

RENEWAL SYSTEM AND ELEVATOR APPARATUS

FIELD

Embodiments described herein relate generally to a renewal system, and an elevator apparatus that is renewed
5 by the renewal system.

BACKGROUND

An elevator apparatus provided in a building to carry passengers, baggage, etc. between different floors and having an elevator car is known. In the known elevator
10 apparatus, a winding machine disposed in a machine room provided above a hoistway in a building drives a rope connected to an elevator car and a balance weight located in the hoistway.

The rope is placed over a main sheave in the winding
15 machine and a deflector sheave in the machine room, and driven by the winding machine that rotates the main sheave. The machine room has a floor having a hole which communicates the hoistway and the machine room and which allows passage of the rope suspended from the main sheave
20 and having a hole which communicates the hoistway and the machine room and which allows passage of the rope suspended from the deflector sheave.

In the elevator apparatus as described above, a renewal is performed to repair a part of the configuration
25 of the elevator apparatus. In the case where the elevator apparatus has a plurality of elevator cars, the renewal may be a replacement of a control board by a new control board

having software that allows efficient operations of the elevator cars. Besides, the renewal may be a replacement of a component, such as the main sheave, by a new one, while the existing elevator car and balance weight are maintained.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partially sectional side view showing a configuration of an elevator apparatus according to an embodiment.

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FIG. 2 is a schematic view showing a renewal main sheave, a deflector sheave, and a part of a resin-coated rope of the elevator apparatus.

FIG. 3 is a partially sectional side view showing a configuration of an elevator apparatus before renewal by a renewal system.

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FIG. 4 is a schematic view showing a main sheave, a deflector sheave, and a part of a steel rope of the elevator apparatus shown in FIG. 3.

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FIG. 5 is a schematic view showing a main sheave, a deflector sheave, and a part of a steel rope of a modification of the elevator apparatus.

DETAILED DESCRIPTION

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According to embodiments, a renewal system for is used in an elevator apparatus comprising: an elevator car located in a hoistway; a balance weight located in the hoistway; a winding machine disposed in a machine room formed above the hoistway; a main sheave provided in the winding machine; a deflector sheave provided in the machine

room; and a steel rope fixed to the elevator car and the balance weight and placed over the main sheave and the deflector sheave.

5 The renewal system comprising: a resin-coated rope used as a replacement for the steel rope; and a renewal system main sheave which is used as a replacement for the main sheave, which is smaller in diameter than the main sheave, and on which the resin-coated rope is placed at a winding angle that is smaller than a winding angle of the
10 steel rope relative to the main sheave.

 A renewal system 1 according to the embodiment, and an elevator apparatus 10 renewed by the renewal system 1 will be explained with reference to FIG. 1 to FIG. 4. The renewal system 1 is used for renewal of an elevator
15 apparatus 10A. The elevator apparatus 10A is renewed into the elevator apparatus 10 by the renewal system 1. Each of the elevator apparatuses 10 and 10A is configured to carry objects, such as passengers and baggage, between floors of a building.

20 FIG. 1 is a partially sectional side view showing a configuration of the elevator apparatus 10. FIG. 2 is a schematic view showing a renewal main sheave 61, a deflector sheave 52, and a part of a resin-coated rope 36 of the elevator apparatus 10. FIG. 3 is a partially
25 sectional side view showing a configuration of the elevator apparatus 10A. FIG. 4 is a schematic view showing a main sheave 51, the deflector sheave 52, and a part of a steel

rope 35 of the elevator apparatus 10A.

First, the elevator apparatus 10A will be explained.
As shown in FIG. 3, the elevator apparatus 10A includes an
elevator car 20 located in a hoistway 11 in a building, a
5 balance weight 30 located in the hoistway 11, a winding
machine 50 disposed in a machine room 40 formed above the
hoistway 11, the main sheave 51 provided in the winding
machine 50, the deflector sheave 52 rotatably provided in
the machine room 40, and the steel rope 35 placed over the
10 main sheave 51 and the deflector sheave 52. In the elevator
apparatus 10A, the steel rope 35 is connected to the
elevator car 20 and the balance weight 30 by a 1:1 roping
method.

The elevator car 20 is configured to contain
15 passengers or baggage inside. The elevator car 20 is shaped
as a box in which an openable and closable door is formed.
The elevator car 20 smoothly moves up and down inside the
hoistway 11 by means of a guide apparatus, such as a guide
rail, formed in the hoistway 11. Passengers and baggage are
20 allowed to get on or off the elevator car 20 through a home
door formed in each floor of the building.

The balance weight 30 is spaced apart from the
elevator car 20 in a horizontal direction inside the
hoistway 11. The balance weight 30 smoothly moves up and
25 down inside the hoistway 11 by means of a guide apparatus,
such as a guide rail.

The winding machine 50 is disposed in the machine room

40 above the elevator car 20. In the winding machine 50, the main sheave 51 is formed to be rotatable in both directions around a rotation axis. The winding machine 50 includes, for example, an electric motor, a decelerator, etc. Furthermore, the winding machine 50 is disposed at a position where the steel rope 35 is set at a predetermined winding angle (to be described later) relative to the main sheave 51.

The winding machine 50 as described above is directly or indirectly fixed to a floor 41 of the machine room 40. In this embodiment, the winding machine 50 is indirectly fixed to the floor 41 via, for example, a plurality of machine beams 42, a plurality of support members 43, a machine base 44, and a machine bed 45.

The main sheave 51 is integrally fixed to an output shaft of the winding machine 50, and rotated by the winding machine 50 in directions of moving the elevator car 20 up and down. The rotation axis of the main sheave 51 is parallel to the horizontal direction. An outer periphery of the main sheave 51 has an annular groove, in which the steel rope 35 is placed. The groove is formed by denting the outer periphery radially inward. The groove has, for example, a U-shaped cross section. The main sheave 51 has a sheave diameter, which is, for example, larger than 320 mm. The sheave diameter is a distance between points in the center of the steel rope 35 placed over the main sheave 51 along a straight line passing the center of the main sheave

51, namely, a center-to-center diameter of the rope.

5 The main sheave 51 is disposed at a position where the steel rope 35 is set at the predetermined winding angle. In this embodiment, as shown in FIG. 4, the main sheave 51 is disposed at a position where the winding angle α of the steel rope 35 is, for example, 120 degrees to obtain necessary traction between the main sheave 51 and the steel rope 35.

10 The winding angle of the steel rope 35 relative to the main sheave 51 refers to an angular range, about a center line of rotation of the main sheave 51, of a part where the steel rope 35 is in contact with the main sheave 51. The necessary traction refers to traction necessary to safely move the elevator car 20 up and down, while the steel rope 15 35 does not slip from the main sheave 51.

 The deflector sheave 52 is disposed in the machine room 40 above the balance weight 30, as shown in FIG. 3. The deflector sheave 52 is rotatably supported by the floor 41 of the machine room 40. A center line of rotation of the 20 deflector sheave 52 is parallel to the main sheave 51. The deflector sheave 52 is configured to bend the steel rope 35 toward the main sheave 51. An annular groove to hold the steel rope 35 is formed in an outer periphery of the deflector sheave 52.

25 The steel rope 35 is formed of a steel wire. The steel rope 35 has a diameter, which is, for example, 8 mm. A floor 41 of the machine room 40 has a hole 41a which allows

passage of a first part of the steel rope 35 suspended from the main sheave 51, the first part corresponding to the part between the main sheave 51 and the elevator car 20.

5 The floor 41 also has a hole 41b which allows passage of a second part of the steel rope 35 suspended from the deflector sheave 52, the second part corresponding to the part between the deflector sheave 52 and the balance weight 30. The holes 41a and 41b communicate the machine room 40 and the hoistway 11.

10 The renewal system 1 will be explained. As shown in FIG. 1 and FIG. 2, the renewal system 1 includes a resin-coated rope 36 as a replacement for the steel rope 35, a renewal winding machine 60 as a replacement for the winding machine 50, and a renewal main sheave 61 as a replacement
15 for the main sheave 51. The renewal main sheave 61 has a diameter smaller than that of the main sheave 51.

The elevator apparatus 10 will be explained below. As shown in FIG. 1 and FIG. 2, the elevator apparatus 10 includes the elevator car 20, the balance weight 30, the
20 renewal winding machine 60, the renewal main sheave 61 provided in the renewal winding machine 60, the deflector sheave 52, and the resin-coated rope 36 placed over the renewal main sheave 61 and the deflector sheave 52. In the elevator apparatus 10, the resin-coated rope 36 is
25 connected to the elevator car 20 and the balance weight 30 by the 1:1 roping method.

The renewal winding machine 60 is an electric motor.

The renewal winding machine 60 is disposed in the machine room 40 above the elevator car 20. Since the diameter of the renewal main sheave 61 is smaller than that of the main sheave 51, an output shaft of the renewal winding machine
5 60 has a diameter smaller than that of the output shaft of the winding machine 50.

The renewal winding machine 60 is disposed at a position where the resin-coated rope 36 is set at a predetermined winding angle (to be described later)
10 relative to the renewal main sheave 61, and a part of the resin-coated rope 36 suspended from the renewal main sheave 61, between the renewal main sheave 61 and the elevator car 20, passes through the hole 41a.

The renewal winding machine 60 is directly or
15 indirectly fixed to the floor 41 of the machine room 40. In this embodiment, the renewal winding machine 60 is indirectly fixed to the floor 41 via, for example, the machine beams 42, the support members 43, and the machine base 44.

20 The renewal main sheave 61 is integrally fixed to an output shaft of the renewal winding machine 60, and rotated by the renewal winding machine 60 in directions of moving the elevator car 20 up and down. A center line of rotation of the renewal main sheave 61 is parallel to a center line
25 of rotation of the deflector sheave 52.

An outer periphery of the renewal main sheave 61 has an annular groove, in which the resin-coated rope 36 is

placed. The groove is formed by denting the outer periphery of the renewal main sheave 61 radially inward. The groove has, for example, a U-shaped cross section. The sheave diameter of the renewal main sheave 61 is smaller than that of the main sheave 51. The sheave diameter of the renewal main sheave 61 is 320 mm or smaller, for example, 200 mm. The sheave diameter of the renewal main sheave 61 is a distance between points in the center of the resin-coated rope 36 placed over the renewal main sheave 61 along a straight line passing the center of the renewal main sheave 61, namely, a center-to-center diameter of the rope.

The renewal main sheave 61 is disposed at a position where the winding angle of the resin-coated rope 36 relative to the renewal main sheave 61 is smaller than the winding angle of the steel rope 35 relative to the main sheave 51. As shown in FIG. 2, the winding angle β of the resin-coated rope 36 relative to the renewal main sheave 61 refers to an angular range about a center line of rotation of the renewal main sheave 61 of a part where the resin-coated rope 36 is in contact with the renewal main sheave 61.

The winding angle of the resin-coated rope 36 relative to the renewal main sheave 61 is set to 85 degrees to 95 degrees. Preferably, the winding angle of the resin-coated rope 36 relative to the renewal main sheave 61 is set to 90 degrees to 95 degrees. In this embodiment, the winding angle of the resin-coated rope 36 relative to the renewal

main sheave 61 is set to, for example, 90 degrees. In FIG. 2, the renewal main sheave 61 that forms the winding angle β of 85 degrees is depicted by two-dot chain lines as a renewal main sheave 61A. The renewal main sheave 61 that forms the winding angle β of 95 degrees is depicted by two-dot chain lines as a renewal main sheave 61B.

The resin-coated rope 36 includes a steel rope, and a resin portion made of resin, such as urethane, that covers the steel rope and forms a peripheral portion. The resin-coated rope 36 has an outer diameter which is, for example, 8 mm. The outer periphery of the resin-coated rope 36 is in contact with the renewal main sheave 61. Traction performance of the resin-coated rope 36 is three times that of the steel rope 35.

Therefore, although the sheave diameter of the renewal main sheave 61 is smaller than that of the main sheave 51 and the winding angle of the resin-coated rope 36 relative to the renewal main sheave 61 is smaller than that of the steel rope 35 relative to the main sheave 51, traction necessary to move the elevator car 20 up and down can be generated between the renewal main sheave 61 and the resin-coated rope 36.

The lower limit of the range of the winding angle of the resin-coated rope 36 relative to the renewal main sheave 61, that is, 85 degrees, is a value that can generate traction necessary to safely move the elevator car 20 up and down.

An example of work to renew the elevator apparatus 10A by the renewal system 1 will be explained below. First, a worker removes the steel rope 35 from the elevator car 20, the balance weight 30, the main sheave 51 of the winding machine 50, and the deflector sheave 52.

Next, the worker replaces the winding machine 50 with the renewal winding machine 60. Then, the worker places the resin-coated rope 36 over the renewal main sheave 61 of the renewal winding machine 60 and the deflector sheave 52, and fixes the resin-coated rope 36 to the elevator car 20 and the balance weight 30. With this work, the renewal is completed. The work described above is a mere example, and the work procedure is not limited to this.

In the renewal system 1 including the resin-coated rope 36 and the renewal main sheave 61 as described above, an integrated structure of the renewal main sheave 61 and the renewal winding machine 60 can be more compact than an integrated structure of the main sheave 51 and the winding machine 50, while traction necessary to move the elevator car up and down is obtained. Accordingly, the degree of freedom of the arrangement of the integrated structure of the renewal main sheave 61 and the renewal winding machine 60 in the machine room 40 can be increased. Therefore, the existing hole 41a can be utilized by arranging the integrated structure of the renewal main sheave 61 and the renewal winding machine 60 at a position where the resin-coated rope 36 suspending from the renewal main sheave 61

passes through the hole 41a. Furthermore, a sheave that can be manufactured at a low cost can be used as the renewal main sheave 61. Consequently, the elevator apparatus 10A can be renewed without a great increase in cost.

5 As described above, in the case of renewal of replacing the main sheave with a new one, necessary traction can be generated between the new main sheave and the rope without a great increase in cost.

10 Furthermore, since the height of the integrated structure of the renewal winding machine 60 and the renewal main sheave 61 can be low, a wide space for working, such as maintenance, can be left in the machine room 40.

15 Moreover, since the renewal winding machine 60 smaller than the winding machine 50 can be employed by using the renewal main sheave 61, the elevator apparatus 10A can be renewed without a great increase in cost.

20 In addition, the length of a part of the resin-coated rope 36 between the renewal main sheave 61 and the deflector sheave 52 can be reduced by setting the winding angle of the resin-coated rope 36 relative to the renewal main sheave 61 to 85 degrees to 95 degrees. Therefore, the length of the resin-coated rope 36 as a whole can be reduced, which can shorten the time required for a work to check the resin-coated rope 36.

25 In this embodiment, the renewal system 1 renews the elevator apparatus 10A, in which the winding angle of the steel rope 35 relative to the main sheave 51 is larger than

95 degrees, to obtain the elevator apparatus 10. However, the embodiment is not limited to the above case. For example, the renewal system 1 can renew an elevator apparatus 10B shown in FIG. 5 as a modification of the
5 elevator apparatus 10A, in which the winding angle α of the steel rope 35 relative to the main sheave 51 is 90 degrees, to obtain the elevator apparatus 10.

In the embodiment described above, the deflector sheave 52 is used for both the elevator apparatuses 10A and
10 10. However, the embodiment is not limited to this case. In another case, when the elevator apparatus 10A is renewed into the elevator apparatus 10, a deflector sheave smaller in diameter than the deflector sheave 52 may be used. In this case, a deflector sheave that is the same in diameter
15 as the renewal main sheave 61 may be used. In other words, the renewal system 1 may include, as a replacement for the deflector sheave 52, a deflector sheave that is smaller in diameter than the deflector sheave 52.

Furthermore, the renewal system 1 of the embodiment
20 includes the renewal winding machine 60. However, the embodiment is not limited to this case. If the winding machine 50 does not need to be replaced with a new one, it may be used even after the renewal without replacement.

While certain embodiments have been described, these
25 embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be

embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims
5 and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

CLAIMS

1. A renewal system for use in an elevator apparatus comprising: an elevator car located in a hoistway; a balance weight located in the hoistway; a winding machine
5 disposed in a machine room formed above the hoistway; a main sheave provided in the winding machine; a deflector sheave provided in the machine room; and a steel rope fixed to the elevator car and the balance weight and placed over the main sheave and the deflector sheave,

10 the renewal system comprising:

a resin-coated rope used as a replacement for the steel rope; and

a renewal system main sheave which is used as a replacement for the main sheave, which is smaller in
15 diameter than the main sheave, and on which the resin-coated rope is placed at a winding angle that is smaller than a winding angle of the steel rope relative to the main sheave.

2. The renewal system of claim 1, wherein
20 the winding angle of the resin-coated rope relative to the renewal system main sheave is set to 85 degrees to 95 degrees.

3. The renewal system of claim 2, wherein
the winding angle of the resin-coated rope relative to
25 the renewal system main sheave is set to 90 degrees or larger.

4. The renewal system of claim 1, further comprising

a renewal system winding machine which is smaller than the winding machine and which is used as a replacement for the winding machine.

5. An elevator apparatus comprising:

- 5 an elevator car located in a hoistway;
- a balance weight located in the hoistway;
- a winding machine disposed in a machine room formed above the hoistway;
- a main sheave provided in the winding machine;
- 10 a deflector sheave provided in the machine room; and
- a resin-coated rope fixed to the elevator car and the balance weight and placed over the main sheave and the deflector sheave, at a winding angle relative to the main sheave set to 85 degrees to 95 degrees.