

ELEVATOR ROPE CLEANING JIG

FIELD

Embodiments described herein relate generally to an elevator rope cleaning jig for wire rope cleaning.

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BACKGROUND

In an elevator, as a hoist which a main rope binding a car and a counterweight together is wound around and hung from is driven, the car and the counterweight are moved up or down in directions opposite to each other.

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In the elevator, a wire rope is used as the main rope. The wire rope is formed of a plurality of strands laid up together around a fiber core in the center, each strand being formed of a plurality of thin steel wires called individual wires laid up together.

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When the wire rope is used for a long time, there are some cases where grease in the wire rope is precipitated and then the precipitation-hardened grease, dust attached thereto and the like cause a problem in the operation of the elevator.

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Therefore, to prevent grease from being hardened or dust from being attached, maintenance such as regular cleaning is required for the wire rope.

Usually, the wire rope is cleaned manually by the operator with a scraper or a brush. However, such manual cleaning involves considerable time and trouble. Further, it is difficult to manually scrape off grease stuck in the grooves (between the strands) of the wire rope.

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Therefore, a rope cleaning jig has been considered to automate the wire rope cleaning. For example, a rope cleaning jig which scrapes grease off with a member having a hole conforming to the outer periphery of the wire rope, attaching to the wire rope and rotating about the axis of the wire rope has been developed.

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In general, the main rope of an elevator includes

of a plurality of wire ropes. In the case of cleaning the main rope with the above-described rope cleaning jig, the member is to be rotated about the axis of each wire rope of the main rope.

5 However, when the members are rotated about the axes of the respective wire ropes, there are some cases where the rotation causes the wire ropes to sway abnormally and become tangled with each other.

SUMMARY

10 According to one embodiment, an elevator rope cleaning jig includes a pair of stages, a plurality of rotational members and a pair of rollers. The pair of stages is provided to sandwich a plurality of to-be-cleaned wire ropes all together from both sides of the
15 plurality of wire ropes. The plurality of rotational members respectively include holes allowing the respective wire ropes to pass through and rotate in contact with the pair of stages when the wire ropes pass through the holes. The pair of rollers is
20 attached to the pair of stages as located below the rotational members, which is sandwich the wire ropes to

suppress swaying of the wire ropes having passed through the holes of the rotational members and rotate in contact with the wire ropes.

BRIEF DESCRIPTION OF THE DRAWINGS

5 FIG. 1 is an explanatory diagram showing an example of the installation position of an elevator rope cleaning jig of an embodiment.

 FIG. 2 is a perspective diagram showing an example of the structure of the rope cleaning jig.

10 FIG. 3 is an explanatory diagram showing an example of the structure of a rotational member.

 FIG. 4 is a diagram showing an example of the relationship between the rotational member and a spatula member.

15 FIG. 5 is a sectional view of the rope cleaning jig.

 FIG. 6 is an explanatory diagram showing an example of the structures of sway suppression rollers.

20 FIG. 7 is a diagram showing a state where a front jig and a rear jig are coupled together.

 FIG. 8 is a diagram showing a state where the rope cleaning jig is installed on a machine beam.

25 FIG. 9 is a diagram showing a state where the wire ropes having passed through the rope cleaning jig are swaying.

 FIG. 10 is a diagram showing a state where the swaying of the wire ropes is suppressed by the sway suppression rollers.

30 FIG. 11 is a diagram showing a state where a scattering prevention member is attached to the upper portions of the spatula members.

 FIG. 12 is an explanatory diagram showing a rope

In an elevator, an elevator control device 11 is installed, for example, in a machine compartment and performs the whole operation control of the elevator including the driving control of a hoist 12. The hoist 12 is supported on a machine beam 13 and installed in the machine compartment together with the elevator controller 11. A main sheave (traction sheave) 14 is attached to the drive shaft of the hoist 12, and a main rope 15 is wound around and hung from the main sheave 14. One end of the main rope 15 is connected to a car 16, and the other end of the main rope 15 is connected to a counterweight (C/W) 17.

Note that, although FIG. 1 illustrates the main rope 15 as if the main rope 15 is a single rope for the sake of convenience, the main rope 15 consists of a plurality of wire ropes as described above. Grease is applied to the wire ropes for lubrication or rust prevention.

When the hoist 12 is driven under the control of the elevator controller 11, the main sheave 14 rotates with the main rope 15 wound around and hung from the main sheave 14, and the car 16 and the counterweight 17 connected to the main rope 15 ascend or descend by a draw well system.

The bottom of the car 16 and the bottom of the counterweight 17 are connected to a compensation rope 18 via a compensation sheave 19. The compensation rope 18 compensates for an imbalance caused by the weight of the main rope 15.

As shown in FIG. 1, the rope cleaning jig 20 of the present embodiment is installed on the machine beam 13 directly below the hoist 12. FIG. 1 shows a case where the rope cleaning jig 20 is installed between the hoist 12 and the car 16 and cleans the main rope 15 passing through the rope cleaning jig 20 from the upper side to the lower side, for example, as the elevator is operated in such a manner as to move the car 16 down.

Next, the structure of the rope cleaning jig 20 will be described with reference to FIGS. 2 to 6. FIG. 2 is a perspective diagram showing the structure of the rope cleaning jig 20.

5 As shown in FIG. 2, the rope cleaning jig 20 includes a pair of stages 201a and 201b provided in such a manner as to sandwich a plurality of to-be-cleaned wire ropes 15a to 15g all together from both sides of the wire ropes 15a to 15g (constituting the
10 main rope 15). The stages 201a and 201b, when coupled together, form holes which allow the respective wire ropes 15a to 15b to pass thorough the rope cleaning jig 20 from the upper side to the lower side. The stages 201a and 201b are coupled together by fasteners 202
15 provided in the stages 201a and 201b.

 On the stages 201a and 201b, a plurality of rotational members 203a to 203g attached to the respective wire ropes 15a to 15g are provided. The rotational members 203a to 203g are grease removal
20 members which remove the above-described grease from the wire ropes 15a to 15g.

 Here, the structures of the rotational members 203a to 203g will be described with reference to FIG. 3. Note that, although FIG. 3 only shows the
25 structure of the rotational member 203a for the sake of convenience, the other rotational members 203b to 203g have similar structures.

 As shown in FIG. 3, the rotational member 203a is in a cylinder shape and has an engagement hole (hole)
30 301 conforming to the uneven outer periphery of the wire rope 15a in the center.

 The rotational member 203a is formed of, for example, an elastic polyurethane resin material, and a slit 302 is made in the rotational member 203a between
35 the engagement hole 301 and the outer periphery. The rotational member 203a is opened from the slit 302 and is rotatably attached to the wire rope 15a.

When the hoist 12 is driven in the above-described state of the rotational member 203a being attached to the wire rope 15a, the wire rope 15a can pass through the engagement hole 301 of the rotational member 203a. It is also possible, by fastening the slit 302 with a bolt or the like (not shown), to prevent the slit 302 from opening and letting the rotational member 203a come off from the wire rope 15a after the rotational member 203a is attached to the wire rope 15a.

The engagement hole 301 has a diameter d substantially the same as the diameter of the wire rope 15a and is designed in such a manner that the engagement hole 301 will closely contact the outer periphery of the wire rope 15a when the rotational member 203a is attached to the wire rope 15a. According to this structure, the rotational member 203a can rotate along the lay of the wire rope 15a and thereby scrape (remove) grease off (from) the wire rope 15a when the wire rope 15a passes through the engagement hole 301.

As shown in FIG. 2, the rotational members 203a to 203g are provided along the arrangement of the wire ropes 15a to 15g. Therefore, the diameter D of the rotational member 203a shown in FIG. 3 is determined according to the spaces between the wire ropes 15a to 15g. More specifically, the diameter D of the rotational member 203a is determined in such a manner that the rotational member 203a can be attached to the wire rope 15a at a small distance (of, for example, a few millimeters) away from the adjacent rotational member 203b (that is, the rotational member 203b attached to the wire rope 15b next to the wire rope 15a to which the rotational member 203a is attached) so that the rotational member 203a will not contact the adjacent rotational member 203b.

As further shown in FIG. 2, spatula members (scrapers) 204a to 204g are attached to the upper

surface of the stage 201a near the respective rotational members 203a to 203g with fixing bolts or the like, and remove the grease scraped off by the rotational members 203a to 203g from the rotational members 203a to 203g.

A grease collection member 205 having a U-shaped cross section is attached to the side surface of the stage 201a with fixing bolts or the like, and the spatula members 204a to 204g are provided between the rotational members 203a to 203g and the grease collection member 205. In this way, the spatula members 204a to 204g remove grease from the upper surfaces of the rotational members 203a to 203g as the rotational members 203a to 203g rotate, and lead the grease into the grease collection member 205.

FIG. 4 shows the relationship between the rotational members 203a to 203g and the spatula members 204a to 204g in the rope cleaning jig 20. Although FIG. 4 only shows the relationship between the rotational member 203a and the spatula member 204a for the sake of convenience, the other rotational members 203b to 203g and the other spatula members 204b to 204g are in similar relationships.

As shown in FIG. 4, the spatula member 204a is provided between the rotational member 203a and the grease collection member 205, and removes grease accumulated on the rotational member 203a and leads the grease into the grease collection member 205. The spatula member 204a is provided at a small distance (of a few millimeters) away from the rotational member 203a so that the spatula member 204a will not interfere with the rotating operation of the rotational member 203a.

As further shown in FIG. 2, to prevent the grease scraped off by the rotational members 203a to 203g from scattering about the rope cleaning jig 20, the rope cleaning jig 20 further includes, for example, a surrounding plate 206 attached to the stage 201b in

such a manner as to surround the rotational members 203a to 203g.

FIG. 5 is a sectional view of the rope cleaning jig 20 of FIG. 2 along line V-V. As shown in FIG. 5,
5 the rope cleaning jig 20 includes sway suppression rollers (rollers) 207a and 207b attached to the stages 201a and 201b in such a manner as to be located directly below the rotational members 203a to 203g (the holes formed of the stages 201a and 201b). The sway
10 suppression rollers 207a and 207b sandwich the wire ropes 15a to 15g to suppress swaying of the wire rope 15a and 15g having passed through the engagement holes 301 of the rotational members 203a to 203g, and rotate in contact with the wire ropes 15a to 15g. The sway
15 suppression rollers 207a and 207b are formed of, for example, polyurethane resin or the like. Further, the sway suppression rollers 207a and 207b are provided at different levels of the stages 201a and 201b as shown in FIG. 5.

20 Further, as shown in FIG. 6, the sway suppression rollers 207a and 207b include a plurality of grooves to stably sandwich the wire ropes 15a to 15g.

Note that, since FIG. 6 is an explanatory diagram of the sway suppression rollers 207a and 207b, a part
25 of the structure of the above-described rope cleaning jig 20 is omitted.

In the following description, the stage 201a, the spatula members 204a to 204g, the grease collection member 205 and the like will be referred to
30 collectively as the front jig of the rope cleaning jig 20. On the other hand, the stage 201b, the surrounding plate 206 and the like will be referred to collectively as the rear jig of the rope cleaning jig 20.

Next, an operation performed in the case of
35 cleaning the main rope 15 with the rope cleaning jig 20 of the present embodiment will be described.

In the case of cleaning (the plurality of wire

ropes 15a to 15g constituting) the main rope 15, the car 16 is moved to the uppermost floor, and then the rope cleaning jig 20 is installed on the machine beam 13.

5 In this case, for example, as shown in FIG. 7, the front jig and the rear jig are installed on the machine beam 13 in such a manner as to insert the wire ropes 15a to 15g in the holes formed of the front jig and the rear jig (the stages 201a and 201b) and to sandwich the
10 wire ropes 15a to 15g all together from both sides, and are coupled together by the fasteners 202. Further, the rotational members 203a to 203g are attached to the wire ropes 15a to 15g, respectively. When the spatula members 204a to 204g are obstructive to the attachment
15 of the rotational members 203a to 203g to the wire ropes 15a to 15g, for example, the rotational members 203a to 203g may be attached before the front jig and the rear jig are coupled together. In this way, the rope cleaning jig 20 in the above-described state of
20 FIG. 2 is obtained, and the installation of the rope cleaning jig 20 is complete. Note that FIG. 8 shows a state where the rope cleaning jig 20 is installed on the machine beam 13.

 After the rope cleaning jig 20 is installed in
25 this way, the elevator car 16 is operated. More specifically, the car 16 is moved in a direction in which the rotational members 203a to 203g attached to the wire ropes 15a to 15g are pushed against the stages 201a and 201b (that is, from the uppermost floor to the
30 lowermost floor).

 Since the rope cleaning jig 20 is installed on (mounted on) the machine beam 13 as shown in FIG. 8, as the car 16 is moved from the uppermost floor to the lowermost floor, the wire ropes 15a to 15g pass through
35 the engagement holes 301 of the rotational members 203a to 203g attached to the wire ropes 15a to 15g. At this time, the rotational members 203a to 203g rotate in the

states of being in contact with (being pressed against) the stages 201a and 201b of the rope cleaning jig 20. Since the rotational members 203a to 203g rotate in close contact with the outer periphery of the wire ropes 15a to 15g as described above, the rotational members 203a to 203g can scrape grease off the wire ropes 15a to 15g while rotating.

The grease scraped off by the rotational members 203a to 203g is accumulated on the upper surfaces of the rotational members 203a to 203g. Here, since the spatula members 204a to 204g are provided near the rotational members 203a to 203g as described above, the grease accumulated on the upper surfaces of the rotational members 203a to 203g is removed by the spatula members 204a to 204g as the rotational members 203a to 203g rotate. The grease removed by the spatula members 204a to 204g is then collected in the grease collection member 205.

The wire ropes 15a to 15g having passed through (the engagement holes 301 of the rotational members 203a to 203g of) the rope cleaning jig 20 are swaying abnormally as shown in FIG. 9 according to the rotation of the rotational members 203a to 203g. When the wire ropes 15a to 15g sway abnormally, the wire ropes 15a to 15g, in particular, portions sagging significantly become tangled with each other.

On the other hand, in the present embodiment, the sway suppression rollers 207a and 207b located directly below the rotational members 203a to 203g sandwich the wire ropes 15a to 15g having passed through the engagement holes 301 of the rotational members 203a to 203g and rotate in contact with the wire ropes 15a to 15g.

According to this structure, as shown in FIG. 10, although the wire ropes 15a to 15g which have just passed through the engagement holes 301 of the rotational members 203a to 203g are still swaying, the

sway suppression rollers 207a and 207b suppress the swaying of the wire ropes 15a to 15g and send out the wire ropes 15a to 15g having their sways suppressed.

5 After the car 16 is moved from the uppermost floor to the lowermost floor in a state where the rope cleaning jig 20 operating in the above-described manner is installed, the rotational members 203a to 203g are detached from the wire ropes 15a to 15g, the front jig and the rear jig are released from the coupling
10 condition, and the rope cleaning jig 20 is uninstalled from the machine beam 13. In this way, the cleaning of the main rope 15 is complete. Note that the grease collected in the grease collection member 205 may be disposed of.

15 As described above, the rope cleaning jig 20 of the present embodiment includes: the pair of stages 201a and 201b which is provided in such a manner as to sandwich the plurality of to-be-cleaned wire ropes 15a to 15g all together from both sides; the plurality of
20 rotational members 203a to 203g which have the engagement holes (holes) 301 allowing the wire ropes 15a to 15g to pass through and rotate in contact with the stages 201a and 201b when the wire ropes 15a to 15g pass through the engagement holes 301; and the pair of
25 sway suppression rollers (rollers) 207a and 207b which is attached to the stages 201a and 201b, sandwiches the wire ropes 15a to 15g to suppress swaying of the wire ropes 15a to 15g having passed through the engagement holes 301 of the rotational members 203a to 203g and
30 rotates in contact with the wire ropes 15a to 15g. In the present embodiment, with this structure, it is possible to suppress swaying of the wire ropes 15a to 15g associated with the rotation of the rotational members 203a to 203g and prevent the swaying from
35 traveling down the wire ropes 15a to 15g beyond the sway suppression rollers 207a and 207b. Therefore, in the present embodiment, it becomes possible to prevent

the wire ropes 15a to 15g from becoming tangled with each other while using the rope cleaning jig 20.

Further, in the present embodiment, since the sway suppression rollers 207a and 207b include the plurality
5 of grooves 208 for sandwiching the wire ropes 15a to 15g, it is possible to sandwich the wire ropes 15a to 15g more stably and suppress the swaying of the wire ropes 15a to 15b more effectively. Still further, since the sway suppression rollers 207a and 207b are
10 provided at different levels of the stages 201a and 201b, the contact areas of the sway suppression rollers 207a and 207b to the wire ropes 15a to 15g can be increased, and thus the swaying of the wire ropes 15a to 15g can be suppressed more effectively.

Still further, in the present embodiment, since the rotational members 203a to 203g scrape (remove)
15 grease off (from) the wire ropes 15a to 15g by rotating in contact with the wire ropes 15a to 15g when the wire ropes 15a to 15g pass through the engagement holes 301, it is possible to clean the wire ropes 15a to 15g
20 simply by moving the car 16, for example, from the uppermost floor to the lowermost floor. Consequently, it is possible to greatly reduce the operator's workload and shorten the cleaning time of the wire
25 ropes 15a to 15g.

Still further, in the present embodiment, the spatula members 204a to 204g which remove the grease
scraped off by the rotational members 203a to 203g from the rotational members 203a to 203g, and the grease
30 collection member 205 which collects the grease removed by the spatula members 204a to 204g are provided. With this structure, in the present embodiment, the operator only needs to dispose of the grease collected in the grease collection member 205 after (the plurality of
35 wire ropes 15a to 15g constituting) the main rope 15 is cleaned, and thus it is possible to even reduce the burden of work subsequent to the cleaning of the main

rope 15.

Note that, although the spatula members 204a to 204g successfully remove and collect all the grease from the rotational members 203a to 203g in the present embodiment, when the rotational members 203a to 203g scrape off a large amount of grease, there are some cases where the grease accumulated on the upper surfaces of the rotational members 203a to 203g scatters beyond the spatula members 204a to 204g and brings undesirable effects such as attaching to the other wire ropes and the like. Therefore, as shown in FIG. 11, it is possible to further attach a scattering prevention member 209 to the upper portions of the spatula members 204a to 204g and thereby prevent the grease scraped off by the rotational members 203a to 203g from scattering.

Here, supposing that the arrangement line of the plurality of wire ropes 15a to 15g wound around and hung from the main sheave 14 is the first line and the arrangement line of the plurality of wire ropes 15a to 15g connected to the car 16 is the second line, depending on elevators, the first line is orthogonal to the second line. In such cases, the wire ropes 15a to 15g extending from the main sheave 14 to the car 16 are twisted as shown in FIG. 12. Although the twist (draw angle) of the wire ropes 15a to 15g is small when the car 16 is at the lowermost floor, the twist (draw angle) of the wire ropes 15a to 15g becomes greater as the car 16 is moved to the uppermost floor. Note that such a twist of the wire ropes 15a to 15g as that of FIG. 12 is called a rope draw.

In the case of cleaning the main rope 15, the car 16 is at first moved to the uppermost floor as described above, and at this time, the wire ropes 15a to 15g is twisted most significantly by the rope draw.

Here, for example, in the case of using a rope cleaning jig not including the sway suppression rollers

207a and 207b, as shown in FIG. 13, since the positions of the wire ropes 15a to 15g are shifted (shifted horizontally) by the rope draw (twist) and the wire ropes 15a to 15g do not fit in the holes formed of the above-described stages 201a and 201b coupled together, the rope cleaning jig cannot be installed. Note that FIG. 13 is a schematic diagram showing a state where the wire ropes 15a to 15g do not fit in the holes formed of the states 201a and 201b. In this case, for example, it is not possible to install the rope cleaning jig without moving the car 16 to a floor lower than the uppermost floor and thereby slackening the twist of the wire ropes 15a to 15g, and thus the cleanable section in the main rope 15 is limited.

On the other hand, according to the rope cleaning jig 20 of the present embodiment, the wire ropes 15a to 15g are sandwiched between the sway suppression rollers 207a and 207b located directly below the holes formed of the stages 201a and 201b, and thus the positions of the wire ropes 15a to 15g will not be shifted by the rope draw or misaligned with the holes formed of the stages 201a and 201b coupled together. That is, in the present embodiment, it is possible to reduce the impact of the rope draw in the installation position of the rope cleaning jig 20 and thereby prevent the cleanable section from being limited.

Note that, although the case of cleaning the main rope 15 between the hoist 12 and the car 16 with the rope cleaning jig 20 as shown in FIG. 1 has been described in the present embodiment, it is also possible to install the rope cleaning jig 20 in such a manner as to clean the main rope 15 between the hoist 12 and the counterweight 17 as shown in FIG. 14, for example. In this case, it is possible to clean the main rope 15 in a similar manner by moving the car 16 from the lowermost floor to the uppermost floor.

Further, although the rope cleaning jig 20 is used

for cleaning the main rope 15 in the present embodiment, the rope cleaning jig 20 may also be used for cleaning the compensation rope 18.

5 Still further, the rope cleaning jig 20 of the present embodiment may include a rotation assist mechanism which assists the rotation of the plurality of rotational members 203a to 203g. The rotation assist mechanism includes, for example, a ball and a supporting member which rotatably supports the ball.
10 By providing the rotation assist mechanisms in the stages 201a and 201b in such a manner as to support the respective rotational members 203a to 203g attached to the wire ropes 15a to 15g, it is possible to rotate the rotational members 203a to 203g smoothly on the balls
15 of the rotation assist mechanisms.

While certain embodiments have been described, these 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
20 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 and their
25 equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

WHAT IS CLAIMED IS:

1. An elevator rope cleaning jig comprising:

a pair of stages configured to sandwich a plurality of to-be-cleaned wire ropes all together from both sides of the plurality of wire ropes;

a plurality of rotational members respectively comprising holes allowing the respective wire ropes to pass through and configured to rotate in contact with the pair of stages when the wire ropes pass through the holes; and

a pair of rollers attached to the pair of stages as located below the rotational members, which is configured to sandwich the wire ropes to suppress swaying of the wire ropes having passed through the holes of the rotational members and rotate in contact with the wire ropes.

2. The elevator rope cleaning jig of Claim 1, wherein the pair of rollers comprises a plurality of grooves for sandwiching the wire ropes.

3. The elevator rope cleaning jig of Claim 2, wherein the pair of rollers is provided at different levels of the pair of stages.

4. The elevator rope cleaning jig of Claim 1, wherein the holes of the rotational members are respectively configured to conform to uneven outer peripheries of the wire ropes, and

the rotational members are configured to scrape off grease stuck in the wire ropes while rotating when the wire ropes pass through the holes of the rotational members.

5. The elevator rope cleaning jig of Claim 4, further comprising:

a spatula member configured to remove the grease scraped off by the rotational members from the rotational members; and

a grease collection member configured to collect the grease removed by the spatula member.

6. The elevator rope cleaning jig of Claim 5, further comprising a scattering prevention member attached to the spatula members and configured to prevent the grease scraped off by the rotational members from scattering.