, thereby, may cause elevator car **102** and counterweight **104** to raise and/or lower in opposite directions. In an exemplary embodiment, when first sheave **103** and second sheave **105** rotate in a first rotational direction **132**, elevator car **102** may be raised and counterweight **104** may be lowered. In an exemplary embodiment, when first sheave **103** and second sheave **105** rotate in a second rotational direction **134**, elevator car **102** may be lowered and counterweight **104** may be raised. In an

exemplary embodiment, first rotational direction **132** may refer to a counterclockwise direction and second rotational direction **134** may refer to a clockwise direction.

(19) In an exemplary embodiment, energy-saving elevator **100** may further include an electromotor **107**. In an exemplary embodiment, electromotor **107** may be configured to be connected to first sheave **103** and/or second sheave **105**. In an exemplary embodiment, electromotor **107** may cause first sheave **103** to rotate around first axis **136**. In an exemplary embodiment, electromotor **107** may cause second sheave **105** to rotate around second axis **156**. In an exemplary embodiment, when elevator car **102** is intended to be raised, electromotor **107** may cause first sheave **103** to rotate around first axis **136** in first rotational direction **132** and cause second sheave **105** to rotate around second axis **156** in first rotational direction **132**. In an exemplary embodiment, when elevator car **102** is intended to be lowered, electromotor **107** may cause first sheave **103** to rotate around first axis **136** in second rotational direction **134** and cause second sheave **105** to rotate around second axis **156** in second rotational direction **132**. In an exemplary embodiment, elevator car **102** may refer to a compartment which may be configured to carry people and/or freight from floor to floor in a building. It also may be understood that a total weight of elevator car **102** may depend on people and/or freight that elevator car **102** carries.

(20) In an exemplary embodiment, energy-saving elevator **100** may further include a first adjustable pulley **108** and a second adjustable pulley **109**. FIG. 2A shows first adjustable pulley **108**, consistent with one or more exemplary embodiments of the present disclosure. FIG. 2B shows a side view of first adjustable pulley **108**, consistent with one or more exemplary embodiments of the present disclosure. As shown in FIG. 2A and FIG. 2B, in an exemplary embodiment, first adjustable pulley **108** may include a first fixed conical member **202** and a first moveable conical member **204**. In an exemplary embodiment, first fixed conical member **202** may be mounted fixedly on first rod **137**. In an exemplary embodiment, when first fixed conical member **202** is mounted fixedly on first rod **137**, it may mean that first fixed conical member **202** is mounted on first rod **137** in such a way that any relative movement between first fixed conical member **202** and first rod **137** may be prevented. In an exemplary embodiment, first fixed conical member **202** may include a first rod receiving hole **222**. In an exemplary embodiment, in order to mount first fixed conical member **202** on first rod **137**, first rod **137** may be inserted into first rod receiving hole **222**. In an exemplary embodiment, first rod **137** may be tightly fitted inside first rod receiving hole **222** to prevent any relative movement between first fixed conical member **202** and first rod **137**.

(21) In an exemplary embodiment, first moveable conical member **204** may be mounted slidably on first rod **137**. In an exemplary embodiment, when first moveable conical member **204** is mounted slidably on first rod **137**, it may mean that first moveable conical member **204** is mounted on first rod **137** in such a way that first moveable conical member **204** may be able to move linearly along first axis **136**. In an exemplary embodiment, first moveable conical member **204** may include a second rod receiving hole **242**. In an exemplary embodiment, in order to mount first moveable conical member **204** on first rod **137**, first rod **137** may be inserted into second rod receiving hole **242**. In an exemplary embodiment, first rod **137** may be loosely fitted inside second rod receiving hole **242** to allow linear movement of first moveable conical member **204** along first axis **136**. In an exemplary embodiment, an inner diameter of second rod receiving hole **242** may be slightly larger than an outer diameter of first rod **137**. For example, the inner diameter of second rod receiving hole **242** may be larger than the outer diameter of first rod **137** by the amount of 1 mm.

(22) In an exemplary embodiment, first fixed conical member **202** may include a first conical surface **224**. In an exemplary embodiment, first conical surface **224** may be formed by revolving a first inclined line **2242** around first axis **136**. In an exemplary embodiment, first conical surface **224** may be bounded between a first smaller circle **2244** and a first larger circle **2246**. In an exemplary embodiment, a diameter of first smaller circle **2244** may be smaller than a diameter of first larger circle **2246**. In an exemplary embodiment, first moveable conical member **204** may include a second conical surface **244**. In an exemplary embodiment, second conical surface **244**

may be formed by revolving a second inclined line **2442** around first axis **136**. In an exemplary embodiment, second conical surface **244** may be bounded between a second smaller circle **2444** and a second larger circle **2446**. In an exemplary embodiment, a diameter of second smaller circle **2444** may be smaller than a diameter of second larger circle **2446**. In an exemplary embodiment, first fixed conical member **202** and first moveable conical member **204** may be mounted on first rod **137** in such a way that first conical surface **224** and second conical surface **244** face each other. In an exemplary embodiment, first conical surface **224** and second conical surface **244** may form a first trapezoid-shape groove **234** between first fixed conical member **202** and first moveable conical member **204**. In an exemplary embodiment, first trapezoid-shape groove **234** may be configured to receive an adjusting cable **101**. In an exemplary embodiment, receiving adjusting cable **101** by first trapezoid-shape groove **234** may refer to inserting adjusting cable **101** into first trapezoid-shape groove **234**. In an exemplary embodiment, adjusting cable **101** may be disposed inside first trapezoid-shape groove **234**. In an exemplary embodiment, adjusting cable **101** may be inserted into first trapezoid-shape groove **234**. In an exemplary embodiment, first conical surface **224** and second conical surface **244** may hold adjusting cable **101** inside first trapezoid-shape groove **234**.

(23) FIG. 3A shows second adjustable pulley **109**, consistent with one or more exemplary embodiments of the present disclosure. FIG. 3B shows a side view of second adjustable pulley **109**, consistent with one or more exemplary embodiments of the present disclosure. In an exemplary embodiment, first adjustable pulley **108** and second adjustable pulley **109** may be coupled to each other by utilizing adjusting cable **101**. In an exemplary embodiment, second adjustable pulley **109** may be substantially similar to first adjustable pulley **108** in structure and function. As shown in FIG. 3A and FIG. 3B, in an exemplary embodiment, second adjustable pulley **109** may include a second fixed conical member **302** and a second moveable conical member **304**. In an exemplary embodiment, second fixed conical member **302** may be mounted fixedly on second rod **157**. In an exemplary embodiment, when second fixed conical member **302** is mounted fixedly on second rod **157**, it may mean that second fixed conical member **302** is mounted on second rod **157** in such a way that any relative movement between second fixed conical member **302** and second rod **157** may be prevented. In an exemplary embodiment, second fixed conical member **302** may include a third rod receiving hole **322**. In an exemplary embodiment, in order to mount second fixed conical member **302** on second rod **157**, second rod **157** may be inserted into third rod receiving hole **322**. In an exemplary embodiment, second rod **157** may be tightly fitted inside third rod receiving hole **322** to prevent any relative movement between second fixed conical member **302** and second rod **157**.

(24) In an exemplary embodiment, second moveable conical member **304** may be mounted slidably on second rod **157**. In an exemplary embodiment, when second moveable conical member **304** is mounted slidably on second rod **157**, it may mean that second moveable conical member **304** is mounted on second rod **157** in such a way that second moveable conical member **304** may be able to move linearly along second axis **156**. In an exemplary embodiment, second moveable conical member **304** may include a fourth rod receiving hole **342**. In an exemplary embodiment, in order to mount second moveable conical member **304** on second rod **157**, second rod **157** may be inserted into fourth rod receiving hole **342**. In an exemplary embodiment, second rod **157** may be loosely fitted inside fourth rod receiving hole **342** to allow linear movement of second moveable conical member **304** along second axis **156**. In an exemplary embodiment, an inner diameter of fourth rod receiving hole **342** may be slightly larger than an outer diameter of second rod **157**. For example, the inner diameter of fourth rod receiving hole **342** may be larger than the outer diameter of second rod **157** by the amount of 1 mm.

(25) In an exemplary embodiment, second fixed conical member **302** may include a third conical surface **324**. In an exemplary embodiment, third conical surface **324** may be formed by revolving a third inclined line **3242** around second axis **156**. In an exemplary embodiment, third conical surface

324 may be bounded between a third smaller circle **3244** and a third larger circle **3246**. In an exemplary embodiment, a diameter of third smaller circle **3244** may be smaller than a diameter of third larger circle **3246**. In an exemplary embodiment, second moveable conical member **304** may include a fourth conical surface **344**. In an exemplary embodiment, fourth conical surface **344** may be formed by revolving a fourth inclined line **3442** around second axis **156**. In an exemplary embodiment, fourth conical surface **344** may be bounded between a fourth smaller circle **3444** and a fourth larger circle **3446**. In an exemplary embodiment, a diameter of fourth smaller circle **3444** may be smaller than a diameter of fourth larger circle **3446**. In an exemplary embodiment, second fixed conical member **302** and second moveable conical member **304** may be mounted on second rod **157** in such a way that third conical surface **324** and fourth conical surface **344** face each other. In an exemplary embodiment, third conical surface **324** and fourth conical surface **344** may form a second trapezoid-shape groove **334** between second fixed conical member **302** and second moveable conical member **304**. In an exemplary embodiment, second trapezoid-shape groove **334** may be configured to receive adjusting cable **101**. In an exemplary embodiment, receiving adjusting cable **101** by second trapezoid-shape groove **334** may refer to inserting adjusting cable **101** into second trapezoid-shape groove **334**. In an exemplary embodiment, adjusting cable **101** may be disposed inside second trapezoid-shape groove **334**. In an exemplary embodiment, adjusting cable **101** may be inserted into second trapezoid-shape groove **334**. In an exemplary embodiment, third conical surface **324** and fourth conical surface **344** may hold adjusting cable **101** inside second trapezoid-shape groove **334**.

(26) FIG. 3C shows a perspective view of first sheave **103** and second sheave **105** when adjustable cable **101** is inserted into first trapezoid-shape groove **234** and second trapezoid-shape groove **334**, consistent with one or more exemplary embodiments of the present disclosure. Referring to FIG. 2B, in an exemplary embodiment, when first moveable conical member **204** moves away from first fixed conical member **202** and along first axis **136**, adjustable cable **101** may move toward first axis **136** inside first trapezoid-shape groove **234**. In an exemplary embodiment, it may be understood that when first moveable conical member **204** moves away from first fixed conical member **202**, first conical surface **224** and second conical surface **244** may become further from each other and, to thereby, may urge adjustable cable **101** to move toward first axis **136** inside first trapezoid-shape groove **234**. In an exemplary embodiment, when first moveable conical member **204** moves toward first fixed conical member **202** and along first axis **136**, adjustable cable **101** may move away from first axis **136** inside first trapezoid-shape groove **234**. In an exemplary embodiment, it may be understood that when first moveable conical member **204** moves toward first fixed conical member **202**, first conical surface **224** and second conical surface **244** may become closer to each other and, to thereby, may urge adjustable cable **101** to move away from first axis **136** inside first trapezoid-shape groove **234**.

(27) Referring to FIG. 3B, in an exemplary embodiment, when second moveable conical member **304** moves away from second fixed conical member **302** and along second axis **156**, adjustable cable **101** may move toward second axis **156** inside second trapezoid-shape groove **334**. In an exemplary embodiment, it may be understood that when second moveable conical member **304** moves away from second fixed conical member **302**, third conical surface **324** and fourth conical surface **344** may become closer to each other and, to thereby, may urge adjustable cable **101** to move toward second axis **156** inside second trapezoid-shape groove **334**. In an exemplary embodiment, when second moveable conical member **304** moves toward second fixed conical member **302** and along second axis **156**, adjustable cable **101** may move away from second axis **156** inside second trapezoid-shape groove **334**. In an exemplary embodiment, it may be understood that when second moveable conical member **304** moves toward second fixed conical member **302**, third conical surface **324** and fourth conical surface **344** may become closer to each other and, to thereby, may urge adjustable cable **101** to move away from second axis **156** inside second trapezoid-shape groove **334**.

(28) FIG. 3D shows a side view and a top view of first sheave **103**, second sheave **105**, and adjustable cable **101** in a first scenario in which first moveable conical member **204** is relatively close to first fixed conical member **202** and second moveable conical member **304** is relatively far from second fixed conical member **302**, consistent with one or more exemplary embodiments of the present disclosure. In an exemplary embodiment, first radius **112** may depend on closeness of first moveable conical member **204** to first fixed conical member **202**. In an exemplary embodiment, first radius **112** may refer to a distance between first axis **136** and adjustable cable **101** as shown in FIG. 3D. In an exemplary embodiment, second radius **114** may depend on closeness of second moveable conical member **304** and second fixed conical member **302**. In an exemplary embodiment, second radius **114** may refer to a distance between second axis **156** and adjustable cable **101** as shown in FIG. 3D. In an exemplary embodiment, in the first scenario, first radius **112** may be greater than second radius **114**. FIG. 3E shows a side view and a top view of first sheave **103**, second sheave **105**, and adjustable cable **101** in a second scenario in which first moveable conical member **204** is relatively far from first fixed conical member **202** and second moveable conical member **304** is relatively close to second fixed conical member **302**. In an exemplary embodiment, in the second scenario, second radius **114** may be greater than first radius **112**.

(29) As further shown in FIG. 1A and FIG. 1B, in an exemplary embodiment, energy-saving elevator **100** may further include a first actuator **182** and a second actuator **192**. In an exemplary embodiment, first actuator **182** may be attached to first moveable conical member **204**. In an exemplary embodiment, first actuator **182** may be configured to move first moveable conical member **204** along first axis **136**. In an exemplary embodiment, first actuator **182** may move first moveable conical member **204** along first axis **136** to increase and/or decrease a distance between first moveable conical member **204** and first fixed conical member **202**. In an exemplary embodiment, first actuator **182** may decrease a distance between first moveable conical member **204** and first fixed conical member **202** by moving first moveable conical member **204** along first axis **136** and in a first direction. In an exemplary embodiment, first actuator **182** may increase a distance between first moveable conical member **204** and first fixed conical member **202** by moving first moveable conical member **204** along first axis **136** and in a second direction. In an exemplary embodiment, second actuator **192** may be attached to second moveable conical member **304**. In an exemplary embodiment, second actuator **192** may be configured to move second moveable conical member **304** along second axis **156**. In an exemplary embodiment, second actuator **192** may move second moveable conical member **304** along second axis **156** to increase and/or decrease a distance between second moveable conical member **304** and second fixed conical member **302**. In an exemplary embodiment, second actuator **192** may decrease a distance between second moveable conical member **304** and second fixed conical member **302** by moving second moveable conical member **304** along second axis **156** and in a first direction. In an exemplary embodiment, second actuator **192** may increase a distance between second moveable conical member **304** and second fixed conical member **302** by moving second moveable conical member **304** along second axis **156** and in a second direction.

(30) As further shown in FIG. 1A and FIG. 1B, in an exemplary embodiment, energy-saving elevator **100** may further include a first gear **172** and a second gear **174**. In an exemplary embodiment, first gear **172** may be connected to first adjustable pulley **108** through first rod **137**. In an exemplary embodiment, second gear **174** may be connected to second adjustable pulley **109** through second rod **157**. In an exemplary embodiment, electromotor **107** may be configured to be connected to first gear **172** and/or second gear **174**. In an exemplary embodiment, electromotor **107** may include a drive gear **176** which may be configured to be engaged with first gear **172** and/or second gear **174**.

(31) FIG. 4A shows a top view of energy-saving elevator **100**, consistent with one or more exemplary embodiments of the present disclosure. In an exemplary embodiment, drive gear **176**

may be configured to be moveable along a third axis **410**. In an exemplary embodiment, drive gear **176** may be connected to a motor that may move drive gear **176** along third axis **410**.

(32) In an exemplary embodiment, when drive gear **176** is engaged with first gear **172**, electromotor **107** may rotate first adjustable pulley **108**. FIG. **4B** shows a top view of energy-saving elevator **100** in a scenario in which drive gear **176** is engaged with first gear **172**, consistent with one or more exemplary embodiments of the present disclosure. In an exemplary embodiment, when drive gear **176** is engaged with second gear **174** (as shown in FIG. **4A**), electromotor **107** may rotate second adjustable pulley **109**.

(33) In an exemplary embodiment, energy-saving elevator **100** may include a first weight sensor and a second weight sensor (not shown in Figures). In an exemplary embodiment, the first weight sensor may be configured to measure a weight of car elevator **102**. In an exemplary embodiment, the second weight sensor may be configured to measure a weight of counterweight **104**. In an exemplary embodiment, the first weight sensor and the second weight sensor may include a dynamometer or a load cell. In an exemplary embodiment, energy-saving elevator **100** may further include a processor **420**. In an exemplary embodiment, processor **420** may receive a first set of data associated with the weight of elevator car **102** from the first weight sensor and receive a second set of data associated with the weight of counterweight **104** from the second weight sensor. In an exemplary embodiment, processor **420** may be configured to control movements of first actuator **182**, second actuator **192**, and drive gear **176**. For example, when elevator car **102** is heavier than counterweight **104** and elevator car **102** is intended to be raised, first actuator **182** may move first moveable conical member **204** along first axis **136** and toward first fixed conical member **202** so that first radius **112** may be increased. Furthermore, second actuator **192** may move second moveable conical member **304** along second axis **156** and away from second fixed conical member **302** so that second radius **114** may be decreased. Additionally, drive gear **176** may be moved to be engaged with first gear **172**. Then, first gear **172** may be rotated in first rotational direction **132** to raise elevator car **102**.

(34) The embodiments have been described above with the aid of functional building blocks illustrating the implementation of specified functions and relationships thereof. The boundaries of these functional building blocks have been arbitrarily defined herein for the convenience of the description. Alternate boundaries can be defined so long as the specified functions and relationships thereof are appropriately performed.

(35) FIG. **5** shows an example computer system **500** in which an embodiment of the present disclosure, or portions thereof, may be implemented as computer-readable code, consistent with exemplary embodiments of the present disclosure. For example, processor **420** may be implemented in computer system **500** using hardware, software, firmware, tangible computer readable media having instructions stored thereon, or a combination thereof and may be implemented in one or more computer systems or other processing systems.

(36) If programmable logic is used, such logic may execute on a commercially available processing platform or a special purpose device. One ordinary skill in the art may appreciate that an embodiment of the disclosed subject matter can be practiced with various computer system configurations, including multi-core multiprocessor systems, minicomputers, mainframe computers, computers linked or clustered with distributed functions, as well as pervasive or miniature computers that may be embedded into virtually any device.

(37) For instance, a computing device having at least one processor device and a memory may be used to implement the above-described embodiments. A processor device may be a single processor, a plurality of processors, or combinations thereof. Processor devices may have one or more processor “cores.”

(38) An embodiment of the disclosure is described in terms of this example computer system **500**. After reading this description, it will become apparent to a person skilled in the relevant art how to implement the disclosure using other computer systems and/or computer architectures. Although

operations may be described as a sequential process, some of the operations may in fact be performed in parallel, concurrently, and/or in a distributed environment, and with program code stored locally or remotely for access by single or multi-processor machines. In addition, in some embodiments the order of operations may be rearranged without departing from the spirit of the disclosed subject matter.

(39) Processor device **504** may be a special purpose or a general-purpose processor device. As will be appreciated by persons skilled in the relevant art, processor device **504** may also be a single processor in a multi-core/multiprocessor system, such system operating alone, or in a cluster of computing devices operating in a cluster or server farm. Processor device **504** may be connected to a communication infrastructure **506**, for example, a bus, message queue, network, or multi-core message-passing scheme.

(40) In an exemplary embodiment, computer system **500** may include a display interface **502**, for example a video connector, to transfer data to a display unit **530**, for example, a monitor. Computer system **500** may also include a main memory **508**, for example, random access memory (RAM), and may also include a secondary memory **510**. Secondary memory **510** may include, for example, a hard disk drive **512**, and a removable storage drive **514**. Removable storage drive **514** may include a floppy disk drive, a magnetic tape drive, an optical disk drive, a flash memory, or the like. Removable storage drive **514** may read from and/or write to a removable storage unit **518** in a well-known manner. Removable storage unit **518** may include a floppy disk, a magnetic tape, an optical disk, etc., which may be read by and written to by removable storage drive **514**. As will be appreciated by persons skilled in the relevant art, removable storage unit **518** may include a computer usable storage medium having stored therein computer software and/or data.

(41) In alternative implementations, secondary memory **510** may include other similar means for allowing computer programs or other instructions to be loaded into computer system **500**. Such means may include, for example, a removable storage unit **522** and an interface **520**. Examples of such means may include a program cartridge and cartridge interface (such as that found in video game devices), a removable memory chip (such as an EPROM, or PROM) and associated socket, and other removable storage units **522** and interfaces **520** which allow software and data to be transferred from removable storage unit **522** to computer system **500**.

(42) Computer system **500** may also include a communications interface **524**. Communications interface **524** allows software and data to be transferred between computer system **500** and external devices. Communications interface **524** may include a modem, a network interface (such as an Ethernet card), a communications port, a PCMCIA slot and card, or the like. Software and data transferred via communications interface **524** may be in the form of signals, which may be electronic, electromagnetic, optical, or other signals capable of being received by communications interface **524**. These signals may be provided to communications interface **524** via a communications path **526**. Communications path **526** carries signals and may be implemented using wire or cable, fiber optics, a phone line, a cellular phone link, an RF link or other communications channels.

(43) In this document, the terms “computer program medium” and “computer usable medium” are used to generally refer to media such as removable storage unit **518**, removable storage unit **522**, and a hard disk installed in hard disk drive **512**. Computer program medium and computer usable medium may also refer to memories, such as main memory **508** and secondary memory **510**, which may be memory semiconductors (e.g. DRAMs, etc.).

(44) Computer programs (also called computer control logic) are stored in main memory **508** and/or secondary memory **510**. Computer programs may also be received via communications interface **524**. Such computer programs, when executed, enable computer system **500** to implement different embodiments of the present disclosure as discussed herein. In particular, the computer programs, when executed, enable processor device **504** to implement the processes of the present disclosure. Accordingly, such computer programs represent controllers of computer system **500**.

Where an exemplary embodiment of method **100** is implemented using software, the software may be stored in a computer program product and loaded into computer system **500** using removable storage drive **514**, interface **520**, and hard disk drive **512**, or communications interface **524**.

(45) Embodiments of the present disclosure also may be directed to computer program products including software stored on any computer useable medium. Such software, when executed in one or more data processing device, causes a data processing device to operate as described herein. An embodiment of the present disclosure may employ any computer useable or readable medium. Examples of computer useable mediums include, but are not limited to, primary storage devices (e.g., any type of random access memory), secondary storage devices (e.g., hard drives, floppy disks, CD ROMs, ZIP disks, tapes, magnetic storage devices, and optical storage devices, MEMS, nanotechnological storage device, etc.).

(46) While the foregoing has described what may be considered to be the best mode and/or other examples, it is understood that various modifications may be made therein and that the subject matter disclosed herein may be implemented in various forms and examples, and that the teachings may be applied in numerous applications, only some of which have been described herein. It is intended by the following claims to claim any and all applications, modifications and variations that fall within the true scope of the present teachings.

(47) Unless otherwise stated, all measurements, values, ratings, positions, magnitudes, sizes, and other specifications that are set forth in this specification, including in the claims that follow, are approximate, not exact. They are intended to have a reasonable range that is consistent with the functions to which they relate and with what is customary in the art to which they pertain.

(48) The scope of protection is limited solely by the claims that now follow. That scope is intended and should be interpreted to be as broad as is consistent with the ordinary meaning of the language that is used in the claims when interpreted in light of this specification and the prosecution history that follows and to encompass all structural and functional equivalents. Notwithstanding, none of the claims are intended to embrace subject matter that fails to satisfy the requirement of Sections 101, 102, or 103 of the Patent Act, nor should they be interpreted in such a way. Any unintended embracement of such subject matter is hereby disclaimed.

(49) Except as stated immediately above, nothing that has been stated or illustrated is intended or should be interpreted to cause a dedication of any component, step, feature, object, benefit, advantage, or equivalent to the public, regardless of whether it is or is not recited in the claims.

(50) It will be understood that the terms and expressions used herein have the ordinary meaning as is accorded to such terms and expressions with respect to their corresponding respective spaces of inquiry and study except where specific meanings have otherwise been set forth herein. Relational terms such as first and second and the like may be used solely to distinguish one entity or action from another without necessarily requiring or implying any actual such relationship or order between such entities or actions. The terms “comprises,” “comprising,” or any other variation thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that comprises a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such process, method, article, or apparatus. An element preceded by “a” or “an” does not, without further constraints, preclude the existence of additional identical elements in the process, method, article, or apparatus that comprises the element.

(51) The Abstract of the Disclosure is provided to allow the reader to quickly ascertain the nature of the technical disclosure. It is submitted with the understanding that it will not be used to interpret or limit the scope or meaning of the claims. In addition, in the foregoing Detailed Description, it can be seen that various features are grouped together in various implementations. This is for purposes of streamlining the disclosure, and is not to be interpreted as reflecting an intention that the claimed implementations require more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive subject matter lies in less than all features

of a single disclosed implementation. Thus, the following claims are hereby incorporated into the Detailed Description, with each claim standing on its own as a separately claimed subject matter. (52) While various implementations have been described, the description is intended to be exemplary, rather than limiting and it will be apparent to those of ordinary skill in the art that many more implementations and implementations are possible that are within the scope of the implementations. Although many possible combinations of features are shown in the accompanying figures and discussed in this detailed description, many other combinations of the disclosed features are possible. Any feature of any implementation may be used in combination with or substituted for any other feature or element in any other implementation unless specifically restricted. Therefore, it will be understood that any of the features shown and/or discussed in the present disclosure may be implemented together in any suitable combination. Accordingly, the implementations are not to be restricted except in light of the attached claims and their equivalents. Also, various modifications and changes may be made within the scope of the attached claims.

Claims

1. An energy-saving elevator comprising: an elevator car; a counterweight; a lift cable interconnected between the elevator car and the counterweight, a first end of the lift cable connected to the elevator car, a second end of the lift cable connected to the counterweight; a hoist-type lifting mechanism, the lift cable connected to the hoist-type lifting mechanism, the hoist-type lifting mechanism comprising: a first adjustable pulley, the hoist-type lifting mechanism configured to lift the elevator car by pulling up the first end of the lift cable by rotating the first adjustable pulley in a first rotational direction; a second adjustable pulley, the hoist-type lifting mechanism configured to lift the counterweight by pulling up the second end of the lift cable by rotating the second adjustable pulley in a second rotational direction; and an adjusting cable interconnected between the first adjustable pulley and the second adjustable pulley, the first adjustable pulley and the second adjustable pulley configured to hold the adjusting cable; wherein the first adjustable pulley comprises: a first fixed conical member with a first conical surface; and a first moveable conical member with a second conical surface, the first moveable conical member configured to move linearly along a first axis, the first conical surface and the second conical surface facing each other, the first conical surface and the second conical surface forming a first trapezoid-shape groove between the first fixed conical member and the first moveable conical member, the first trapezoid-shape groove configured to receive the adjusting cable, the first conical surface and the second conical surface configured to hold the adjusting cable inside the first trapezoid-shape groove, the adjusting cable configured to move away from the first axis inside the first trapezoid-shape groove responsive to moving the first moveable conical member towards the first fixed conical member along the first axis, the adjusting cable configured to move towards the first axis inside the first trapezoid-shape groove responsive to moving the first moveable conical member away from the first fixed conical member along the first axis.
2. The energy-saving elevator of claim 1, wherein the second adjustable pulley comprises: a second fixed conical member with a third conical surface; and a second moveable conical member with a fourth conical surface, the second moveable conical member configured to move linearly along a second axis, the third conical surface and the fourth conical surface facing each other, the third conical surface and the fourth conical surface forming a second trapezoid-shape groove between the second fixed conical member and the second moveable conical member, the second trapezoid-shape groove configured to receive the adjusting cable, the third conical surface and the fourth conical surface configured to hold the adjusting cable, the adjusting cable configured to move away from the second axis inside the second trapezoid-shape groove responsive to moving the second moveable conical member toward the second fixed conical member along the second axis, the adjusting cable configured to move toward the second axis inside the second trapezoid-shape

groove responsive to moving the second moveable conical member away from the second fixed conical member along the second axis.

3. The energy-saving elevator of claim 2, wherein: the first conical surface comprises a uniform first inclined surface around the first axis; the second conical surface comprises a uniform second inclined surface around the first axis; the third conical surface comprises a uniform third inclined surface around the second axis; and the fourth conical surface comprises a uniform a uniform fourth inclined line around the second axis.

4. The energy-saving elevator of claim 3, wherein: the first conical surface is bounded between a first smaller circle of the first fixed conical member and a first larger circle of the first fixed conical member, a diameter of the first smaller circle smaller than a diameter of the first larger circle; the second conical surface is bounded between a second smaller circle of the first moveable conical member and a second larger circle of the first moveable conical member, a diameter of the second smaller circle smaller than a diameter of the second larger circle; the third conical surface is bounded between a third smaller circle of the second fixed conical and a third larger circle of the second fixed conical member, a diameter of the third smaller circle smaller than a diameter of the third larger circle; and the fourth conical surface is bounded between a fourth smaller circle of the second moveable conical member and a fourth larger circle of the second moveable conical member, a diameter of the fourth smaller circle smaller than a diameter of the fourth larger circle.

5. The energy-saving elevator of claim 4, wherein: the first fixed conical member comprises a first front surface, the first front surface comprising a circular shape, an outer circle of the first front surface coinciding the first smaller circle; the first moveable conical member comprises a second front surface, the second front surface comprising a circular shape, an outer circle of the second front surface coinciding the second smaller circle; the second fixed conical member comprises a third front surface, the third front surface comprising a circular shape, an outer circle of the third front surface coinciding the third smaller circle; and the second moveable conical member comprises a fourth front surface, the fourth front surface comprising a circular shape, an outer circle of the fourth front surface coinciding the fourth smaller circle.

6. The energy-saving elevator of claim 5, wherein: the first front surface faces the second front surface; and the third front surface faces the fourth front surface.

7. The energy-saving elevator of claim 6, further comprising: a first rod, a main axis of the first rod coinciding with the first axis, the first fixed conical member mounted fixedly on the first rod, the first moveable conical member mounted slidably on the first rod; and a second rod, a main axis of the second rod coinciding with the second axis, the second fixed conical member mounted fixedly on the second rod, the second moveable conical member mounted slidably on the second rod.

8. The energy-saving elevator of claim 7, further comprising: a first sheave mounted on the first rod by utilizing a first idler bearing, the first idler bearing disposed between the first sheave and the first rod, the first idler bearing configured to urge the first sheave to rotate around the first axis synchronously with the first rod responsive to clockwise rotation of the first rod around the first axis, the first rod remaining stationary responsive to counterclockwise rotation of the first rod around the first axis; and a second sheave mounted on the second rod by utilizing a second idler bearing, the second idler bearing disposed between the second sheave and the second rod, the second idler bearing configured to urge the second sheave to rotate around the second axis synchronously with the second rod responsive to counterclockwise rotation of the second rod around the second axis, the second rod remaining stationary responsive to clockwise rotation of the second sheave around the second axis; wherein the first sheave and the second sheave are configured to hold the lift cable, the lift cable wrapped around the first sheave and the second sheave.

9. The energy-saving elevator of claim 8, further comprising: a first actuator attached to the first moveable conical member, the first actuator configured to move the first moveable conical member along the first axis; and a second actuator attached to the second moveable conical member, the

second actuator configured to move the second moveable conical member along the second axis.

10. The energy-saving elevator of claim 9, wherein: the first adjustable pulley is configured to rotate around the first axis; and the second adjustable pulley is configured to rotate around the second axis.

11. The energy-saving elevator of claim 10, wherein the first axis is parallel to the second axis.

12. The energy-saving elevator of claim 11, further comprising an electromotor, the electromotor configured to: rotate the first adjustable pulley around the first axis; and rotate the second adjustable pulley around the second axis.

13. The energy-saving elevator of claim 12, wherein the electromotor comprises a drive gear, the drive gear configured to move along a third axis, the third axis parallel to the first axis and the second axis.

14. The energy-saving elevator of claim 13, further comprising: a first gear connected to the first adjustable pulley, the electromotor configured to be engaged with the first gear responsive to the drive gear being in a first position along the third axis; and a second gear connected to the second adjustable pulley, the electromotor configured to be engaged with the second gear responsive to the drive gear being in a second position along the third axis.

15. The energy-saving elevator of claim 14, wherein the electromotor configured to: rotate the first adjustable pulley around the first axis responsive to the electromotor being engaged with the first gear; and rotate the second adjustable pulley around the second axis responsive to the electromotor being engaged with the second gear.

16. The energy-saving elevator of claim 15, further comprising: a first weight sensor associated with the elevator car, the first weight sensor configured to measure a weight of the elevator car; and a second weight sensor associated with the counterweight, the second weight sensor configured to measure a weight of the counterweight.

17. The energy-saving elevator of claim 16, further comprising one or more processors configured to: receive a first set of data associated with the weight of the elevator car from the first weight sensor; receive a second set of data associated with the weight of the counterweight from the second weight sensor; control the first actuator and the second actuator based on the first set of data and the second set of data; and control a position of the electromotor along the third axis based on the first set of data and the second set of data.
